Rampion OWF

ROUND 3 ZONE 6: Migratory Bird Report

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TABLE OF CONTENTS

1. INTRODUCTION

Natural Power Consultants (NPC) has been undertaking boat-based bird and marine mammal baseline surveys for the Rampion Offshore Wind Farm (ROWF) since March 2010. The purpose of this report is to review migratory species of bird which could potentially be affected by the development, in order to inform the requirements for the Environmental Impact Assessment (EIA) and Habitat Regulations Appraisal (HRA) processes.

2. SPECIES ACCOUNTS - MIGRANT BIRDS

The following migratory species accounts outline the population and conservation status of each of the species covered, the likelihood of their occurrence within the ROWF area, and the potential risks of the development posed to each of them. Only migratory species considered likely to pass through the development site reasonably frequently are considered fully in the species accounts. See Table 1 for a breakdown of which species were considered for fuller treatment and which ones were not. A table outlining the threats posed, along with the level of risk is given for each group. Raw data for each species on a monthly basis are also presented.

Table 1. Migrant birds predicted to be regularly on passage in the vicinity of the wind farm site.

Species group	**Larger movements**	**Smaller movements**
Swans, geese and ducks	Dark-bellied brent goose, teal, eider, common scoter, velvet scoter, red-breasted merganser	European white-fronted goose, wigeon, garganey, mallard, shoveler, tufted duck
Divers and grebes	Red-throated diver, great crested grebe	Black-throated diver, Slavonian grebe
Cormorants and herons		Grey heron, little egret
Raptors and owls		Honey buzzard, marsh harrier, sparrowhawk, osprey, kestrel, merlin, hobby, short-eared owl
Gamebirds and rails		Quail, corncrake, coot, water rail
Waders	Oystercatcher, ringed plover, grey plover, knot, sanderling, dunlin, bar-tailed godwit, curlew, redshank, turnstone	Avocet, stone-curlew, little ringed plover, dotterel, golden plover, lapwing, curlew sandpiper, ruff, snipe, black-tailed godwit, whimbrel, greenshank, common sandpiper, green sandpiper, grey phalarope, jack snipe, woodcock, wood sandpiper
Neopasserines	Swift	Woodpigeon, turtle dove, cuckoo, nightjar

Passerines	Skylark, sand martin, house martin, swallow, meadow pipit, white wagtail, robin, wheatear, song thrush, redwing, fieldfare, blackbird, sedge warbler, whitethroat, garden warbler, blackcap, willow warbler, chiffchaff, starling, chaffinch, siskin, linnet	Rock pipit, tree pipit, yellow wagtail, grey wagtail, wren, redstart, black redstart, nightingale, whinchat, mistle thrush, ring ouzel, grasshopper warbler, reed warbler, lesser whitethroat, wood warbler, goldcrest, firecrest, spotted flycatcher, pied flycatcher, brambling, greenfinch, goldfinch, lesser redpoll, reed bunting, carrion crow, jackdaw

2.1. Geese

The following species of geese and ducks are expected to pass through the ROWF area.

2.1.1. Brent goose

There are two distinct populations of brent geese that winter in the UK (plus another population from Arctic Canada that winters in Ireland) (Wernham *et al*., 2008). The 'pale-bellied' subspecies of brent goose breeds in Svalbard in Arctic Norway and winters on North Sea coasts: in the UK this is mainly in NE England. 'Dark-bellied' brent geese breed in the Russian Arctic and winter in NW Europe, including England, France and the low countries. It is this dark-bellied race that is found along the south and south-east coasts of England and which has been recorded during the ornithological surveys of this site.

Dark-bellied brent goose is a Species of European Conservation Concern and it is protected by the Wildlife & Countryside Act and the EC Birds Directive.

During October and November migrating dark-bellied brent geese move west from a stopover in the Wadden Sea area of Denmark, Germany and the Netherlands into England and northern France. Peak numbers are found in England over the mid-winter period. The birds begin to move back to the Wadden Sea stopover during late-February to April. Although brent geese do not winter on the East Sussex coast they do winter in large numbers further to the east (e.g. in Kent) and further to the west (e.g. Hampshire, West Sussex). Birds will thus fly through the study area on their way to wintering sites along the south coast. There is also a connectivity between the populations in England and France, with some of the more mobile birds moving between these two areas. Migration can be nocturnal or diurnal and is almost always over the sea along coasts.

2.1.2. White-fronted goose

Two distinct sub-species of white-fronted geese winter in the UK: the Greenland white-fronted goose which winters in northern and western Britain; and the European white-fronted goose which winters in smaller numbers in southern England. Therefore only the European white-front has potential to pass through the Rampion OWF area.

European white-fronted geese migrate to the UK from Russia via central Europe. Although they leave their breeding grounds in September/ October, the birds do not arrive into the UK until November. However birds continue to arrive after this, with peak numbers occurring in England in late January/ early February (Owen *et al*, 1986). Most white-fronted geese begin their return migration in March and most have left the UK by the end of this month.

Although white-fronted geese do feed on coastal and estuarine grasslands, most birds use managed grassland and agricultural land in inland areas, over the winter period. This habitat preference, and their overland migration route across Europe, suggests that this species is less likely to migrate offshore along the south coast of England than e.g. brent goose. However some movement between England and France may occur.

2.1.3. Review of risk to geese

Table 2. Review of potential risks to geese (dark-bellied brent goose and European white-fronted goose) posed by the proposed ROWF site is below The only potential risk is collisions, although macro-avoidance rates of 82% have been demonstrated for species of geese (Cook *et al*., 2011).

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration. Additional distance to avoid wind farm negligible in relation to migratory distance.
Collision	Low	Broad front migration. Low numbers recorded in the survey area. High avoidance rates. Low collision risk estimates.
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

2.2. Ducks

The following species of ducks are expected to pass through the ROWF area..

2.2.1. Mallard

The mallard is a sedentary species, with a non breeding population numbering around 680,000 (Musgrove *et al*., 2011), and a breeding population of between 47,700 and 114,400 pairs (Baker *et al*., 2006). There are small scale movements of non-breeding birds into the UK, and some UK breeding birds winter elsewhere in northern Europe. The majority of Mallard movements into and out of the UK are thought to occur across the English Channel, or the central and southern North Sea (Wright *et al*., 2011).

The mallard is protected by 14 SPAs in Britain, all for non-breeding aggregations. The closest SPA to the EDA for non-breeding mallard is the Severn Estuary SPA (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.2. Garganey

The garganey is the only wildfowl species that is a summer visitor to Britain and Ireland, with the possibility of some birds crossing the country on passage migration. Breeding birds are mainly found within central and south-eastern England with an estimated population of 15-125 pairs (Wernham *et al*., 2002). There are two migratory routes used by European breeding populations in autumn, with the British population following a southerly route across the Mediterranean to Morocco and Algeria,

or southeast to Italy and the Balkans, then probably directly across and wintering south of the Sahara in the northern tropics. Migration routes from Britain may be concentrated in the area around the eastern English Channel and southern North Sea.

There are no designated SPAs for garganey in Britain. This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.3. Shoveler

The breeding population of shoveler in Britain is estimated at 1,000-1,500 pairs increasing to 18,000 individuals wintering in the UK by birds from northern Europe (Wright *et al*., 2011). Peak counts in Britain occur in October by these immigrants that presumably cross the North Sea. A large proportion of these birds move on into France, Spain and the Mediterranean for the winter, probably crossing the English Channel.

The Shoveler is protected by one SPA for breeding birds in Britain, the Ouse Washes SPA. A further 26 sites are designated for non-breeding aggregation, the closest being to the proposed wind farm site are; the Arun Valley SPA, Chichester and Langstone Harbours, Dungeness to Pett Level SPA, Poole Harbour SPA, Solent and Southampton Waters SPA, Thames Estuary and Marshes SPA and The Swale SPA (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.4. Wigeon

The wigeon is a scarce breeding bird in Britain, with between 300 and 500 pairs (Baker *et al*., 2006). Approximately 440,000 individuals winter in Great Britain (Musgrove *et al*., 2011), arriving from their breeding grounds in north-eastern Europe. They are distributed widely across Britain in winter, and although specific migration routes remain unknown, it is assumed that the largest concentrations of migrating birds would be in the North Sea (Wright *et al*., 2011). The winter influx occurs between August and November, with birds returning in March and April, although movements may occur away from these times due to hard weather, or smaller scale movements within the wintering range (Wright *et al*., 2011).

The wigeon is protected by 40 SPAs in Britain, two for breeding birds, and 38 for non-breeding aggregations. The Arun Valley SPA, Chichester and Langstone Harbours SPA and Solent and Southampton Water SPA have wigeon as a listed feature for non-breeding birds. This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.5. Teal

The teal is a scarce breeding bird in Britain, with between 1,500 and 2,600 pairs (Baker *et al*., 2006). Approximately 210,000 Eurasian teal winter in Great Britain (Musgrove *et al*., 2011). In addition, many birds use the British Isles en route to wintering sites in more southerly areas of Europe. Specific migration routes for Eurasian teal are not known. Ringing data suggests that movements occur over

all parts of the UK, and as the wintering distribution is widespread, a pattern of movement is unlikely to be determined with current knowledge. Birds arrive from their breeding grounds between July and November, and leave again between February and May. During the winter, hard weather can induce more movement of birds into the UK from the north and east, as well as immigration from the UK to the continent (Wright *et al*., 2011).

The teal is protected by 30 SPAs in Britain, all for non-breeding aggregations. The Arun Valley SPA, Chichester and Langstone Harbours SPA and Solent and Southampton Water SPA have teal as a listed feature (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.6. Tufted duck

The tufted duck has a breeding population of 7-8,000 territories (Baker *et al*., 2006) and a wintering population of 110,000 individuals (Musgrove *et al*., 2011). The influx of wintering birds originates in Iceland, Scandinavia and Russia, and arrival begins in the autumn, with movements continuing through till January. Most of these birds then leave Britain in April and May to return to their breeding grounds. Movements are probably across the North Sea, with some birds moving over a stretch of the North Atlantic to Iceland (Wright *et al*., 2011).

The Tufted duck is protected by seven SPAs in Britain, all for non-breeding aggregations of birds. The closest SPA to the EDA for non-breeding tufted duck is the Severn Estuary SPA and Abberton Reservoir SPA. This species is listed on Annex 2 of the Birds Directive.

The potential for collisions would be the main risk for this species, although macro-avoidance rates of 45% have been demonstrated for freshwater duck species (Cook *et al*., 2011).

2.2.7. Common scoter

Common scoter are a very rare breeding bird in Britain, with fewer than 100 pairs (Baker *et al*., 2006), but have a wintering population of approximately 100,000 birds (Musgrove *et al*., 2011). Moulting flocks of this species occur in the summer and these birds may number as many as 30,000. These birds probably come from Scandinavia and Russia, so although the precise routes taken by migrating birds are not known, it can be assumed that these birds cross the North Sea. Moulting birds arrive in June and depart in September. Birds wintering in British waters arrive mainly from the Baltic, in September (Cabot, 2009).

Common scoter are protected by ten SPAs in Britain. Two of these are for breeding birds both occurring in Scotland (northern Scotland and Inner Hebrides) with six sites designated for non-breeding aggregations, the closest being the North Norfolk Coast SPA. There are also two offshore SPAs for this species, the closest being the Carmarthen Bay SPA (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive, and is listed by the JNCC as a 'regularly occurring migratory species'.

Common scoter are very highly sensitive to disturbance, highly sensitive to habitat loss and show medium sensitivity barrier effects (Maclean *et al*., 2009) with micro-avoidance rates of 99.6% during daylight and 99.1% at night (Cook *et al*., 2011). Macro-avoidance rates ranging between 88.6 and 90% have been demonstrated in common scoter. Data collated from several proposed wind farm sites has shown that the mean flight height of the common scoter is 9.3 m, with 4% of all birds recorded flying in a generic 'collision risk zone' of 20 – 150 m above the sea (Cook *et al*., 2011).

2.2.8. Velvet scoter

The velvet scoter has a wintering population in Britain of approximately 2,500 birds (Musgrove *et al*., 2011), with the majority being found on the east coast of Scotland. Moulting birds also aggregate in small numbers during the summer months. Ringing recoveries suggest that some birds using British waters are from Scandinavia, but it is thought that Russian birds are involved as well. The timing of their movements is similar to that of common scoter (Cabot, 2009).

There are four SPAs protecting velvet scoter in Britain, all for non-breeding aggregations of birds. Of these, the North Norfolk Coast SPA is the closest site to the proposed EDA wind farm site (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive, and is listed by the JNCC as a 'regularly occurring migratory species'.

Velvet scoter are very highly sensitive to disturbance, highly sensitive to habitat loss, and show medium sensitivity to barrier effects (Maclean *et al*., 2009), with micro-avoidance rates of 99.6% during daylight and 99.1% at night. Macro-avoidance rates of 67% have been demonstrated in seaduck. Data collated from several proposed wind farm sites has shown that the mean flight height of the velvet scoter is 1 m, with 0% of all birds recorded flying in a generic 'collision risk zone' of 20 – 150 m above the sea (Cook *et al*., 2011).

2.2.9. Red-breasted merganser

The red-breasted merganser has a breeding population of 2,150 (Baker *et al*., 2006) and a wintering population of 8,400 in Britain (Musgrove *et al*., 2011), with birds arriving in winter from Europe. Those arriving from Iceland are distributed across northerly parts of Britain, while those coming from central Europe are mainly found on the east coast. Autumn migration of these birds occurs between October and December, with spring migration between February and May. During these times therefore, birds could be encountered in the North Sea, and sea areas to the north and east of the British Isles (Wright *et al*., 2011).

Red-breasted mergansers are protected by 15 SPAs in Britain, all for non-breeding aggregations of birds. Of these, the Chichester and Langstone Harbour SPA, Poole Harbour SPA and Solent and Southampton Water SPA are the closest sites to the proposed EDA wind farm site (Stroud *et al*., 2003). This species is listed on Annex 2 of the Birds Directive, and is listed by the JNCC as a 'regularly occurring migratory species'.

Migrating red-breasted mergansers show medium sensitivity to barrier effects (Maclean *et al*., 2009), with micro-avoidance rates of 99.6% during daylight and 99.1% at night. Macro-avoidance rates of 67% have been demonstrated in seaduck (Cook *et al*., 2011).

2.2.10. Review of potential risks to ducks

Table 3. Review of potential risks to freshwater ducks (wigeon and teal) recorded in the survey area posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Low numbers recorded in the survey area

Risk	Threat to species	Justification
Collision	Low	Low flight height Low numbers recorded in the survey area Broad front migration Reasonable macro-avoidance rates High micro-avoidance rates
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

Table 4. Review of potential risks to freshwater ducks not recorded in the survey area (mallard, garganey and shoveler) posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Not recorded in the survey area
Collision	Low	Low mean flight height Low proportion of birds in generic collision risk zone Not recorded in the survey area Broad front migration Reasonable macro-avoidance rates High micro-avoidance rates
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

Table 5. Review of potential risks to seaducks recorded in the survey area (common scoter, velvet scoter and red-breasted merganser) posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Low numbers recorded in the survey area
Collision	Low	Low mean flight height Low numbers recorded in the survey area Broad front migration High macro-avoidance rates High micro-avoidance rates
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

2.3. Herons

2.3.1. Grey Heron

The grey heron has a UK breeding population of 14,200 pairs (Baker *et al*., 2006). The species is largely sedentary, with the only large scale movements being occasional post natal dispersal as far as North Africa, or to Britain from Scandinavia (Wright *et al*., 2011).

The grey heron is not protected by any SPAs in Britain.

There are currently no data available on flight heights or avoidance rates of herons at offshore installations. Herons observed near a colony showed 100% avoidance of an anemometry mast, with the majority of flight time spent below 30 m (Airtricity 2008).

2.3.2. Little egret

The little egret has a UK breeding population of between 146 – 162 pairs, increasing to between 800 – 900 individuals in winter. There is also a substantial peak of 1,650 individuals in autumn (Baker *et al*., 2006).
The little egret is protected by three SPAs in Britiain; Poole harbour SPA, Tamar Estuaries Complex SPA, and the closest to the proposed site, Chichester and Langstone Harbours SPA. Each of these are designated for non-breeding populations.

There are currently no data available on flight heights or avoidance rates of herons at offshore installations. Little egrets observed at an onshore site spent a significant period of flight time (27 %) at risk height (c. 30 – 140 m) (Riley 2011).

2.3.3. Review of the potential risks to herons

Table 6. Review of potential risks to herons predicted to occur in the survey area (grey heron and little egret) posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Largely sedentary Not recorded in the survey area
Collision	Low	Low mean flight height Not recorded in the survey area Largely sedentary High micro-avoidance rates onshore
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

2.4. Divers and grebes

2.4.1. Red-throated diver

The red-throated diver is a rare breeding bird in Britain, with fewer than 1,500 pairs (Baker *et al*., 2006). The winter population is around 17,000 birds (Musgrove *et al*., 2011), with the largest concentrations in the southern North Sea, and off the Welsh and northwest English coasts. Little is known of the movements of this species.

Red-throated diver are protected by 11 SPAs in Britain, and all occur within north and west Scotland. One SPA is designated for non-breeding aggregations, the Firth of Forth SPA (Stroud *et al*., 2003). There are also two offshore SPA for this species the closest being the Outer Thames Estuary SPA to the proposed wind farm site. This species is listed on Annex 1 of the Birds Directive.

Red-throated divers show high sensitivity to disturbance and habitat loss (Maclean *et al*., 2009) . Data collated from several proposed wind farm sites has shown that the mean flight height of the red-throated diver is 4.5 m, with 4% of all birds recorded flying in a generic 'collision risk zone' of 20 – 150 m above the sea. Macro-avoidance rates of 52% have been demonstrated for divers (Cook *et al*., 2011).

2.4.2. Black-throated diver

The black–throated diver is a rare breeding bird in Britain, with around 155 – 189 pairs (Baker *et al*., 2006). British breeding birds are supplemented by winter immigrants and increasing the winter population to 1,400-1,800 individuals. Birds leave the breeding sites by August gathering on inland lochs before moving to the coast by October. Wintering birds remain close inshore with concentrations along the coasts of Denmark, Germany the Netherlands and Belgium with smaller number around the coasts of Britain, notably in the Moray Firth, the Firth of Forth and the northeast end of the English Channel. Little is known of the movements of the British breeding population during winter.

There are 14 SPAs designated for breeding birds, all occurring within western and northern Scotland. This species is listed on Annex 1 of the Birds Directive.

Black-throated divers show high sensitivity to disturbance and habitat loss (Maclean *et al*., 2009). Data collated from several proposed wind farm sites has shown that 12 % of black-throated diver recorded flying in a generic 'collision risk zone' of 20 – 150 m above the sea. Macro-avoidance rates of 52% have been demonstrated for divers (Cook *et al*., 2011).

2.4.3. Slavonion grebe

Slavonion grebes are patchily distributed within Western Europe. In the UK, breeding occurs only within Scotland, with a population numbering 39 – 43 pairs, with up to 725 individuals in winter (Baker *et al*., 2006). Europe's grebes move mainly to inshore seas and estuaries close to their breeding areas during winter months. The UK's breeding population probably winters around Britain and Ireland coasts with the majority of birds occurring along the south coast of England (Stroud *et al*., 2003).

There are six SPAs designated for breeding birds within Britain, all within the Highland and Grampian regions in Scotland. Three SPAs are designated for non-breeding aggregations, the closest being to the proposed wind farm site the Exe Estuary SPA. This species is listed on Annex 1 of the Birds Directive.

2.4.4. Great crested grebe

The great crested grebe is a scarce breeding bird with a population numbering 9,400 UK pairs, increasing to 19,140 individuals during the winter. There are some large wintering concentrations of this species on the south coast of England.

Great-crested grebes are protected by 17 SPAs in the UK. Lough Neagh and Loch Beg SPA is designated for breeding birds and for the post breeding moult period. The other 16 are designated for wintering aggregations, and several of these are situated in south eastern England. WeBS data show that a five year mean of around 900 birds (between 03/04 and 07/08) winter in Rye Bay, the highest mean for any UK site during this period, and adjacent to the survey areas (Holt *et al.* 2009)

Displacement effects on great crested grebes have been shown to be negligible in the Netherlands (Winkleman 1989)

2.4.5. Review of risks to divers

Table 7. Review of potential risks to divers posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration

Risk	Threat to species	Justification
Collision	Low	Low mean flight height Low proportion of birds in generic collision risk zone Broad front migration Reasonable macro-avoidance rates
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

2.4.6. Review of risks to grebes

Table 8. Review of potential risks to grebes posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Not recorded in the survey area
Collision	Low	Low mean flight height Low proportion of birds in generic collision risk zone Not recorded in the survey area Broad front migration
Displacement	Low	Rampion OWF site not used for foraging or resting
Disturbance	Low	Rampion OWF site not used for foraging or resting

2.5. Raptors and Owls

The following species are expected to pass through the ROWF site.

2.5.1. Honey buzzard

The honey buzzard is a long-distant migrant arriving in Britain from tropical Africa via the Strait of Gibraltar to breed from mid–to late May and departing from mid-August (Wernham *et al*., 2002). The breeding population in Britain and Ireland is thought to number 33-69 pairs (Baker *et al*., 2006) with distribution from the traditional areas of southeast and southern England with suspected expansion northwards and westwards within the UK. Evidence from satellite tagged birds (Dennis 2011) shows that migrating birds depart the UK across the English Channel at a variety of locations.

Breeding honey buzzard is protected by 1 SPA; the New Forest SPA. This species is listed on the Annex 1 of the Birds Directive.

Broad winged raptors typically try to avoid long sea crossings, as they struggle to make them due to a lack of lift at sea. Therefore, barrier effects caused by offshore installations may have significant impacts. However, Raptors have been demonstrated to show a macro-avoidance rate of 22 % (Cook *et al*., 2011.

2.5.2. Marsh harrier

The marsh harrier is a rare breeding bird with a population of 201 pairs (Baker *et al*., 2006), with the majority of breeding bird's occurring in England with main concentrations in eastern coastal areas of East Anglia and north Kent with smaller numbers present in northeast England and southern and eastern Scotland. Some individuals overwinter in Britain e.g. Broadland, Suffolk and Kent, though the majority of birds move to southern Europe and northwest Africa or south of the Sahara (Wernham *et al*., 2002).

On the Rampion boat-based surveys, three marsh harrier were recorded on autumn passage in September 2011.

Breeding marsh harrier is protected by 10 SPAs, the nearest being the North Kent Marshes SPA to the proposed Rampion wind farm site. This species is listed on Annex 1 of the Birds Directive.

2.5.3. Sparrowhawk

The sparrowhawk in Britain and Ireland is a non-migrant and relatively sedentary though numbers are supplemented in the winter by migrants mainly from northern Europe and Scandinavia. These birds mainly arrive into Britain in September and October and remain throughout the winter, while others continue to wintering areas in the Low Countries and France. The return passage occurs mainly in April (Wernham *et al.*, 2002). This species is common and widespread throughout the UK with an estimated breeding population of 41,000 pairs (Baker *et al.*, 2006).

Sparrowhawk is listed on Annex 1 of the Birds Directive, but there are no SPAs designated for this species in Britain, although birds do occur in numbers on many SPAs classified for other species.

2.5.4. Osprey

The osprey is a migrant from West Africa returning to Britain to breed from late March to early April. Birds from northwest Europe tend to migrate from early August in a south or southwest direction after the breeding season following a route via France and Spain, crossing North Africa around Gibraltar (Wernham *et al.*, 2002). The breeding distribution of this species has slowly expanded from the Scottish highlands into southern Scotland and northern England and there are now thought to be around 149 breeding pairs (Baker *et al.*, 2006). Migrating ospreys have been shown to cross the English Channel at a variety of sites (RSPB website).

This species is protected by nine SPAs including breeding and feeding sites. This species is listed on Annex 1 of the Birds Directive.

2.5.5. Kestrel

The Kestrel is common throughout Britain and Ireland with a widespread distribution across Europe, Asia and Africa. The majority of northeast Europe breeding populations are totally migratory due to permanent snow cover, wintering in lowland Europe and some as far as Africa. Birds from more southern areas tend to be more sedentary (Wernham *et al.*, 2002). The UK population during the winter is supplemented by birds from Scandinavia and the Baltic region. The breeding population in the UK is estimated at 36,800 pairs (Baker *et al.*, 2006).

Kestrel is listed on Annex 1 of the Birds Directive, but there are no SPAs designated for this species in Britain, although birds do occur in significant numbers on many SPAs classified for other species.

2.5.6. Merlin

The Merlin has an extensive northern holarctic range of which two subspecies occur in Britain and Ireland. The race *aesalon* extends from Ireland to northwest Siberia with the majority of birds remaining in the UK throughout the year. The *subaesalon race* breeds in Iceland with a proportion wintering in Britain and Ireland (Wernham *et al.*, 2002). Breeding birds in northern Europe migrate south and west in autumn to winter across west and central Europe including northwest Africa and the Mediterranean basin. Small numbers of birds move south from the breeding areas in the UK and

appear to cross to continental Europe. The breeding population in the UK is estimated at 1,330 pairs with the wintering population estimated at 1,300 individuals (Baker *et al*., 2006).

This species is protected by 15 SPAs, 14 for breeding birds in northern England, Wales and Scotland and one SPA for non-breeding birds (Dorset Heathlands SPA). This species is listed on Annex 1 of the Birds Directive.

2.5.7. Hobby

The hobby breeds throughout the Palearctic between Britain and Japan and its range within Western Europe lies between the Mediterranean and the Arctic Circle in Sweden, Finland and Russia (Wernham *et al*., 2002). The entire European hobby breeding population migrates southwest to Africa via France and Spain, though precise wintering destinations remain unclear. Hobbies generally return to their UK breeding sites from late April to mid-May and migrate south during September up to mid-October. The species breeding range within Britain is central, southern and eastern England into south Wales and expanding into north England and southern Scotland with an estimated breeding population of 2,200 pairs (Baker *et al*., 2006).

Hobby is listed on Annex 1 of the Birds Directive, but there are no SPAs designated for this species in Britain, although birds do occur in numbers on many SPAs classified for other species.

2.5.8. Short-eared owl

The short-eared owl has a wide global range with a scattered distribution within Western Europe. On the continent this species is strongly migratory in the north and, broadly a partial migrant in other parts of its breeding range, and nomadic at times throughout. It is a partial migrant in Britain with an estimated breeding population of 1000-3500 pairs and a wintering population between 5,000-50,000 individuals (Baker *et al*., 2006). Britain receives a substantial influx of birds from the continent (Scandinavia, Iceland and Russia) in the autumn, primarily from late August through to November, mainly to the east coast and to a lesser extent the southern counties (Wernham *et al*., 2002).

This species is protected by six SPAs for breeding birds and is listed on Annex 1 of the Birds Directive.

2.5.9. Review of risks to raptors and owls

No species of raptors or owls are expected to pass through the ROWF site in anything other than in very small numbers.

Broad winged raptors typically try to avoid long sea crossings, as they struggle to make them due to a lack of lift at sea. Therefore, barrier effects caused by offshore installations on key migratory routes may have significant impacts. Raptors have been demonstrated to show a macro-avoidance rate of 22 % (Cook *et al*., 2011).

Table 9. Review of potential risks to raptors and owls posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration
Collision	Moderate	High to very high collision risk. Broad front and low density migration Some macro-avoidance
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

2.6. Gamebirds and rails

The following species are expected to pass through the ROWF site.

2.6.1. Quail

Quail are rare breeding birds in Britain, with a breeding population ranging between 4–315 pairs due to the species irruptive nature (Baker *et al*., 2006). In good years they can be distributed anywhere in the UK.

The quail is not protected by any SPAs in the UK and is listed on Annex 2 of the Birds Directive.

2.6.2. Corncrake

The corncrake is a rare breeding species in the UK, with a population of 589 calling males (Baker *et al*., 2006). It is mainly found in western Scotland.

Corncrakes are protected by 10 SPAs for breeding birds, all but one of which are located on the Western Isles of Scotland. Corncrakes are listed on Annex 1 of the Birds Directive.

2.6.3. Coot

The coot is a common breeding bird in the UK with a breeding population of between 21,700 and 27,600 pairs. In winter, the population increases to 188,000 individuals (Baker *et al*., 2006) . The winter influx is believed to originate from Baltic and North Sea areas.

Coots are protected by six SPAs, all of which are designated for non-breeding aggregations. This species is listed on Annex 2 of the Birds Directive.

2.6.4. Water rail

The water rail is a scarce breeding species in the UK with a population of between 700 – 1,400 pairs (Baker *et al*., 2006). The majority of water rails are believed to be sedentary, but ringing recoveries suggest that small numbers move towards the continent in winter, and that the UK wintering population is supplemented by a small influx of continental birds.

There are no SPAs designated for this species in the UK. The water rail is listed on Annex 2 of the Birds Directive.

2.7. Waders

The following species are expected to pass through the ROWF site.

2.7.1. Oystercatcher

The UK breeding population of oystercatchers is 113,000 pairs (Baker *et al*., 2006). Approximately 320,000 oystercatcher winter in the UK (Musgrove *et al*., 2011), with some 200,000 of these arriving from breeding grounds on the continent, to the north and east. Those that winter in eastern areas arrive from Scandinavia or the near continent, and those from Iceland and the Faroes concentrate in Ireland and northern areas of the UK. Some UK breeders move southward (especially those from more northern areas), with some birds crossing the English Channel or Irish Sea. In spite of this knowledge of the provenance of wintering birds in different parts of the UK, exact migration routes are unknown. Birds arrive into the UK in late summer and return to their breeding grounds in spring, although immature birds remain on the wintering grounds (Wright *et al*., 2011).

The oystercatcher is protected by 33 SPAs in Britain, three for breeding birds, and 30 for non-breeding aggregations. The breeding designations all lie on the west coast of Scotland. The closest SPA to the proposed wind farm site for non breeding aggregations is the Chichester and Langstone Harbours SPA. A further two sites occur within south-east England; the Medway Estuary and Marshes and The Swale SPAs (Stroud *et al*., 2003). This species is not listed on the Birds Directive.

2.7.2. Avocet

The UK breeding population of avocets is 877 pairs, increasing to 3,395 individuals in winter. British breeding Avocets are generally concentrated along the coasts of East Anglia and Kent. The north-west European breeding population migrate south-west to winter on the coasts of France, Iberia, whilst other European birds move to North Africa and the Arabian Gulf. British breeding birds remain on the eastern and southern coasts of England and supplemented with birds from the Low Countries. Migration occurs during July-November and mid-March-mid April (Stroud *et al*., 2003).

Avocet are protected by six SPAs in Britain for breeding birds which in total support 92.7% of the UK's breeding population and a further 12 SPAs for non-breeding birds. Sites supporting both breeding and non-breeding aggregations nearest the proposed wind farm site are The Medway Estuary and Marshes SPA and The Swale SPA. Also supporting non-breeding birds are Poole Harbour SPA and Thames Estuary and Marshes SPA (Stroud *et al*., 2003). This species is listed on Annex 1 of the Birds Directive.

2.7.3. Stone curlew

Stone curlew breed in much of southern and central Europe. The British breeding population of 347 pairs of is confined to central southern England and East Anglia. The northern population of birds within European migrate south and is thought that breeding birds in Britain migrate across the English Channel to France in the autumn before continuing their journey southwards. Their return journey in the spring is suspected to follow a more easterly route across the southern North Sea (Stroud *et al*., 2003).

There are three SPAs designated to breeding birds in Britain which in total support 98% of the breeding population with the closest being Porton Down Spa and Salisbury Plain SPA. The third site is the Breckland SPA in Norfolk. This species is listed on Annex 1 Birds Directive.

2.7.4. Little ringed plover

Little ringed plovers breed within southern parts of Britain with an estimated population of 1,115 pairs. Autumn migration occurs during late July early August, mainly crossing the English Channel to

France before continuing southwards. Birds return during March and April possibly migrating on a broader scale with some birds crossing into Britain further east spreading from the Channel into the southern North Sea (Stroud *et al.*, 2003).

There are no SPAs designated for little ringed plover in Britain and this species is not listed on the Birds Directive.

2.7.5. Ringed plover

The current British breeding population of ringed plovers is 5438 pairs. British breeding ringed plovers are fairly sedentary, or make small scale movements to wintering grounds over the Irish Sea and English Channel. Large numbers of birds breeding in more northern areas use the UK as a staging post en route to wintering areas in south western Europe and west Africa, with the current non-breeding population estimate of 34,000 (Musgrove *et al.*, 2011), thought to be conservative due to the difficulties in recording turnover of birds at individual sites. Scandinavian breeders tend to use the east coast of Britain while those breeding in more northern areas use western parts of the British Isles, so although specific migration routes are unknown, movements are likely to occur throughout British waters. Spring migration of birds toward northern breeding areas occurs through the UK during April and May (Wright *et al.*, 2011).

Breeding ringed plover are protected by five SPAs in Britain, with the closest to the proposed EDA wind farm site being on the North Norfolk coast. Of the 27 sites designated for non-breeding aggregations, the closest to the proposed wind farm site are on the south coast of England; Chichester and Langstone Harbour SPA (passage period) and Solent and Southampton SPA (winter period) with both sites supporting >1% of the international population. A further three sites occur within south-east England; The Thames Estuary and Marshes, Medway Estuary and Marshes and The Swale (Stroud *et al.*, 2003). This species is not listed on the Birds Directive.

2.7.6. Dotterel

The European distribution of dotterel breeds in northern Russia, Norway, Sweden, Finland and Britain. The majority of the population in Britain is found in the Highlands of Scotland with small populations within northern England and southern Scotland (Stroud *et al.*, 2003). The breeding population in Britain is estimated at 510-750 pairs. Spring passage across western Europe occurs between mid-April and late May but with most birds arriving in early May to their Scottish breeding sites. Some movements can occur during May-July between Scottish and Norwegian breeding birds and presumably across the North Sea. The majority of longer distance migratory movement southwards and out of the UK probably occurs in September and October possibly via the south-west of the country (Stroud *et al.*, 2003).

All 12 SPAs are designated to breeding birds and all occur within the Scottish Highlands. This species is listed on the Annex 1 Birds Directive.

2.7.7. Golden plover

Approximately 22,500 pairs of golden plover breed in Britain (Baker *et al.*, 2006), with numbers of up to 400,000 wintering birds (Musgrove *et al.*, 2011). Some British breeding birds are known to undergo southerly migration towards wintering areas in southern Europe and northern Africa, while others remain within the UK. The numbers in winter are swollen by influx of birds from the north west (particularly into Ireland and western Britain) and from north eastern Europe (into eastern Britain, mainly via the Netherlands). These autumn movements occur between July and September, with wintering birds returning towards breeding grounds as early as February (Wright *et al.*, 2011).

Golden plover are protected by 29 SPAs in Britain, with 7 designated for breeding birds, and 22 for non-breeding aggregations. There are three breeding designations in England, the North and South Pennines Moors and North York Moors. The closest non-breeding designations to the proposed EDA wind farm site is The Swale SPA and supports >1% of the national population (Stroud *et al*., 2003). This species is listed on Annex 1 of the Birds Directive.

2.7.8. Grey plover

The grey plover does not breed in Britain, and has a passage and wintering population of 43,000 individuals. These birds originate in Russia and arrive between late summer and autumn, with most arriving in September, having staged on the coast of Denmark. Numbers in Britain then decline as many of these birds continue their movements south and west, over the English Channel. Spring passage occurs between March and May, as birds return to their breeding grounds over the North Sea (Wright *et al*., 2011). Grey plover are mainly concentrated in the south-east and north-west of England though do occur on most coasts in the UK (Stroud *et al*., 2003).

This species is listed on Annex 2 of the Birds Directive. The grey plover is protected by 28 SPAs in Britain, all designated for non-breeding birds. The closest SPAs to the proposed wind farm site for non-breeding grey plover are the Chichester and Langstone Harbours SPA and the Solent and Southampton Water SPA. A further three sites occur within south-east England; The Thames Estuary and Marshes, Medway Estuary and Marshes and The Swale SPAs, two of which support >1% of the international population (Stroud *et al*., 2003).

2.7.9. Lapwing

The lapwing is a common bird in Britain, with between 137,000 and 174,000 breeding pairs (Baker *et al*., 2006), and a wintering population of 620,000 individuals (Musgrove *et al*., 2011). The British breeding population is partially migratory, with some birds moving westward towards wintering grounds in France and Iberia. Other birds arrive in Britain from continental breeding grounds to winter, mainly from late September to early November, making the return migration from March to May. Migration is thought to occur over the North Sea, Irish Sea and English Channel (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. The lapwing is protected by 38 SPAs in Britain, all designated for aggregations of non-breeding birds. There are six SPAs within south-east England for non-breeding lapwing, the closest being; Chichester and Langstone Harbour SPA, Solent and Southampton Water SPA and Poole Harbour SPA. Three other sites occur in south-east England that have non-breeding aggregations of dunlin as listed features; The Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA, and The Swale SPA (Stroud *et al*., 2003).

2.7.10. Knot

Around 320,000 red knot winter in Britain (Musgrove *et al*., 2011), arriving from breeding grounds in Canada and Greenland during July to September, after staging in Iceland or Norway. The return migration in spring occurs in May and birds use the same Norwegian or Icelandic staging posts, and there are movements of UK wintering birds across the North Sea towards the Wadden Sea in March.

There is considerable movement between wintering sites during the early winter, some birds crossing the North Sea or English Channel. These movements of red knot appear to be well known but precise knowledge of the routes taken is lacking. The variety of movements, and large numbers involved

suggest that red knot could pass over any sea area of the UK during spring and autumn (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. Knot are protected by 25 SPAs in Britain, all designated for non-breeding birds. The closest SPAs for non breeding aggregations to the proposed wind farm site are Chichester and Langstone Harbours SPA and The Swale SPA (Stroud *et al*., 2003).

2.7.11. Sanderling

Britain hosts up to 16,000 sanderling in winter (Musgrove *et al*., 2011), or en route from northern breeding grounds to wintering areas in continental Europe and Africa. Precise routes are not known but it is assumed that migrating sanderling could occur anywhere in British waters during spring or autumn passage. Autumn passage is from July to August, with birds returning in spring from March to May (Wright *et al*., 2011).

This species is not listed on the Birds Directive. The sanderling is protected by 11 SPAs in Britain, all designated for non-breeding aggregations. The closest SPA for non breeding aggregations to the proposed wind farm site is the Chichester and Langstone Harbours SPA (Stroud *et al*., 2003).

2.7.12. Dunlin

British breeding dunlin, numbering just under 10,000 pairs (Baker *et al*., 2006), winter in western Africa and migrate there via staging posts in France and Iberia. Also, large numbers of dunlin breeding in Iceland and the Baltic winter in similar areas, and those from further north pass through Britain in large numbers. The exact numbers of birds involved in these movements is difficult to ascertain due to high levels of turnover at key sites. These birds do not appear to have fixed migration routes and so could possibly occur anywhere in British waters during spring and autumn migration. These birds tend to migrate towards there wintering grounds between June and August, and return in spring during April and May. Birds breeding in Greenland also pass through the UK towards similar wintering areas at similar times of year.

In addition to the above, up to 350,000 dunlin winter in Britain (Musgrove *et al*., 2011), from breeding grounds in Russia and Scandinavia. The majority of these birds arrive in October and November having moulted on the Wadden Sea and return to their breeding grounds in April and May. Movements of these birds are thought to be concentrated around the southern North Sea and the eastern English Channel (Wright *et al*., 2011).

This species is listed on Annex 1 of the Birds Directive. The Dunlin is protected by 46 SPAs in Britain, with eight designated for breeding birds and 38 designated for non-breeding aggregations. The closest SPA for non breeding aggregations are Chichester and Langstone Harbour SPA, Solent and Southampton Water SPA and Poole Harbour. A further three sites occur in south-east England that have non-breeding aggregations of dunlin as listed features; Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA and The Swale SPA (Stroud *et al*., 2003).

2.7.13. Ruff

The ruff has a wide breeding distribution within Europe from northern Russia, Finland, northern Sweden and Norway and localised breeding distribution in most north-east European countries from the Baltic Seas to Britain. Ruff generally occur on passage migration between breeding sites in Scandinavia or Russia to wintering sites in sub-Saharan Africa, North Africa or further south in Europe, probably across the North Sea and English Channel. Passage bird numbers peak in the UK from July to October but birds may also pass across UK waters at other times of year. Birds tend to follow a more

easterly migration route during spring with few passing across the UK. A small number of birds breed in Britain with all regular breeding sites occurring within the East Anglia Fens and north and north-west England. Small numbers also winter.

This species is listed on Annnex 1 of the Birds Directive. There are 12 SPAs designated for Ruff in Britain, four for breeding birds and eight for non-breeding aggregations. The closest designated site to the proposed wind farm is Pagham Harbour SPA (Stroud *et al*., 2003).

2.7.14. Common sandpiper

Approximately 12,000 pairs of common sandpiper breed in Britain. These birds migrate southward to spend the winter in sub-Saharan Africa, probably crossing the English Channel. Spring migration occurs around April, with birds returning south in late summer and early autumn. Numbers passing through Britain are swollen by birds passing through from Scandinavia and north west Europe, these birds passing over the North Sea (Wright *et al*., 2011).

There are no SPAs designated for common sandpipers in Britain, and this species is not listed on the Birds Directive.

2.7.15. Green sandpiper

Green sandpiper that occur within the Western Palearctic winter in northwest Europe, around the Mediterranean and north and south of the Sahara in Africa (Wernham *et al*., 2002). In the UK birds occur both as migrants (mainly in autumn) and as wintering birds, largely in central and southern England. Passage migration occurs from mid June to October with peak numbers between July and September, and wintering birds depart in spring during April or early May. It is likely that migration involves crossings of the southern and central North Sea for both passage and wintering birds, and the English Channel for passage birds only, although specific routes are not known. Numbers of birds passing across UK waters are relatively low and represent less than 1% of the international population (Stroud *et al*., 2003).

There are no SPAs designated for green sandpipers in Britain, and this species is not listed on the Birds Directive.

2.7.16. Curlew sandpiper

Curlew sandpipers mainly occur on the east and south coasts of Britain during passage migration, mainly in the autumn with smaller numbers during the spring. Migration routes across UK waters are mainly in the North Sea and English Channel (Stroud *et al*., 2003).

There are no SPAs designated for curlew sandpipers in Britain, and this species is not listed on the Birds Directive.

2.7.17. Greenshank

The breeding distribution of Greenshank extends widely across the boreal regions of Eurasia, and Britain lies at the extreme west of their breeding range. This species is restricted to the Scottish uplands, but much larger numbers occur throughout Britain and Ireland on passage migration during the autumn and spring. In winter, birds move south and occur across much of Africa south of the Sahara, the shores of the Middle East, much of India and south-east Asia and coastal regions of Australia. As passage birds occur all around the UK, it must be assumed that they could migrate across any UK waters.

Greenshanks are protected by two SPAs, the Caithness and Sutherland Peatlands SPA and the Lewis Peatlands SPA, both designated for breeding birds (Stroud *et al*., 2003).

2.7.18. Redshank

British breeding redshank, numbering approximately 39,000 pairs (Baker *et al*., 2006), are largely sedentary and remain within the British Isles during the winter. Large numbers of Icelandic breeders arrive in autumn, between June and August, with non breeding estimates of around 120,000 in Britain (Musgrove *et al*., 2011). The distribution of these arrivals suggests that birds could occur anywhere within British waters (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. Redshank are protected by 40 SPAs in Britain, with four sites designated for breeding birds and 36 for non-breeding aggregations. Among the breeding designations, the closest to the proposed wind farm site is North Norfolk Coast SPA. For non-breeding aggregations the closest SPAs are The Chichester and Langstone Harbours and Solent and Southampton Water. Three other SPAs occur in south-east England; Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA and The Swale SPA. All sites have non-breeding aggregations of redshank as listed features (Stroud *et al*., 2003).

2.7.19. Turnstone

Turnstones are a highly migratory species. Birds that winter in the UK migrate from breeding grounds in northern Greenland and arctic Canada via Iceland arriving in autumn between late July and September, and some return from late February but the majority of spring migration occurs in April and May. Smaller numbers of birds cross the North Sea to or from Scandinavia at similar times. Many birds spend the whole winter in Britain but there are also large numbers of passage birds that continue their migrations to sites further south in continental Europe or Africa, and many of these birds probably migrate via the English Channel. Although the fact that Turnstone are widespread around the UK coast, mean that Turnstone migration routes could potentially pass across any parts of UK waters.

There are 13 designated SPAs in Britain for non-breeding aggregations of turnstone. The closest site to the proposed wind farm is the Thanet Coast and Sandwich Bay SPA (Stroud *et al*., 2003).

2.7.20. Black-tailed godwit

The black-tailed godwit is a rare breeding bird in Britain, with between 44 and 52 pairs (Baker *et al*., 2006). It is much more numerous in winter and on passage, with 43,000 individuals wintering in Britain (Musgrove *et al*., 2011). British breeding birds migrate southward for the non-breeding season from July, and through to the autumn. The return spring migration occurs during March and April.

Icelandic breeding black-tailed godwits pass through, and winter in, Britain. Influx begins during July and August, with birds returning to Iceland during April and May. Precise routes for these movements are not known (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. The black-tailed godwit is protected by 29 SPAs in Britain, two for breeding birds, and 27 for non-breeding aggregations. The closest SPA for non-breeding birds to the proposed wind farm site are Chichester and Langstone Harbours SPA, Solent and Southampton Water SPA and Poole Harbour SPA all of which support >1% of the international population. A further three sites occur within south-east England; The Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA and The Swale SPA (Stroud *et al*., 2003).

2.7.21. Bar-tailed godwit

Bar-tailed godwits are common in Britain in winter, with a population of 38,000 individuals (Musgrove *et al*., 2011). These birds arrive from Scandinavia and Russia in late summer and early autumn, with some continuing on through Britain to winter in areas further south and west, and return in February and March. The exact routes taken by these birds are not known, but with many birds staging in the Wadden Sea, it is thought that routes may concentrate around this area (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. The bar-tailed godwit is protected by 23 SPAs in Britain, all designated for non-breeding aggregations of birds. Of these, the Chichester and Langstone Harbours SPA and The Swale SPA are the closest sites to the proposed wind farm site (Stroud *et al*., 2003).

2.7.22. Curlew

The Curlew has a breeding population of around 107,000 pairs in Britain (Baker *et al*., 2006), with approximately 140,000 individuals wintering (Musgrove *et al*., 2011). British breeding birds tend to remain within the British Isles during the winter, with general movement being in a south westerly direction. These movements occur between June and October after the breeding season, with birds making the return leg between January and March.

Influx of birds from breeding grounds in northern and eastern Europe coincides with post-breeding movements of British birds, but birds returning to the continent do so slightly later, between March and May. Ringing recoveries suggest that the bulk of curlews arriving into Britain do so across the southern North Sea (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. Curlew are protected by 26 SPAs in Britain, with one designated for breeding birds (the North Pennine moors SPA) and a further 25 for non-breeding aggregations. The Chichester and Langestone Harbours SPA, Solent and Southampton Water SPA and Poole Harbour SPA all have curlew listed as listed features, and all lie on coastline adjacent to the proposed wind farm site. A further two site occur within south-east England; Medway Estuary and Marshes SPA and The Swale SPA (Stroud *et al*., 2003).

2.7.23. Whimbrel

The whimbrel is a rare breeding bird in Britain with 530 breeding pairs (Baker *et al*., 2006). Larger numbers of birds occur on passage, en route from breeding grounds to the north and north east towards wintering sites in western Africa. It is assumed that movements occur across a broad front, but large concentrations at selected sites suggest that specific migration routes may exist, at least in some areas. Current estimates suggest that just under 4,000 whimbrel pass through Britain in spring (Calbrade *et al*., 2010), but it is likely that this is an underestimate due to the difficulties in ascertaining levels of turnover at key sites (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. Whimbrel are protected by 12 SPAs in Britain, one for breeding birds in Shetland, and 11 for non-breeding aggregations. There are three sites for non-breeding designations within south-east England, the closest to the proposed wind farm site being Chichester and Langstone Harbour SPA. Others are Thames Estuary and Marshes SPA and Medway Estuary and Marshes SPA (Stroud *et al*., 2003).

2.7.24. Snipe

The snipe is a common breeding bird in Britain, with between 52,600 and 69,000 breeding pairs, and approximately 100,000 wintering individuals. It is a chain migrant, with some British breeding birds moving south and west over the English Channel and Irish Sea to continental wintering grounds, and birds of the subspecies *faeroeensis* passing through mainland Britain having bred in Iceland, the Faeroes, Shetland and Orkney. The southerly movement commences in August and continues through to October, with the return spring movements taking place during March and April. It is possible that over one million snipe pass through or winter in Britain each year. Exact migration routes for snipe are not known, and although only one SPA is designated for common snipe it might be safest to assume that all UK waters are used my migratory snipe (Wright *et al*., 2011).

This species is listed on Annex 2 of the Birds Directive. The snipe is protected by one SPA in Britain. The Somerset Levels and Moors is designated for non-breeding aggregations of birds.

2.7.25. Woodcock

The woodcock is a common breeding bird in Britain, and has a wintering population of around 1,400,000 birds. British breeding woodcock are largely sedentary, with only very small numbers moving south west towards France and Iberia. Influx of birds breeding in north western Europe begins in October and carries on through to December, with birds thought to arrive in Britain on a broad front despite particularly large numbers passing through a few well covered sites. The return migration in spring occurs between February and April.

This species is listed on Annex 2 of the Birds Directive. There are no SPAs designated for woodcock in Britain, and this species is listed on Annex 2 of the Birds Directive.

2.7.26. Grey phalarope

Grey phalaropes are a pelagic species wintering off western and south-western Africa, western South America and the southern United States. The Breeding distribution of this species is predominantly restricted to arctic coasts (Wernham *et al*., 2002). Adult females leave their breeding grounds during July whilst males remain to late July and early August. Migration takes place pelagically with birds from northeast North America, Greenland, and Iceland thought to migrate southeast across the north Atlantic and arriving to their wintering grounds by the end of November where they remain through until March and early April. Autumn passage occurs during September and October off southwest Ireland and southwest England. Small numbers of birds occur during spring passage (April-May) around British and Irish coasts.

There are no SPAs designated for grey phalarope in Britain, and this species is not listed on the Birds Directive.

2.7.27. Review of risks to waders

Table 10. Review of potential risks to waders recorded in the survey area (oystercatcher, grey plover, knot, sanderling, dunlin, turnstone, bar-tailed godwit, curlew, whimbrel and grey phalarope) posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Low numbers recorded in the survey area
Collision	Low	Low numbers recorded in the survey area Broad front migration Reasonable macro-avoidance rates

Risk	Threat to species	Justification
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

Table 11. Review of potential risks to waders not recorded in the survey area (avocet, stone curlew, little ringed plover, ringed plover, dotterel, golden plover, lapwing, ruff, common sandpiper, green sandpiper, curlew sandpiper, greenshank, redshank, black-tailed godwit, snipe and woodcock) posed by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Not recorded in the survey area
Collision	Low	Not recorded in the survey area Broad front migration Reasonable macro-avoidance rates
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

Macro-avoidance rates of 51% have been demonstrated for wading birds (Cook *et al*., 2011).

2.8. Neopasserines

The following species of near-passerine are expected to pass through the ROWF area.

2.8.1. Woodpigeon

Woodpigeon is a very abundant species in the UK with a population estimate of between 2,500,000 and 3,000,000 territories (Baker *et al*., 2006). British breeders are resident, and although movements of woodpigeons along British coasts, including the south coast, are often recorded, there is no ringing evidence to suggest that woodpigeons regularly emigrate from the UK to Europe. Woodpigeons are migratory in northern and eastern Europe however and these birds move south-west in the autumn (mid-September to mid-November) and winter in France and Iberia. Large sea crossings are generally avoided but weather dependent influxes of woodpigeons on to the east coast of Britain, involving birds that have crossed the North Sea, do sometimes occur. These birds are then likely to continue on to their Iberian wintering grounds and this may account for sightings of woodpigeons on the south coast of England.

No woodpigeons were recorded on the boat-based surveys.

There are no SPAs designated for woodpigeon in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.8.2. Turtle dove

Turtle dove is a declining species in the UK with the last population estimate, of 44,000 territories in 2000 (Baker *et al*., 2006) probably now an over-estimate. Turtle doves are summer migrants to Europe which winter in tropical Africa. British and western European breeders move south or south-west in the autumn, crossing from Spain to Morocco on their way to the wintering grounds. This passage usually occurs in August and September. Return migration in the spring usually takes place in late April and May.

No turtle doves were recorded on the boat-based surveys.

Turtle dove is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population. It is also a priority species in the UK Biodiversity Action Plan.

2.8.3. Cuckoo

Cuckoos are an uncommon and declining species in the UK with an estimated population of 14,000 pairs (Baker *et al.*, 2006). All birds migrate south to spend the winter in southern Africa. Autumn migration takes place mostly in August. Cuckoos return to the UK in April and early May.

No cuckoos were recorded on the boat-based surveys.

Cuckoo is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population.

2.8.4. Swift

Swifts are common, but declining, in the UK, with a population of 80,000 pairs (Baker *et al.*, 2006). In the winter swifts are found in southern Africa. In the UK, swifts generally arrive in May and depart in late July/ August. Even during the breeding season swifts may make long flights between England and mainland Europe, as part of big weather movements around depressions as a way of avoiding rainfall.

Swifts were recorded in May, June and July in both years of the Rampion boat surveys. The small number of records makes it difficult to detect patterns, but a light headwind appears to favour migration. Out of a total of 35 swifts, two (5.7%) were detected at collision risk height.

The swift is Amber Listed in the UK on the List of Species of Conservation Concern due to the recent decline in its population.

2.8.5. Nightjar

The nightjar is a scarce, and declining, species in Britain with a population in the range of 3,700 to 5,500 males (Conway *et al.*, 2007). Nightjars leave Britain in August/ September, when they migrate nocturnally to their wintering areas in tropical Africa. Nightjars return to Britain in late April and May.

Nightjars have not been recorded on the boat-based surveys.

Nightjar is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population. It is also a priority species in the UK Biodiversity Action Plan.

2.8.6. Review of risks to neopasserines

A macro-avoidance rate of 53% has been demonstrated for land birds responding to offshore wind farms, along with micro-avoidance rates of 99.86% for a mixture of resident and migrant species.

Table 12. Review of potential risks posed to neopasserines by the proposed ROWF site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration in small numbers Low numbers recorded in the survey area
Collision	Low	Broad front migration in small numbers Low numbers recorded in the survey area

Risk	Threat to species	Justification
		Reasonable macro-avoidance rates Reasonable micro-avoidance rates Flight height assumed to be very high for migrants
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

2.9. Passerines

The following species of passerines are expected to pass through the ROWF area.

2.9.1. Skylark

The population of skylark breeding in Britain, measured in territories, is 1,700,000 (Baker *et al*., 2006). British skylarks may undertake altitudinal migration in large numbers but for the most part, remain within Britain for the winter, unless the weather becomes particularly severe. The winter population is augmented by influx from northern Europe, and some of these birds continue in a south westerly direction, spending the winter in France or the Iberian Peninsula. The numbers of birds involved in these movements are not known, but in the context of British waters the largest concentrations of passage birds are in the North Sea and the English Channel (Wright *et al*., 2011).

Skylarks were recorded flying through the Rampion study site in November 2011. These birds fit the migration pattern described above of Scandinavian birds passing through the UK as they move to more south-westerly wintering grounds in continental Europe.

Skylark is listed on Annex 2 of the Birds Directive, but there are no SPAs designated for skylark in Britain (Stroud *et al*., 2003).

2.9.2. Sand martin

The sand martin is a common summer visitor to Britain, with between 85,000 and 270,000 nests. Influx into Britain occurs between March and May, with birds arriving mainly in the south east, and then spreading throughout the rest of the country along coastlines. In the autumn, sand martins depart for wintering grounds in southern Europe and northern and western Africa between July and September (Wright *et al*., 2011).

Records of sand martin on the Rampion site fit with the migration pattern described above with a spring peak in April and a, higher, autumn peak in September. The autumn migration of sand martins is more protracted than for house martin and barn swallow, beginning, as it does, in July.

There are no SPAs designated for sand martin in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.3. House martin

The house martin is a common breeding bird in Britain with between 253,000 and 505,000 pairs (Baker *et al*., 2006), which shows a similar migration strategy to the barn swallow. During spring and autumn migration, large numbers of birds cross the English Channel and Irish Sea, with those continuing further north doing so over land or following coastal routes. Spring migration into Britain mainly occurs in April, with autumn migration happening between August and October (Wright *et al*., 2011).

Peak spring migration in the Rampion site was detected in May, and in September for the autumn migration.

There are no SPAs designated for house martin in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.4. Swallow

The barn swallow with approximately 680,000 pairs (Baker *et al*., 2006), is a common breeding bird in Britain with large numbers migrating between here and the species' African wintering grounds. Spring migration occurs between March and May, with return passage between August and October. The majority of barn swallows make sea crossings over the English Channel or Irish Sea, with those breeding further north making their way towards their breeding grounds over land or following coastal routes. Autumn migration patterns are believed to be similar (Wright *et al*., 2011).

Perhaps as a result of their larger UK breeding population, rather than differences in migration strategy, swallows were seen in much larger numbers on the Rampion survey than the two martin species. The September total was particularly high. Of interest was that some of the swallows recorded migrating in September were seen travelling north rather than south, though this may be a result of birds caught up in peculiar weather systems. Weather parameters on peak migration days have been looked at but do not highlight any specific conditions as being required. However days that are fine and clear with a headwind often seem to be chosen for the Channel crossing. There was a clear pattern in that migrants were recorded mostly in the first few hours after dawn, with a significant drop-off in birds recorded after this time. The vast majority of migrating swallows recorded on the boat-survey were below rotor sweep height, though this may be partly as a result of observer detection. In the combined total of swallows recorded during the two September 2011 surveys (742 birds), all were below 20 m altitude except for nine (1.2%) that were close to turbine rotor height (20-30 m) and five birds (0.7%) were at collision risk height (30-170 m).

There are no SPAs designated for barn swallow in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.5. Meadow pipit

The meadow pipit is a common breeding bird in Britain with a population, measured in territories, of 1,600,000 (Baker *et al*., 2006). A large proportion of these British breeding birds migrate south west to winter in the Iberian Peninsula. Those remaining in Britain for the winter are joined by migrants from northern Europe, with some of these birds also continuing further south. Meadow pipits are widespread in Britain during the whole year, so passage birds could occur anywhere in British waters, but the largest concentrations are likely to be in southern areas. Spring passage occurs in March and April, with autumn birds moving southward between July and October (Wright *et al*., 2011).

After swallow, meadow pipit was the most abundant passerine species recorded on the boat-based surveys. Their numbers will be under-estimated however as many 'unidentified pipits' and a proportion of the 'unidentified passerines' will also be of this species. Peak migration of meadow pipits was recorded in March in the spring, and in September in the autumn. Days with gentle winds witnessed the largest movements. Of a total of 262 meadow pipits recorded on the three peak ESAS surveys for this species, all were below turbine rotor height. 13.4% of these were in the height band 20-30 m (just below rotor height).

There are no SPAs designated for meadow pipit in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.6. Tree pipit

Tree pipit is a common, but declining, breeding species in the UK with the last estimate being of 78,000 breeding pairs (Baker *et al*., 2006). Birds breeding in the UK and elsewhere in western and northern Europe migrate south or south-west in the autumn, passing through Iberia then onwards to wintering grounds in tropical Africa. Thus birds seen on migration on the English south coast may include both British breeding birds and some from Scandinavia. Autumn migration occurs mostly in September and early October. Spring passage occurs in the UK during April and May.

Although no tree pipits were picked out during the Rampion surveys, a large number of pipits were unidentified to species level (86 during the September and October surveys). Although this coincided with meadow pipit migration, it may be that some tree pipits were amongst this total.

Tree pipit is Red Listed in the UK on the List of Species of Conservation Concern due to the recent decline in its population.

2.9.7. Rock pipit

Rock pipit is a fairly common species in the UK. It breeds on rocky coastlines and numbers 34,000 pairs (Baker *et al*., 2006). Most British rock pipits are resident but some undergo local dispersion, mostly within the UK but some moving as far as the near continent. Scandinavian rock pipits move south-west in winter and some of these come to the UK, or may pass through the UK on their way to Iberian coasts.

Although no rock pipits were picked out during the Rampion surveys, it is possible that a small number were amongst the total of 'unidentified pipit' recorded during the surveys.

There are no SPAs designated for rock pipit in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.8. Pied wagtail

The British race of the white wagtail, commonly known as the pied wagtail, is a common breeding bird in Britain, with between 255,000 and 330,000 territories (Baker *et al*., 2006). It makes southerly movements during the winter. Some birds remain within the British Isles but others cross the English Channel and Bay of Biscay to winter in France and the Iberian Peninsula. These movements occur alongside continental and Icelandic breeding birds that pass through Britain en route towards similar wintering locations. Some of these continental breeding birds also remain in Britain for the winter. Precise migration routes are not known for this species, apart from the spring passage of continental breeding birds showing a westerly bias through the British Isles. It is therefore likely to occur anywhere within British waters on migration (Wright *et al*., 2011).

On the Rampion boat-based surveys pied wagtails on spring passage were only recorded in March. More birds were recorded in the autumn, with a peak in October. No white wagtails have been recorded on the survey though some were not identified to race.

There are no SPAs designated for pied wagtail in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.9. Grey wagtail

Grey wagtail is a fairly common breeding species in Britain with between 34,000 and 41,000 pairs (Baker *et al*., 2006). Though most birds are resident, it is also recorded on autumn migration, especially at southern headlands and inshore islands, as birds from northern areas move south-west. Peak migration is in September. Return migration in the spring is less conspicuous.

Grey wagtails have been recorded on both spring and autumn migrations on the Rampion survey with single birds seen in March and September. This is likely to be a true representation of the small numbers passing through the site.

There are no SPAs designated for grey wagtail in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.10. Yellow wagtail

Yellow wagtail is a declining breeding species in Britain, with the most recent estimate being of 12,000 to 27,000 pairs (Baker *et al*., 2006). Most breeding birds are in the southern half of the UK. It is a summer visitor to Europe with birds wintering in tropical Africa. Migration is mostly diurnal and occurs in a broad front in both spring and autumn. Autumn passage is from August to early October with a peak in September. In spring birds are generally recorded on migration in the UK from mid-April to early June. Yellow wagtails recorded on passage in the UK in spring also include small numbers of individuals belonging to races that breed elsewhere in Europe.

Only one yellow wagtail was seen on the Rampion boat surveys, in April 2010.

Yellow wagtail is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population.

2.9.11. Wren

The wren is a very common bird in the UK with an estimated 8 million territories (Baker *et al*., 2006). British wrens are mostly sedentary but short distance migrations do occur, particularly as a result of cold weather conditions. Many of the wrens breeding in Iceland and Scandinavia are migratory and some of these are likely to winter in the UK.

Perhaps surprisingly, given their tiny size and mostly nocturnal migration movements, wren has been recorded on the Rampion boat surveys. Single birds were recorded in October and November 2011.

There are no SPAs designated for wren in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.12. Redstart

Redstart is a common, but declining, summer visitor to the UK, with 101,000 pairs in 2000 (Baker *et al*., 2006). European breeding birds winter in Africa, north of the Equator. Autumn migration is on a broad front lasting from late August to early October. Spring migration is during late April and May. Some Scandinavian breeders add to the totals passing through the UK at these times.

No redstarts were detected by the boat-based surveys.

Redstart is Amber Listed in the UK on the List of Species of Conservation Concern.

2.9.13. Black redstart

Black redstarts are rare as a breeding species in the UK, with an estimated population of 80-100 pairs, which are found in mostly urban or industrial areas in south-east and central England. However black redstarts breeding in central and Eastern Europe move west or south-west in the autumn and some of these pass through the UK on migration, with small numbers remaining to spend the winter in coastal areas in the southern half of the UK.

A black redstart was recorded on a Rampion boat survey in November 2011.

Black redstart is listed as a Schedule 1 species on the Wildlife & Countryside Act 1981 (as amended), is on the UK Biodiversity Action Plan, and is Amber Listed on the List of Species of Conservation Concern due its small breeding population within the UK.

2.9.14. Robin

The British population of robins, which numbers just under six million territories (Baker *et al*., 2006), is largely sedentary. However Scandinavian robins are migratory, and can occur in large numbers on passage in the British Isles, but these birds move on to spend the winter in southern Europe and Africa. Precise movements of migrating robins are not known, but migrating Scandinavian birds will cross the North Sea and the English Channel (Wright *et al*., 2011).

A very small number of robins have been detected by the boat-based surveys on the Rampion site, in April and in September.

There are no SPAs designated for robin in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.15. Wheatear

The Northern wheatear is a common breeding bird in Britain, with a population of around 56,000 pairs (Baker *et al*., 2006). British breeding birds arrive from wintering areas in west Africa during March and early April, and depart southward in the autumn. Birds breeding to the north and west of Britain (e.g. Iceland, Greenland) also pass through the British Isles on passage, though generally a little later than their British counterparts. Precise migration routes are not known for this species and it may occur anywhere in British waters on migration. Concentrations of passage birds could occur in the English Channel, or to the north and west of the British Isles (Wright *et al*., 2011).

Too few wheatears were detected by the boat-based survey to detect migration patterns of this species over the site, with the only records coming from September.

There are no SPAs designated for wheatear in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.16. Whinchat

The whinchat is a fairly common, but declining, breeding species in the UK with a population estimate of 14,000 to 28,000 pairs. Whinchats breeding in the UK and elsewhere in Europe spend the winter in tropical Africa. Spring migration takes place in April and May, and autumn migration takes place mainly in September.

No whinchats were detected by the boat-based surveys.

Whinchat is Amber Listed in the UK on the List of Species of Conservation Concern due to its declining population.

2.9.17. Nightingale

Nightingale is an uncommon, and declining, breeding species in the UK, with a population in the range of 5600 to 9350 males (Wilson *et al*, 2002) with breeding restricted to the south-eastern half of England. Nightingales leave for their wintering grounds in western Africa during August and September, moving in a south-westerly direction. Birds return in the spring during April and May.

Nightingale was not recorded during the Rampion boat surveys.

Nightingale is Amber Listed in the UK on the List of Species of Conservation Concern due to its declining population.

2.9.18. Mistle thrush

There are estimated to be 205,000 pairs of this common breeding species in the UK (Baker *et al*., 2006). British mistle thrushes are mostly sedentary however a small proportion may migrate south within the UK, or as far afield as France. Mistle thrushes in northern and eastern Europe are migratory and small numbers of these may winter in the UK. Autumn migration within Britain is usually in August to November. Birds return early in the spring with February and March being the peak months.

Mistle thrush has not been recorded during the Rampion boat surveys.

This species is Amber Listed on the List of Species of Conservation Concern due to the recent declines in its UK breeding population.

2.9.19. Song thrush

The song thrush is a common bird in Britain, with over 1,144,000 territories, and these birds are largely sedentary. There are recorded south westerly movements towards France and Iberia out with the breeding season but these are uncommon. Some birds also pass through Britain on migration from Scandinavia but the scale of this movement is not known.

Song thrush were only recorded on the survey in March 2011 when a relatively large number of birds were recorded flying north into the UK. These are likely to have been birds that were displaced from the UK as a result of the severe winter weather in the preceding months.

There are no SPAs designated for song thrush in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.20. Redwing

The redwing is a very rare breeder in the UK with usually fewer than 17 pairs, but it is a common winter visitor, with almost 700,000 (Baker *et al*., 2006) birds wintering in Britain. Most redwing arrive across the North Sea, as the majority of British wintering birds have come from Russia and Scandinavia, but Icelandic and Faroese birds move to western Scotland.

Autumn influx of redwings occurs in greatest numbers during October, with spring movements happening between March and May. Redwing can occur anywhere in UK waters on passage, as many of those arriving from the north east may continue on towards wintering grounds further south in Europe, or they may arrive in the UK via a more easterly route. Specific migration routes are not known, and are likely to be weather dependent, but it is likely to occur in good numbers on passage in the North Sea and to the north west of the British Isles (Wright *et al*., 2011), with fewer birds in the south of the country.

The only redwing to be recorded on the Rampion surveys was a single bird in November 2011.

There are no SPAs designated for redwing in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.21. Fieldfare

The fieldfare is an irregular breeding bird in Britain, but is a numerous winter visitor, with a winter population of 680,000 individuals. Birds wintering in Britain arrive from Scandinavia from September, on a broad front. Spring migration occurs from March through to May.

Migrating fieldfares were detected on the Rampion boat-based surveys both in the spring (March) and autumn (November). These are likely to be birds that were migrating beyond the UK in a south-westerly direction towards France or Iberia.

There are no SPAs designated for fieldfare in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.22. Blackbird

The British breeding population of blackbirds, numbering around five million territories (Baker *et al*., 2006), is largely sedentary, but large numbers of this species spend the winter in Britain or use it as a staging ground, en route to southern Europe. No precise routes are known for these migratory populations, but ringing recoveries show their provenance to be to the east of Britain, so these birds probably cross the North Sea (Wright *et al*., 2011).

Blackbirds were recorded on the Rampion survey in March and November 2011.

There are no SPAs designated for blackbird in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.23. Ring ouzel

The ring ouzel is an uncommon, and declining, summer visitor to the uplands of the UK, with a population in the range of 6150 to 7550 pairs (Wotton *et al*,). British and north European ring ouzels winter in southern Spain and north-west Africa. Scandinavian breeders may pass through the UK on migration in spring and autumn. Spring passage is mostly during April and May and autumn migration is in September and October.

Ring ouzels were not recorded during the Rampion boat surveys.

Ring ouzel is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population. It is also a priority species in the UK Biodiversity Action Plan.

2.9.24. Blackcap

Blackcaps are common breeding birds in Britain, with over 930,000 territories. Birds breeding in Britain are summer visitors, arriving from their wintering grounds in southern Europe and North Africa in April and May, and departing again during the autumn. Small numbers of blackcap also over-winter in Britain, arriving in the autumn from western and central Europe. Specific migration routes are not known for this species (Wright *et al*., 2011).

Blackcap has not been recorded on a Rampion boat survey. However this species will not be easy to identify at sea under normal circumstances so it may have been overlooked.

There are no SPAs designated for blackcap in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.25. Garden warbler

Garden warbler is a common breeding species in the UK with an estimated 190,000 territories (Baker *et al*., 2006). Birds breeding in the UK and western Scandinavia migrate south or south-west in the autumn, passing through Iberia on their way to wintering grounds in tropical and south Africa. Spring migration follows the same route in the opposite direction. Both migrations are prolonged but the autumn peak at British observatories is in early September, when drift migrants from the continent are also passing through the UK. Peak migration in the spring is in May.

Garden warblers have not been recorded on a Rampion boat survey. However this species will not be easy to identify at sea under normal circumstances so it may have been overlooked.

There are no SPAs designated for garden warbler in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.26. Lesser whitethroat

Lesser whitethroat is a common breeding species in the UK, mostly in the southern half of the country, with a total of 64,000 territories (Baker *et al*., 2006). Unlike other migratory passerines breeding in Britain, lesser whitethroats fly round the eastern end of the Mediterranean to reach their wintering grounds in eastern Africa. Lesser whitethroats arriving and departing the UK tend to be concentrated on the east and, more especially, south coast of England. Peak migration in the UK is usually in late August/ early September in the autumn, and in late April/ early May in the spring.

Lesser whitethroat has not been recorded on a Rampion boat survey. However this species will not be easy to identify at sea under normal circumstances so it may have been overlooked.

There are no SPAs designated for garden warbler in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.27. Whitethroat

Whitethroat is a common, but declining, breeding species with 931,000 territories in the UK. Whitethroats breeding in the UK, western Europe and western Scandinavia migrate in a direction west of south, passing through Iberia, then on to wintering grounds in sub-Saharan Africa. In the spring whitethroats reach the UK in a broad front from late April to May. In the autumn the peak migration south through the UK is in August and September.

A single whitethroat has been recorded on the Rampion boat surveys, in April 2011.

Whitethroat is Amber Listed on the List of Species of Conservation Concern due to recent declines in its UK breeding population.

2.9.28. Sedge warbler

Sedge warbler is an abundant breeding species in the UK with an estimated 297,000 territories (Baker *et al*., 2006). These birds winter in sub-Saharan Africa. The main arrival of sedge warblers in the UK in the spring is in April and the main departure is in August/ September.

Sedge warblers have not been identified on a Rampion boat survey.

There are no SPAs designated for sedge warbler in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.29. Reed warbler

The number of UK breeding pairs of this species is estimated to be 91,000 (Baker *et al*., 2006), with almost all being in the southern half of the UK. Most breeders leave Europe in a south-westerly direction, passing through Iberia on their way to wintering grounds in tropical Africa. Autumn migration in the UK is usually in August/ September and in the spring most birds arrive in May.

Reed warblers have not been identified on a Rampion boat survey.

There are no SPAs designated for reed warbler in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.30. Grasshopper warbler

Grasshopper warblers are uncommon and declining in the UK, with a breeding population of around 11,000 pairs (Baker *et al*., 2006). Birds migrate from Europe through Iberia and onwards to wintering grounds in West Africa. Spring passage in the UK is usually during April and May and in the autumn is in August and September.

Grasshopper warbler has not been identified on the Rampion boat surveys.

In the UK, grasshopper warbler is Red Listed on the List of Species of Conservation Concern due to recent declines in its breeding population.

2.9.31. Willow warbler

The willow warbler is a common breeding bird in Britain, with 2,125,000 territories. It winters in western Africa, arriving in Britain in spring during April, and departs towards its wintering grounds in late summer and early autumn. Specific migration routes are not known for this species (Wright *et al*., 2011).

There have been two April records of willow warbler identified on the boat surveys.

There are no SPAs designated for willow warbler in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.32. Wood warbler

The wood warbler is a fairly common, but declining, species in the UK with the last population estimate being of around 17,000 males. Autumn migration to tropical Africa is mostly through the central Mediterranean region, but in the spring a larger proportion of wood warblers move through the western Mediterranean. Arrival into the UK peaks in late April and May. Post-breeding departure from the UK is mostly in August.

Wood warblers have not been recorded from the Rampion boat-based surveys.

Wood warbler is Red Listed in the UK on the List of Species of Conservation Concern due to its declining population. It is also a priority species in the UK Biodiversity Action Plan.

2.9.33. Chiffchaff

The chiffchaff is a common breeding bird in Britain, with over 800,000 territories. It is also becoming a more frequent winter resident. Those undergoing autumn migration do so in September, and winter in western Africa, returning to Britain in early spring. Specific migration routes are not known for this species (Wright *et al*., 2011).

One chiffchaff has been recorded on the Rampion surveys on spring passage (March) and three have been recorded on autumn passage (September).

There are no SPAs designated for chiffchaff in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.34. Goldcrest

The goldcrest is a common breeding bird in Britain, with a population of 842,000 territories, with many more arriving during the autumn. These birds arrive across the North Sea from the Baltic and Scandinavia, most often in response to harsh weather. These autumnal influxes occur between September and November, with birds returning to their breeding grounds during March and April. Some birds also make movements across the English Channel and Irish Seas at similar times. Specific migration routes are not known for this species (Wright *et al*., 2011).

No goldcrests were detected during the boat-based Rampion surveys, however their tiny size means that they could be easily overlooked at sea.

There are no SPAs designated for goldcrest in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.35. Firecrest

The number of firecrests in the UK fluctuates annually but it is always rare as a breeding bird with an estimate of 80 to 250 breeding males, located mostly in the south-east of England. Firecrests breeding in central Europe are migratory and in the autumn move west or south, with small numbers of these wintering in southern parts of the UK. Firecrests avoid long sea crossings where possible, with most birds entering the UK across the English Channel. Peak migration in the UK is in October in the autumn. In the spring most migrating firecrests are reported from the south and south-east with peak numbers in late March/ early April.

No firecrests were recorded on the Rampion boat-based surveys.

The firecrest is Amber Listed in the UK on the List of Species of Conservation Concern due to its small breeding population.

2.9.36. Spotted flycatcher

Spotted flycatchers are a declining species in the UK, with a maximum population estimate of 59,000 pairs. UK and western European breeders move south in the autumn through western France and Iberia en route to southern Africa. This occurs mostly in August and September. Return migration in the spring is relatively late, occurring in May and early June in the UK.

Spotted flycatcher has not been recorded from the Rampion boat-based surveys.

Spotted flycatcher is Red Listed in the UK on the List of Species of Conservation Concern due to the continued decline in its breeding population. It is also listed in the UK Biodiversity Action Plan.

2.9.37. Pied flycatcher

The pied flycatcher population is estimated to be 38,000 in the UK (Baker *et al*., 2006) though this number is in decline. Autumn passage brings Scandinavian birds to Britain, as migrants travel a long way west (to stop-over in north-west Iberia) before flying south to their western African wintering grounds. Autumn passage peaks in September and returning birds arrive back in the UK mainly in late April/ early May.

Pied flycatcher was not recorded on the Rampion boat-based surveys.

Pied flycatcher is Amber Listed in the UK on the List of Species of Conservation Concern due to recent declines in its breeding population.

2.9.38. Starling

The starling is a common breeding bird in Britain, with a population of just over 800,000 pairs (Baker *et al*., 2006). UK breeders are mainly sedentary. In autumn and winter, the British population is swollen by birds from all over continental Europe. Some Scandinavian birds enter the UK by directly crossing the North Sea. However there is a more concentrated migration route along the coast of the southern North Sea with birds from northern and eastern Europe moving west along this coast, with some then crossing the English Channel to spend the winter in Britain. Autumn passage occurs between September and November. Starlings return to their breeding grounds early, during February and March.

The starlings recorded on the Rampion surveys correspond with the migration pattern described above, with a spring peak in March and an autumn peak in November.

Starling is Red Listed in the UK on the List of Species of Conservation Concern due to recent declines in its breeding population.

2.9.39. Chaffinch

The chaffinch is a very common breeding species in Britain, with a population of 5,974,000 territories. Most of these remain within Britain during the winter, and numbers are swollen at this time by an influx of birds from Scandinavia and continental Europe. As many as 20 million chaffinches may cross the North Sea during the autumn, many wintering in Britain, but some continuing on to winter in

Ireland. Movements occur mainly between September and November, with the return journey between February and May. While some chaffinches make direct crossings of the North Sea, most make the shorter sea crossing between the Low Countries and south eastern England. Broad front migration is more frequent during the spring (Wright *et al*., 2011).

Observations of chaffinch on the Rampion surveys fit in with the migration pattern described above, with peaks in March and October.

There are no SPAs designated for chaffinch in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.40. Brambling

The Brambling is an irregular breeder but a common winter visitor to Britain, with a wintering population of between 45,000 and 1,800,000. These birds arrive from Scandinavia and Russia on a broad front across the North Sea. The influx occurs between September and November, with birds returning towards their breeding grounds during April and May (Wright *et al*., 2011).

No bramblings were identified on the Rampion boat surveys.

There are no SPAs designated for brambling in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.41. Greenfinch

The breeding population of greenfinch in the UK is thought to be 695,000 pairs (Baker *et al*., 2006). These greenfinch are mostly resident but some birds in northern Britain may undergo short migrations south and west in the winter. Small numbers of greenfinch also come into the UK over the winter in westerly movements from continental Europe. Greenfinch that do migrate do so in October and November in the autumn and in March and April in spring.

No greenfinch were identified on the Rampion boat surveys.

There are no SPAs designated for greenfinch in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.42. Goldfinch

Goldfinch is a common species in the UK with a breeding population of 299,000 territories. Goldfinches are mostly resident in the UK, however some British breeders move south in the autumn, including some birds that leave the UK to winter further south in Europe. In addition some continental goldfinches move west or south-west in the autumn and some of these winter in Britain. Autumn passage is mostly in September to November and spring passage is mostly in April.

On the Rampion surveys goldfinch was seen in the spring in April and peaked in the autumn in October, which matches the migration pattern described above.

There are no SPAs designated for goldfinch in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.43. Siskin

The siskin is a common breeding bird in Britain, with a population of 369,000 pairs. The breeding population is believed to be largely sedentary, with wintering populations swollen by an influx from Scandinavia and the Baltic. These birds arrive in the autumn and return towards their breeding sites in April. Specific migration routes are not known for this species (Wright *et al*., 2011).

This species has been recorded in autumn only, when a total of 18 were recorded during October surveys.

There are no SPAs designated for siskin in Britain (Stroud *et al*., 2003), and this species is not listed on the Birds Directive.

2.9.44. Lesser redpoll

Lesser redpoll is a common, but declining, breeding species in the UK with an estimated population of 25,000 pairs (Baker *et al*., 2006). Most British breeders also winter within the UK. Those that do migrate (e.g. those in northern Britain) undertake movements in a south-easterly direction. In years when food is scarce these birds may disperse as far as France, the Low Countries and Germany. Long sea crossings tend to be avoided, thus these movements are likely to be across the English Channel. As Scandinavian migrants tend to move in a south-easterly direction most of these birds move into eastern Europe but in eruptive years some of these birds are likely to enter the UK.

No redpolls were identified on the Rampion boat surveys.

Lesser redpoll is Red Listed in the UK on the List of Species of Conservation Concern due to recent declines in its breeding population.

2.9.45. Linnet

The linnet is a common, but declining, species in the UK with an estimated population of 535,000 pairs (Baker *et al*., 2006). Most British birds are resident but some birds move south-west in the Autumn. Likewise birds from Scandinavia move south-west in the autumn, with some of these reaching the UK. Autumn passage is mostly in mid-September to mid-October and spring passage is mostly in April.

On the Rampion surveys linnets have been recorded in April and October, which fits in with the migration pattern described above.

Linnet is Red Listed in the UK on the List of Species of Conservation Concern due to recent declines in its breeding population.

2.9.46. Review of risks to passerines

A macro-avoidance rate of 53% has been demonstrated for land birds responding to offshore wind farms, along with micro-avoidance rates of 99.86% for a mixture of resident and migrant species.

Table 13. Review of potential risks posed to passerines migrating over land (sand martin, house martin, swallow) by the proposed Rampion wind farm site:

Risk	Threat to species	Justification
Barrier effects	Low	Migrates over land in this region Not recorded in the survey area
Collision	Low	Migrates over land in this region Not recorded in the survey area

Risk	Threat to species	Justification
		Reasonable macro-avoidance rates Reasonable micro-avoidance rates Flight height assumed to be very high for migrants
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

Table 14. Review of potential risks posed to passerines migrating over land and sea (skylark, meadow pipit, tree pipit, rock pipit, pied wagtail, grey wagtail, yellow wagtail, wren, redstart, black redstart, robin, wheatear, whinchat, nightingale, mistle thrush, song thrush, redwing, fieldfare, blackbird, ring ousel, blackcap, garden warbler, lesser whitethroat, whitethroat, sedge warbler, reed warbler, grasshopper warbler, willow warbler, wood warbler, chiffchaff, goldcrest, firecrest, spotted flycatcher, pied flycatcher, starling, chaffinch, brambling, greenfinch, goldfinch, siskin, lesser redpoll, linnet) by the proposed Rampion wind farm site:

Risk	Threat to species	Justification
Barrier effects	Low	Broad front migration Low numbers recorded in the survey area
Collision	Low	Broad front migration Low numbers recorded in the survey area Reasonable macro-avoidance rates Reasonable micro-avoidance rates Flight height assumed to be very high for migrants
Displacement	Low	ROWF site not used for foraging or resting
Disturbance	Low	ROWF site not used for foraging or resting

In the tables below, the following should be noted: [These tables are up to date to end of Nov 2011]

In the first year of surveys (March 2010 to February 2011) one survey per month was carried out. In the second year of surveying (March 2011 to February 2012) two surveys per month were carried during peak migration times, which were March to May and September to November. Therefore survey effort was not constant for all months.

During March to May 2011 and September to November 2011 a dedicated Migration Observer was present on the survey vessel, in addition to the European Seabirds at Sea (ESAS) surveyors, in order to maximise the number of migrating birds recorded during the survey.

The totals in the tables have been corrected to avoid duplication of bird sightings between the ESAS survey and the migration survey.

Only birds in flight have been included in these totals.

Table 15. Total numbers of geese and ducks recorded in the Rampion study area.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dark-bellied brent goose		28		40						139	6	
Probable white-fronted goose		11										
Unidentified goose species				4								
Wigeon										2		
Teal			4							7		
Eider	2		6							2		
Common scoter			55	204	50	23	8	13	49	10	7	
Velvet scoter									1			
Red-breasted merganser			4	1								
Unidentified duck species	1		10	25					2		2	

Table 16. Total numbers of divers recorded in the Rampion study area.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red-throated diver			25	5							3	
Black-throated diver				3								
Unidentified diver species			4	3	1					1	2	

Table 17. Total numbers of raptors and owls recorded in the Rampion study area.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marsh harrier									4			
Kestrel				1					1	1		
Merlin										2		
Peregrine											1	
Unidentified falcon species										1		
Probable short-eared owl										1		

Table 18. Total numbers of waders recorded in the Rampion study area.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oystercatcher										1		
Grey plover			5		1							
Dunlin			29		2				11			
Bar-tailed godwit				32	33							
Whimbrel				15	1							
Curlew			1			2	2				1	
Whimbrel/ curlew				4								
Turnstone			2		10							

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grey phalarope									2	1		
Unidentified wader sp.			24	11	33				4	10	1	

Table 19. Total numbers of passerines and neopasserines recorded in the Rampion study area.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Carrion crow				1								
Swift					12	5	18					
Skylark											11	
Swallow				66	130	4			1616	134		
Sand martin			1	8	1		9	9	34	2		
House martin			2	5	10				46	9		
Unidentified hirundine sp.				15		2			119			
Whitethroat				1								
Willow warbler				2								
Chiffchaff			1						3			
Unidentified warbler species				1						4		
Wren										1	1	
Starling			62							8	85	
Blackbird			2								1	
Song thrush			48									
Redwing											1	
Fieldfare			2								1	
Unidentified thrush species										5	14	
Black redstart											1	

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Robin				1					2			
Wheatear									2			
Yellow wagtail				1								
Grey wagtail			1						1			
Pied wagtail			4						9	26		
Meadow pipit			197	54					352	73	1	
Unidentified pipit species			4	2					38	58	2	
Chaffinch			11							14		
Siskin									18			
Goldfinch			4							9	1	
Linnet				2						7		
Unidentified finch species			40						3	42	5	
Unidentified passerine sp.			34	55	1				117	411	4	

3. CONCLUSIONS

This report summarises the predicted risks posed to migratory bird species from the Rampion OWF. This is based on the results from the boat-based surveys between March 2010 and November 2011, and our knowledge of population sizes, species' distributions, likely flight routes, and behaviour. The risks for each of the species are summarised in Table 20; see the main section of this report for further details

Table 20. Summary of likely risks to migratory bird species from the Rampion OWF.

Species group	Threat to species
Geese	Low
Ducks	Low
Herons	Low
Divers	Low
Grebes	Low
Raptors and owls	Moderate (collision)
Waders	Low
Neopasserines	Low
Passerines	Low

As part of the work commissioned by SOSS (Strategic Ornithological Support Services), a review of migratory species in relation to offshore wind projects is being undertaken by the BTO. A draft of this report (Wright et al, 2011) has been used in the production of this current report, but there may be updates in the final version that will need to be taken into account for the Rampion OWF EIA. As part of the final version of this report, a modelling framework is being recommended to predict the collision risk to species that may pass through the proposed wind farm site.

It is recommended that with this report NPC, as part of their support-package, discuss the key species with Natural England that will be required as part of this modelling process. Post these discussions, modelling specific to migrants can be undertaken by NPC.

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