

## **Alde Ore Estuary Special Protection Area: DRAFT Supplementary advice on conserving and restoring site features**



This document provides supplementary advice about the conservation objectives for the Alde Ore Estuary Special Protection Area (SPA), forming part of the [conservation advice package](#).

In many cases, the attribute targets show if the current objective is to either 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. Where there is no evidence to determine a [marine] feature's condition, a vulnerability assessment, which includes sensitivity and exposure information for features and activities in a site, has been used as a proxy for condition. In these cases, the condition is referred to as 'not assessed'. As new information on feature condition becomes available, this will be added so that the advice remains up to date. Evidence used in preparing the supplementary advice table has been cited with full references provided at the end of the package. Where references have not been provided, Natural England has applied ecological knowledge and expert judgement.

There are some instances where the feature, subfeature or supporting habitat name varies on MAGIC site maps from the conservation advice. [Find the alternative names](#).

### **Supplementary information on qualifying features**

The following sections give you additional, site-specific information on the qualifying features.

#### **Avocet, *Recurvirostra avosetta* (breeding)**

Historically the number of breeding pairs within the SPA has been higher than 100 (1993-1996) however in the latest 5 year mean (2010-2013) the number of breeding pairs was 42. These pairs were found to be nesting at Havergate Island and Orford Ness. The decline in the site contrasts with an increase in the wider GB population.

Avocet is present in the site all year round. Breeding starts in April on nest scrapes BirdLife International, 2014 at Havergate Island, Doveys and Belpers lagoons Royal

Society for the Protection of Birds (RSPB), 2005, by June most of the chicks have hatched and the flocks leave the estuary by August.

Since monitoring began in 1996 fledging rates have been poor. On Havergate Island, 86 pairs fledged only 16 young in 1996. On Orford Ness, 17 pairs attempted to breed in 2012 but no young survived for more than a few days. This was largely due to predation by foxes and gulls Crawshaw, 2012.

Feeding habitat includes the intertidal estuary mudflats and the saline lagoons of Havergate Island and Orford Ness. At high tide the birds feed in the lagoons, moving onto the mudflats as they become exposed. Prey includes invertebrates such as insects, crustaceans and worms found in the soft muds.

Condition Assessment: Not assessed

### **Avocet, *Recurvirostra avosetta* (non-breeding)**

The 5 year mean peak of Avocet 1991/92-1995/1996 was 706 individuals which has increased to 1, 597 (5 year mean 2008/2009- 2012/2013). This represents 21% of the GB non-breeding population British Trust for Ornithology (BTO), 2014 Austin et al., 2014.

Avocet are present all year round as they use the site for both breeding and overwintering Joint Nature Conservation Committee (JNCC), 2012b. The overwintering birds are part of the Western European population, which start to arrive on the Suffolk coast in October. The birds start to leave the SPA in February to return to their European breeding grounds with many of the overwintering population breeding outside of Great Britain.

In the Alde-Ore Estuary SPA avocet roost on saltmarsh and banks between Blackheath and Snape. Foraging is particularly concentrated around Iken, Snape and Butley Creek where large flocks of more than 600 birds can be seen in winter British Trust for Ornithology (BTO), 2011.

Condition Assessment: Not assessed

### **Lesser black-backed gull, *Larus fuscus***

At classification the breeding population of lesser black-backed gull was 14,070 pairs (4 year mean 1994-1997 Joint Nature Conservation Committee (JNCC), 2014.

Since classification, the number of breeding pairs has decreased to 768 at Havergate Island and 1678 at Orford Ness in 2007 with only 1267 pairs breeding on

Havergate Island and 640 on Orford Ness in 2012 Joint nature Conservation Committee (JNCC), 2012a.

Outside the breeding season, often fewer than 10 birds are seen Crawshaw, 2012. In February, the breeding population starts to return. Laying stops by end of May and most individuals have left the SPA by July.

The gulls prefer to nest on islands in large colonies with many nesting on Lantern Marshes on Orford Ness. A small colony exists on the southern end of the Ness and on Havergate Island at Dovey's Lagoon. In 2012, all ground nesting failed on Orford Ness, the only successful pairs nested on the roofs of the Pagodas and the Cobra Mist building Crawshaw, 2012.

Lesser black-backed gull are omnivorous and opportunistic feeders and at Havergate and Orford Ness some have learnt to predate chicks of breeding wader and tern colonies.

Condition Assessment: Not assessed

### **Little Tern, *Sternula albifrons***

Between 2003- 2013 no more than 3 pairs were breeding within the estuary during any given year, often none bred at all Little Tern Group, 2013. Little tern can however be seen roosting on the shingle ridges at Shingle Street, Orford Ness and Havergate Island.

As a summer visitor they start to arrive from the West African wintering grounds at the beginning of May. On arrival they explore the SPA and wider Suffolk coast looking for suitable shingle nesting sites before settling and breeding. The last known nesting colony was at Sudbourne Beach, south of Slaughden on Orford Ness in 2013 Banks and Austin, 2004. In the same year 40 birds were recorded on Shingle Street but due to disturbance they moved to the Deben Knolls of Deben Estuary SPA, where a breeding colony was established Little Tern Group, 2013.

Condition Assessment: Not assessed

### **Marsh harrier, *Circus aeruginosus***

In addition to the breeding population, birds are present throughout the year with the site having a wintering population of around 8 birds. Spring brings considerable bird movement in the estuary as northern breeding marsh harrier pass through. In the autumn the returning migratory marsh harriers are seen moving south.

Breeding habitats are located in the upper estuary at Iken, Sudbourne, Boyton and on Orford Ness. Prey includes small mammals (voles, rats and rabbits) and birds (pipit *Anthus spp.*, bearded reedling *Panurus biarmicus*, and moorhen *Gallinula chloropus*) which are found in reedbeds and saltmarshes throughout the SPA and in nearby extensive dry arable farmland. Males can be bigamous or trigamous and require home ranges of up to 1,407 ha, depending on the breeding cycle stage European Science Foundation, 2009, European Science Foundation, 2013. It is therefore unlikely that the site will hold more than 2-3 males with 4-5 breeding females. With 8 females recorded breeding just outside the SPA in 2012 and 2013, the Alde Ore Estuary SPA likely can't support a larger population than recently recorded.

Condition Assessment: Not assessed

### **Redshank, *Tringa totanus***

When the site was classified the number of overwintering redshank was 1, 662 individuals (5 year mean peak 1989/90- 1993/94) Natural England, 2014a. Since classification, the population has fluctuated widely in response to weather severity with the five year peak mean 2008/2009- 2012/2013 being 1, 921, similar to that when the SPA was classified Austin et al., 2014.

Numbers of wintering birds in the estuary vary greatly depending on weather conditions with far fewer present in extreme cold snaps. There were 5,268 redshank present in 1997, which was an unusually warm winter across Suffolk Banks and Austin, 2004.

Across the site redshank are found frequenting the saltmarshes, mudflats and saline lagoons del Hoyo et al., 1996. At high tide they roost on the upper saltmarshes at Snape, on Orford Ness and on Havergate Island with smaller numbers at Butley Creek.

The saltmarsh and intertidal mudflats and sandflats of the SPA are the main feeding habitat for redshank. On the mudflats they feed on annelid worms *Nereis* sp, molluscs *Peringa ulvae* and amphipods *Corophium* sp. They occasionally feed on small fish from shallow waters on Orford Ness and Havergate Island. At high tides they move onto the grazing marshes and scrapes of Havergate, Orford Ness, Hazelwood marshes and the upper saltmarshes at Iken

Condition Assessment: Not assessed

### **Ruff, *Philomachus pugnax***

The 5 year peak mean (2008/09 to 2012/13) of ruff within the SPA is five individuals Austin et al., 2014.

Great Britain is at the northern of the Ruff's range for overwintering. Hence more birds pass through during migration with numbers peaking twice annually. In autumn during their southern migration to wintering grounds as far as southern Africa and in spring heading North to breed in Scandinavia, Iceland and Russia BirdLife International, 2013. Wintering ruff also aggregate outside the SPA at Trimley and Minsmere. Presence during migration is dependent on food availability and prevailing weather conditions. In bad weather ruff tend to move swiftly south.

Main feeding habitats are intertidal mudflats and non-tidal marshes. At high tide they move onto the grazing marshes and scrapes of Havergate, Orfordness and Hazelwood. Their wide food range includes small terrestrial invertebrates (beetles and flies) when on the marshes. On the abundant mudflats and scrapes they feed on aquatic estuarine invertebrates e.g. caddis flies, worms, frogs and molluscs.

Condition Assessment: Not assessed

### **Sandwich Tern, *Sterna sandvicensis***

Sandwich tern have been recorded as nesting on the site since 1986 however the colony on Havergate Island disappeared in 1997 and since has only nested in some years with a maximum of 15 pairs in 2003 Joint Nature Conservation Committee (JNCC), 2014.

Sandwich tern is a summer visitor to the SPA and starts to arrive at the end of March. They nest on Havergate Island, historically in large aggregations of over 100 birds. Prior to 1996 nesting also occurred on the seaward side of the Orford Ness spit. Past nesting attempts on Havergate have been on raised mounds in gravels and shingle with very limited vegetation. Breeding success has been limited by predation of the eggs and young by lesser black-backed gull, fox and brown rat. Numbers of pairs attempting to breed fluctuates due to the tendency for mass movements between colonies Suffolk Ornithologists' Group, 1996, Burgess and Hiron, 1992.

Sandwich tern feed in the shallow waters along the shingle beaches of Orford Ness and Havergate with key prey species including sandeel and sprat del Hoyo et al., 1996.

Condition Assessment: Not assessed

## Site-specific seasonality table

In the table below, the months highlighted in grey in each row indicate the months in which significant numbers of each mobile designated feature are most likely to be present at the site during a typical calendar year. Where count data were available, highlighted months with significant numbers were defined on the basis of one or both of the following criteria being met in more than three-fifths (60%) of the years within the six years period 2007-2012. The two criteria used were: i) monthly maxima exceed 10% of the highest mean of monthly maxima over the six-year period; ii) monthly maxima exceed the 2012/2013 national significance threshold. These criteria were predominantly used for non-breeding bird features (based on WeBS data). Where insufficient count data were available to use these criteria, months with significant numbers were highlighted on the basis of generic information on seasonal patterns of occurrence in published sources (see references in table below).

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying bird features during the principal periods of site usage by those features. The months which are not highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require consideration. Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional surveys may be required.

Non-breeding waterbird monthly maxima data for this site are available upon request from the Wetland Bird Survey (WeBS: <http://www.bto.org/volunteer-surveys/webs/data/submit-data-request>). Breeding seabird data are available from the Seabird Monitoring Programme at <http://jncc.defra.gov.uk/smp/Default.aspx>

**Table 1.** Presence by month of mobile designated features at the Alde-Ore Estuary SPA. Grey indicates periods of presence in significant numbers whereas blank (white) indicates either periods of absence or of presence but only in numbers of less significance.

Common Name	Latin Name	Designated Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
Avocet	<i>Recurvirostra avosetta</i>	Nonbreeding ; Wintering													Cramp and Simmons, 1983
Lesser black-backed gull	<i>Larus fuscus</i>	Breeding													Forrester and Andrews, 2007, Wernham et al., 2002, Cramp and Simmons, 1983
Little tern	<i>Sterna albifrons</i>	Breeding													Kober et al., 2010, Forrester and Andrews, 2007, Pennington et al., 2004, Cramp and Simmons, 1983
Marsh harrier	<i>Circus aeruginosus</i>	Breeding													del Hoyo et al., 1994
Redshank	<i>Tringa totanus</i>	Nonbreeding ; Wintering													Wernham et al., 2002, Cramp and Simmons, 1983
Ruff	<i>Philomachus pugnax</i>	Nonbreeding ; Wintering													Wernham et al., 2002, Cramp and Simmons, 1983
Sandwich tern	<i>Sterna sandvicensis</i>	Breeding													Forrester and Andrews, 2007, Brown and Grice, 2005, Pennington et al., 2004, Cramp and Simmons, 1983
Avocet	<i>Recurvirostra avosetta</i>	Breeding													Cramp and Simmons, 1983

### Supplementary advice table: attributes applying to individual features

The following table shows attributes which apply to the individual features listed.

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Breeding (summer) season	Breeding population: abundance	Maintain presence of the breeding feature whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve.</p> <p>Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in the future should also be taken into account.</p> <p>The latest 5-year mean (2010-2013) was 42 pairs (nesting at Havergate Island and Orford Ness including new habitat created in the Airfield). Historically numbers recorded at these locations were higher (100 pairs, 1992-1996).</p>	<p>Warrington et al., 2014; National Trust and Royal Society for the Protection of Birds (RSPB), 2014</p> <p>Historic and latest site count data is in part derived from combined RSPB and National Trust data. Please contact your Natural England Advisor for further information.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Breeding (summer) season	Breeding population: productivity and survival	Restore the abundance and structure of the assemblage at or above its current or target level (whichever is the higher) through restoring breeding productivity and adult survival.	<p>This target is provided to reflect the required abundance and long-term viability of the population. Changes in the availability of adult birds of breeding age to reproduce, and the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Overall breeding success of the SPA population may also be substantially influenced by any changes in the level of predation of eggs and chicks by generalist native species and/or introduced non-native species.</p> <p>Productivity varies considerably between years, with 18 juveniles fledging in 2014, zero in 2013 and 2012 and 19 in 2010</p>	National Trust and Royal Society for the Protection of Birds (RSPB), 2014
Avocet	Breeding (summer) season	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.	The UK Air Pollution Information System ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical Loads:</p> <p>Nitrogen depositions critical load is (20 – 30 kg N ha<sup>-1</sup> yr<sup>-1</sup>) for Pioneer, low-mid, mid-upper saltmarshes.</p> <p>Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) in littoral sediment set for Higher Plants.</p> <p>NO<sub>x</sub> critical load is 30µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for littoral sediment, set for All vegetation)</p> <p>SO<sub>2</sub> Concentration µg/m<sup>3</sup> Maximum: 1.94 Minimum: 1.29 Average: 1.41</p>	<p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. No expected negative impact on the species due to impacts on the species' broad habitat from acidity. No critical levels have been assigned for SO<sub>2</sub>.</p> <p>Air pollution impacts on vegetation diversity. Aerial deposits of nitrogen may exceed the site relevant critical load (20 – 30 kg N ha<sup>-1</sup> yr<sup>-1</sup>) above which the diversity of saltmarsh vegetation begins to be altered (possibly to reed) and adversely impacted. Many land use practices contribute to this problem locally.</p> <p>Current loads:</p> <p>Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p>	<p>has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				<p>Ammonia Concentration <math>\mu\text{g}/\text{m}^3</math> Maximum: 1.55 Minimum: 0.48 Average: 1.05</p> <p>NOx Concentration <math>\mu\text{g}/\text{m}^3</math> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	
Avocet	Breeding (summer) season	Supporting habitat: conservation measures	Restore the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target.</p> <p>Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan</p>	Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				<p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Breeding (summer) season	Supporting habitat: extent and distribution of supporting habitat for the breeding season	<p>Restore the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)</p> <p>Suggested mitigation is to e.g. create Islands on existing lenses of higher ground within Hazelwood Marshes. (IPENS)</p>	<p>To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection.</p> <p>Hydrological changes: Flood wall breaches in December 2013 (due to the tidal surge) have led to flooding of Hazelwood Marshes and Lantern Marshes south (both currently intertidal). This has led to a loss of nesting habitat and saline lagoons (IPENS).</p> <p>Coastal Squeeze: Seawalls afford little scope for natural adaptation of the estuary to sea level rise through roll back of habitat. Saltmarsh is at risk of being squeezed in the future (although in 2014 the estuary was perceived as in balance) and limited areas of natural habitat transition within the site could be lost. The developing policy of the Alde and Ore Estuary Partnership should consider scope for natural adaptation to sea level rise. (IPENS)</p> <p>Invasive species: Spartina is encroaching on estuarine muds. With Spartina at the front, and reed encroaching at the back, saltmarsh could be squeezed out. (IPENS) An area of Airfield Marsh that had naturally developed into a coastal grazing marsh but was prone to drying out in summer was modified to retain water levels which resulted in increased breeding.</p> <p>Area of the supporting habitat is currently understood to be:</p>	<p>Natural England, 2014b; Warrington et al., 2014; Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				432.25 ha Annual vegetation of drift lines, Unknown ha Atlantic salt meadows, 1.31 ha Coastal lagoons, 149.36 ha Freshwater and Coastal grazing marsh, 7.70 ha Intertidal mixed sediment, 799.28 ha Intertidal mud, 5.08 ha intertidal sand and muddy sand, Unknown ha Salicornia and other annuals colonising mud and sand, Unknown ha Spartina swords.	
Avocet	Breeding (summer) season	Supporting habitat: hydrology/f low	Maintain the stability of standing water levels (<2 cm fluctuation) in order to prevent flooding of	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute.	Cadbury et al., 1989
Avocet	Breeding (summer) season	Supporting habitat: landform	Maintain the availability of shallow sloping nesting sites and avoid changes in the probability that they will flood at critical times of year.	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting/rearing, feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature.	Hill, 1988; Goutner, 1986; del Hoyo et al., 1996

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Breeding (summer) season	Supporting habitat: salinity	Maintain water salinity at <2.5%	<p>This feature is known to be particularly susceptible to changes in the salinity (concentration of salt) of its shallow brackish/fresh water habitat; Salinity is a major factor determining the distribution and composition of communities of aquatic invertebrates such as insects, crustaceans and worms on which this feature feeds. High levels of salinity can adversely affect invertebrate food for adults and chicks.</p> <p>The principal factors governing the temporal and spatial nature of the salinity regime of coastal sites are the diurnal incursion of the tide and fresh water flow from the river(s). Any activity changing either of these factors can result in a change to the salinity regime.</p>	Cadbury and Richards, 1978; Hill et al., 1989; del Hoyo et al., 1996]
Avocet	Breeding (summer) season	Supporting habitat: vegetation characteristics	Maintain the proportion of vegetated to bare ground within nesting areas with generally <40% vegetated	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	Goutner, 1986
Avocet	Breeding (summer) season	Supporting habitat: water depth	Maintain the availability and area of standing water of 3-5 cm deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators.	Cadbury et al., 1989

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Breeding (summer) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water</p> <p>Current EA chemical quality; does not require assessment.</p> <p>Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO data (WFD High/Good boundary)</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Non-breeding (winter and/or passage) season	Non-breeding population: abundance	Maintain the presence of the non-breeding feature whilst avoiding deterioration from its current level of abundance as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account.</p> <p>The SPA's population was 1,597 individuals (5 year mean 2008/09 to 2012/13; WeBS Online), accounting for national increases, this represents 21% of the GB non-breeding population.</p> <p>The 5 year peak mean 1991/1992-1995/1996 was 706 individuals.</p>	Austin et al., 2014

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Non-breeding (winter and/or passage) season	Non-breeding population: condition and survival	Maintain overall adult survival and body condition at a level which is consistent with maintaining the abundance and structure of the population at or above its current or target level, whichever is the higher.	This target is provided to reflect the required abundance and long-term viability of the population. Poor winter body condition may negatively affect a bird's ability to move, forage, and survive whilst present on the SPA, and subsequently affect its ability to migrate and reproduce whilst in its summer breeding grounds.	
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: air quality	<p>Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical loads:</p> <p>Nitrogen depositions critical load is (20 – 30 kg N ha<sup>-1</sup> yr<sup>-1</sup>) for Pioneer, low-mid,</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of</p>	The UK Air Pollution Information System ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>mid-upper saltmarshes.</p> <p>Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) in littoral sediment, set for higher plants.</p> <p>NO<sub>x</sub> critical load is 30 µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for littoral sediment, set for All vegetation.</p>	<p>abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No critical levels have been assigned for SO<sub>2</sub>. Habitat not classed as sensitive to acidity (Littoral sediment).</p> <p>Current loads:</p> <p>Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p> <p>Ammonia Concentration µg/m<sup>3</sup> Maximum: 1.55 Minimum: 0.48 Average: 1.05</p> <p>NO<sub>x</sub> Concentration µg/m<sup>3</sup> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p>	
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan</p> <p>Wildfowling is controlled by a management plan and Natural England consent.</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England</p>	Joint Nature Conservation Committee (JNCC), 2011; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: extent and distribution of supporting non-breeding habitat	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding)	<p>This target may apply to supporting habitat which also lies outside the site boundary.</p> <p>Area of the supporting habitat is currently understood to be:</p> <p>432.25 ha Annual vegetation of drift lines,  Unknown ha Atlantic salt meadows,  1.31 ha Coastal lagoons,  149.36 ha Freshwater and Coastal grazing marsh,  7.70 ha Intertidal mixed sediment,  799.28 ha Intertidal mud,  5.08 ha intertidal sand and muddy sand,  Unknown ha Salicornia and other annuals colonising mud and sand,  Unknown ha Spartina swords.</p>	
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: landscape	Maintain the area of open and unobstructed terrain around roosting and feeding sites.	<p>This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat.</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Non-breeding (winter and/or passage) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO data (WFD High/Good boundary)</p>	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Avocet	Year-round	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting nesting/ foraging and/or roosting birds should not reach levels that substantially affect the feature.	<p>The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate).</p> <p>This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.</p>	Holm and Laursen, 2009
Avocet	Year-round	Supporting habitat: food availability within supporting habitat	Maintain the distribution, abundance and availability of key prey items	<p>This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.</p> <p>Key prey items include (e.g. Gammarus, Corophium, flies, beetles, Neries, Hydrobia, Cardium, gobies. Preferred prey sizes (e.g. worms between 4-15 mm long).</p>	Cramp and Simmons, 1983; Hill et al., 1989; Reay, 1991; Moreira, 1995; del Hoyo et al., 1996]

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Breeding population: abundance	Restore the size of the population to 14,074 pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count, or equivalent	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve.</p> <p>Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account.</p> <p>For classification in 1996, the SPA's breeding population was given as 14,074 pairs (4 year mean 1994-1997 derived from the JNCC Seabird Monitoring Programme database; agreed by NE's Chief Scientist in 2012), which at the time represented 11.3% of the Western Europe/Mediterranean/Western Africa breeding population. However, after a peak of 23,400 pairs in 2000, numbers reduced significantly below the target.</p>	Joint Nature Conservation Committee (JNCC), 2014; Banks and Austin, 2004; Joint Nature Conservation Committee (JNCC), 2012b

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Breeding population: productivity and survival	Restore the abundance and structure of the assemblage at or above its current or target level (whichever is the higher) through restoring breeding productivity and adult survival.	<p>This target is provided to reflect the required abundance and long-term viability of the population. Changes in the availability of adult birds of breeding age to reproduce, and the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Overall breeding success of the SPA population may also be substantially influenced by any changes in the level of predation of eggs and chicks by generalist native species and/or introduced non-native species.</p> <p>Productivity rates of the Havergate Island colony were 0.15, 0.35 and 0.5 from 2009 to 2011. Studies of colonies without significant controlling factors demonstrate productivity rates of 0.43 to 0.69. By comparison, the SPA colony appears to have productivity and survival issues.</p>	Joint Nature Conservation Committee (JNCC), 2014; Cramp and Simmons, 1983

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No expected negative impact on species due to impacts on the species' broad habitat from Nitrogen, acidity, Ammonia, NO<sub>x</sub> or SO<sub>2</sub>.</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				provided for species where they have been provided by APIS.	
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas. The maximum offshore distance reached was 159 km of breeding colonies.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Results from the study of 25 tagged individuals during 2010 and 2011 breeding seasons show that 10% of journeys gulls made from Orford Ness were offshore	British Trust for Ornithology (BTO), 2015; Thaxter et al., 2011; Thaxter et al., 2012

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target.</p> <p>Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan.</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England.</p>	Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance in close proximity to nesting and/or feeding birds should not reach levels that substantially affect the feature.	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Restore the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)	<p>To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection.</p> <p>Area of the supporting habitat is currently understood to be:  432.25 ha Annual vegetation of drift lines,  Unknown ha Atlantic salt meadows,  1.31 ha Coastal lagoons,  149.36 ha Freshwater and coastal grazing marsh,  3.31 ha Intertidal biogenic reef: mussel beds,  7.70 ha Intertidal mixed sediments,  799.28 ha Intertidal mud,  5.08 ha Intertidal sand and muddy sand,  Unknown ha Salicornia and other annuals colonising mud and sand,  Unknown ha Spartina swards.</p>	Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: vegetation characteristics	Maintain the extent and distribution of predominantly medium to tall [i.e. 20-60 cm] grassland swards.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	Hosey and Goodridge, 1980; Calladine, 1997; Snow and Perrins, 1998

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Breeding (summer) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water</p> <p>Current EA chemical quality; does not require assessment.</p> <p>Current EQ ecological quality: moderate potential</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO data (WFD High/Good boundary)</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Lesser black-backed gull	Non-breeding (winter and/or passage) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Little tern	Breeding (summer) season	Breeding population: abundance	Restore the presence of the breeding feature whilst avoiding deterioration from its current level of abundance as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve.</p> <p>Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account.</p> <p>In 2013 a maximum of 4 pairs attempted to breed at the site.</p>	Little Tern Group, 2013; Cook and Robinson, 2010

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Breeding population: productivity and survival	Restore the abundance and structure of the assemblage at or above its current or target level (whichever is the higher) through restoring breeding productivity and adult survival.	This target is provided to reflect the required abundance and long-term viability of the population. Changes in the availability of adult birds of breeding age to reproduce, and the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Overall breeding success of the SPA population may also be substantially influenced by any changes in the level of predation of eggs and chicks by generalist native species and/or introduced non-native species.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Supporting habitat: air quality	<p>Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical Loads: Nitrogen critical load is 8-15 kg N ha<sup>-1</sup> yr<sup>-1</sup> for coastal stable dune grassland</p> <p>Acidity critical loads are: MinCLminN: 0.223 MaxCLminN: 0.438 MinCLMaxS: 0.480 MaxCLMaxS: 4.140 MinCLMaxN: 0.730 MaxCLMaxN: 4.578</p> <p>For acid grassland and: MinCLminN: 0.856 MaxCLminN: 1.710 MinCLMaxS: 4.000 MaxCLMaxS: 4.000</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>Habitat not classed as sensitive to acidity (Supralittoral sediment, acidic and calcareous type). No critical levels have been assigned for SO<sub>2</sub>.</p> <p>Current loads:</p>	<p>The UK Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>MinCLMaxN: 4.856 MaxCLMaxN: 5.710 For Calcareous grassland (using base cation).</p> <p>Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m-3) in littoral sediment, Supralittoral sediment (calcareous and acidic type) set for Higher Plants.</p> <p>NOx critical load is 30 µg NOx/m<sup>3</sup> annual mean, 75µg NOx/m<sup>3</sup> 24-hour mean for littoral sediment, set for all vegetation.</p>	<p>Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p> <p>Acid Deposition Nitrogen   Sulphur keq/ha/yr Maximum: 1.3   0.21 Minimum: 0.87   0.19 Average: 1.09   0.2</p> <p>Ammonia Concentration µg/m<sup>3</sup> Maximum: 1.55 Minimum: 0.48 Average: 1.05</p> <p>NOx Concentration µg/m<sup>3</sup> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	
Little tern	Breeding (summer) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas, generally within 6 km of breeding colonies.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	del Hoyo et al., 1996; Perrow et al., 2006; Thaxter et al., 2012

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including shooting) requires partnership agreement through a management plan</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England.</p>	Joint Nature Conservation Committee (JNCC), 2011; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting nesting and/or feeding birds should not reach levels that substantially affect the feature.	<p>The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.</p> <p>In Suffolk, identified sources of disturbance include, walkers, dogs, beach-fishing, motorbikes, four-wheel drive vehicles, quad bikes or helicopters. Where human disturbance becomes too great, the colony is abandoned.</p>	Suffolk Biodiversity Partnership, 2006

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)	<p>To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection.</p> <p>Area of the supporting habitat is currently understood to be: 432.25 ha Annual vegetation of drift lines, 1.31 ha Coastal lagoons.</p>	Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014
Little tern	Breeding (summer) season	Supporting habitat: landform	Maintain the availability of shallow sloping nesting sites, grading to [ $<30$ cm] above water level, or the probability that they will	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting/rearing, feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature.	del Hoyo et al., 1996

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Little tern	Breeding (summer) season	Supporting habitat: vegetation characteristics	Maintain vegetation cover (generally <15%) throughout areas used for nesting, providing sufficient bare ground for the colony as a	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	Richards, 1990; Burgess and Hirons, 1992; del Hoyo et al., 1996
Little tern	Breeding (summer) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water. Current EA chemical quality; does not require assessment. Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			5th percentile of DO data (WFD High/Good boundary)		
Little tern	Year-round	Supporting habitat: food availability within supporting habitat	Maintain the availability of key prey species (e.g. crustacea, annelids, sandeel, herring, clupeidae) at preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	del Hoyo et al., 1996; Perrow et al., 2006

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Breeding (summer) season	Breeding population: abundance	Maintain the presence of the breeding feature whilst avoiding deterioration from its current level of abundance as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve</p> <p>Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data.</p> <p>Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account.</p>	
Marsh harrier	Breeding (summer) season	Breeding population: productivity and survival	Maintain the abundance and structure of the assemblage at or above its current or target level (whichever is the higher) through maintaining breeding productivity and adult survival.	<p>This target is provided to reflect the required abundance and long-term viability of the population. Changes in the availability of adult birds of breeding age to reproduce, and the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Overall breeding success of the SPA population may also be substantially influenced by any changes in the level of predation of eggs and chicks by generalist native species and/or introduced non-native species.</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Breeding (summer) season	Supporting habitat: air quality	<p>Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical levels: Nitrogen depositions critical load is 15-30 kg N ha<sup>-1</sup> yr<sup>-1</sup> for rich fens.</p> <p>Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) set for fen, marsh and swamp.</p> <p>NO<sub>x</sub> critical load is 30 µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for Fen, marsh and swamp, set for All vegetation.</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition.</p> <p>It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No critical levels have been assigned for SO<sub>2</sub>. Habitat not classed as sensitive to acidity (Fen, marsh and swamp).</p>	<p>The UK Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				<p>Current load:</p> <p>Current loads for Max/Min/Av are 18.2/12.2/15.2 kg N/ha/yr</p> <p>Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p> <p>Acid Deposition Nitrogen   Sulphur keq/ha/yr Maximum: 1.3   0.21 Minimum: 0.87   0.19 Average: 1.09   0.2</p> <p>Ammonia Concentration µg/m3 Maximum: 1.55 Minimum: 0.48 Average: 1.05</p> <p>NOx Concentration µg/m3 Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Breeding (summer) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target.</p> <p>Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England</p>	<p>Joint Nature Conservation Committee (JNCC), 2011; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c</p> <p>Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
					Agency, 2014

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Breeding (summer) season	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)	<p>To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection.</p> <p>Area of the supporting habitat is currently understood to be:  432.25 ha Annual vegetation of drift lines,  Unknown ha Atlantic salt meadows,  1.31ha Coastal lagoons,  1.68 ha Coastal reedbeds,  149.36 ha Freshwater and coastal grazing marsh,  Unknown ha Salicornia and other annuals colonising mud and sand,  Unknown ha Spartina swards.</p>	
Marsh harrier	Breeding (summer) season	Supporting habitat: vegetation characteristics	Maintain a management regime that ensures the constant availability of areas of dense reed stands as nesting cover.	<p>The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.</p>	Cramp and Simmons, 1980

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Breeding (summer) season	Supporting habitat: water depth	Maintain the availability of water over the entire reedbed area, with a high proportion of the area with a water depth of 0.1 m to 0.3 m.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators.	Newbold, 1997
Marsh harrier	Breeding (summer) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water</p> <p>Current EA chemical quality; does not require assessment. Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			data (WFD High/Good boundary).		
Marsh harrier	Year-round	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting nesting, feeding and/or communal roosting birds should not reach levels that substantially affect the feature.	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Marsh harrier	Year-round	Supporting habitat: food availability within supporting habitat	Maintain the distribution, abundance and availability of key prey items (e.g. mammals, birds) of preferred prey sizes (e.g. voles, mice, rabbit; birds of pipit to duck size).	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	Cramp and Simmons, 1980; Sills, 1984; Underhill-Day, 1985
Marsh harrier	Year-round	Supporting habitat: landscape	Maintain continuous reed cover over large areas avoiding fragmentation of extensive reedbeds.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat.	English Nature, 1994

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Non-breeding population: abundance	Maintain the size of the population at a level which is above 1,662 individuals (5 year winter peak mean 1989/90-1993/94) or its current level where this is higher, as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account.</p> <p>Since classification, the wintering population of the SPA has fluctuated widely in response to weather severity. The SPA population 5 year peak mean (2008/09 to 2012/13) is 1,921, similar to that when the SPA was classified.</p>	Natural England, 2014a; Joint Nature Conservation Committee (JNCC), 2011; Austin et al., 2014

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Non-breeding population: condition and survival	Maintain overall adult survival and body condition at a level which is consistent with maintaining the abundance and structure of the population at or above its current or target level, whichever is the higher.	This target is provided to reflect the required abundance and long-term viability of the population. Poor winter body condition may negatively affect a bird's ability to move, forage, and survive whilst present on the SPA, and subsequently affect its ability to migrate and reproduce whilst in its summer breeding grounds.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: air quality	<p>Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical loads: Nitrogen depositions critical load is 20 – 30 kg N ha<sup>-1</sup> yr<sup>-1</sup> for Pioneer, low-mid, mid-upper saltmarshes.</p> <p>Acidity critical load is: MinCLminN: 0.223 MaxCLminN: 0.438 MinCLMaxS: 0.480 MaxCLMaxS: 4.140 MinCLMaxN: 0.730 MaxCLMaxN: 4.578</p> <p>For Acid grassland and: MinCLminN: 0.856 MaxCLminN: 1.710</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition.</p> <p>It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No expected negative impact on species due to impacts on the species' broad habitat. No critical levels have been assigned for SO<sub>2</sub>.</p>	<p>The UK Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>MinCLMaxS: 4.000 MaxCLMaxS: 4.000 MinCLMaxN: 4.856 MaxCLMaxN: 5.710</p> <p>For calcareous grassland (using base cation). Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) in littoral sediment, set for higher plants.</p> <p>NO<sub>x</sub> critical load is 30 µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for littoral sediment, set for All vegetation.</p>	<p>Current loads: Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p> <p>Acid Deposition Nitrogen   Sulphur keq/ha/yr Maximum: 1.3   0.21 Minimum: 0.87   0.19 Average: 1.09   0.2</p> <p>Ammonia Concentration µg/m<sup>3</sup> Maximum: 1.55 Minimum: 0.48 Average: 1.05</p> <p>NO<sub>x</sub> Concentration µg/m<sup>3</sup> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>SO<sub>2</sub> Concentration µg/m<sup>3</sup> Maximum: 1.94 Minimum: 1.29 Average: 1.41</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan.</p> <p>Wildfowling is controlled by a management plan and NE consent.</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England</p>	National Trust and Royal Society for the Protection of Birds (RSPB), 2014; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting foraging and/or roosting birds should not reach levels that substantially affect the feature.	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.	Burton et al., 2002; Kirby et al., 2004
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: extent and distribution of supporting non-breeding habitat	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/ wintering period (moulting, roosting, loafing, feeding).	This target may apply to supporting habitat which also lies outside the site boundary.  Area of the supporting habitat is currently understood to be: 432.25 ha Annual vegetation of drift lines, Unknown ha Atlantic salt meadow, 1.31 ha Coastal lagoons, 149.36 ha Freshwater and Coastal Grazing Marsh, 3.31 ha Intertidal biogenic reed: mussel beds, 7.70 ha Intertidal mixed sediments, 799.28 ha Intertidal mud, 5.08 ha Intertidal sand and muddy sand, Unknown ha Salicornia and other annuals colonising mud and sand.	Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England,

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
					2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: hydrology/f low	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute.	Ravenscroft and Beardall, 2003

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: landform	Maintain a high density of channel networks within intertidal feeding areas.	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting/rearing, feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature.	Lourenço et al., 2005
Redshank	Non-breeding (winter and/or passage) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water</p> <p>Current EA chemical quality; does not require assessment. Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			data (WFD High/Good boundary)		
Redshank	Year-round	Supporting habitat: food availability within supporting habitat	Maintain availability of key prey species (e.g. earthworm, leatherjacket, grassland/marsh invertebrates) of preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	Cramp and Simmons, 1983; del Hoyo et al., 1996

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Year-round	Supporting habitat: food availability within supporting habitat	Maintain the availability of key prey species (e.g. Hydrobia, Macoma, Corophium, Neires) of preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	Goss-Custard et al., 1977; del Hoyo et al., 1996
Redshank	Year-round	Supporting habitat: hydrology/low	Maintain water availability within feeding areas to maintain moderately high water tables that provide shallow surface water.	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute.	Royal Society for the Protection of Birds (RSPB), 1997;93 Sutherland and Hill, 1995; Ausden et al., 2003; Smart et al., 2006
Redshank	Year-round	Supporting habitat: landscape	Maintain open and unobstructed terrain around nesting, roosting and feeding sites.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Redshank	Year-round	Supporting habitat: vegetation characteristics	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	
Redshank	Year-round	Supporting habitat: water depth	Maintain the availability of standing water of 1-5 cm deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important in deterring predators. This feature needs shallow water pools for its breeding habitat and may also prefer to feed in grasslands in the winter which are partly flooded.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Non-breeding population: abundance	Maintain the presence of the non-breeding feature whilst avoiding deterioration from its current level of abundance as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve (subject to natural changes). Therefore, where at any time the population size is greater than the minimum target-value given, any measures and/or impact-assessments should take account of this higher level. Unless otherwise stated the population size will be that measured using standard methods such as peak mean counts or breeding bird surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are correct.</p> <p>At classification in 1996, the non-breeding population of ruff in the SPA was just three individuals (5 year mean 1991/92 to 1995/06), which at the time represented 0.4% of the GB non-breeding population. The 5 year peak mean (2008/09 to 2012/13) figure is five individuals.</p>	Natural England, 2014a; Joint Nature Conservation Committee (JNCC), 2011; Austin et al., 2014

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Non-breeding population: condition and survival	Maintain overall adult survival and body condition at a level which is consistent with maintaining the abundance and structure of the population at or above its current or target level, whichever is the higher.	This target is provided to reflect the required abundance and long-term viability of the population. Poor winter body condition may negatively affect a bird's ability to move, forage, and survive whilst present on the SPA, and subsequently affect its ability to migrate and reproduce whilst in its summer breeding grounds.	Austin et al., 2014

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: air quality	<p>Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical loads: Nitrogen depositions critical load is 20 – 30 kg N ha<sup>-1</sup> yr<sup>-1</sup> for Pioneer, low-mid, mid-upper saltmarshes.</p> <p>Acidity critical load is: MinCLminN: 0.223 MaxCLminN: 0.438 MinCLMaxS: 0.480 MaxCLMaxS: 4.140 MinCLMaxN: 0.730 MaxCLMaxN: 4.578</p> <p>For Acid grassland and: MinCLminN: 0.856</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition.</p> <p>It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No expected negative impact on the species due to impacts on the species' broad habitat from Nitrogen, acidity, Ammonia or NO<sub>x</sub>. Littoral sediment is not</p>	<p>The UK Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>MaxCLminN: 1.710 MinCLMaxS: 4.000 MaxCLMaxS: 4.000 MinCLMaxN: 4.856 MaxCLMaxN: 5.710 For calcareous grassland (using base cation).</p> <p>Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) in littoral sediment, set for higher plants.</p> <p>NO<sub>x</sub> critical load is 30 µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for littoral sediment, set for all vegetation.</p>	<p>sensitive to acidity. No critical levels have been assigned for SO<sub>2</sub>.</p> <p>Current loads:</p> <p>Nitrogen Deposition kg N/ha/yr Maximum: 18.2 Minimum: 12.18 Average: 15.21</p> <p>Acid Deposition Nitrogen   Sulphur keq/ha/yr Maximum: 1.3   0.21 Minimum: 0.87   0.19 Average: 1.09   0.2</p> <p>Ammonia Concentration µg/m<sup>3</sup> Maximum: 1.55 Minimum: 0.48 Average: 1.05 NO<sub>x</sub> Concentration µg/m<sup>3</sup> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>SO<sub>2</sub> Concentration µg/m<sup>3</sup> Maximum: 1.94 Minimum: 1.29 Average: 1.41</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider. Effective predator control (including by shooting) requires partnership agreement through a management plan.</p> <p>Wildfowling is controlled by a management plan and NE consent.</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England</p>	Joint Nature Conservation Committee (JNCC), 2011; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting foraging and/or roosting birds should not reach levels that substantially affect the feature.	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: extent and distribution of supporting non-breeding habitat	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding).	<p>This target may apply to supporting habitat which also lies outside the site boundary.</p> <p>Area of the supporting habitat is currently understood to be:  432.25 ha Annual vegetation of drift lines,  Unknown ha Atlantic salt meadows,  1.31 ha Coastal lagoons,  149.36 ha Freshwater and coastal grazing marsh,  3.31 ha Intertidal mixed sediments,  799.28 ha Intertidal mud,  5.08 ha Intertidal sand and muddy sand,  Unknown ha Salicornia and other annual colonising mud and sand,  Unknown ha Spartina swards.</p>	Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: food availability within supporting habitat	Maintain the availability of key prey species (e.g. Caddis flies, crustaceans, molluscs and worms) of preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	del Hoyo et al., 1992

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Non-breeding (winter and/or passage) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water. Current EA chemical quality; does not require assessment.</p> <p>Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO data (WFD High/Good boundary)</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; Natural England, 1996; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Year-round	Supporting habitat: food availability within supporting habitat	Maintain availability of key prey species (e.g. dipteran flies, beetles, earthworms) at preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	Cramp and Simmons, 1983; del Hoyo et al., 1996
Ruff	Year-round	Supporting habitat: landscape	Maintain open and unobstructed terrain around nesting, roosting and feeding sites.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat.	
Ruff	Year-round	Supporting habitat: vegetation characteristics	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	<p>The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.</p> <p>Grazing management is implemented by the National Trust on Orford Ness with the aim to attract breeding and overwintering waders.</p>	National Trust and Royal Society for the Protection of Birds (RSPB), 2015

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Ruff	Year-round	Supporting habitat: water depth	Maintain the availability of water at optimal depths, typically 1-3 cm deep, over at least 50% of the total water area (non-tidal).	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators.	Stroud et al., 1990; van Rhijn, 1991
Sandwich tern	Breeding (summer) season	Breeding population: abundance	Restore the presence of the breeding feature whilst avoiding deterioration from its current level of abundance as indicated by the latest mean peak count or equivalent.	<p>This target is required in order to sustain the population and contribute to a viable local national and bio-geographic species population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation/restoration measures to achieve.</p> <p>Given the natural fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum or current levels, maintaining the ability of the site to support the feature in such higher numbers in future should also be taken into account..</p> <p>However, the SPA's colony on Havergate Island disappeared in 1997 and since has only nested in some years with a maximum of 15 pairs in 2003.</p>	Joint Nature Conservation Committee (JNCC), 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Breeding population: productivity and survival	Restore the abundance and structure of the assemblage at or above its current or target level (whichever is the higher) through restoring breeding productivity and adult survival.	This target is provided to reflect the required abundance and long-term viability of the population. Changes in the availability of adult birds of breeding age to reproduce, and the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Overall breeding success of the SPA population may also be substantially influenced by any changes in the level of predation of eggs and chicks by generalist native species and/or introduced non-native species.	Joint Nature Conservation Committee (JNCC), 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Supporting habitat: air quality	<p>Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>).</p> <p>Critical Loads: Nitrogen depositions critical load is 8 – 10 kg N ha<sup>-1</sup> yr<sup>-1</sup> for Coastal stable dune grasslands, acid type; 10-15 kg N ha<sup>-1</sup> yr<sup>-1</sup> for the calcareous type, and 10-20 kg N ha<sup>-1</sup> yr<sup>-1</sup> for Shifting coastal dunes.</p> <p>Acidity critical load is MinCLminN: 0.223 MaxCLminN: 0.438 MinCLMaxS: 0.480 MaxCLMaxS: 4.140 MinCLMaxN: 0.730 MaxCLMaxN: 4.578</p>	<p>This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats.</p> <p>Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), and critical loads for nutrient nitrogen deposition and acid deposition.</p> <p>It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.</p> <p>No expected negative impact on the species due to impacts on the species' broad habitat from acidity. No critical levels have been assigned for SO<sub>2</sub>.</p>	<p>The UK Air Pollution Information System (<a href="http://www.apis.ac.uk">www.apis.ac.uk</a>) provides a comprehensive source of information on air pollution and its effects on habitats and species. APIS has been developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology.</p>

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
			<p>For acid grassland; and  MinCLminN: 0.856  MaxCLminN: 1.710  MinCLMaxS: 4.000  MaxCLMaxS: 4.000  MinCLMaxN: 4.856  MaxCLMaxN: 5.710</p> <p>For Calcareous grassland (using base cation)  Ammonia critical load is 3µg NH<sub>3</sub>/m<sup>3</sup> (annual mean) (2-4 µg NH<sub>3</sub> m<sup>-3</sup>) in supralittoral sediment set for Higher Plants.</p> <p>NO<sub>x</sub> critical load is 30µg NO<sub>x</sub>/m<sup>3</sup> annual mean, 75µg NO<sub>x</sub>/m<sup>3</sup> 24-hour mean for littoral sediment, set for all vegetation.</p>	<p>Current loads:  Nitrogen Deposition kg N/ha/yr Maximum: 18.2  Minimum: 12.18 Average: 15.21</p> <p>Ammonia Concentration µg/m<sup>3</sup> Maximum: 1.55  Minimum: 0.48 Average: 1.05</p> <p>NO<sub>x</sub> Concentration µg/m<sup>3</sup> Maximum: 9.73 Minimum: 10.38 Average: 9.62</p> <p>Current levels are based on measured-interpolated data for a 3 year average 2009-2011 with targets only provided for species where they have been provided by APIS.</p>	

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Supporting habitat: connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas, generally within 49 km of breeding colonies.	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	Thaxter et al., 2012
Sandwich tern	Breeding (summer) season	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	<p>This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target.</p> <p>Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.</p> <p>Threats to supporting habitats posed by sea level rise and coastal squeeze are being addressed through the EA Local Environment Action Plan and the Estuary Management Plan. 'Managed realignment' is a potential option to consider.</p> <p>Effective predator control (including by shooting) requires partnership agreement through a</p>	Joint Nature Conservation Committee (JNCC), 2011; Alde and Ore Estuary Partnership, 2014; Natural England, 2014c

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
				<p>management plan.</p> <p>A considerable part of the site is sympathetically managed by the Suffolk Wildlife Trust, National Trust, RSPB and Natural England.</p>	
Sandwich tern	Breeding (summer) season	Supporting habitat: disturbance caused by human activity	The frequency, duration and/or intensity of disturbance affecting nesting and/or feeding birds should not reach levels that substantially affect the feature.	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.	Bourne and Smith, 1974; Garthe and Hüppop, 2004

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)	<p>To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection.</p> <p>Area of the supporting habitat is currently understood to be: 432.25 ha Annual vegetation of drift lines, Unknown ha Atlantic salt meadows, 1.31 ha Coastal lagoons.</p>	Dargie, 1993, Natural England, 2010b; Gilbert et al., 1996, Downie, 1996, Natural England, 2013, Sneddon and Randall, 1993, Natural England, 2007, Ordnance Survey, 2009, Ordnance Survey, 2005, Dyer et al., 1991, Marine Nature Conservation Review, 1992, Natural England, 2010a, English Nature, 2003, Hill et al., 1996 Brown et al., 2013, Environment Agency, 2014
Sandwich tern	Breeding (summer) season	Supporting habitat: landform	Maintain the availability of shallow sloping nesting sites, grading to [ $<30$ cm] above water level, or the probability that they will not	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting/rearing, feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature.	Snow and Perrins, 1998; del Hoyo et al., 1996

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Supporting habitat: vegetation characteristics	Maintain vegetation cover which should be <10% throughout areas used for nesting, providing sufficient bare ground for the colony as a	<p>The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.</p> <p>Condition assessment shows an intact vegetation structure. Where a SSSI unit has been classed as unfavourable, this is mainly due to disturbance.</p>	Natural England, 2015; Burgess and Hirons, 1992; del Hoyo et al., 1996

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Breeding (summer) season	Supporting habitat: water quality/quantity	<p>Restore water quality and quantity to a standard which provides the necessary conditions to support the SPA feature, where the supporting habitats of the feature are dependent on surface water.</p> <p>Current EA chemical quality; does not require assessment.</p> <p>Current EQ ecological quality: moderate potential.</p> <p>Maintain Dissolved Oxygen (DO) at <math>\geq 5.7\text{mg l}^{-1}</math> standardised to a salinity of 35 using 5th percentile of DO data (WFD High/Good boundary)</p>	<p>For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.</p> <p>Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.</p>	Environment Agency Marine Monitoring Service, 2014; European Commission (EC), 2011

Feature	Season	Attribute	Target	Supporting and/or explanatory notes	References
Sandwich tern	Year-round	Supporting habitat: food availability within supporting habitat	Maintain the availability of key prey species (e.g. sandeel, sprat) at preferred prey sizes.	This target is included because the availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	Cramp et al., 1974; del Hoyo et al., 1996

### Alternative feature / subfeature / supporting habitat names found on MAGIC site maps

Definitions for the alternative feature names shown on MAGIC site maps, are available within the [UK Biodiversity Action Plan priority habitat descriptions](#).

Supporting habitat / feature name used throughout the conservation advice package (annex 1 feature code)	Alternative feature name as shown on MAGIC site maps
Freshwater and coastal grazing marsh	Coastal and floodplain grazing marsh
Annual vegetation of drift lines (H210)	Coastal vegetated shingle
Perennial vegetation of stony banks (H1220)	Coastal vegetated shingle
Vegetated sea cliffs of the Atlantic and Baltic coasts (H1230)	Maritime cliffs and slope
Coastal reedbeds	Reedbeds
Coastal lagoons (H1150)	Saline lagoons
Atlantic decalcified fixed dunes ( <i>Calluno-ulicetea</i> ) (H2150)	Coastal sand dunes
Dunes with <i>Hippophae rhamnoides</i> (H2060)	Coastal sand dunes
Dunes with <i>Salix repens</i> ssp. <i>argentea</i> ( <i>Salicion arenariae</i> ) (H2170)	Coastal sand dunes
Embryonic shifting dunes (H2110)	Coastal sand dunes
Fixed dunes with herbaceous vegetation (grey dunes) (H2130)	Coastal sand dunes
Humid dune slacks (H2190)	Coastal sand dunes

Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (H2120)	Coastal sand dunes
Atlantic salt meadows ( <i>Glauco-puccinellietalia maritimae</i> ) (H1330)	Saltmarsh
Mediterranean and thermo-Atlantic halophilous scrubs ( <i>Sarcocornetea fruticosi</i> ) (H1420)	Saltmarsh
<i>Salicornia</i> and other annuals colonising mud and sand (H1310)	Saltmarsh
<i>Spartina</i> swards ( <i>Spartinion maritimae</i> ) (H1320)	Saltmarsh
Lower saltmarsh	Saltmarsh
Lower-mid saltmarsh	Saltmarsh
Mid-upper saltmarsh	Saltmarsh
Pioneer saltmarsh	Saltmarsh
Transition and driftline saltmarsh	Saltmarsh
Upper saltmarsh	Saltmarsh

The following conservation advice features / subfeatures/ supporting habitats are currently not available through MAGIC because the definition is still being confirmed.

- Intertidal stony reef
- Subtidal stony reef
- Water column
- Seabird assemblage (AS\_1\_b)
- Waterbird assemblage (AS\_2\_nb)
- All non-habitat species

## References

- ALDE AND ORE ESTUARY PARTNERSHIP (2014) Draft Estuary Plan. Alde and Ore Estuary Partnership.
- AUSDEN, M., ROWLANDS, A., SUTHERLAND, W. J. & JAMES, R. (2003) Diet of breeding Lapwing *Vanellus vanellus* and Redshank *Tringa totanus* on coastal grazing marsh and implications for habitat management: Capsule Management of coastal grazing marshes for these breeding wading birds should prescribe maintaining shallow pools in May and June instead of until the end of April as currently set out in most coastal grazing marsh ESA agri-environment schemes. *Bird Study*, 50, 285-293.
- AUSTIN, G. E., CALBRADE, N. A., MELLAN, H. J., MUSGROVE, A. J., HEARN, R. D., STROUD, D. A., WOTTON, S. R. & HOLT, C. A. (2014) Waterbirds in the UK 2012/13: The Wetland Bird Survey. Thetford, BTO/RSPB/JNCC.
- BANKS, A. N. & AUSTIN, G. E. (2004) Statistical comparisons of waterbird site trends with regional and national trends for incorporation within the WeBS Alerts system., British Trust for Ornithology (BTO).
- BIRDLIFE INTERNATIONAL (2013) Species factsheet: *Philomachus pugnax*.
- BIRDLIFE INTERNATIONAL (2014) Species factsheet: *Recurvirostra avosetta*.
- BOURNE, W. R. P. & SMITH, A. J. M. (1974) Threats to Scottish sandwich terns. *Biological Conservation*, 6, 222-224.
- BRITISH TRUST FOR ORNITHOLOGY (BTO) (2011) WeBS data for sector 12(33926) of Butley Creek 2011. British Trust for Ornithology (BTO),.
- BRITISH TRUST FOR ORNITHOLOGY (BTO) (2014) The Wetland Bird Survey.
- BRITISH TRUST FOR ORNITHOLOGY (BTO) (2015) Tracking lesser black-backed gulls.
- BROWN, A. & GRICE, P. (2005) *Birds in England*, London, T & A D Poyser.
- BROWN, C., HULL, S., FROST, N. & MILLER, F. (2013) In-depth review of evidence supporting the recommended Marine Conservation Zones - MB0116. ABP Marine Environmental Research Ltd; Marine Planning Consultants; Marine Biological Association of the United Kingdom.
- BURGESS, N. D. & HIRONS, G. J. M. (1992) Creation and management of artificial nesting sites for wetland birds. *Journal of Environmental Management*, 34, 285-295.
- BURTON, N. H. K., ARMITAGE, M. J. S., MUSGROVE, A. J. & REHFISCH, M. M. (2002) Impacts of Man-Made Landscape Features on Numbers of Estuarine Waterbirds at Low Tide. *Environmental Management*, 30, 0857-0864.
- CADBURY, C. J., HILL, D., PARTRIDGE, J. & SORENSON, J. (1989) The history of the avocet (*Recurvirostra avosetta*) population and it's management in England since recolonisation. *RSPB Conservation Review*, 3, 9-13.
- CADBURY, C. J. & RICHARDS, P. A. (1978) *The breeding and feeding ecology of the Avocet Recurvirostra avosetta in Suffolk, England.*, Sandy, UK., RSPB.
- CALLADINE, J. (1997) A comparison of Herring Gull *Larus argentatus* and Lesser Black-backed Gull *Larus fuscus* nest sites: their characteristics and relationships with breeding success. *Bird Study*, 44, 318-326.
- COOK, A. S. C. P. & ROBINSON, R. A. (2010) How representative is the current monitoring of breeding success in the UK? Thetford, British Trust for Ornithology.
- CRAMP, S., BOURNE, W. R. P. & SAUNDERS, D. (1974) *The Seabirds of Britain and Ireland.*, London, Collins.
- CRAMP, S. & SIMMONS, K. E. L. (Eds.) (1980) *Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Volume 2, Hawks to Bustards.*, Oxford, UK., Oxford University Press.
- CRAMP, S. & SIMMONS, K. E. L. (Eds.) (1983) *Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Volume 3: Waders to Gulls*, Oxford, Oxford University Press.
- CRAWSHAW, D. (2012) Orfordness NNR Bird Report. Natural England.

- DARGIE, T. C. (1993) The distribution of lowland wet grassland in England. *English Nature Research Reports*. Peterborough, English Nature.
- DEL HOYO, J., ELLIOT, A. & SARGATAL, J. (1992) *Handbook of the Birds of the World, vol 1: Ostrich to Ducks.*, Barcelona, Lynx Edicions.
- DEL HOYO, J., ELLIOT, A. & SARGATAL, J. (1994) *Handbook of the birds of the world, Vol. 2. New World vultures to guineafowl.*, Barcelona, Spain., Ediciones Lynx.
- DEL HOYO, J., ELLIOT, A. & SARGATAL, J. (1996) *Handbook of the Birds of the World, vol 3: Hoatzin to Auks.*, Barcelona, Lynx Edicions.
- DOWNIE, A. J. (1996) Saline lagoons and lagoon-like ponds in England. *English Nature Science Series*. English Nature.
- DYER, M., GRIST, N. & SMITH, I. (1991) Essex/Suffolk estuaries intertidal surveys 1990. Unicomarine Ltd. Report to National Rivers Authority, Anglian Region.
- ENGLISH NATURE (1994) Species action plans for birds. Marsh harrier.
- ENGLISH NATURE (2003) Intertidal mudflats layer for England. English Nature.
- ENVIRONMENT AGENCY (2014) The extent of saltmarsh in England and Wales.
- ENVIRONMENT AGENCY MARINE MONITORING SERVICE (2014) TraC Winter Dissolved Inorganic Nitrogen tool-level classifications (at water body level, aggregated to MPA). Peterborough, Environment Agency.
- EUROPEAN COMMISSION (EC) (2011) Links between the Water Framework Directive (WFD 2000/60/EC) and Natura Directives (Birds Directive 2009/147/EC) and Habitats Directive 92/43/EEC). European Commission.
- EUROPEAN SCIENCE FOUNDATION (2009) Raptors – a field guide for surveys and monitoring - Marsh Harrier.
- EUROPEAN SCIENCE FOUNDATION (2013) Marsh Harrier - *Circus aeruginosus*.
- FORRESTER, R. & ANDREWS, I. (Eds.) (2007) *The Birds of Scotland*, Scottish Ornithologists' Club.
- GARTHE, S. & HÜPPOP, O. (2004) Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. *Journal of Applied Ecology*, 41, 724-734.
- GILBERT, G., PAINTER, M. & SMITH, K. W. (1996) An inventory of British reedbeds in 1993. *RSPB Conservation Review*, 10, 39-45.
- GOSS-CUSTARD, J. D., KAY, D. G. & BLINDELL, R. M. (1977) The density of migratory and overwintering redshank, *Tringa totanus* (L.) and curlew, *Numenius arquata* (L.), in relation to the density of their prey in south-east England. *Estuarine and Coastal Marine Science*, 5, 497-510.
- GOUTNER, V. (1986) The nesting habitats of avocets in the Evros Delta, Greece. *Wader Study Group Bulletin*, 48, 12-13.
- HILL, D. (1988) Population dynamics of the avocet (*Recurvirostra avosetta*) breeding in Britain. *Journal of Animal Ecology*, 57, 669-683.
- HILL, D., JONGS, S., CADBURY, J. & PARTRIDGE, J. (1989) *Hydrological management and lagoon creation for avocets at Havergate.*, Sandy, UK., RSPB.
- HILL, T., EMBLOW, C. S. & NORTHERN, K. O. (1996) Marine Nature Conservation Review Sector 6. Inlets in Eastern England: Area Summaries. JNCC.
- HOLM, T. E. & LAURSEN, K. (2009) Experimental disturbance by walkers affects behaviour and territory density of nesting Black-tailed Godwit *Limosa limosa*. *Ibis*, 151, 77-87.
- HOSEY, G. R. & GOODRIDGE, F. (1980) Establishment of territories in two species of gull on Walney Island, Cumbria. *Bird Study*, 27, 73-80.
- JOINT NATURE CONSERVATION COMMITTEE (JNCC) (2011) Alde, Ore and Butley Estuaries Natura 2000 Standard Data Form.
- JOINT NATURE CONSERVATION COMMITTEE (JNCC) (2012a) Seabird Monitoring Program - Alde Ore lesser black-backed gull figures to 2012. JNCC.
- JOINT NATURE CONSERVATION COMMITTEE (JNCC) (2012b) Seabird Population Trends and Causes of Change.
- JOINT NATURE CONSERVATION COMMITTEE (JNCC) (2014) JNCC Seabird Monitoring Programme.

- KIRBY, J., DAVIDSON, N., GILES, N., OWEN, M. & SPRAY, C. (2004) *Waterbirds & Wetland Recreation Handbook: A review of issues and management practice.*, Slimbridge, The Wildfowl & Wetlands Trust.
- KOBER, K., WEBB, A., WIN, I., O'BRIEN, S., WILSON, L. J. & REID, J. B. (2010) An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. Peterborough, Joint Nature Conservation Committee (JNCC).
- LITTLE TERN GROUP (2013) Annual Report. Little Tern Group.
- LOURENÇO, P. M., GRANADEIRO, J. P. & PALMEIRIM, J. M. (2005) Importance of drainage channels for waders foraging on tidal flats: relevance for the management of estuarine wetlands. *Journal of Applied Ecology*, 42, 477-486.
- MARINE NATURE CONSERVATION REVIEW (1992) Deben and Ore estuaries littoral survey. Joint Nature Conservation Committee.
- MOREIRA, F. (1995) The winter feeding ecology of Avocets *Recurvirostra avosetta* on intertidal areas. I. Feeding strategies. *Ibis*, 137, 92-98.
- NATIONAL TRUST & ROYAL SOCIETY FOR THE PROTECTION OF BIRDS (RSPB) (2014) Alde Ore Future For Wildlife - Orfordness and Havergate Island.
- NATIONAL TRUST & ROYAL SOCIETY FOR THE PROTECTION OF BIRDS (RSPB) (2015) Grazing marsh on Orford Ness.
- NATURAL ENGLAND (1996) EC Directive 791409 on the Conservation of Wild Birds: Special Protection Area - North Norfolk Coast.
- NATURAL ENGLAND (2007) Environmentally Sensitive Areas. Natural England.
- NATURAL ENGLAND (2010a) Futurecoast. Peterborough, Natural England.
- NATURAL ENGLAND (2010b) Natural England Site Information System (ENSIS) Marine SSSI data. Peterborough, Natural England.
- NATURAL ENGLAND (2013) Higher Level Stewardship: Environmental Stewardship Handbook, Fourth Edition – January 2013.
- NATURAL ENGLAND (2014a) Alde Ore Estuary SPA Citation.
- NATURAL ENGLAND (2014b) Planning for the Future Improvement Programme for England's Natura 2000 Sites (IPENS) Site Improvement Plan - Alde-Ore Estuaries. Natural England.
- NATURAL ENGLAND (2014c) Site improvement plan - Alde-Ore Estuaries. Natural England.
- NATURAL ENGLAND (2015) Condition of SSSI Units for Site: Alde-Ore Estuary.
- NEWBOLD, C. (1997) *Water level requirements of wetland plants and animals.*, Peterborough, English Nature.
- ORDNANCE SURVEY (2005) OS Profile Ordnance Survey.
- ORDNANCE SURVEY (2009) OS MasterMap Ordnance Survey.
- PENNINGTON, M., OSBORN, K., HARVEY, P., RIDDINGTON, R., OKILL, D., ELLIS, P. & HEUBECK, M. (2004) *The birds of Shetland.*, London, Christopher Helm.
- PERROW, M. R., SKEATE, E. R., LINES, P., BROWN, D. & TOMLINSON, M. L. (2006) Radio telemetry as a tool for impact assessment of wind farms: the case of Little Terns *Sterna albifrons* at Scroby Sands, Norfolk, UK. *Ibis*, 148, 57-75.
- RAVENSCROFT, N. O. M. & BEARDALL, C. H. (2003) The importance of freshwater flows over estuarine mudflats for wintering waders and wildfowl. *Biological Conservation*, 113, 89-97.
- REAY, P. J. (1991) Wintering avocets in Devon and Cornwall. *Devon Birds*, 44, 3-11.
- RICHARDS, A. (1990) *Seabirds of the northern hemisphere.*, Limsfield, U.K. , Dragon's World Ltd.
- ROYAL SOCIETY FOR THE PROTECTION OF BIRDS (RSPB) (1997) *The Wet Grassland Guide: Managing Floodplain and Coastal Wet Grasslands for Wildlife.*, Sandy, Royal Society for the Protection of Birds.
- ROYAL SOCIETY FOR THE PROTECTION OF BIRDS (RSPB) (2005) Avocet report. RSPB.
- SILLS, N. (1984) Marsh Harriers at Titchwell Marsh Reserve (1980-1983). Part 2: feeding ecology. *Norfolk & Norwich Naturalists Society Transactions*, 27, 84-95.

- SMART, J., GILL, J. A., SUTHERLAND, W. J. & WATKINSON, A. R. (2006) Grassland-breeding waders: identifying key habitat requirements for management. *Journal of Applied Ecology*, 43, 454-463.
- SNEDDON, P. & RANDALL, R. E. (1993) Coastal vegetated shingle structures of Great Britain: main report. . Peterborough, Joint Nature Conservation Committee (JNCC).
- SNOW, D. W. & PERRINS, C. M. (1998) *The Birds of the Western Palearctic. Concise Edition*, Oxford, Oxford University Press.
- STROUD, D. A., MUDGE, G. P. & PIENKOWSKI, M. W. (1990) *Protecting Internationally Important Bird Sites: A Review of the EEC Special Protection Area Network in Great Britain.*, Peterborough, Nature Conservancy Council.
- SUFFOLK BIODIVERSITY PARTNERSHIP (2006) Suffolk Local Biodiversity Action Plan - Little Tern. Suffolk Biodiversity Partnership.
- SUFFOLK ORNITHOLOGISTS' GROUP (1996) Suffolk Birds: Records of breeding Sandwich Tern. The Suffolk Naturalists Society.
- SUTHERLAND, W. J. & HILL, D. A. (1995) *Managing Habitats For Conservation.*, Cambridge, Cambridge University Press.
- THAXTER, C. B., LASCELLES, B., SUGAR, K., COOK, A. S. C. P., ROOS, S., BOLTON, M., LANGSTON, R. H. W. & BURTON, N. H. K. (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation*, 156, 53-61.
- THAXTER, C. B., ROSS-SMITH, V. H., CLARK, N. A., CONWAY, G. J., RECHFISCH, M. M., BOUTEN, W. & BURTON, N. H. K. (2011) Measuring the interaction between marine features of Special Protection Areas with offshore wind farm development zones through telemetry: First breeding season report., British Trust for Ornithology.
- UNDERHILL-DAY, J. C. (1985) The food of breeding Marsh Harriers *Circus aeruginosus* in East Anglia. *Bird Study*, 32, 199-206.
- VAN RHIJN, J. G. (1991) *The Ruff: Individuality in a Gregarious Wading Bird.*, London, T & A D Poyser.
- WARRINGTON, S., GUILLIAT, M., LOHOAR, G. & MASON, D. (2014) Effects of lagoon creation and water control changes on birds at a former airfield at Orford Ness, Suffolk, UK: Part 1 – breeding pied avocets, common redshank and northern lapwing. *Conservation Evidence*, 11, 53-56.
- WERNHAM, C. V., TOMS, M. P., MARCHANT, J. H., CLARK, J. A., SIRIWARDENA, G. M. & BAILLIE, S. R. (Eds.) (2002) *The Migration Atlas: Movements of the birds of Britain and Ireland*, London, T & A.D. Poyser.