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**An assessment of numbers of wintering divers, seaduck and grebes in inshore marine
areas of Scotland**

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Summary

Scottish inshore waters are well known strongholds of seaducks, divers and grebes. Such species are afforded protection through the EU Birds Directive. Scottish Natural Heritage (SNH) will advise Scottish Government where the most important areas for these species could merit protection as Special Protection Areas (SPAs). To support SNH in identifying possible marine SPAs and to provide the necessary quantitative evidence on inshore aggregations of seaduck, divers and grebes, the Joint Nature Conservation Committee (JNCC) completed a multi-year programme of surveys and analysis, the results of which are presented in this report.

To identify inshore areas that might be suitable for SPA classification, 45 areas of search around the UK were identified where potentially important numbers of waterbirds congregate outside the breeding season. In the 21 of these areas which were located in Scotland, data were collected over a period of ten years (2000–2010) during the winter season (November to March). They were collected by either aerial surveys, land-based counts or boat surveys, whichever survey method was most appropriate to ensure the collection of representative data. Data were analysed to provide population estimates for each species and area of search, and population sizes were compared with the relevant population thresholds defined in Stages 1.1, 1.2, 1.3 and 1.4 of the UK SPA Selection Guidelines (Stroud *et al* 2001; Mudge & Buxton 2013).

Of the 21 areas of search, 14 held populations of at least one species exceeding the relevant population thresholds defined under Stages 1.1 or 1.2 of the UK SPA Selection Guidelines on a regular basis, and 16 of the areas held populations which exceeded their 1% UK population on a regular basis and could be considered by SNH under Stage 1.4 (Mudge & Buxton 2013). Only two areas did not hold any species in relevant numbers.

Great northern divers (*Gavia immer*) and red-throated divers (*Gavia stellata*) were well represented and regularly present in numbers exceeding the relevant thresholds of Stage 1.1 in ten and four areas of search, respectively. Black-throated diver (*Gavia arctica*), Slavonian grebe (*Podiceps auritus*), little gull (*Larus minutus*), European shag (*Phalacrocorax aristotelis*), common eider (*Somateria mollissima mollissima*) and the subspecies of the common eider found in Shetland (*Somateria mollissima faeroensis*) also occurred in numbers that exceeded the relevant SPA threshold at Stage 1.1 or 1.2 in at least one area of search. Greater scaup (*Aythya marila*), long-tailed duck (*Clangula hyemalis*), common scoter (*Melanitta nigra*), velvet scoter (*Melanitta fusca*), common goldeneye (*Bucephala clangula*) and red-breasted merganser (*Mergus serrator*) do not exceed their relevant population thresholds under Stage 1.2 of the guidelines, but exceed their 1% UK population thresholds in at least one area of search, so they could be considered by SNH under Stage 1.4). Goosander (*Mergus merganser*), great-crested grebe (*Podiceps cristatus*), red-necked grebe (*Podiceps grisegena*) and great cormorant (*Phalacrocorax carbo*) were not present in numbers >1% of their UK populations in any of the inshore areas of search.

None of the individual areas of search held numbers of birds above the threshold of 20,000 individuals for an assemblage feature under Stage 1.3 of the UK SPA selection guidelines. However, a merged Outer Firth of Forth and St Andrews Bay complex, that combines these two individual areas of search, is under consideration by SNH. This combined complex would exceed the threshold of 20,000 individuals. At other areas of search there are existing intertidal SPAs that abut the inshore areas of search. If SNH decides to extend these existing SPAs to incorporate important areas for inshore waterbirds – instead of considering them individually - the resulting overall populations might exceed the threshold for an assemblage feature.

In the **Firth of Forth** area of search, mean of peak population estimates of red-throated diver, Slavonian grebe and little gull exceeded the threshold under Stage 1.1 of the UK SPA Selection guidelines. However, red-throated diver and little gull were not regularly present in these numbers, exceeding the relevant threshold in only one survey year, and Slavonian grebe numbers were below the minimum of 50 individuals that has been applied to date for SPA selection (Stroud *et al* 2001). Common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye and red-breasted merganser exceeded 1% of their respective UK wintering populations and could be considered under Stage 1.4. Red-necked grebe also exceeded 1% of the UK wintering population but the numbers present were less than 50 individuals.

In the **Firth of Tay** area of search red-throated diver and common eider regularly exceeded the relevant thresholds at Stage 1.1 and 1.2, respectively. This area of search supported the largest populations of red-throated diver and common eider of all areas surveyed in Scotland. Long-tailed duck, common scoter, velvet scoter and red-breasted merganser exceeded 1% of their UK wintering populations and could be considered under Stage 1.4, but velvet scoter did not meet the criterion for regularity of occurrence.

Due to the close proximity of the Firth of Forth and Firth of Tay areas of search a potential single site “**Outer Firth of Forth and St Andrews Bay complex**” is under consideration by SNH, linking these two individual areas together. The population estimates provided for this complex are the summed population estimates from the individual Firth of Forth and Firth of Tay areas of search. Within this potential joint site common eider, red-throated diver and little gull exceed the 1% thresholds under Stage 1.1 and 1.2 of the UK SPA Selection Guidelines. Long-tailed duck, common scoter, velvet scoter, common goldeneye, and red-breasted merganser exceeded 1% of their UK wintering populations and could be considered under Stage 1.4.

The **Aberdeen Bay** area of search held numbers of red-throated diver that just exceeded the UK SPA Selection Guidelines threshold at Stage 1.1, but the birds were not present in these numbers on a regular basis. Common eider exceeded 1% of their UK wintering population under Stage 1.4, but were not present in these numbers on a regular basis.

The **Moray Firth** area of search supported populations of red-throated diver and great northern diver that exceeded the UK SPA Selection Guidelines thresholds at Stage 1.1. Black-throated diver and Slavonian grebe also exceeded their respective Stage 1.1 thresholds however the number of birds present was fewer than 50 individuals. Greater scaup, common scoter, common eider, long-tailed duck, velvet scoter, common goldeneye and red-breasted merganser exceeded 1% of the UK wintering population and could be considered under Stage 1.4. Red-necked grebe also exceeded 1% of their UK wintering population but fewer than 50 individuals were estimated within the area of search. The Moray Firth area of search held the largest populations of long-tailed duck, common scoter, velvet scoter and common goldeneye of all areas surveyed in Scotland.

The **Scapa Flow** area of search in the south of the Orkney Islands regularly supported numbers of black-throated diver, great northern diver and Slavonian grebe that exceeded the 1% threshold at Stage 1.1. European shag exceeded the 1% threshold at Stage 1.2. Long-tailed duck, common goldeneye and red-breasted merganser and undifferentiated common eider exceeded 1% of the UK wintering population and could be considered under Stage 1.4. Scapa Flow held the highest populations of red-breasted merganser, red-necked grebe, Slavonian grebe and European shag of all areas of search in Scotland.

In the **North Orkney** area of search populations of great northern diver and Slavonian grebe exceeded the thresholds at Stage 1.1 of the UK SPA Selection Guidelines. However, only two years of data were available for Slavonian grebe which is less than recommended under the UK SPA Selection Guidelines to determine regularity of occurrence. Undifferentiated common eider, long-tailed duck, and red-breasted merganser exceeded 1% of their respective UK wintering populations and could be considered under Stage 1.4. Velvet scoter and European shag also exceeded this threshold but only two years of data were available, so regular occurrence could not be shown.

The **West Shetland** area of search regularly supported Slavonian grebes and great northern divers in numbers exceeding their respective Stage 1.1 thresholds. The estimated wintering population of common eider ssp. *faeroensis* was well in excess of the Stage 1.2 threshold. Long-tailed duck and red-breasted merganser exceeded 1% of their respective UK wintering populations and could be considered under Stage 1.4.

The **East Shetland** area of search regularly supported numbers of great northern diver and Slavonian grebe that exceeded the Stage 1.1 threshold. Common eider ssp. *faeroensis* exceeded the Stage 1.2 threshold. Long-tailed duck and red-breasted merganser exceeded 1% of their UK wintering populations and could be considered under Stage 1.4.

The **Unst** area in Shetland is the most northerly Scottish area of search. Numbers of all seaduck, divers and grebes were low and no species or assemblage of species occurred in numbers that exceeded the relevant thresholds from the UK SPA Selection Guidelines.

The **Loch Eriboll** area of search, on the north coast of mainland Scotland, supported relatively low numbers of seaduck, divers and grebes. Great northern diver exceeded their population threshold under Stage 1.1; however, there were fewer than 50 individuals recorded. No other species exceeded the relevant 1% threshold under the UK SPA Selection Guidelines, but the population estimates from limited Wetland Bird Survey (WeBS) data were almost certainly underestimates of the true numbers of birds using the area.

The **Wester Ross** area of search, in north-west Scotland, supported numbers of great northern diver, black-throated diver and Slavonian grebe in excess of the 1% threshold under Stage 1.1 of the guidelines. However, the number of Slavonian grebe present was less than 50 individuals. This area supported the largest estimated wintering population of black-throated diver of the surveyed areas in Scotland. Red-breasted merganser exceeded 1% of the UK wintering population and could be considered under Stage 1.4.

Within the **Broad Bay** area of search, on the east coast of the island of Lewis in the Outer Hebrides, great northern diver and Slavonian grebe exceeded 1% of their respective UK wintering populations under Stage 1.1. However Slavonian grebe numbers were fewer than 50 individuals. Long-tailed duck and common eider exceeded 1% of the UK wintering population and could be considered under Stage 1.4.

The **Outer Hebrides** area of search supported numbers of great northern diver, black-throated diver and Slavonian grebe in excess of the thresholds at Stage 1.1 of the UK SPA Selection Guidelines. However, the black-throated diver number was less than 50 individuals and Slavonian grebes were not regularly present. The Outer Hebrides area of search held the highest population of great northern divers of any area surveyed around Scotland. Common eider, long-tailed duck and red-breasted merganser occurred in numbers that exceeded 1% of their UK wintering populations and could be considered under Stage 1.4.

The **Coll** and **Tiree** area of search included both the north and south sides of the islands, and supported numbers of great northern diver that exceeded the 1% threshold under Stage 1.1. Common eider exceeded 1% of the UK wintering population and could be considered under Stage 1.4.

The **Mull** area of search supported great northern divers and Slavonian grebe in excess of the 1% threshold under Stage 1.1, though numbers of Slavonian grebe were fewer than 50 individuals.

The **Loch Indaal** area of search, on the south coast of the island of Islay, supported a population of great northern divers which exceeded the 1% threshold under Stage 1.1; however, these numbers were not regularly present. Slavonian grebe was also present in numbers that exceeded 1% of their UK wintering population but the estimated population was fewer than 50 individuals. Greater scaup exceeded 1% of the UK wintering population and could be considered under Stage 1.4. Loch Indaal supported the highest number of greater scaup of the areas of search around Scotland.

The **Sound of Gigha** area of search, along the west coast of the Kintyre peninsula, regularly supported great northern divers in excess of their 1% population threshold under 1.1 of the UK SPA Selection Guidelines. Black-throated diver and Slavonian grebe also exceeded their respective 1% population thresholds under Stage 1.1, but their numbers were below 50 individuals. Common eider and red-breasted merganser exceeded 1% of their UK wintering population estimates, but red-breasted merganser was not regularly present in numbers above the 1% threshold. The Sound of Gigha held the second highest population of great northern diver, after the Outer Hebrides area of search.

The **Firth of Clyde** area of search supported a population of red-throated divers which regularly exceeded the 1% population threshold under Stage 1.1. Slavonian grebes were present in numbers that exceeded the SPA threshold under Stage 1.1, numbers above 50 individuals were recorded in three of five seasons. Black-throated diver and great northern diver also exceeded their respective 1% population thresholds under Stage 1.1 but their numbers were below 50 individuals. Common eider, common goldeneye and red-breasted merganser exceeded 1% of their UK wintering population estimates and could be considered under Stage 1.4. Great crested grebe (*Podiceps cristatus*) and great cormorant were recorded in highest numbers of all the areas surveyed in Scotland, but did not exceed the relevant 1% thresholds under Stage 1.2 or 1.4.

The **Loch Ryan** area of search, in south-west Scotland, supported a population of Slavonian grebes which exceeded the 1% threshold under Stage 1.1, but was less than 50 individuals. Greater scaup and red-breasted merganser exceeded 1% of the UK wintering population and could be considered under Stage 1.4. Common eider also exceeded 1% of the UK wintering population, but did not meet the criterion for regularity of occurrence.

The **Luce Bay** area of search, in south-west Scotland, supported a population of great northern divers, which regularly exceeded the UK SPA Selection Guidelines threshold under Stage 1.1.

The **Solway Firth** area of search is shared with England and is the most southerly of the Scottish areas of search. The area supported a population of red-throated divers over three times the UK SPA Selection Guidelines Stage 1.1 threshold. Numbers of greater scaup and common scoter exceeded 1% of their respective UK wintering populations and they could be considered under Stage 1.4, though greater scaup did not meet the criterion for regularity of occurrence. The Solway Firth area of search supported the highest numbers of goosander of

the inshore areas surveyed in Scotland. Goosander did not exceed the relevant 1% threshold, although considerable numbers of this species occur within the WeBS count sectors of the adjoining Solway Estuary.

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1 Introduction

Scotland is home to a large variety of bird species associated with its diverse marine environment. With 11,000km of coastline, over 800 islands and a large range of coastal habitats it provides an attractive environment for marine birds. Inshore waters, with their range of firths, lochs and sounds, are well known strongholds of seaducks, divers and grebes (Forrester *et al* 2007).

Of the 106 bird species using UK marine waters (<http://www.bou.org.uk/british-list/>), 45 do so in numbers >50 individuals per year. All of the latter - with the exception of black guillemot (*Cephus grille*) - are covered by Article 4 of the Birds Directive ([Council Directive 2009/147/EC](#)) and their most important marine areas should therefore be classified as Special Protection Areas (SPAs). In the UK, SPAs are identified through the application of the Selection Guidelines for Special Protection Areas (Stroud *et al* 2001). The guidelines suggest protected areas where bird populations either exceed defined population thresholds on a regular basis or where areas have a particular ecological importance for these species.

For bird aggregations in Scottish inshore waters, Scottish Natural Heritage (SNH) provides advice to the Scottish Government on which areas could be considered for protection under the Birds Directive. To be able to apply the UK SPA Selection Guidelines, SNH needs to quantify the populations of seaducks, divers and grebes regularly using Scottish inshore waters. To support SNH's efforts to identify possible SPAs, the Joint Nature Conservation Committee (JNCC) and SNH completed a programme of aerial surveys, land-based counts and boat surveys over the period from 2000 to 2010, to collect data on inshore aggregations of seaduck, divers and grebes during the non-breeding season (November to March). Notable concentrations of these species also occur at other times of year (e.g. during pre- or post-breeding moult). Although these concentrations may merit further consideration for protection as they may be sensitive to human pressures, they will not be covered in this document.

The aim of this report is to provide SNH with the evidence needed to form its advice to Scottish Government on possible locations for SPA designation. The report presents the numbers of wintering aggregations of inshore waterbirds in 21 areas of search around Scotland and indicates where species exceed population thresholds given by the UK SPA Selection Guidelines (Stage 1, see below). Where species exceed the relevant population thresholds on a regular basis, areas will be further assessed by SNH to identify the most suitable areas for consideration by government (Stage 2, see below).

The introduction to each of the individual areas of search provides some background on the site, including some of the relevant existing protected areas within or adjacent to the area of search. Appendix 1 presents the data sources that were available at each of the sites and shows which data contributed to the mean of peak population estimate for each species. Appendix 2 presents the population estimates produced from Distance analysis of aerial survey data with 95% confidence intervals.

The UK SPA Selection Guidelines for the identification of SPAs advise that sites should be identified in two stages (Stroud *et al* 2001): While Stage 1 identifies areas that are likely to qualify for SPA status, Stage 2 further considers these areas to select the most suitable areas in number and size for SPA classification.

Stage 1 of the Guidelines identifies areas as follows:

1. Stage 1.1: an area is used regularly by 1% or more of the Great Britain (UK) population of a species listed in Annex I of the EC Birds Directive.
2. Stage 1.2: an area is used regularly by 1% or more of the biogeographic population of a regularly occurring migratory species, other than those listed in Annex I of the EC Birds Directive.
3. Stage 1.3: an area is used regularly by an assemblage of more than 20,000 waterbirds comprising at least two species.
4. Stage 1.4: where the application of stages 1.1-1.3 does not identify an adequate suite of areas, additional sites may be selected if they meet one or more of the Stage 2 guidelines.

The 1% population thresholds for species listed on Annex I of the Birds Directive were taken from Musgrove *et al* (2013), for regularly occurring migratory species 1% of the biogeographic population was taken from Wetlands Population Estimate (WPE) 5, Wetlands International (2015). The national population size of some wintering waterbirds is very small and 1% of these populations can sometimes give very small values of just a few individuals which in an international context are not of major significance in sustaining viable biogeographical populations of these species (Stroud *et al* 2001). In this context it has been the long-standing practice amongst the statutory nature conservation bodies to require at least 50 individuals to be regularly present for the area to be considered for SSSI (Site of Special Scientific Interest) site selection and this has also applied to SPA site selection (Stroud *et al* 2001). Wintering waterbird species that are affected by this criterion are great northern diver, black-throated diver, Slavonian grebe, red-necked grebe and little gull. However, there have been exceptions to this guidance dependent on the conservation needs of individual species (UK SPA Scientific Working Group 2002).

Stage 1's fourth guideline gives consideration, using the Stage 2 judgements, to cases where a species' population status, ecology or movement patterns may mean that an adequate number of areas cannot be identified from Stage 1's first three guidelines alone. To apply this guideline in a consistent and repeatable manner, SNH considers species exceeding 1% of their UK population within an area of search under Stage 1.4.

Stage 2 of the Guidelines considers the following:

1. Population size and density: Areas holding or supporting more birds than others and/or holding or supporting birds at higher concentrations are favoured for selection.
2. Species range: Areas selected for a given species provide as wide a geographic coverage across the species' range as possible.
3. Breeding success: Areas of higher breeding success than others are favoured for selection.
4. History of occupancy: Areas known to have a longer history of occupation or use by the relevant species are favoured for selection.

5. Multi-species areas: Areas holding or supporting the larger number of qualifying species under Article 4 of the Directive are favoured for selection.
6. Naturalness: Areas comprising natural or semi-natural habitats are favoured for selection over those which do not.
7. Severe weather refuges: Areas used at least once a decade by significant proportions of the biogeographical population of a species in periods of severe weather in any season, and which are vital to the survival of a viable population, are favoured for selection.

2 Methods

2.1 Species of interest and areas of search

The target species were those inshore waterbirds that spend the winter period within coastal areas of the UK and are listed in Table 1 of the African-Eurasian Waterbird Agreement Action Plan (Convention on the Conservation of Migratory Species 1999 http://www.cms.int/species/aewa/aew_ap.htm): greater scaup *Aythya marila*, common eider *Somateria mollissima*, long-tailed duck *Clangula hyemalis*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, common goldeneye *Bucephala clangula*, red-breasted merganser *Mergus serrator*, goosander *Mergus merganser*, red-throated diver *Gavia stellata*, black-throated diver *Gavia arctica*, great northern diver *Gavia immer*, great crested grebe *Podiceps cristatus*, red-necked grebe *Podiceps grisegena*, Slavonian grebe *Podiceps auritus*, little grebe *Tachybaptus ruficollis* and black-necked grebe *Podiceps nigricollis*. Additionally, data on numbers and distribution of little gull *Larus minutes*, European shag *Phalacrocorax aristotelis* and great cormorant *Phalacrocorax carbo* were considered. These species aggregate in coastal waters outside the breeding season.

Based on expert judgement and existing data, coastal waters were divided into 21 geographically distinct areas of search, such as estuaries and bays, which could potentially support important numbers of waterbirds (Figure 1a and b). The seaward limit of the areas of search was defined by water depth, based on expert knowledge of the ecology of the target species. Where feasible the areas of search extended to cover inshore waters of <50m depth. If it was evident the seaward limit of the bird distribution had not been captured, then subsequent surveys were extended to try and encompass the full extent of the distribution.

The landward limits were based upon the Mean Low Water Spring (MLWS) tidal level as the landward boundary, as in Scotland existing (terrestrial) SPAs usually extend at most to MLWS. By using MLWS as the landward boundary, overlap or gaps between SPAs are avoided.

2.2 Data collection

For each species and area of search, the most suitable survey method to capture the numbers and distributions of the target species was chosen. The choice of visual aerial survey, land-based count or boat survey was based on knowledge of the benefits and constraints of each method with respect to the ecology of the bird species to be surveyed. Further information on each of these methods is provided below. For more detail on general survey methods see Kahlert *et al* (2000) and Camphuysen *et al* (2004). The numbers and types of surveys carried out in each area of search varied due to the geography of the site, the ecology of the species present and logistical constraints.

During data collection, some birds were identified only to genus. Where only one species of diver or scoter species was recorded in an area of search, unidentified divers or scoters were assigned to that species. However, in many areas more than one possible species was observed, so any observations of unidentified divers could not be assigned to a particular species and were therefore not included in the analyses. Exclusion of these observations will underestimate the numbers of species present in the area of search, unless large numbers are not identified to species level it should not markedly alter the identification of important areas for

these species. It is unlikely that any systematic spatial pattern is linked to the likelihood of an observation being identified only to genus.

2.2.1 Aerial surveys

In most cases, data were collected by visual aerial surveys as they were considered most time and cost effective for covering large areas, and enabled better coverage in areas of very shallow water. This allowed repeated surveys to be undertaken over a number of years, something which would have been difficult to achieve with the much slower boat based surveys. Aerial surveys were also deemed to be the most suitable method where species are prone to disturbance by boat (Schwemmer *et al* 2011). Digital aerial surveys can be carried out at higher elevation than visual surveys but were a novel, untested survey method at the time so all aerial data were collected by visual survey. However, aerial surveys might underestimate numbers of birds close inshore as the planes cannot survey close to coasts with steep cliffs. They might also underestimate cryptic species that are difficult to detect from planes such as grebes and black-throated diver.

The aerial surveys followed standardised methods as described by Kahlert *et al* (2000) and Camphuysen *et al* (2004). Data were collected using distance sampling methods (Buckland *et al* 2001) along line-transects to improve the population estimates. Some strip transect surveys were carried out prior to 2000/2001. Aerial surveys in 2001/02 allocated all bird observations to one of three distance bands (where bands B and C were combined) all subsequent surveys allocated birds to one of four distance bands (for details, see section 2.3.1).

Aerial surveys were carried out from a Partenavia (PN-68) or an Islander plane flown at 76m (250ft) above the sea, at a speed of 185km per hour (100 knots). Line-transects were spaced 2km apart (4km at the Outer Hebrides due to logistical constraints), and oriented perpendicular to the coast in order to sample across the depth gradient which was expected to be the principle environmental gradient influencing the distribution of birds at the site. This distance maximises detection of birds located between transects, while minimising the risk of double counting birds on neighbouring transects. Observers recorded numbers of birds and time (to the nearest second) of observation from both sides of the aircraft. A Global Positioning System (GPS) recorded the location of the aircraft every second. Observations of individuals and flocks were assigned to one of four distance bands, according to their perpendicular distance from the transect line: 44-163m from the transect line (band A); 164-432m (band B); 433-1000m (band C); and >1000m (band D). Observers determined these distances using a clinometer, using fixed angles of declination from the visual horizon.

2.2.2 Land-based counts

Land-based counts are systematic counts undertaken for a specified time period at a series of locations along a stretch of coast. The data collected were considered as complete counts of species within the sector/area that was surveyed.

Land-based counts were available from Wetland Bird Survey (WeBS) data (<http://www.bto.org/volunteer-surveys/webs/data>). In addition, at some areas of search JNCC commissioned land-based surveys or used targeted survey data such as Royal Society for the Protection of Birds (RSPB) seaduck counts in the Moray Firth, which were available for some areas of search.

Land-based counts are not ideal for surveying marine species as individuals beyond 2km from the coast are rarely detected (Webb & Reid 2004). However, some species, such as grebes and black-throated diver, are not reliably detected and identified from boats or aircraft and land-based counts are the best method for assessing their numbers and distribution along the coast. Land-based counts can be complementary to aerial surveys by surveying areas close to the shore that cannot be covered from the air.

WeBS count data provided a useful source of information for many areas of search. However, the spatial and temporal coverage of the data was varied and in some areas insufficient to provide a representative estimate of the numbers of birds present. WeBS counts collect data on a wider range of species than considered in this report and did not prioritise the target species or areas considered here. In addition, WeBS counts are undertaken once per month on predetermined dates when weather conditions might not be optimal. Therefore, data from targeted systematic land-based counts were generally used in preference to WeBS data where they were available.

2.2.3 Boat surveys

Boat surveys are not ideal for species prone to disturbance, such as seaduck and divers (Schwemmer *et al* 2011), as they are displaced from their original location by the boat and numbers may be underestimated as a consequence. However, in some areas boat surveys are the only safe method for surveying bird numbers, e.g. where steep cliffs prevent aerial surveys close inshore. Boat surveys were undertaken at east and west Shetland, and also at the firths of Forth and Tay though these were not used in favour of more recent data.

Data from boat surveys undertaken at East Shetland and West Shetland were collected using strip transects that assume all observations to a specified distance are recorded. Strip transect methods underestimate numbers as they do not account for birds missed by observers because they were further away from the transect line. Section 2.3.1 below and the site accounts for East Shetland and West Shetland provide further information.

2.3 Data analysis

The first stage in assessing the data was to determine which species were present in numbers that exceeded the relevant UK SPA selection guideline thresholds in each of the areas of search.

2.3.1 Estimating numbers of birds in an area of search

An overview of the methods used for estimating numbers of birds within an area of search are given here but the individual area of search sections within this report contain more detailed information on the specific methods and approaches used in each area.

Population size was defined as the number of birds estimated to be using the area of search on the date the survey was conducted.

Distance sampling

Distance sampling (Buckland *et al* 2001) is a method which improves population estimates of study objects (collected along a transect line) by accounting for individuals missed by observers because they are some distance away. The number of missed observations is estimated by

modelling a 'detection function' that describes the decline in the probability of detecting an individual with increasing distance from the transect line. These detection functions are used to estimate the total number of birds per survey, including the missed individuals. From these, estimates of the total abundance of birds within the entire survey area can be calculated, along with 95% confidence limits.

Here, distance sampling analysis was conducted using the software Distance 6.0 (Thomas *et al* 2010). Where a sufficient number of observations of a species was recorded, it was applied to all line-transect data from aerial surveys and boat surveys, as both these survey methods provided the necessary information about distance from the observer. Generally, at least 15 observations were needed to generate a suitable detection function. If too few observations of a species were recorded, the survey was instead treated as a strip transect and population estimates were generated by extrapolation. The most appropriate model for the detection function was selected by the Akaike Information Criterion, following standard guidelines described in Buckland *et al* (2001). The data from land-based counts could not be corrected in this way as observations were not assigned to distance bands.

Mean of peak estimate

In each area of search and for each species, a mean of peak estimate was calculated to provide a measure of peak numbers which can generally be expected to occur in the area. Five years of data were used where possible for calculating the mean of peak population estimate (Table 1 and Appendix 1). This is standard practice deriving from recommendations under the Ramsar Convention. However, population estimates based on three years (the minimum needed to establish regularity of occurrence) are provided where insufficient suitable data were available.

For each species, the mean of peak figure was determined as follows:

- for each survey, a population estimate (with the help of Distance sampling for line-transect data) or a total count of all birds observed (land-based count data) in the area of search was calculated;
- a peak count was then identified from all surveys within a winter season (November to March); and
- an average of the peak counts was calculated from the five (or three) most recent winter seasons.

Five years is the generally accepted reporting period (mean of the peak annual counts over five years) derived from recommendations under the Ramsar Convention (Ramsar Convention Secretariat 2013). As discussed by Webb and Reid (2004) five years of best quality data on inshore waterbird aggregations were not available at many sites, so they suggested a minimum of three years of data should be used in line with the guidance on establishing regularity of occurrence under the Ramsar Convention.

The best available data were used to calculate a mean of peak estimate for each species present in an area of search. Where there was a choice of data sources for this calculation (i.e. aerial survey, boat survey, JNCC targeted land-based counts or WeBS counts), the data that provided the highest (peak) estimate in a winter season were used. Consequently, the mean of peak estimates in some cases was derived from a mixture of data sources. The survey method and number of winter seasons used to calculate the mean of peaks estimates varied between species and area of search (see individual area of search sections for more information). Data

from different survey methods (e.g. land-based counts and aerial surveys) were not summed even though coverage may have been complementary. The assumptions these methods are based on differ from each other, hence these techniques cannot easily be combined.

The size of the assemblage was calculated by summing all individual species' mean of peak estimates, to assess whether the numbers of birds present in each area of search exceeded the Stage 1.3 threshold for a waterbird assemblage (20,000 individuals) of the UK SPA Selection Guidelines.

Regularity

An assessment was made of the regularity with which the requisite numbers of birds occurred within each area of search. As these are mobile species, this was done to ensure that any areas identified as important for wintering waterbirds were used by these species on a consistent basis over a number of years.

The UK SPA Selection Guidelines (Stroud *et al* 2001) adopted the definition of regularity defined by 'The Conference of the Contracting Parties to the Ramsar Convention'. Ramsar site selection criteria define regular occurrence as:

- the requisite number of birds is known to have occurred in two thirds of the seasons for which adequate data are available, the total number of seasons being not less than three; or
- the mean of the maxima of those seasons in which the site is internationally important, taken over at least five years, amounts to the required level (means based on three or four years may be quoted in provisional assessments only).

Webb and Reid (2004) considered these definitions of regularity for inshore waterbird aggregations and suggested the most appropriate definition to use is that "two thirds of the seasons for which adequate data are available, the total number of seasons being not less than three". It is also suggested that although the Ramsar definition of regular allows for further compromise in remote areas or for rare species that "such compromise may be inappropriate in the marine environment, where transient aggregations of prey might lead to irregular occurrences of very large numbers of some inshore birds at a site."

Therefore this report, with reference to Webb and Reid (2004), considers that a population is regularly occurring if "the requisite number of birds is known to have occurred in two thirds of the seasons for which adequate data are available, the total number of seasons being not less than three".

However, there are circumstances in which the mean of peaks method would be more appropriate. For example, where there is evidence that a site provides a severe weather refuge resulting in unusually high counts in one year.

3 Results

The results are presented as a species overview across all the areas of search, followed by sections that present more detailed information on each area of search.

Fourteen of the 21 Scottish areas of search supported numbers of a diver or grebe species that regularly exceeded the relevant UK SPA Selection Guidelines Stage 1.1 threshold (Figure 1a, Table 1). Great northern diver regularly occurred in numbers that exceeded the threshold of 50 birds in ten areas of search. The current UK wintering population estimate of 2,500 individuals for great northern diver (Musgrove *et al* 2013) is likely to be an underestimate, given that the sum of the population estimates for this species across all areas of search is 4,688 individuals, however these surveys were not undertaken concurrently so movement of birds between sites is possible. Nonetheless, any new population estimate is unlikely to alter the threshold figure of 50 birds that has been applied to date and so would not change the number of areas of search supporting populations of great northern divers which exceed the UK SPA Selection Guidelines thresholds under Stage 1.1.

Red-throated divers were regularly present in numbers exceeding the threshold of 170 birds in four areas of search. Moray Firth was the only area of search at which red-throated divers and great northern divers both occurred together in numbers in excess of the Stage 1.1 thresholds. The results reflect the different distributions of these two diver species around Scotland (Figure 1a).

Black-throated diver, Slavonian grebe, European shag, common eider (*ssp. mollissima*) and the subspecies of common eider found in Shetland (*ssp. faeroensis*) also occurred in numbers that exceeded the relevant SPA threshold at Stage 1.1 or 1.2 on a regular basis in at least one area of search. European shag and the two *ssp.* of common eider were the only regularly occurring migratory species recorded in numbers that exceeded the relevant SPA Stage 1.2 threshold (Figure 1a).

Goosander did not meet the Stage 1.2 threshold of 2,700 birds in any of the areas of search in Scotland, nor did the number within any of the areas of search exceed 1% of the UK wintering population under Stage 1.4. The Solway Firth area of search recorded the highest numbers of goosander, 110 birds. This is just below the 1% UK threshold of 120 individuals, although high numbers have been recorded in the adjacent WeBS count sectors of the Solway Estuary. Within the UK, goosander is currently protected at two sites under Article 4.2 of the Birds Directive ([Council Directive 2009/147/EC](#)) as a listed component of non-breeding waterbird assemblages at the Inner Moray Firth SPA and the Firth of Tay and Eden Estuary SPA. The status of goosander within the UK has been - and remains - under review (Hearn 2013).

None of the individual areas of search supported total numbers of waterbirds that exceeded the assemblage threshold of 20,000 individuals (Table 1). However, there is the potential for combined areas to exceed this threshold and reach qualifying numbers under Stage 1.3 of the guidelines e.g. the Outer Firth of Forth and St Andrews Bay complex or the Solway Firth where an existing intertidal SPA might be combined with the adjacent inshore areas of search.

Generally, the areas of search on the east coast of Scotland were more diverse than the west coast areas of search, supporting different seaduck species (Figure 1b). Long-tailed duck and both common and velvet scoter tended to occur most numerous on the east coast of Scotland, with the exception of Luce Bay and the Solway Firth, which supported high numbers of common

scoter. Common goldeneye, great crested grebe and greater scaup were rarely recorded in most areas, but were present in high numbers in a few areas of search, including the Solway Firth, the Firth of Forth, the Moray Firth and Loch Ryan. Red-breasted merganser and red-throated diver were present in most areas of search, although numbers varied, with red-breasted merganser tending to be more abundant in the north of Scotland and red-throated diver in the east and south of Scotland. Slavonian grebe tended to occur in greater numbers in the east and north of Scotland, but was present in some west coast areas of search.

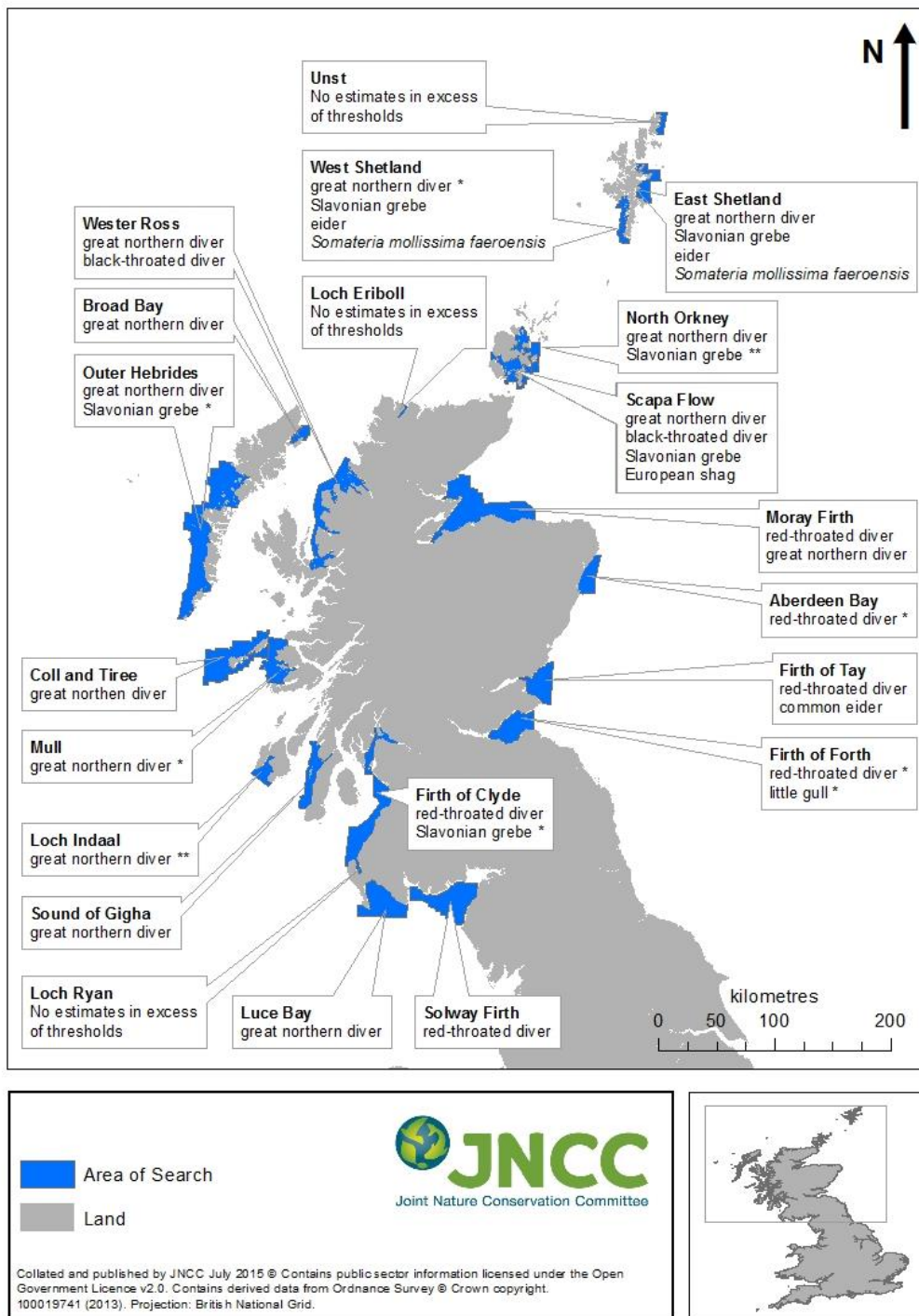


Figure 1a. Areas of search and species present in numbers that regularly exceeded the relevant UK SPA Selection Guidelines threshold at Stage 1.1 or Stage 1.2. ** This population estimate is based on <3 years of data, a minimum of three years of data is needed to establish regularity of occurrence (Stroud *et al* 2001). * These species do not meet the criterion for regularity (Stroud *et al* 2001).

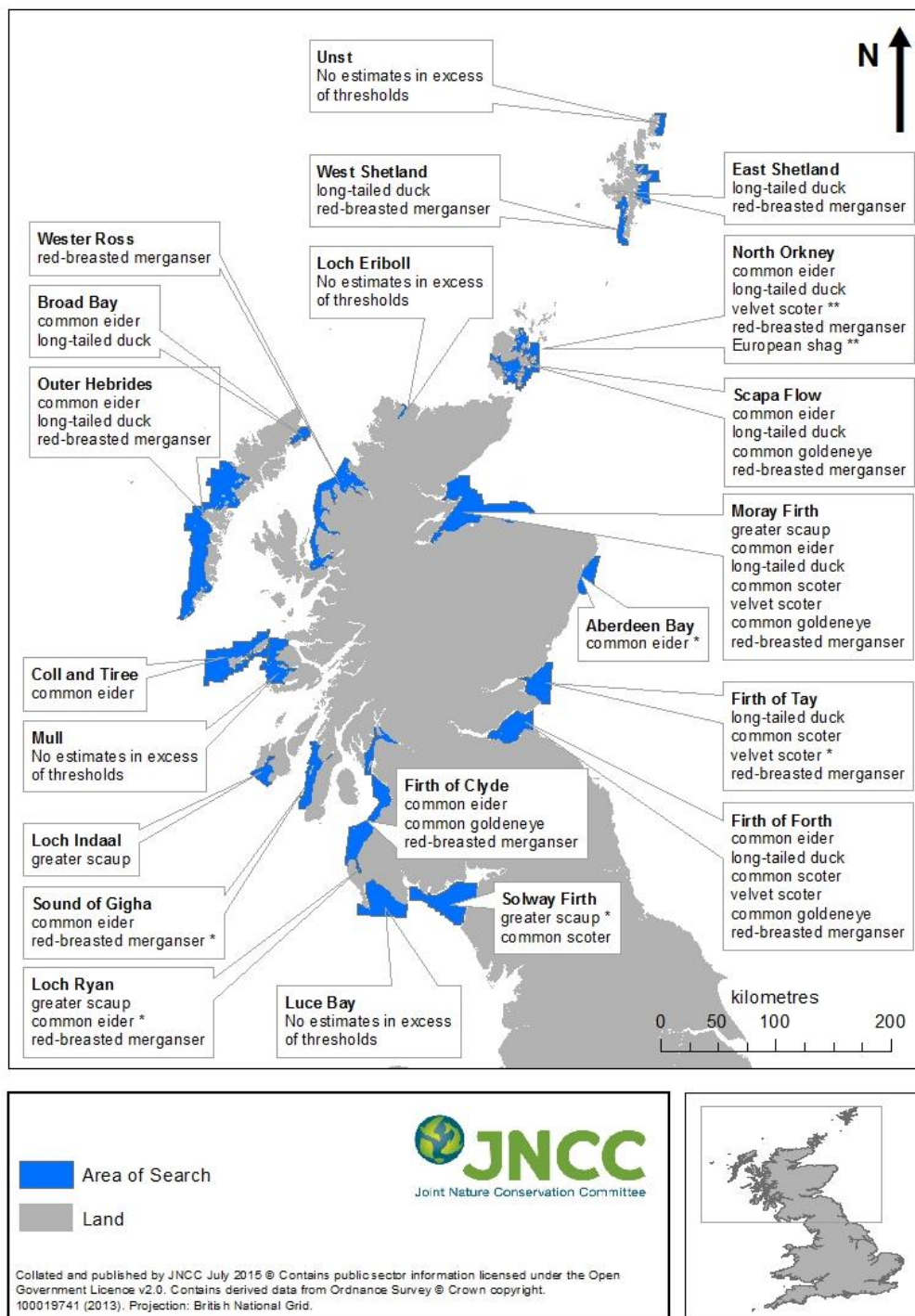


Figure 1b. Areas of search and species present in numbers that regularly exceeded 1% of the UK population under stage 1.4 of the UK SPA Selection Guidelines (Mudge & Buxton 2013). ** This population estimate is based on <3 years of data, a minimum of three years of data is needed to establish regularity of occurrence (Stroud *et al* 2001). * These species do not meet the criterion for regularity (Stroud *et al* 2001).

Table 1. Mean of peak population estimates. Dark grey cells: population estimates exceeding Stage 1.1 or 1.2 thresholds; light grey cells: population estimates exceeding 1% UK wintering thresholds under Stage 1.4 (Mudge & Buxton 2013). Outlined cells: highest estimate for each species in Scottish areas of search. The sum of all the population estimates is given in the assemblage column. Appendix 1 provides the population estimates used to calculate the mean of peaks.

Species	greater scaup	common eider	common eider <i>ssp. faeroensis</i>	long-tailed duck	common scoter	velvet scoter	common goldeneye	red-breasted merganser	goosander	red-throated diver	black-throated diver	great northern diver	great crested grebe	red-necked grebe	Slavonian grebe	little gull	European shag	great cormorant	assemblage
SPA threshold	3,100	10,300	85	16,000	5,500	4,500	11,400	1,700	2,700	170	50	50	3,500	500	50	50	2,000	1,200	20,000
1% UK	52	600	55	110	1,000	25	200	84	120	170	6	25	190	1	11	50	1,100	350	
Firth of Forth	0	9,845	-	978	2,218	577	546	189	11	269*	2	1	22	7 ^a	26 ^a	106*	153	149	15,099
Firth of Tay	3	11,739	-	994	2,482	198*	43	180	4	634	0	0	3	0	4	20	6	101	16,411
Outer Firth of Forth and St Andrews Bay complex	3	21,584	-	1,972	4,700	775	589	369	15	903	2	1	25	7 ^a	30 ^a	126*	159	250	31,510
Aberdeen Bay	1	724*	-	30	550	3	6	28	0	172*	0	0	1	0	0	0	-	-	1,515
Moray Firth	930	1,745	-	5,001	5,479	1,488	907	151	2	366	16 ^a	162	3	2 ^a	43 ^a	7	105	207	16,614
Scapa Flow	0	1,994	-	1,393	148	13	219	539	1	66	57	506	0	12 ^a	135	0	2,929	77	8,089
North Orkney	2	1,471	-	952	60	147 [^]	42	279	0	65	4	317	0	1 ^a	120 [^]	0	1,742 [^]	144	5,346
West Shetland	0	-	1,021 ¹	162	3	1	69	195	0	13	0	52*	0	0	78	0	920	198	2,712
East Shetland	0	-	252 ¹	166	2	0	48	234	0	24	0	200	0	0	54	0	817	76	1,873
Unst	0	-	20 ^{1^}	12 [^]	1	0	2	24	0	2 [^]	0	14 [^]	0	0	1	0	0	0	76
Loch Eriboll	0	34	-	13	0	0	6	29	1	3	5	40 ^a	0	0	10	0	76	12	229
Wester Ross	0	127	-	28	22	0	194	135	1	9	61	153	0	0	27 ^a	0	501	14	1,268
Broad Bay	0	729	-	346	117	2	3	33	0	54	3	440	0	0	16 ^a	0	34	2	1,779
Outer Hebrides	0	5,414	-	842	88	1	3	239	0	59	43 ^a	1,400	0	0	51*	0	10	16	8,166
Coll and Tiree	12	1,483	-	108	0	0	0	41	0	7	0	496	0	0	0	0	-	-	2,147
Mull	0	118	-	30	0	0	19	21	0	11	1	67*	0	0	26 ^a	0	47	0	340
Loch Indaal	1,059	143	-	6	43	0	11	60	0	17	3	56 [^]	0	0	22 ^a	0	33	11	1,464

Species	greater scaup	common eider	common eider ssp. <i>faeroensis</i>	long-tailed duck	common scoter	velvet scoter	common goldeneye	red-breasted meranser	goosander	red-throated diver	black-throated diver	great northern diver	great crested grebe	red-necked grebe	Slavonian grebe	little gull	European shag	great cormorant	assemblage
SPA threshold	3,100	10,300	85	16,000	5,500	4,500	11,400	1,700	2,700	170	50	50	3,500	500	50	50	2,000	1,200	20,000
1% UK	52	600	55	110	1,000	25	200	84	120	170	6	25	190	1	11	50	1,100	350	
Sound of Gigha	0	1,339	-	73	44	6	31	121*	1	8	12 ^a *	539	0	0	37 ^a	0	61	4	2,276
Firth of Clyde	16	2,651	-	53	18	3	457	164	4	233	14 ^a	31 ^a	132	0	59 [*]	0	258	269	4,362
Loch Ryan	1,027	672*	-	13	160	0	147	101	0	77	1	6	57	0	36 ^a	0	49	16	2,362
Luce Bay	0	369	-	25	815	6	21	46	0	142	0	204	0	0	1	0	3	6	1,638
Solway Firth	95*	14	-	0	1,592	0	10	12	110	540	0	4	17	0	0	0	0	224	2,618

¹ The eider subspecies *Somateria mollissima faeroensis* (1% of biogeographic population is 85, 1% of UK wintering population is 55). The eider at the North Orkney and Scapa Flow sites are considered as common eider spp. *mollissima*, see section (3.6 Scapa Flow) for details.

[^] This population estimate is based on <3 years of data. A minimum of three years of data were needed to establish regularity of occurrence (Stroud *et al* 2001).

^{*} These species do not meet the criterion for regularity (Stroud *et al* 2001).

^a The 1% UK threshold for some species is very low, just one or a few individuals. Such low numbers are not of significance in maintaining the biogeographic population of a species and therefore it has been long-standing practice amongst the statutory nature conservation bodies that a minimum of 50 individuals of a species are required to justify a possible SPA (Stroud *et al* 2001).

There have been exceptions to this guideline based on the conservation needs of individual species (UK SPA Scientific Working Group 2002).

3.1 Firth of Forth

Introduction

The Firth of Forth area of search extends west from North Berwick on the south coast and Anstruther on the north coast, to Dalgety Bay and Drum Sands in the west (Figure 2). A deep narrow channel of 60 metre sea depth runs in the middle of the Firth, but most of the area of search has a water depth of 20-30 metres. The subtidal area has a mud and sandy mud substrate, with sand and muddy sand in the shallow coastal areas and mixed sediment towards the inner Firth (McBreen *et al* 2011). The coastal area includes a diverse range of habitats including lagoons, salt marsh, sand dunes and cliffs. Extensive intertidal sand-flats and mud-flats occur in the Inner Firth and support a rich diversity of invertebrate fauna (Haskoning 2002). Three SPAs are already classified within the Firth of Forth area of search: The Firth of Forth SPA, Forth Islands SPA and the Imperial Dock Lock, Leith SPA. The Firth of Forth SPA was classified in 2001 for wintering red-throated diver, Slavonian grebe and passage Sandwich tern (*Sterna sandvicensis*) under Article 4.1 of the EU Birds Directive (Council Directive 2009/147/EC). Under Article 4.2 of the Birds Directive, it was classified for an internationally important assemblage of overwintering birds (95,000 waterfowl, five year peak mean) including red-throated diver, great crested grebe, Slavonian grebe, great cormorant, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye and red-breasted merganser. The Forth Islands SPA was classified in 1990 for breeding seabirds including European shag under Article 4.2 of the Birds Directive, and great cormorant listed as part of an internationally important assemblage of 90,000 breeding seabirds, 1985-1988. Imperial Dock Lock, Leith SPA was classified to protect a large breeding colony of common tern *Sterna hirundo*.

Site-specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Firth of Forth were collected by boat-based survey conducted in January 1998, by aerial survey that included two strip transect aerial surveys in December 2000 and February 2001, and by six line-transect surveys carried out between December and February in 2001/02, 2003/04 and 2004/05. The 2001/02 line-transect surveys assigned observations to three distance bands; subsequent line-transect surveys used four distance bands. Data from land-based WeBS counts within the Firth of Forth area of search were collated from the most recent five years of available data (2006/07 to 2010/11). The extent of the aerial survey in the Firth of Forth and the coverage from land-based WeBS counts are presented in Figure 3.

The following decisions were taken based on the data that were available for the Firth of Forth area of search:

Data from the boat based survey conducted in 1998 were not used for the population estimates as more recent data were available from aerial surveys. Strip transect aerial survey data were not used as they are likely to under estimate the true number of birds because they cannot be corrected using distance sampling.

The line-transect aerial surveys all had good spatial coverage of the area of search (Figure 4) and therefore all surveys were used to calculate the mean of peak estimates. Distance sampling was used to generate population estimates for each species within the area of search.

With the exception of one great northern diver, all divers observed during aerial surveys were recorded either as red-throated diver or unidentified diver species. Consequently, unidentified diver observations were assumed to be red-throated divers and analyses were performed on combined red-throated and unidentified diver data.

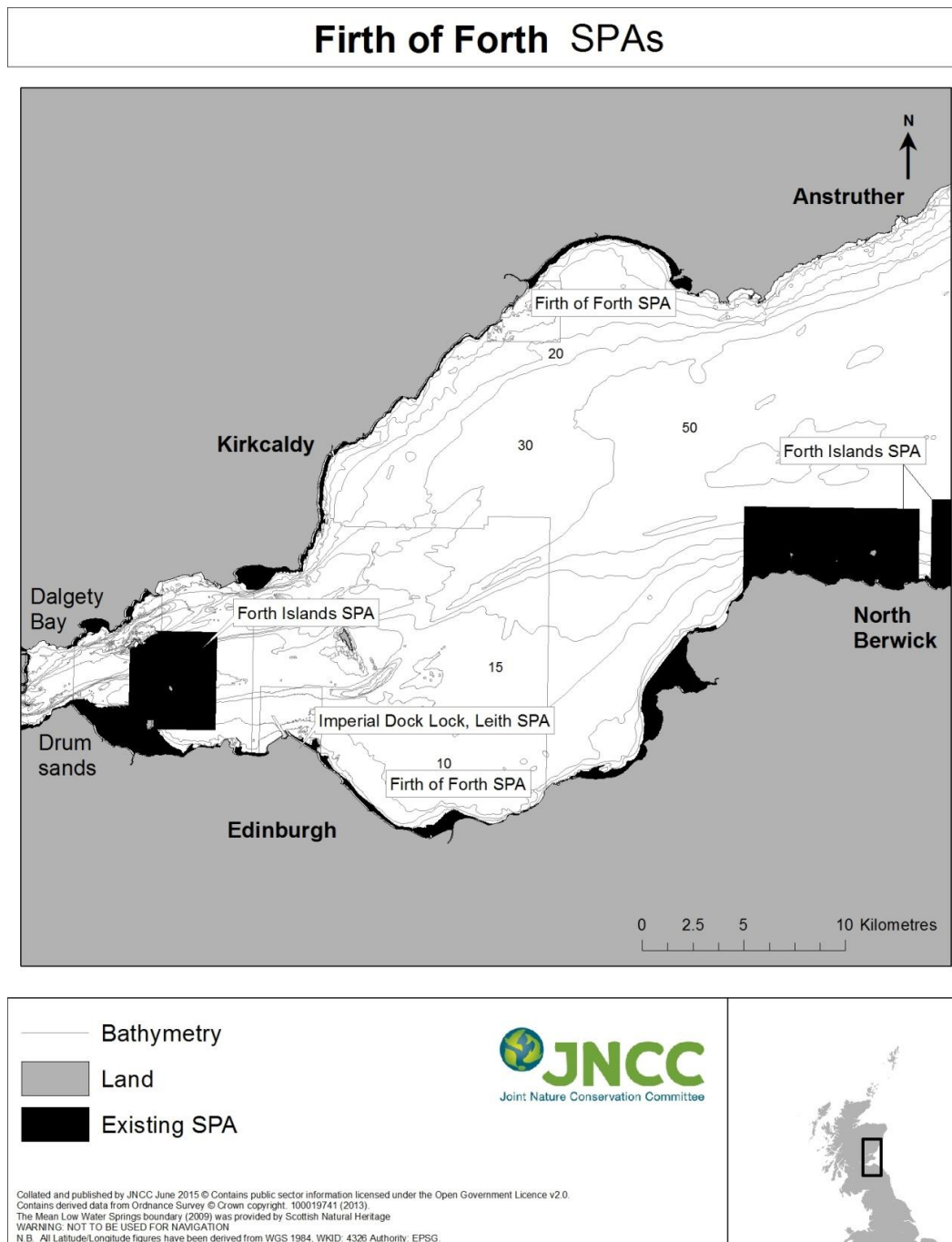


Figure 2. The Firth of Forth area of search showing bathymetry and existing SPAs.

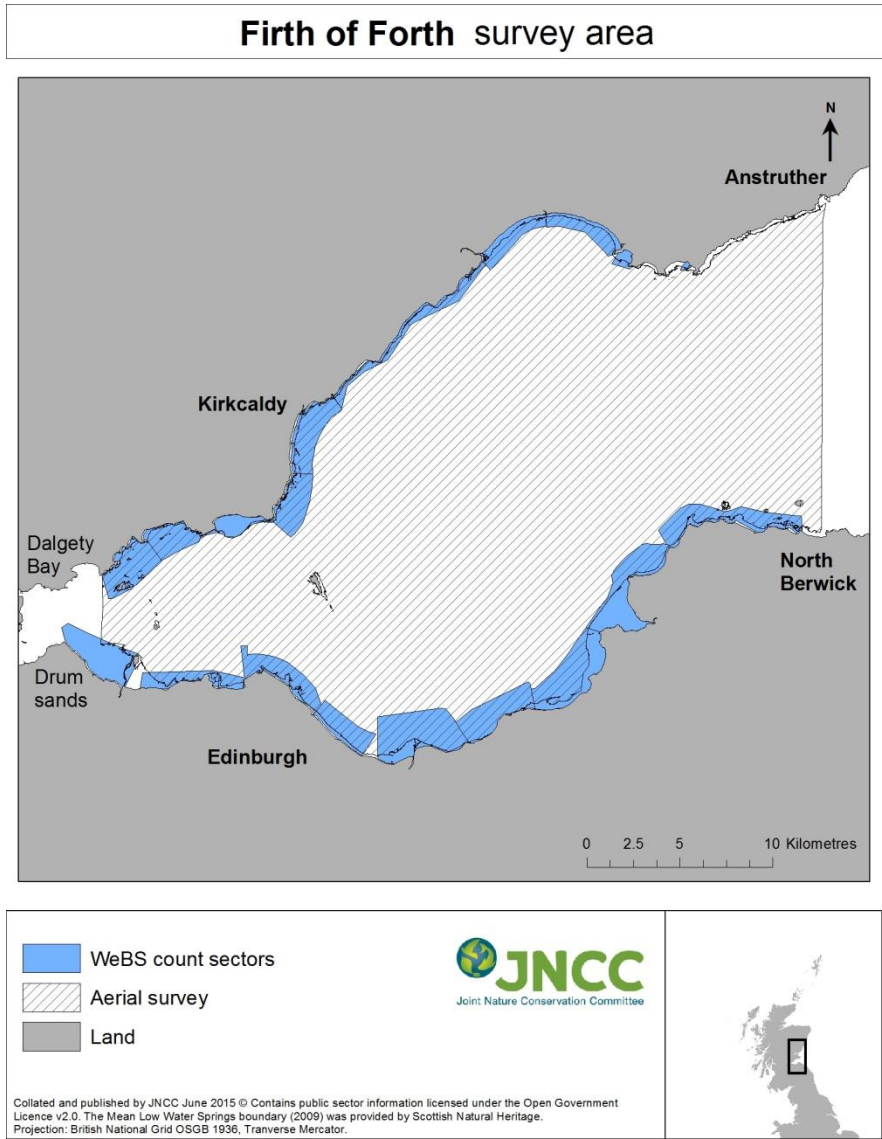


Figure 3. Firth of Forth area of search showing the areas surveyed by aerial survey and land-based WeBS counts.

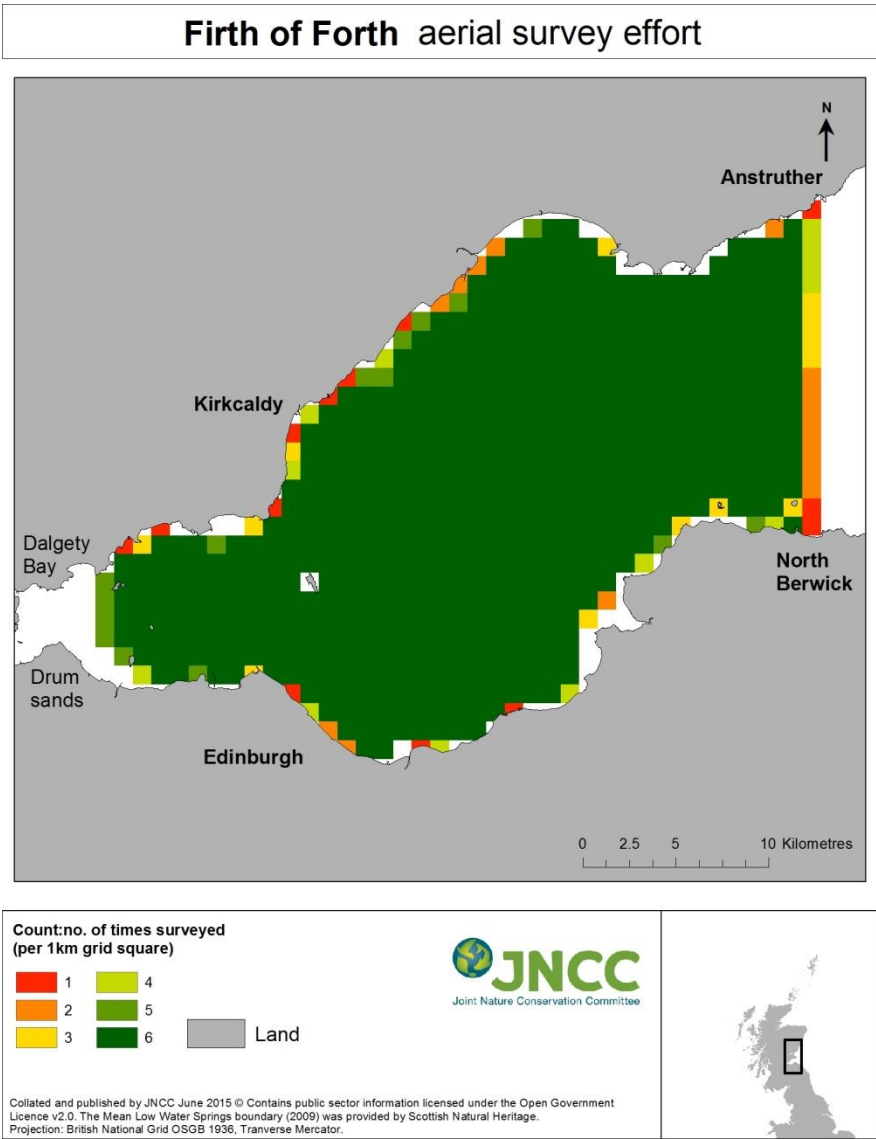


Figure 4. The survey effort for aerial survey in the Firth of Forth is displayed as the number of times each 1km grid cell was surveyed. This survey effort map does not include strip transect aerial surveys as these were not included in calculating the population estimates.

Results

Table 2 presents a summary of the survey data that were available for each species within the Firth of Forth and indicates where species were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.1 of Appendix 1.

Common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye and red-breasted merganser occurred in numbers that exceeded 1% of their respective UK wintering population estimates and are therefore included as potential interest features of the SPA under Stage 1.4 of the UK SPA Selection Guidelines (Table 2).

Although the Annex I species red-throated diver and little gull exceeded their relevant population thresholds, they did not meet the criterion for regularity of occurrence. Both these species exceeded the 1% threshold under Stage 1.1 in only one of three years.

Red-throated divers would meet these guidelines as part of the “Outer Firth of Forth and St Andrews Bay complex” and therefore might be considered further as part of this larger site. Little gull (317) were recorded within the area of search on the aerial survey in 2003/04, but zero counts were recorded for little gull in the other years of aerial survey, so it does not meet the criterion of regularity. However, this was the largest population of little gull recorded in the inshore areas of search in Scotland. Little gulls are often missed by observers during aerial surveys, and the population estimates presented here should therefore be considered a minimum estimate of little gull using the Firth of Forth in winter. At present, there is no UK population threshold against which to assess whether little gull exceeds the UK SPA Selection Guidelines (Musgrove *et al* 2013) so a default threshold of 50 birds has been used to date (Stroud *et al* 2001).

Slavonian grebe and red-necked grebe were below the generally applied minimum number of 50 individuals for SPA site selection, although they were present in numbers that regularly exceeded their respective 1% UK thresholds.

The time period over which the five-year mean of WeBS data were taken (2006/07-2010/11) is more recent than the aerial survey (2001/02, 2003/04, 2004/05). Aerial survey and WeBS counts undertaken in the same season indicate that the land-based WeBS counts underestimated some species. Aerial survey provided the best estimate (i.e. they gave the highest mean of peak estimate with good coverage of the survey area) for red-throated diver, little gull, common eider, long-tailed duck and common scoter. The population estimates for velvet scoter, common goldeneye and red-breasted merganser were based on WeBS data as for all these species WeBS data cover a longer time period providing a five year mean of peak (Table 2), and goldeneye were not recorded by aerial surveys.

The WeBS counts indicate there may have been a decline in the numbers of some species such as common eider, long-tailed duck, common scoter and Slavonian grebe in more recent years since the aerial surveys were undertaken (Cook *et al* 2013). For example, a five year mean of peak estimate for Slavonian grebe during the period 2001/02 to 2005/06 (73) would have exceeded the minimum threshold of 50 individuals generally applied on site selection but the estimate of 26 over the current five-year period (2006/07–2010/11) is less than this. However, for many species the extent of this decline cannot be assessed, as comparing data collected by aerial survey with WeBS counts in the same season shows WeBS data under recorded numbers of some species.

Table 2. Firth of Forth area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1, Table A1.1 for further details.

Species		population thresholds (ind.)		data available	population size (ind.)	Exceeds guideline population threshold under:	Meets all criteria: - >1% threshold - regular - >50 ind.
		1% biog.	1% UK				
common eider	(migratory)	10,300	600	Aerial Boat WeBS	9,845 5,363 3,329	1.4	✓
long-tailed duck	(migratory)	16,000	110	Aerial Boat WeBS	978 874 160	1.4	✓
common scoter	(migratory)	5,500	1,000	Aerial Boat WeBS	2,218 1,226 612	1.4	✓
velvet scoter	(migratory)	4,500	(25) 50	WeBS Boat Aerial	577 1,513 332	1.4	✓
common goldeneye	(migratory)	11,400	200	WeBS Aerial Boat	546 0 0	1.4	✓
red-breasted merganser	(migratory)	1,700	84	WeBS Aerial Boat	189 252 427	1.4	✓
red-throated diver	(Annex 1)		170	Aerial Boat WeBS	269 158 24	1.1	not regular
little gull	(Annex 1)		50	Aerial Boat WeBS	106 15 0	1.1	not regular
Slavonian grebe	(Annex 1)		(11) 50	WeBS Aerial Boat	26 0 0	1.1	<50 ind.
red-necked grebe	(migratory)	500	(1) 50	WeBS Aerial Boat	7 0 0	1.4	<50 ind.
greater scaup	(migratory)	3,100	52	WeBS Boat Aerial	0 0 0		
goosander	(migratory)	2,700	120	WeBS Aerial Boat	11 0 0		
black-throated diver	(Annex 1)		(6) 50	WeBS Aerial Boat	2 0 0		
great northern diver	(Annex 1)		(25) 50	WeBS Aerial Boat	1 0 0		
great crested grebe	(migratory)	3,500	190	WeBS Aerial Boat	22 0 0		

An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland

Species		population thresholds (ind.) 1% biog. 1% UK		data available	population size (ind.)	Exceeds guideline population threshold under:	Meets all criteria: - >1% threshold - regular - >50 ind.
European shag	(migratory)	2,000	1,100	WeBS Aerial Boat	153 - 0		
great cormorant	(migratory)	1,200	350	WeBS Aerial Boat	149 - 0		

3.2 Firth of Tay

Introduction

The Firth of Tay area of search encompasses the marine area from just north of Arbroath to Fife Ness in the south, including St Andrews Bay and the mouth of the Tay estuary between Tayport and Broughty Ferry (Figure 5). The substrate is largely sand and muddy sand, with areas of rock or reef around headland areas such as Fife Ness (McBreen *et al* 2011). The coastal and intertidal habitats include mudflats, sandflats, lagoons, coastal sand dunes, bogs and marshes. The inshore areas of the Firth of Tay and Eden Estuary include an existing intertidal SPA, a Ramsar site and a marine Special Area of Conservation (SAC). The Firth of Tay and Eden Estuary SPA was classified in 2000 for qualifying numbers of wintering bar-tailed godwit (*Limosa lapponica*). The site also supports an internationally important assemblage of overwintering birds (48,000 waterfowl, including great cormorant, common eider, long-tailed duck, common scoter, velvet scoter and common goldeneye).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Firth of Tay area of search were collected from a boat-based survey conducted in January 1998, an aerial survey that included two strip transect surveys in December 2000 and February 2001, and seven line-transect surveys undertaken between December and February in 2001/02, 2003/04 and 2004/05. The 2001/02 line-transect surveys assigned observations to three distance bands, subsequent surveys used four distance bands. Data from land-based WeBS counts within the Firth of Tay area of search were collated from the most recent five years of available data (2006/07 to 2010/11) (Figure 6).

The following decisions were taken based on the data that were available for the Firth of Tay area of search:

Data from the boat based survey conducted in 1998 were not used for the population estimates as more recent data were available from aerial surveys. Also, the boat based population estimates were extrapolated from raw counts and are therefore likely to be an underestimate. It was not possible to produce a distance corrected estimate for these data because an appropriate detection function could not be produced for each species despite having a sufficient number of observations. Similarly, strip transect aerial surveys under estimate the true number of birds as they cannot be corrected using distance sampling.

WeBS count data indicate a decline in numbers of long-tailed duck, common scoter and velvet scoter in the Firth of Tay. It is difficult to determine whether these numbers reflect a true decline or whether high counts in 2004/05 represent a survey anomaly.

Aerial survey data were used for common eider, long-tailed duck, common scoter, velvet scoter and red-breasted merganser as a comparison between the different data sources indicated that WeBS counts underestimated the numbers of these species.

The line-transect aerial surveys all had good spatial coverage of the area of search (Figure 7) and therefore all seven surveys were used to calculate the mean of peak estimates. Since all diver observations were recorded as either red-throated diver (285 individuals) or unidentified

diver (11 individuals), it was assumed that all unidentified divers were in fact red-throated divers. One black-throated diver was recorded during WeBS counts.

Firth of Tay SPAs

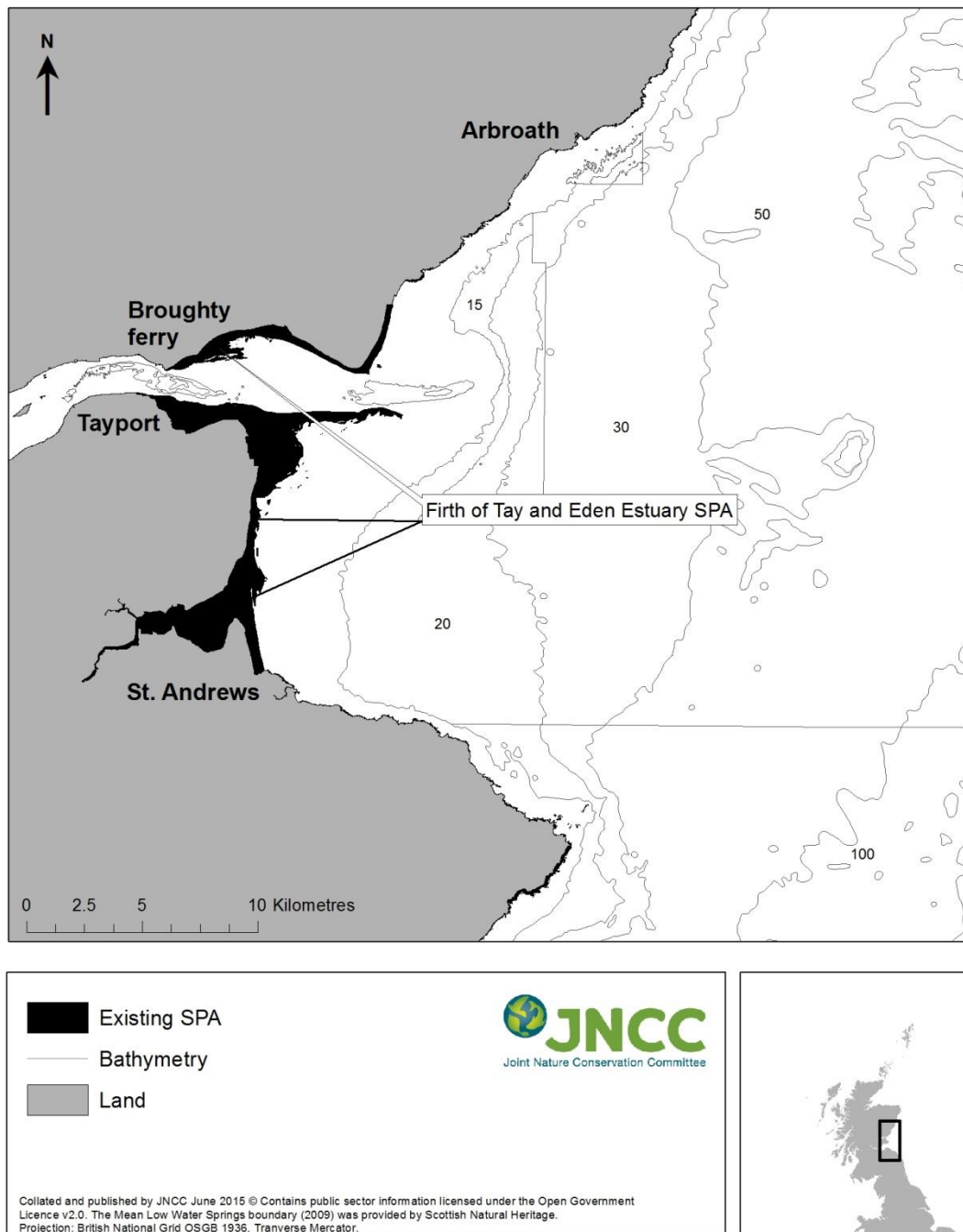


Figure 5. The Firth of Tay area of search showing bathymetry and existing SPA sites.

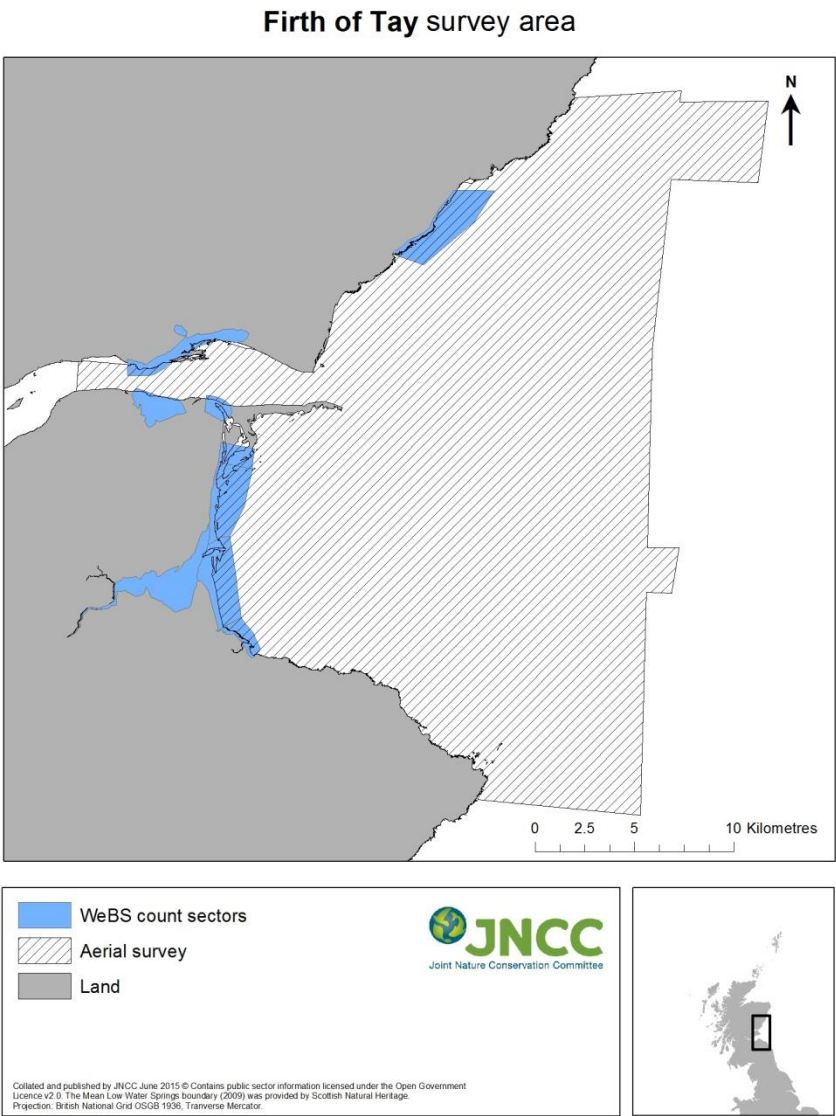


Figure 6. Map of the Firth of Tay showing the areas surveyed by aerial survey and land-based WeBS counts.

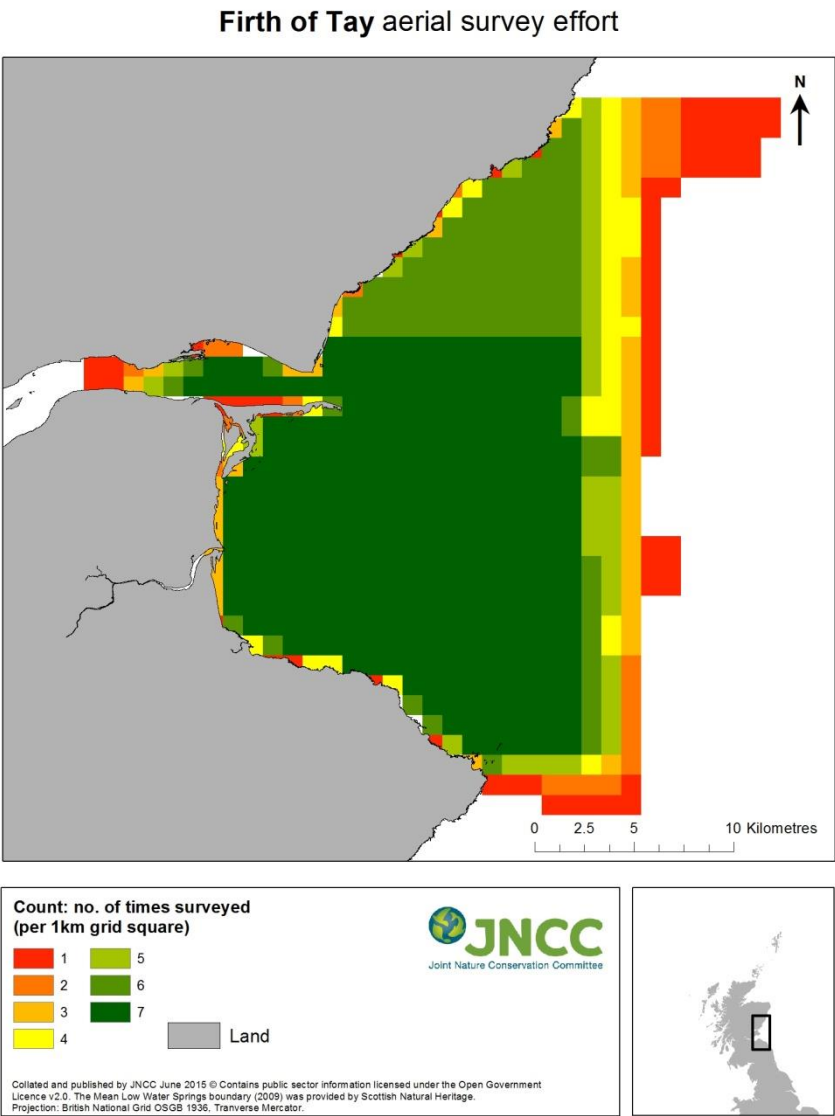


Figure 7. The survey effort for aerial survey in the Firth of Tay is displayed as the number of times each 1km grid cell was surveyed. This survey effort map does not include strip transect aerial surveys as these were not included in calculating the population estimates.

Results

Table 3 presents a summary of the survey data that were available for each species within the Firth of Tay and indicates where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.2 of Appendix 1.

The Firth of Tay supported the largest populations of red-throated divers and common eider of the areas of search in Scotland, although the estimated population size of red-throated diver varied considerably within and between years. Red-throated diver, an Annex I species regularly exceeded the 1% threshold under Stage 1.1; and common eider were present in numbers that regularly exceeded 1% of their biogeographic threshold under Stage 1.2 (Table 3, Table A1.2 Appendix 1).

Long-tailed duck, common scoter and red-breasted merganser occurred in numbers that regularly exceeded their respective 1% thresholds under Stage 1.4.

Although velvet scoter also exceeded the 1% threshold the requisite numbers of birds were not regularly present and only exceeded the threshold number in one of three years of aerial survey data. However, the larger "Outer Firth of Forth and St Andrews Bay complex" would support numbers of velvet scoter that regularly exceed this threshold.

Peak annual estimates for little gull were well below the minimum threshold of 50 individuals, though these are likely to be an underestimate because little gull are difficult to identify from aerial survey. A boat survey in 1998 recorded 216 individuals, however, this was not included in the mean of peaks estimates assessment as the more recent data available from the aerial line-transect surveys were used in preference to the 1998 boat survey data. Further survey would be required to provide a reliable estimate due to high spatio-temporal variability of little gull.

Aerial survey provided the best available population estimate (i.e. they gave the highest mean of peak estimate with good coverage of the survey area) for all of the species that exceeded the relevant 1% population thresholds within the area of search: red-throated diver, common eider, long-tailed duck, common scoter, red-breasted merganser.

Table 3. Firth of Tay area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
red-throated diver	(Annex 1)		170	Aerial	634	1.1	✓
				Boat	387		
				WeBS	4		
common eider	(migratory)	10,300	550	Aerial	11,739	1.2	✓
				Boat	5,300		
				WeBS	5,361		
long-tailed duck	(migratory)	16,000	110	Aerial	994	1.4	✓
				Boat	111		
				WeBS	28		
common scoter	(migratory)	5,500	1,000	Aerial	2,482	1.4	✓
				Boat	1,474		
				WeBS	149		

Species		population thresholds (ind) 1% biog. 1% UK		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
red-breasted merganser	(migratory)	1,700	84	Aerial Boat WeBS	180 3 74	1.4	✓
velvet scoter	(migratory)	4,500	(25) 50	Aerial Boat WeBS	198 280 2	1.4	not regular
common goldeneye	(migratory)	11,400	200	WeBS	43		
gosander	(migratory)	2,700	120	Aerial Boat WeBS	0 0 4		
greater scaup	(migratory)	3,100	52	Aerial Boat WeBS	0 0 3		
black-throated diver	(Annex 1)		(6) 50	Aerial WeBS Boat	0 0 0		
great northern diver	(Annex 1)		(25) 50	Aerial WeBS Boat	0 0 0		
great crested grebe	(migratory)	3,500	190	WeBS Aerial Boat	3 0 0		
red-necked grebe	(migratory)	500	(1) 50	WeBS Aerial Boat	0 0 0		
Slavonian grebe	(migratory)		(11) 50	WeBS Aerial Boat	4 0 0		
little gull	(Annex 1)		50	Aerial Boat WeBS	20 216 0		
European shag	(migratory)	2,000	1,100	WeBS Aerial Boat	6 - 0		
great cormorant	(migratory)	1,200	350	WeBS Aerial Boat	101 - 0		

3.3 Outer Firth of Forth and St Andrews Bay complex

Due to the close proximity of the Firth of Forth and Firth of Tay areas of search, together with overlapping seabird interest in the area, a potential single 'Outer Firth of Forth and St Andrews Bay complex' linking these individual areas has been considered by SNH (Figure 8). Population estimates of inshore wintering waterbird and seabird species within this larger complex can only be based on the areas that have been surveyed within this site. Therefore the population estimates provided for this complex are the summed population estimates from the individual Firth of Forth and Firth of Tay sites. These may be an underestimate of the true number of birds supported by the area as they do not account for unsurveyed areas.

Within this potential joint site the following species regularly exceeded the 1% thresholds under Stage 1.1 and 1.2 of the UK SPA Selection Guidelines: red-throated diver and common eider. Long-tailed duck, common scoter, velvet scoter, common goldeneye, and red-breasted merganser regularly exceeded 1% of their UK wintering populations (under Stage 1.4).

Firth of Forth and Firth of Tay areas of search

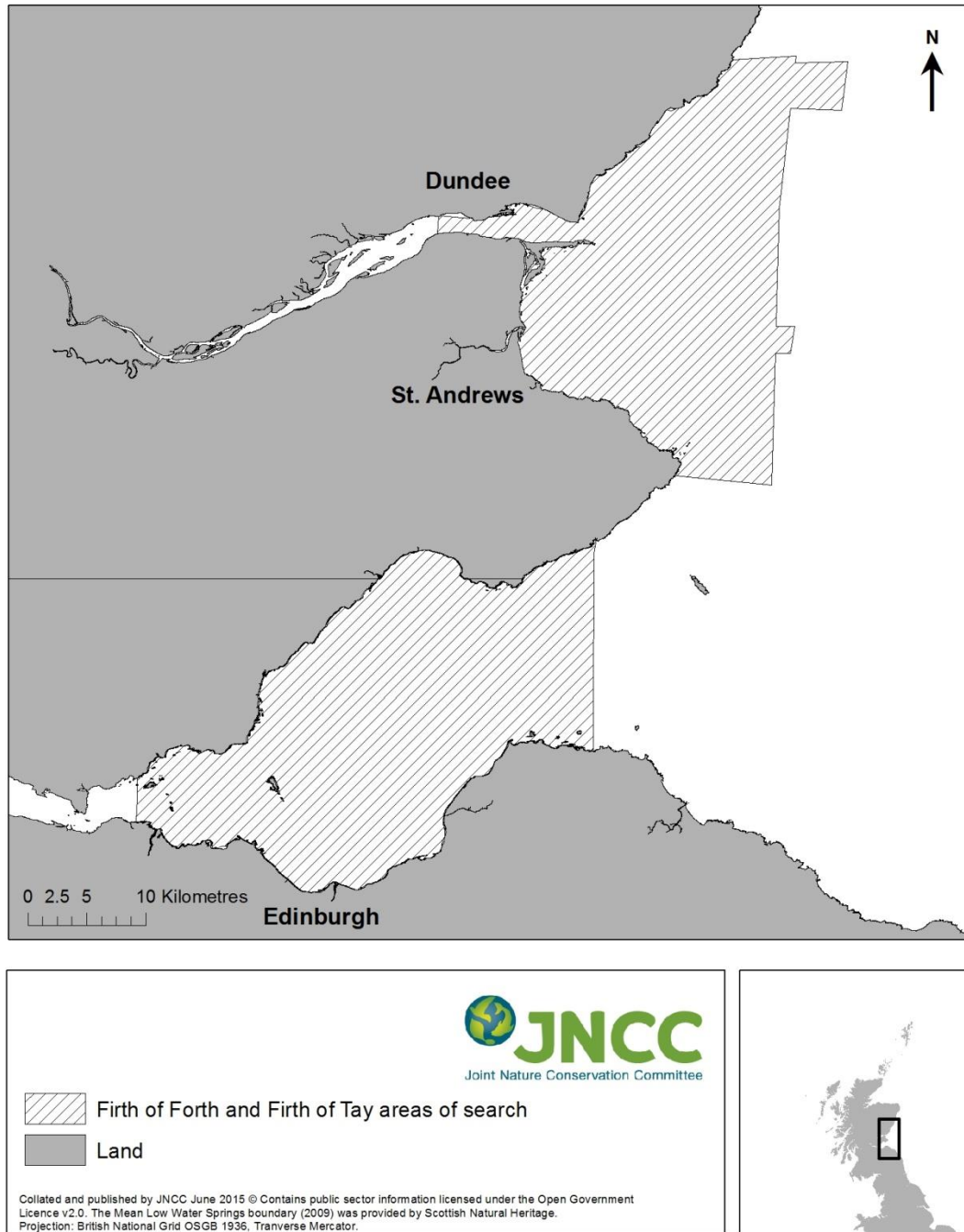


Figure 8. Firth of Forth and Firth of Tay areas of search that due to their proximity could be combined to form part of an Outer Firth of Forth and St Andrews Bay complex.

Table 4. Outer Firth of Forth and St Andrews Bay complex, which are summed estimates from the individual Firth of Forth and Firth of Tay areas of search (Tables 2 and 3). See Appendix 1, tables A1.1 and A1.2) for further details.

Species		population thresholds (ind)		Firth of Forth population size (ind.)	Firth of Tay population size (ind.)	Outer Firth of Forth and St Andrews Bay complex population size (ind.)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK					
red-throated diver	(Annex 1)		170	269	634	903	1.1	✓
common eider	(migratory)	10,300	550	9,845	11,739	21,584	1.2	✓
long-tailed duck	(migratory)	16,000	110	978	994	1,972	1.4	✓
common scoter	(migratory)	5,500	1,000	2,218	2,482	4,700	1.4	✓
velvet scoter	(migratory)	4,500	50	577	198	775	1.4	✓
common goldeneye	(migratory)	11,400	200	546	43	589	1.4	✓
red-breasted merganser	(migratory)	1,700	84	189	180	369	1.4	✓
little gull	(Annex 1)		50	106	20	126	1.1	not regular
Slavonian grebe	(Annex 1)		50	26	4	30	1.1	< 50 ind
red-necked grebe	(migratory)	500	50	7	0	7	1.4	< 50 ind
goosander	(migratory)	2,700	120	11	4	15		
greater scaup	(migratory)	3,100	52	0	3	3		
black-throated diver	(Annex 1)		50	2	0	2		
great northern diver	(Annex 1)		50	1	0	1		
great crested grebe	(migratory)	3,500	190	22	3	25		
European shag	(migratory)	2,000	1,100	153	6	159		
great cormorant	(migratory)	1,200	350	149	101	250		

3.4 Aberdeen Bay

Introduction

Aberdeen Bay area of search encompasses the inshore area stretching from Cruden Bay in the north to Doonies Yawns in the south. It is a fairly discrete, shallow (0-30m) inshore area located along the Aberdeenshire coast (Figure 9). The sediments of Aberdeen Bay are predominantly sandy (McBreen *et al* 2011) with mussel beds and sandy shores providing productive feeding opportunities for waterbirds. Three rivers provide freshwater input to Aberdeen Bay, the river Ythan at Newburgh, the river Don at Bridge of Don, Aberdeen, and the river Dee at Torry, Aberdeen.

Two terrestrial SPAs have been classified in, or adjacent to, Aberdeen Bay: Buchan Ness to Collieston Coast SPA and Ythan Estuary, Sands of Forvie and Meikle Loch SPA (Figure 9). The Buchan Ness to Collieston Coast SPA was classified for breeding black-legged kittiwake *Rissa tridactyla*. The Ythan Estuary, Sands of Forvie and Meikle Loch SPA was classified for an assemblage of 22,817 wintering waterfowl, as well as breeding little tern, common tern and sandwich tern.

Site specific methods

The numbers of birds using the Aberdeen Bay area of search were estimated using six line-transect aerial surveys: in December and February 2003/04 and 2004/05, and December and January 2005/06. Observations were allocated to one of four distance bands. In addition systematic land-based counts were carried out from November 2004 to March 2007.

The few records of 'unidentified diver species' were not assumed to be red-throated divers, despite no other diver species being recorded, as divers were only recorded 'unidentified diver species' if the observer was certain they were not red-throated divers but could not identify them to species level (Mark Lewis, *pers. comm.*).

The line-transect aerial surveys all had good spatial coverage of the area of search and therefore all six surveys were used to calculate the mean of peak estimates (Figure 11). Distance sampling was used to estimate the numbers of each species using the area of search where possible, if this could not be done population estimates were extrapolated from raw counts.

Twelve land-based count surveys were undertaken over four winter seasons 2003/04 to 2006/07 (Table 5, Table A1.3) and provided good coverage of the coastline within the area of search (Figure 10).

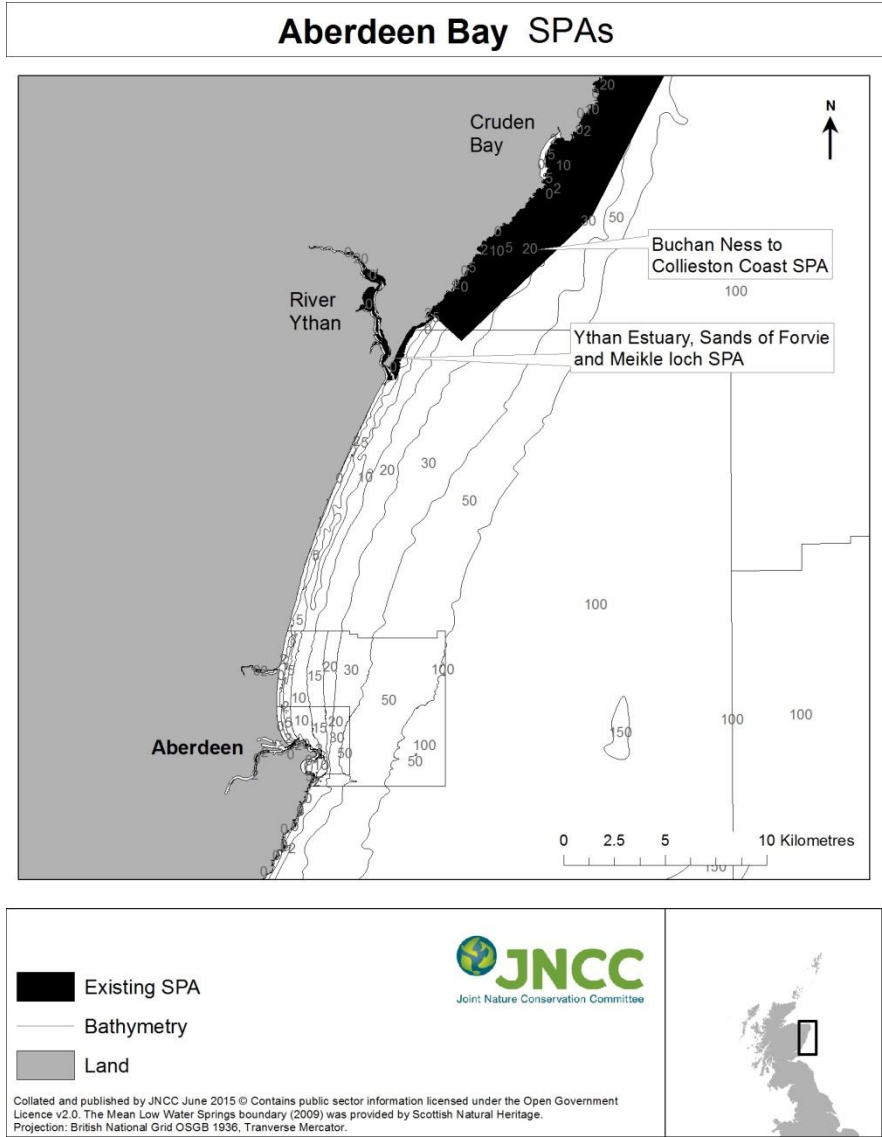


Figure 9. Bathymetry and existing SPAs classified within Aberdeen Bay area of search.

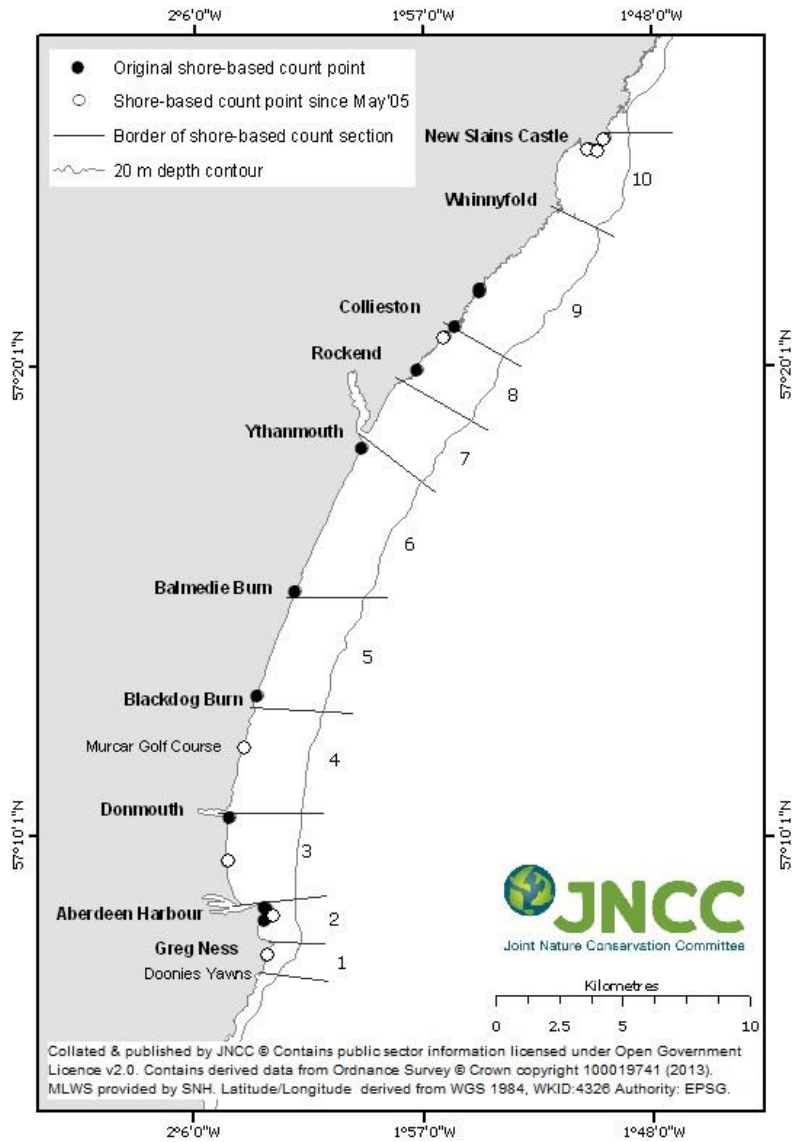


Figure 10. Land-based count sectors for the Aberdeen Bay area of search.

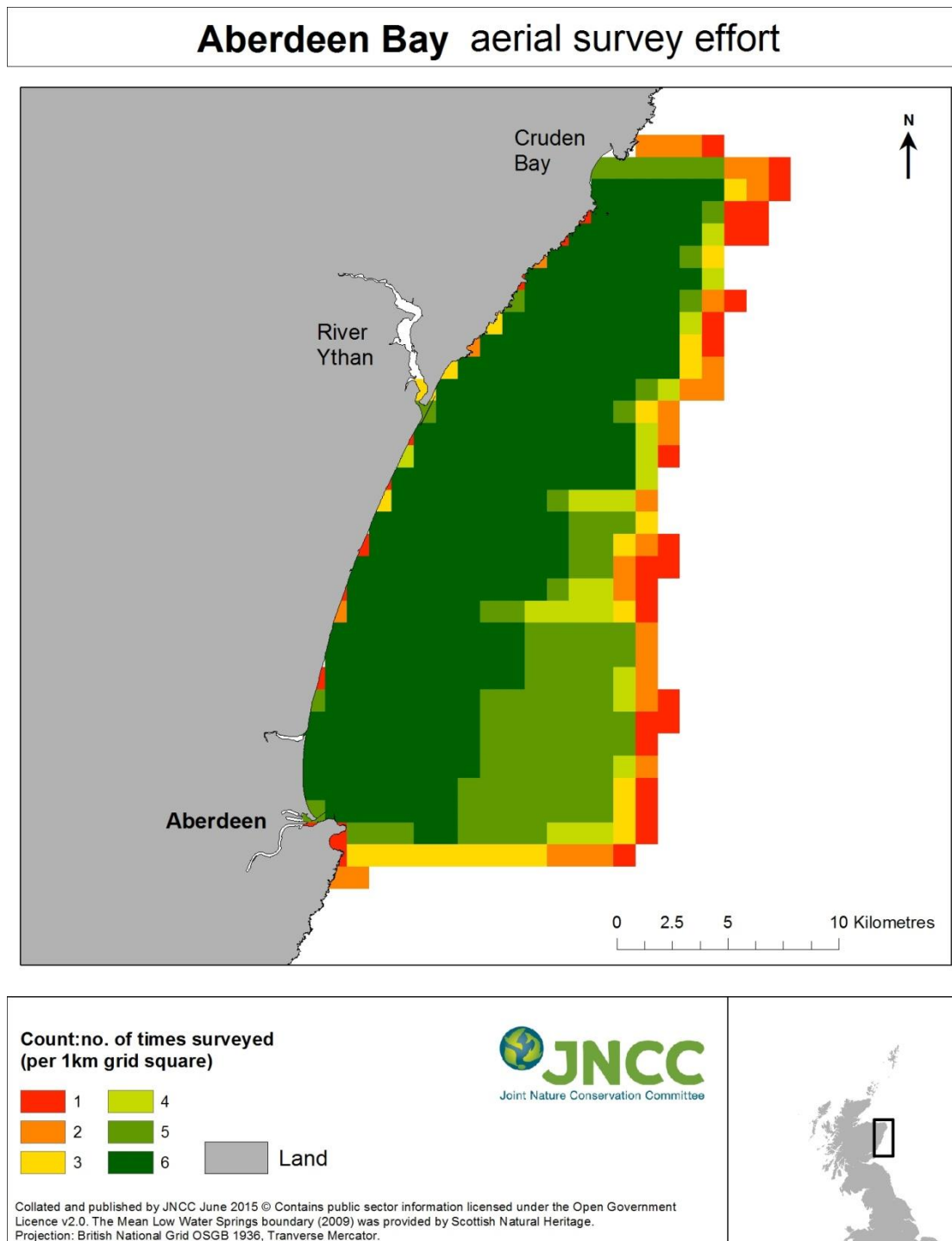


Figure 11. The survey effort for aerial survey in Aberdeen Bay is displayed as the number of times each 1km grid cell was surveyed.

Results

Table 5 provides an overview of the Aberdeen Bay area of search showing the survey data that were available for each species, and where they were present in sufficient numbers to exceed

the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.3 of Appendix 1. Common eiders were present in Aberdeen Bay area of search in numbers that exceeded 1% their UK wintering population under Stage 1.4 but did not meet the criterion for regularity of occurrence (Table 5).

No other species was recorded in sufficient numbers to exceed the Stage 1.1 or Stage 1.2 thresholds.

Red-throated diver narrowly exceeded the 1% threshold under Stage 1.1 however they were not regularly present in these numbers (Table 5, Table A1.3 Appendix 1).

Table 5. Aberdeen Bay showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind) 1% biog. 1% UK		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
common eider	(migratory)	10,300	550	LBC	724	1.4	not regular
				Aerial	706		
red-throated diver	(Annex 1)		170	Aerial	172	1.1	not regular
				LBC	137		
greater scaup	(migratory)	3,100	52	LBC	1		
				Aerial	0		
long-tailed duck	(migratory)	16,000	110	LBC	30		
				Aerial	11		
common scoter	(migratory)	5,500	1,000	Aerial	550		
				WeBS	477		
velvet scoter	(migratory)	4,500	(25) 50	Aerial	3		
				LBC	1		
common goldeneye	(migratory)	11,400	200	LBC	6		
				Aerial	0		
red-breasted merganser	(migratory)	1,700	84	LBC	28		
				Aerial	3		
goosander	(migratory)	2,700	120	LBC	0		
				Aerial	0		
black-throated diver	(Annex 1)		(6) 50	Aerial	0		
				SBC	0		
great northern diver	(Annex 1)		(25) 50	Aerial	0		
				LBC	0		
great crested grebe	(migratory)	3,500	190	LBC	1		
				Aerial	0		
red-necked grebe	(migratory)	500	(1) 50	LBC	0		
				Aerial	0		
Slavonian grebe	(Annex 1)		(11) 50	LBC	0		
				Aerial	0		
little gull	(Annex 1)		50	Aerial	0		
				LBC	0		

3.5 Moray Firth

Introduction

The Moray Firth is a large sea area that includes the Inverness, Beauly, Cromarty and Dornoch Firths (Figure 12). The area of search extends from Helmsdale on the east Caithness coast to Portsoy on the Moray Coast. Most of the area is shallow water of less than 30m depth, with a sand and muddy sand substrate, although the Moray Firth Basin to the southeast of the Firth has a depth of 50m. Much of the coastal area consists of mud flats, sand flats, lagoons and saltmarsh.

A large part of the area of search is an SAC, the Moray Firth SAC, designated in 2005 for Annex 1 habitats (sandbanks which are slightly covered by seawater all the time), and Annex 2 species (bottlenose dolphin *Tursiops truncatus*).

Four intertidal SPAs have been classified in the Moray Firth. The Cromarty Firth SPA was classified in 1999 for an internationally important assemblage of 30,200 wintering waterfowl, as well as breeding common tern and osprey *Pandion haliaetus*. The Moray and Nairn Coast SPA and the Dornoch Firth and Loch Fleet SPA were classified in 1997 for internationally important assemblages of wintering waterfowl as well as breeding osprey. The Inner Moray Firth SPA was also classified for breeding common tern, osprey and for wintering red-breasted merganser, amongst other shorebird species.

Moray Firth SPAs

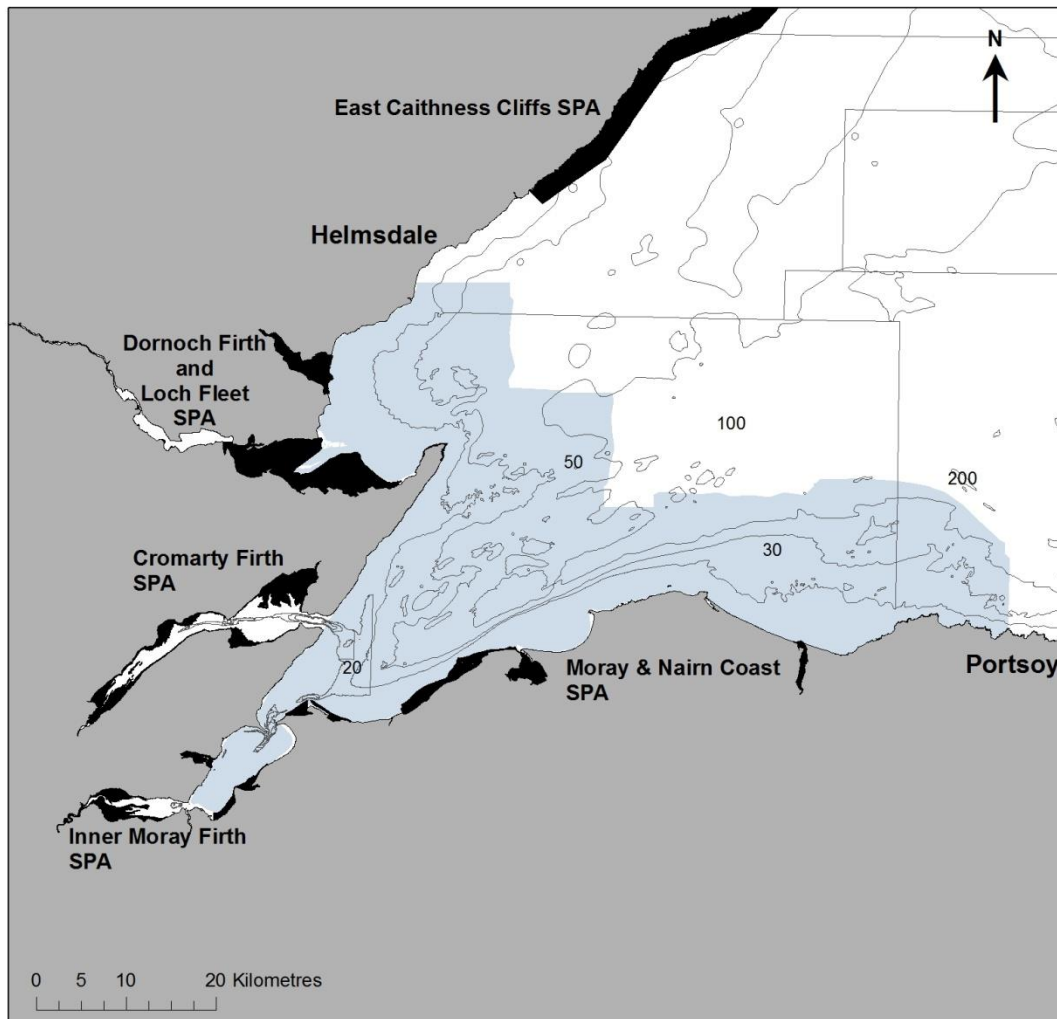


Figure 12. The Moray Firth area of search showing bathymetry and existing SPA sites.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Moray Firth area of search were collected using ten aerial surveys during the winter seasons of 2000 to 2007. This included one strip transect survey in January 2001 and nine line-transect surveys. The line-transect surveys carried out in January and February 2002 assigned observations to three distance bands. Subsequent transect surveys in December and March 2002/03, December and February 2003/04, March 2005, January 2006 and February 2007 used four distance bands. Land-based RSPB seaduck counts provided complementary data on waterbird numbers in the Moray Firth from 2001/02 to 2005/06 (Butterfield 2001, 2003; Donald & Butterfield 2002; Kalejta-Summers 2004; Dillon 2005). Land-based WeBS count data generally had good coverage within the area of search and the most recent five years of available data (2006/07 to 2010/11) were assessed. WeBS counts were the only available source of data for goosander, European shag and great cormorant (Figure 13).

The following decisions were taken regarding the data that were available for the Moray Firth: Strip transects underestimate the true number of birds as they cannot be corrected using distance sampling, therefore the strip transect aerial survey data (2000/01) were not included in the mean of peak estimates calculations.

The line-transect aerial surveys in 2002/03 only covered half of the area of search. This coverage was considered insufficient so they were excluded from the mean of peak population estimates (Figure 14).

Targeted winter counts of divers, grebes and seaducks undertaken by the RSPB in the Moray Firth (1990/01 to 2005/06) had good spatial coverage of the area of search and were generally used in preference to WeBS counts as the former surveys specifically focused on divers and seaduck, in contrast to WeBS counts which collect data on many other groups such as waders and wildfowl. The RSPB counts stopped in 2005/06 so WeBS data were used to check for any indication of a decline in the numbers of any species since that time to ensure the most representative data were used. WeBS counts indicated a decline in numbers of common scoter, velvet scoter, common goldeneye and shag, however numbers of other species have remained consistent and estimates of red-breasted merganser, Slavonian grebe and great cormorant have increased based on the last ten years of WeBS counts.

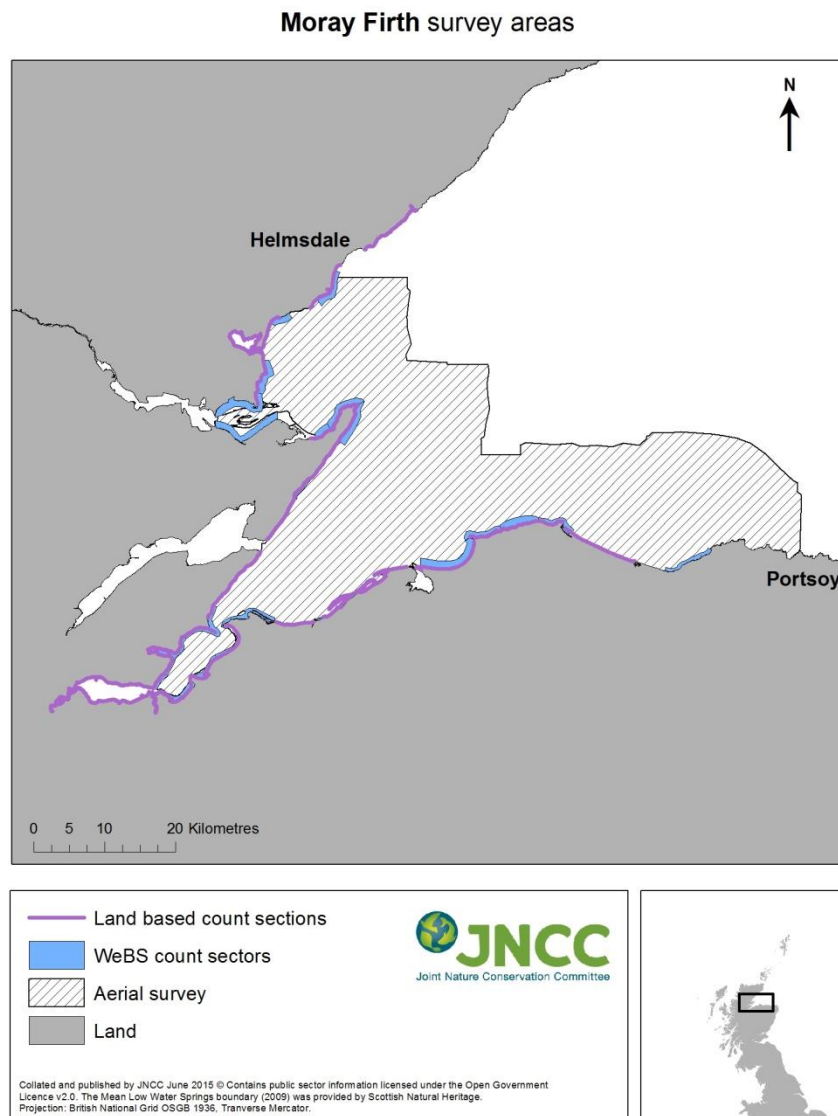


Figure 13. Map of the Moray Firth showing the areas surveyed by aerial survey and land-based, RSPB and WeBS counts. The land-based count sections include some areas of the Moray Firth not covered by aerial survey e.g. RSPB count sections include Beaully Firth and Loch Fleet.

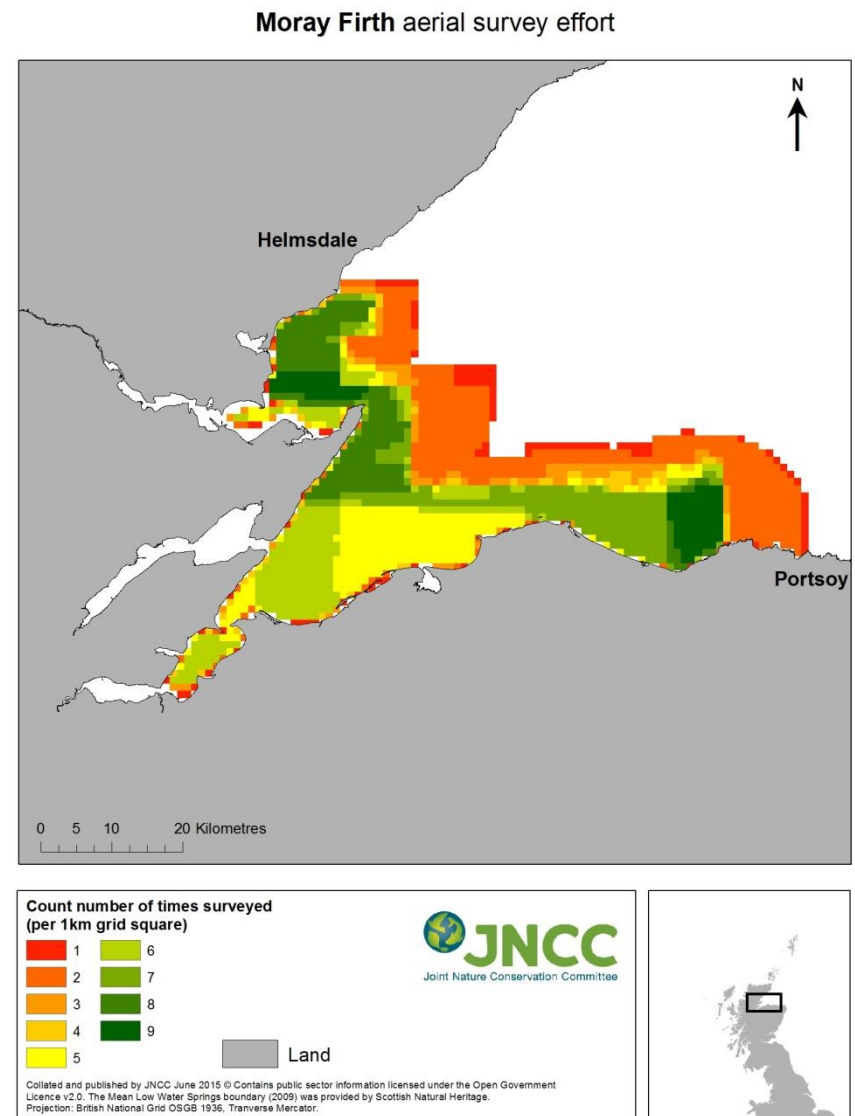


Figure 14. The survey effort for aerial survey in the Moray Firth is displayed as the number of times each 1km grid cell was surveyed. This survey effort map does not include strip transect aerial surveys as these were not included in calculating the population estimates.

Results

Table 6 presents a summary of the Moray Firth area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.4 of Appendix 1.

The Annex I species red-throated diver and great northern diver regularly exceeded their respective population thresholds under Stage 1.1 (Table 6).

A further seven species, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye, and red-breasted merganser regularly occurred in numbers that exceeded 1% of their UK wintering population estimates, and can be considered under Stage 1.4.

Black-throated diver, Slavonian grebe and red-necked grebe also exceeded their respective 1% thresholds, however none of these species were present in numbers that exceeded the minimum threshold of 50 individuals.

The Moray Firth supported the largest populations of long-tailed duck, common scoter, velvet scoter and common goldeneye of the inshore areas surveyed in Scotland.

Aerial survey provided the best estimate (i.e. they gave the highest mean of peak estimate with good coverage of the survey area) for red-throated diver, great northern diver and common eider.

Land-based RSPB counts provided the best data for greater scaup, long-tailed duck, common scoter, velvet scoter, common goldeneye and red-breasted merganser.

WeBS count data suggest there has been a decline in the number of some species (e.g. common scoter and velvet scoter) within the Moray Firth area of search in the years since the aerial surveys were undertaken. However, this cannot be assessed for the diver species and common eider, where aerial survey provided the best estimate of their populations, as WeBS counts under-record numbers of these species.

Table 6. Moray Firth area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - >1% threshold - regular - >50 ind
		1% biog.	1% UK				
red-throated diver	(Annex 1)		170	Aerial LBC WeBS	366 119 28	1.1	✓
great northern diver	(Annex 1)		25 (50)	Aerial WeBS LBC	162 2 59	1.1	✓
greater scaup	(migratory)	3,100	52	LBC WeBS Aerial	930 492 0	1.4	✓
common eider	(migratory)	10,300	600	Aerial LBC WeBS	1,745 1,435 970	1.4	✓
long-tailed duck	(migratory)	16,000	110	LBC Aerial WeBS	5,001 3,167 3,118	1.4	✓
common scoter	(migratory)	5,500	1,000	LBC Aerial WeBS	5,479 2,544 1,442	1.4	✓
velvet scoter	(migratory)	4,500	25 (50)	LBC WeBS Aerial	1,488 206 249	1.4	✓
common goldeneye	(migratory)	11,400	200	LBC WeBS Aerial	907 169 74	1.4	✓
red-breasted merganser	(migratory)	1,700	84	LBC WeBS Aerial	151 91 90	1.4	✓
black-throated diver	(Annex 1)		6 (50)	LBC WeBS Aerial	16 4 0	1.1	<50 ind
Slavonian grebe	(Annex 1)		11 (50)	LBC WeBS Aerial	43 26 0	1.1	<50 ind
red-necked grebe	(migratory)	500	1 (50)	LBC WeBS Aerial	2 0 0	1.4	<50 ind
goosander	(migratory)	2,700	120	WeBS Aerial LBC	2 0 0		
great crested grebe	(migratory)	3,500	190	LBC WeBS Aerial	3 1 0		
little gull	(Annex 1)		50	LBC Aerial WeBS	7 0 1		
European shag	(migratory)	2,000	1,100	WeBS Aerial LBC	105 - -		
great cormorant	(migratory)	1,200	350	WeBS Aerial LBC	207 - -		

3.6 Scapa Flow

Introduction

Scapa Flow forms a natural harbour almost entirely surrounded by mainland Orkney to the north and north-east, Hoy to the west, South Walls and Flotta to the south and Burray and South Ronaldsay to the east. The Churchill barriers (a series of four causeways) link the islands of South Ronaldsay via Burray, Lamb Holm and Glims Holm to mainland Orkney allowing only limited water exchange between Scapa Flow and the open sea. The main inputs to Scapa Flow from the open sea are to the south, between South Ronaldsay and South Walls (Hoy), and in the north-west between Hoy and the Orkney mainland (Figure 15). Scapa Flow area of search extended beyond this natural harbour from east Copinsay to south of South Ronaldsay and west into Hoy Sound. The area of search comprised 462km² of sea, most of it between 20 and 30m deep. Sediments were primarily sandy and muddy but became coarser in areas where tidal currents were stronger.

A number of terrestrial SPAs have already been classified around Scapa Flow at Switha, Pentland Firth Islands, Copinsay, Orkney mainland moors and Hoy. Hoy has also been designated as an SAC, with Stromness Heaths and coast SAC and Loch of Stenness SAC adjoining the western part of the area of search.

The Hoy SPA was classified for breeding red-throated divers, breeding great skua *Stercorarius skua* and an assemblage of 120,000 breeding seabirds, including great skua and black-legged kittiwake. Other SPAs in this area are North Caithness Cliffs SPA (classified for breeding northern fulmar *Fulmarus glacialis*, common guillemot *Uria aalge*, razorbill *Alca torda* and black-legged kittiwake); Copinsay SPA (classified for breeding great black-backed gull *Larus marinus*, black-legged kittiwake and common guillemot); Switha SPA (classified for wintering barnacle geese *Branta leucopsis*); Pentland Firth Islands SPA (classified for breeding Arctic tern *Sterna paradisaea*), and Orkney Mainland Moors SPA (classified for red-throated diver, hen harrier *Circus cyaneus* and short eared owl *Asio flammeus*).

Hoy SPA, Copinsay SPA and North Caithness Cliffs SPA were extended by two kilometres into the marine environment in 2009, to support maintenance activities, such as preening and resting of some of the protected seabird features.

Scapa Flow existing SPAs

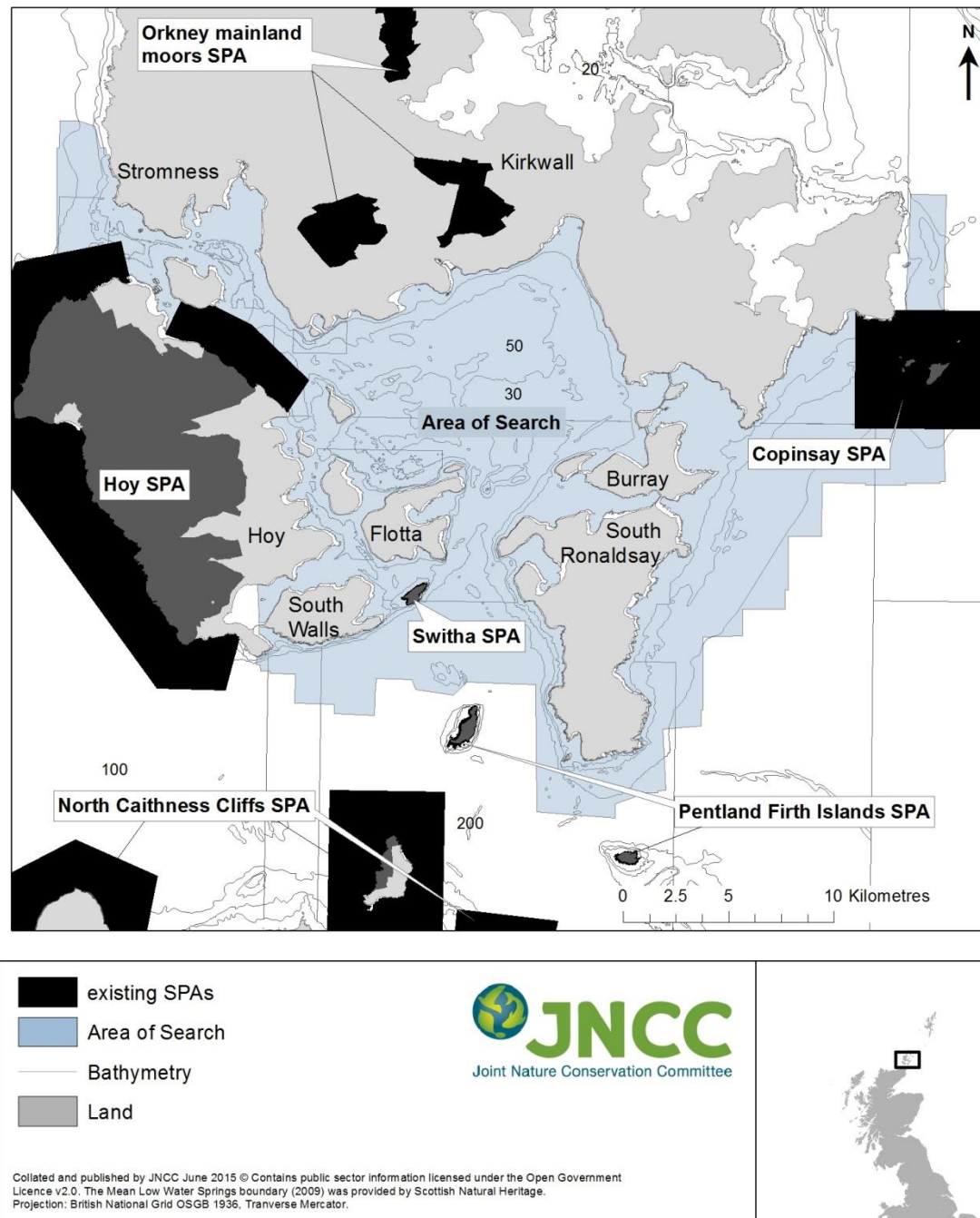


Figure 15. Existing SPAs and bathymetry around the Scapa Flow area of search.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in Scapa Flow were collected from five line-transect aerial surveys carried out in December 2002, February 2004,

March 2005 and January and February 2006 (Figure 17). Observations were allocated to one of four distance bands.

Land-based counts and boat surveys were undertaken in the winter seasons of 1998/99, 2000/01 and 2006/07. The earlier two counts were commissioned by the RSPB and the more recent by JNCC. The survey area was split into 44 sectors, 43 were counted from land and one was counted from a boat. Land-based counts were carried out at 132 count points and birds were recorded in 1km Ordnance Survey grid squares. Boat surveys were conducted along four line-transects spaced 2km apart. Uniform detection was assumed to 1km on both sides of the boat, providing complete coverage of the area. This method required intensive and systematic coverage of the survey area to minimise the number of undetected birds and avoid double counting of birds. The boat travelled at 12km per hour, covering 1km in five minutes.

The spatial coverage of WeBS counts was limited (Figure 16) however the count data from 2006/07 – 2010/11 were assessed.

An aerial survey conducted in December 2002 was confined to the area within Scapa Flow and was not included in the mean of peak assessments due to its limited spatial coverage. WeBS data were not used to provide population estimates as better quality data were available from either aerial survey or land and boat-based counts for all species.

Unidentified diver records from the aerial survey data could not be allocated to a particular species as all three species of diver were recorded within the area of search. Of all divers observed during line-transect surveys (310), 91% of birds were identified as great northern divers, 4% were red-throated divers and 5% (15) could not be identified to species level. Furness *et al* (2010) investigated eider species in the Shetland islands and found birds from the Shetlands should be classified as the subspecies of common eider *Somateria mollissima faeroensis* based on molecular data. The genetics and biometrics of eider in the Orkney islands remains unknown (Furness *et al* 2010), therefore in this report eider in the Orkney islands (and Scapa Flow area of search) were classified as undifferentiated common eider.

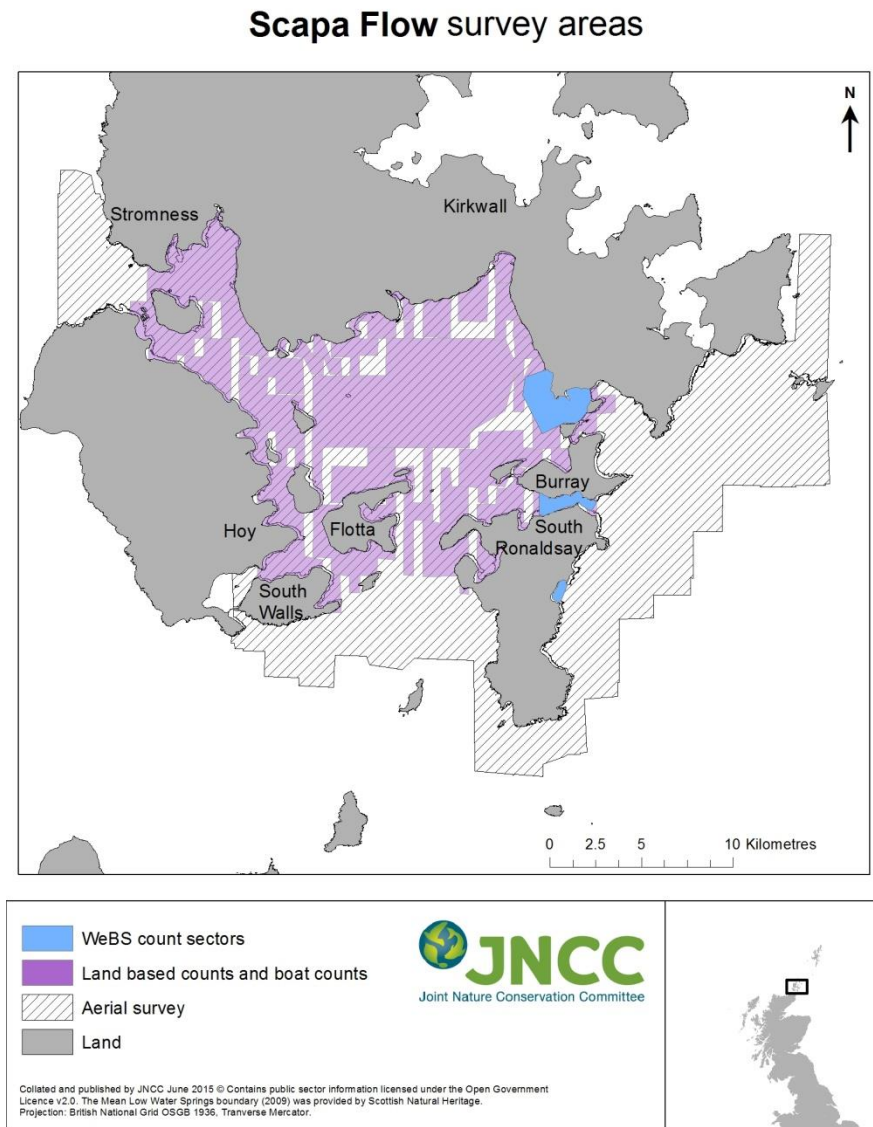


Figure 16. Map of Scapa Flow showing the areas surveyed by aerial survey, boat and land-based counts, and WeBS count sectors.

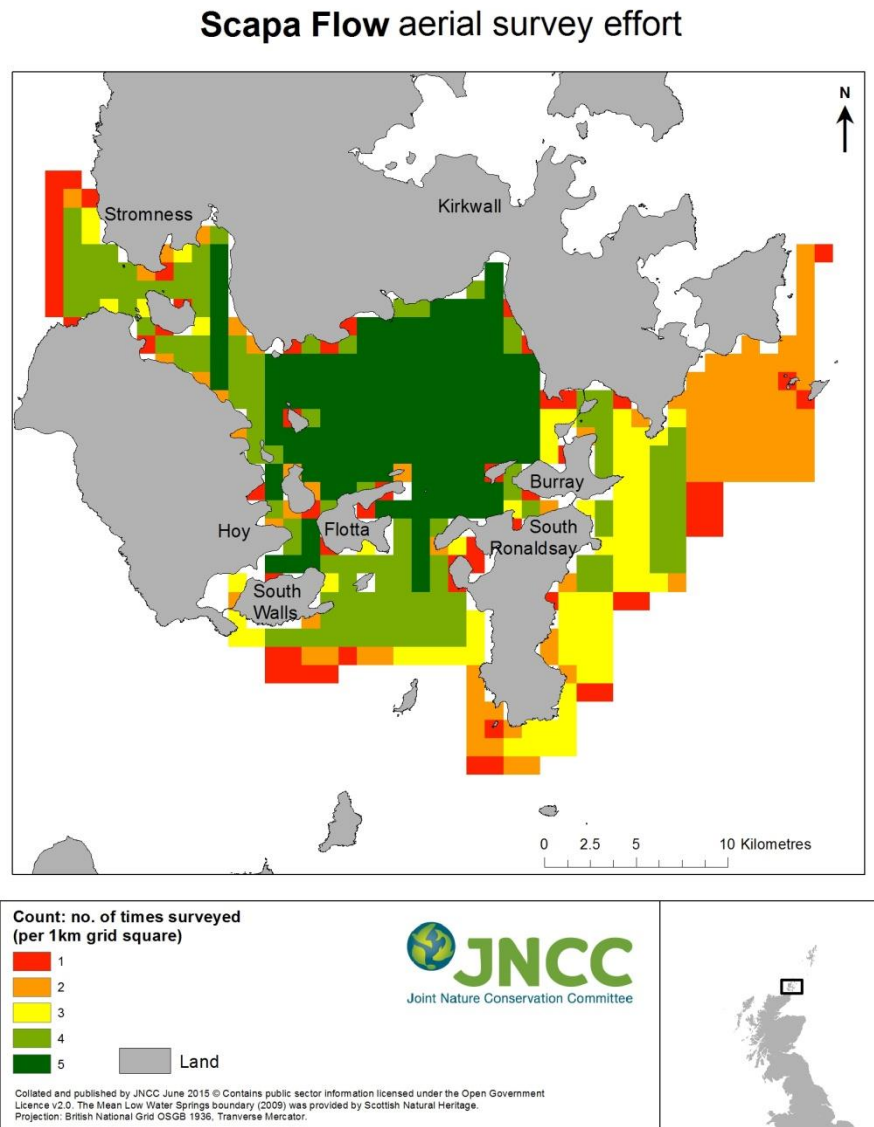


Figure 17. Survey effort for aerial survey in Scapa Flow is displayed as the number of times each 1km grid cell was surveyed.

Results

Table 7 presents a summary of the Scapa Flow area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.5 of Appendix 1.

The Annex I species great northern diver, black-throated diver and Slavonian grebe occurred in numbers that regularly exceeded the default threshold of 50 birds (Table 7).

European shag was regularly present in numbers that exceeded the 1% threshold under Stage 1.2.

Long-tailed duck, undifferentiated common eider, common goldeneye and red-breasted merganser exceeded 1% of their respective UK wintering populations and can be considered under Stage 1.4 of the UK SPA Selection Guidelines.

The population estimates for all of the above species were based on the three winter seasons of land-based and boat-based surveys as these recorded the highest population estimates from the available data and provided good coverage; all of these species met the criterion for regularity of occurrence.

Scapa Flow supported the largest wintering populations of red-breasted merganser, red-necked grebe, Slavonian grebe and European shag in all inshore areas of search in Scotland. The area is also important for black-throated diver and great northern diver, the second highest population of black-throated diver and the third highest population of great northern diver from all Scottish areas of search was recorded here.

Table 7. Scapa Flow area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		50	LBC Aerial WeBS	506 236 0	1.1	✓
black-throated diver	(Annex 1)		50	LBC Aerial WeBS	57 0 1	1.1	✓
Slavonian grebe	(Annex 1)		50	LBC Aerial WeBS	135 0 11	1.1	✓
European shag	(migratory)	2,000	1,100	LBC Aerial WeBS	2,929 0 190	1.2	✓
common eider spp.	(migratory)	10,300	600	LBC Aerial WeBS	1,994 1,850 0	1.4	✓
<i>mollissima</i> , long-tailed duck	(migratory)	16,000	110	LBC Aerial WeBS	1,393 631 0	1.4	✓
common goldeneye	(migratory)	11,400	200	LBC Aerial WeBS	219 13 37	1.4	✓
red-breasted merganser	(migratory)	1,700	84	LBC Aerial WeBS	539 101 0	1.4	✓
goosander	(migratory)	2,700	120	Aerial LBC WeBS	0 1 0		
red-throated diver	(Annex 1)		170	LBC Aerial WeBS	66 20 0		
greater scaup	(migratory)	3,100	52	Aerial LBC WeBS	0 0 0		
common scoter	(migratory)	5,500	1,000	Aerial LBC WeBS	148 5 0		
velvet scoter	(migratory)	4,500	50	LBC Aerial WeBS	13 0 0		
great crested grebe	(migratory)	3,500	190	Aerial LBC WeBS	0 0 0		
red-necked grebe	(migratory)	500	50	LBC Aerial WeBS	12 0 0		
little gull	(Annex 1)		50	Aerial LBC WeBS	0 0 0		
great cormorant	(migratory)	1,200	350	LBC WeBS Aerial	77 13 0		

3.7 North Orkney

Introduction

The Orkney Islands are located off the north coast of mainland Scotland. The North Orkney area of search covers the inshore waters east of Mainland, from Eynhallow in the west as far as Shapinsay and Deer Sounds in the east and north to the waters around Egilsay. The waters around North Orkney are mostly less than 20m deep, only the outer part of Deer Sound has a water depth greater than 30m (Figure 18). The sediment in North Orkney is predominantly gravel, with small areas of sand, rock and mixed sediment (McBreen *et al* 2011).

There are twelve terrestrial SPAs classified on the Orkney Islands (Figure 18). Two of these, Hoy SPA and Orkney Mainland Moors SPA, support breeding red-throated divers, among other species, including other seabird species. Hoy SPA also supports a seabird assemblage. None of the twelve SPA currently classified in Orkney protect any of the target species outside the breeding season.

Hoy SPA, Rousay SPA and East Sanday Coast SPA were extended into the marine environment by two kilometres in 2009.

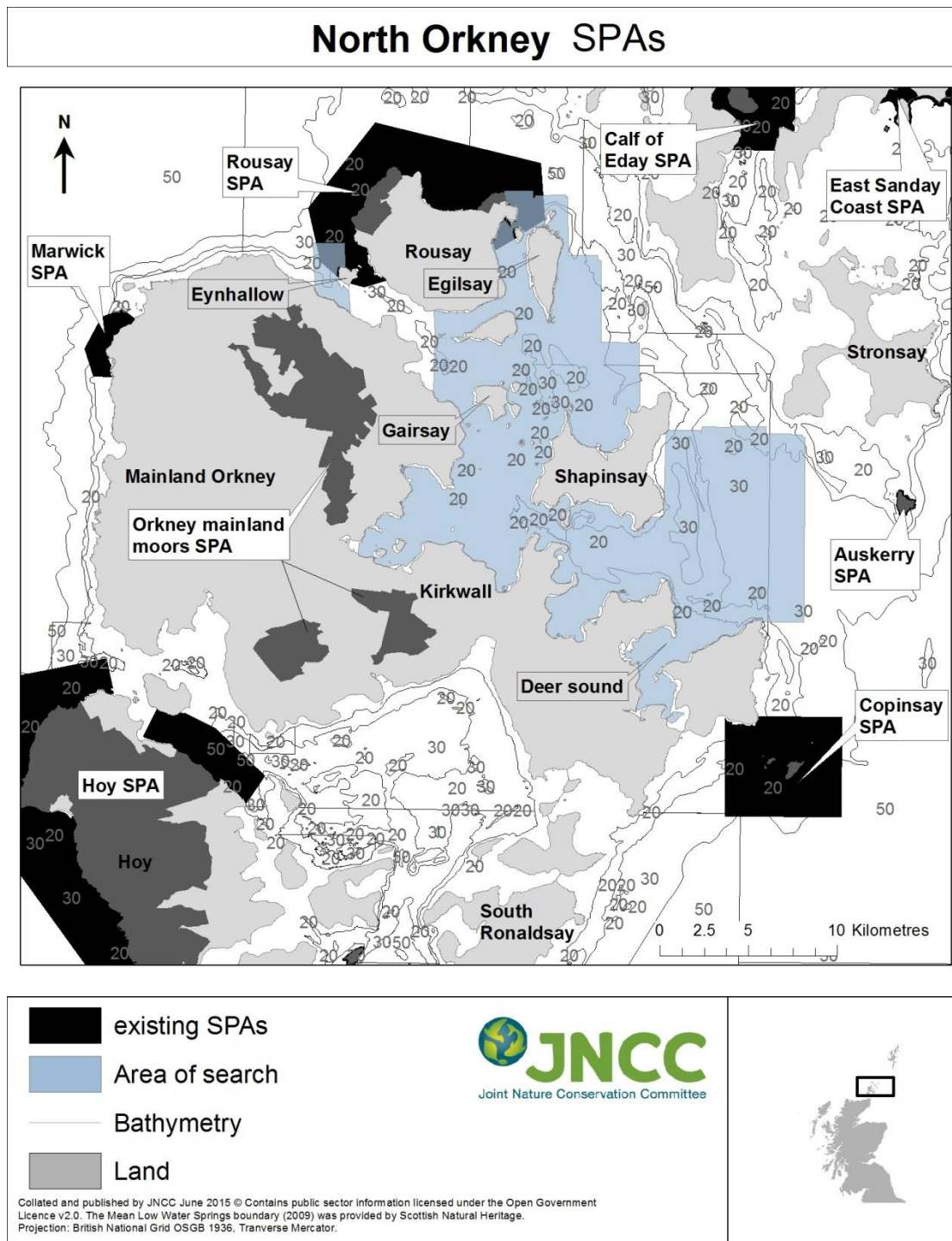


Figure 18. Existing SPAs and bathymetry around the North Orkney area of search.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes around North Orkney were collected from four aerial line-transect surveys carried out in the winter seasons of 2005/06, 2006/07 and 2007/08 (Figure 20). Observations were assigned to four distance bands. The inshore waters around North Orkney are known to hold Slavonian grebes and black-throated

divers during the winter (Benn 1985; Williams 2002), therefore land-based counts were carried out to complement data collected by aerial survey. Thirteen land-based count surveys of the sectors south of Gairsay were conducted in two winter seasons 2007/08 and 2008/09, six were conducted of the sectors north of Gairsay in 2007/2008 consequently the sectors were not surveyed consistently in all seasons (Figure 19).

Data from land-based WeBS counts within the North Orkney area of search were collated from the most recent five years of available data (2006/07 to 2010/11).

The following decisions were taken regarding data that were available for the North Orkney area of search:

The line-transect aerial surveys in January and February 2006 did not survey an area in the north of the area of search (in the Gairsay and Stronsay Firths) so they were not used in estimating mean of peak numbers (Figure 20). The spatial coverage of WeBS count data was limited; only four count sectors were regularly surveyed in the south east of the area of search (Figure 19). Therefore, JNCC contracted land-based count data were generally preferred over WeBS data where available.

Any unidentified diver records (three unidentified diver observations) were not included in the analyses. They could not be assigned to a particular species as more than one species of diver was regularly recorded in this area of search.

Eider in the Orkney islands were classified as *Somateria mollissima mollissima*, as there is currently no evidence to suggest they should be considered as the subspecies of eider *Somateria mollissima faeroensis*, found in the Shetland Islands (Furness *et al* 2010). For both land-based counts and aerial survey only two years of representative data were available, but a minimum of three seasons of data are required to establish regularity of occurrence. Therefore, where the data were available a combination of these two data sources were used to provide an estimate based on three years of data for example: two years of aerial survey and one year of land-based count data. However, the best available estimate for many species within this area of search was based on just two years (aerial or land-based count) as data were not available for a third year. WeBS count data are likely to underestimate numbers as the spatial coverage of WeBS count sectors was poor.

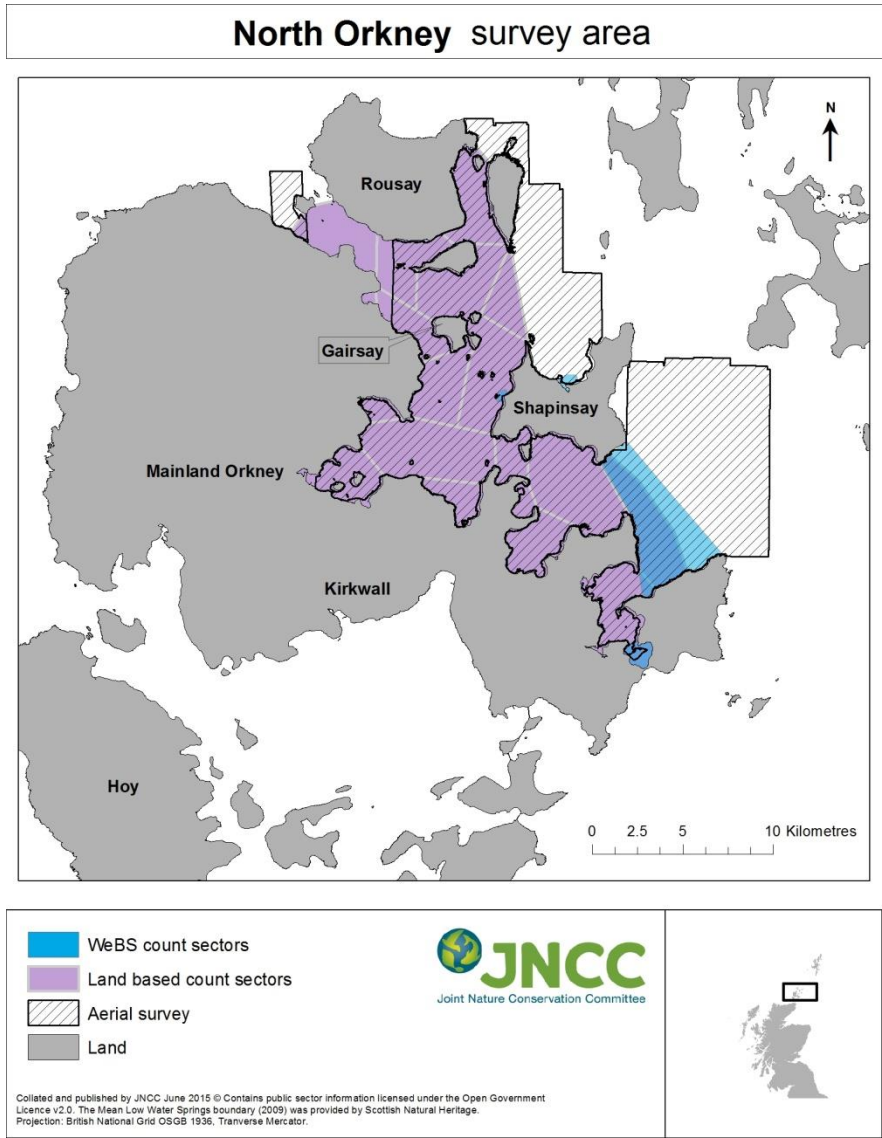


Figure 19. Map of North Orkney showing the areas surveyed by aerial survey, JNCC contracted land-based counts and WeBS counts.

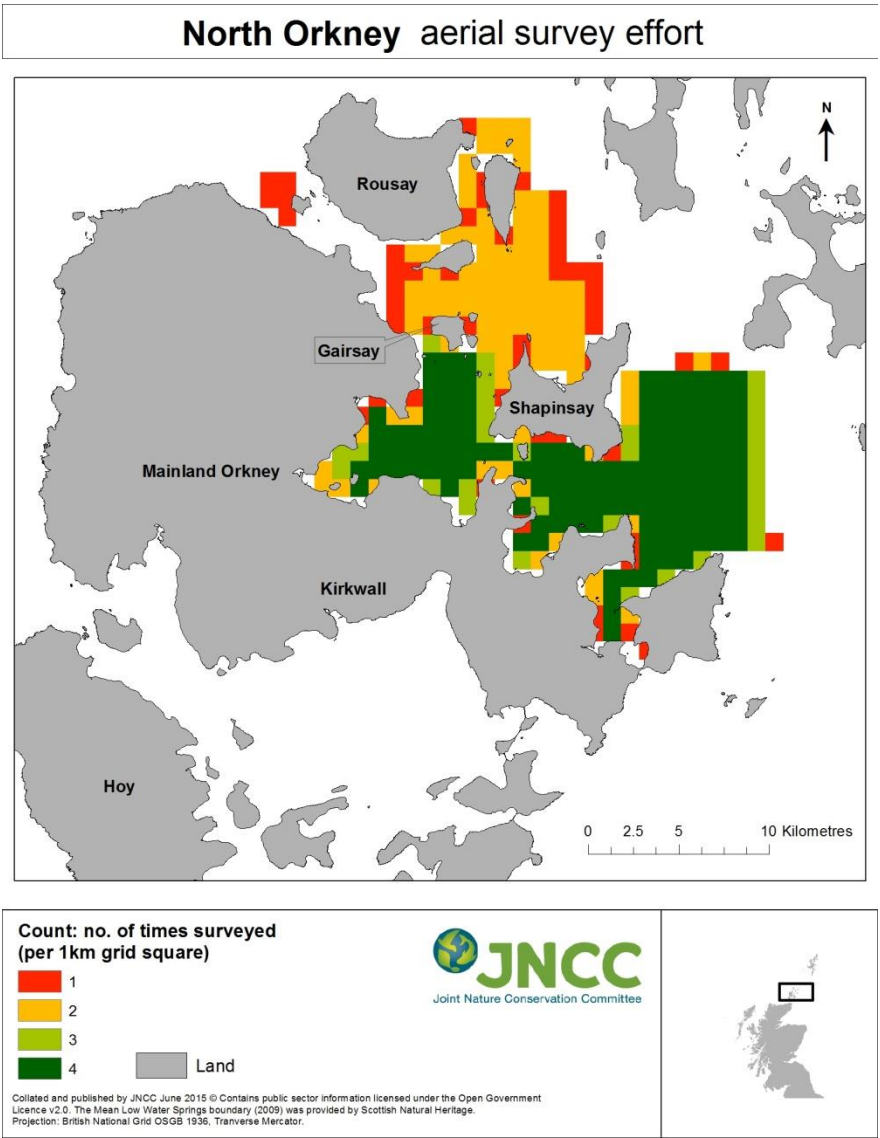


Figure 20. The survey effort for aerial survey in the North Orkney area of search is displayed as the number of times each 1km grid cell was surveyed.

Results

Table 8 provides an overview of the North Orkney area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.6 of Appendix 1.

Great northern diver occurred in numbers that regularly exceeded the minimum threshold of 50 individuals under Stage 1.1 (Table 8).

Common eider, long-tailed duck and red-breasted merganser were regularly present in numbers that exceeded 1% of their respective thresholds under Stage 1.4.

Velvet scoter, European shag and Slavonian grebe also exceeded their respective thresholds under Stage 1.4 and Stage 1.1, respectively (Table 8), but the regularity with which these species occur in the North Orkney area of search could not be assessed. Only two years of land-based count data (RSPB seaduck survey) were available for these species and they were not observed on the aerial surveys.

North Orkney had the second highest populations of Slavonian grebe and European shag of all areas of search in Scotland and supports high numbers of red-breasted merganser.

Table 8. North Orkney area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		50	LBC, Aerial WeBS	317 8	1.1	✓
common eider ssp. mollissima	(migratory)	10,300	600	Aerial, LBC WeBS	1,471 49	1.4	✓
long-tailed duck	(migratory)	16,000	110	Aerial, LBC WeBS	952 81	1.4	✓
red-breasted merganser	(migratory)	1,700	84	LBC, Aerial WeBS	279 35	1.4	✓
Slavonian grebe	(Annex 1)		50	LBC WeBS	120 1	1.1	2 years data, insufficient to test regularity of occurrence. 2 years data, insufficient to test regularity of occurrence. 2 years data, insufficient to test regularity of occurrence.
velvet scoter	(migratory)	4,500	50	Aerial LBC WeBS	0 147 2	1.4	
European shag	(migratory)	2,000	1,100	Aerial LBC WeBS	0 1,742 23	1.4	
greater scaup	(migratory)	3,100	52	Aerial WeBS LBC	0 2 0		
common scoter	(migratory)	5,500	1,000	Aerial LBC WeBS	60 0 0		
common goldeneye	(migratory)	11,400	200	LBC, WeBS Aerial	42 0 0		
goosander	(migratory)	2,700	120	WeBS Aerial LBC	0 0 0		
red-throated diver	(Annex 1)		170	LBC, Aerial WeBS	65 1		
black-throated diver	(Annex 1)		50	LBC WeBS Aerial	4 0 0		
great crested grebe	(migratory)	3,500	190	WeBS Aerial LBC	0 0 0		
red-necked grebe	(migratory)	500	50	LBC WeBS Aerial	1 0 0		
little gull	(Annex 1)		50	Aerial LBC WeBS	0 0 0		
great cormorant	(migratory)	1,200	350	LBC WeBS Aerial	144 3 0		

3.8 West Shetland

Introduction

Shetland is an archipelago of approximately 100 islands off the north coast of Scotland. The West Shetland area of search covers a stretch of the south-west coast of mainland Shetland, from Sumburgh head in the south up to, and including, a number of inlets north of a line from Skelda Ness to Scalloway. These inlets include Weisdale Voe and Whiteness Voe (Figure 21). The waters around the coast of West Shetland are mostly less than 30 metres deep but increase in depth quickly 2-3km from the coast (Figure 21). The sediment is predominantly rock or reef and coarse sediment, with small areas of sand (McBreen *et al* 2011).

There are eleven terrestrial SPAs classified on and around the Shetland Islands. Sumburgh Head SPA supports important numbers of breeding Arctic terns *Sterna paradisaea* (2% of UK population) and an overall assemblage of more than 20,000 breeding seabirds including northern fulmar, black-legged kittiwake, Arctic tern and common guillemot as listed features. The SPA was extended by 2km into the marine environment in September 2009 to support maintenance behaviours of northern fulmar and common guillemot. The Lochs of Spiggie and Brow SPA was classified for its wintering population of whooper swans *Cygnus cygnus*.

Site specific methods

Data on the number and distributions of birds using the West Shetland area of search were collected from four JNCC aerial surveys, and ten surveys undertaken by Shetland Oil Terminal Environmental Advisory Group (SOTEAG) between 2000/01 to 2010/11. SOTEAG surveys were undertaken using both land-based counts and boat survey. The boat survey consisted of a track along the coastline 250m from the shore, land-based counts were used to survey within the deep inlets or voes (Harvey & Heubeck 2012). The inner parts of these voes were not covered by aerial survey and were outside the area of search (Figure 22). The land-based and boat based counts were combined to give a total count for the area of search. The four line-transect aerial surveys, covering the main part of the area of search, were carried out over three winters, in February 2008, February 2009, March 2009 and February 2010. Observations were allocated to one of four distance bands. SOTEAG data were recorded for ten of the 11 consecutive winter seasons from 2000/01 to 2010/11; survey data were not available for 2008/09.

All four of the JNCC aerial surveys were used to assess the numbers and distribution of birds. The areas within the area of search that were surveyed by SOTEAG varied between years. In order to provide an estimate for the area as a whole the most recent count was used as a proxy count for an area that was not surveyed in a particular season. This is the correction that was used within the SOTEAG reports and in Harvey and Heubeck (2012).

Furness *et al* (2010) investigated eider species in the Shetland islands and found birds from the Shetlands should be classified as the subspecies of common eider *Somateria mollissima faeroensis* based on molecular data. Therefore in this report eider in the Shetland islands are classified as the subspecies of eider *Somateria mollissima faeroensis* and are assessed against the relevant population thresholds for this subspecies. The threshold to be used under Stage 1.2 of the guidelines - 1% of the biogeographic population of *Somateria mollissima faeroensis* is 85 individuals, and 1% of the UK population is 55 individuals, the threshold used by SNH under Stage 1.4 of the guidelines.

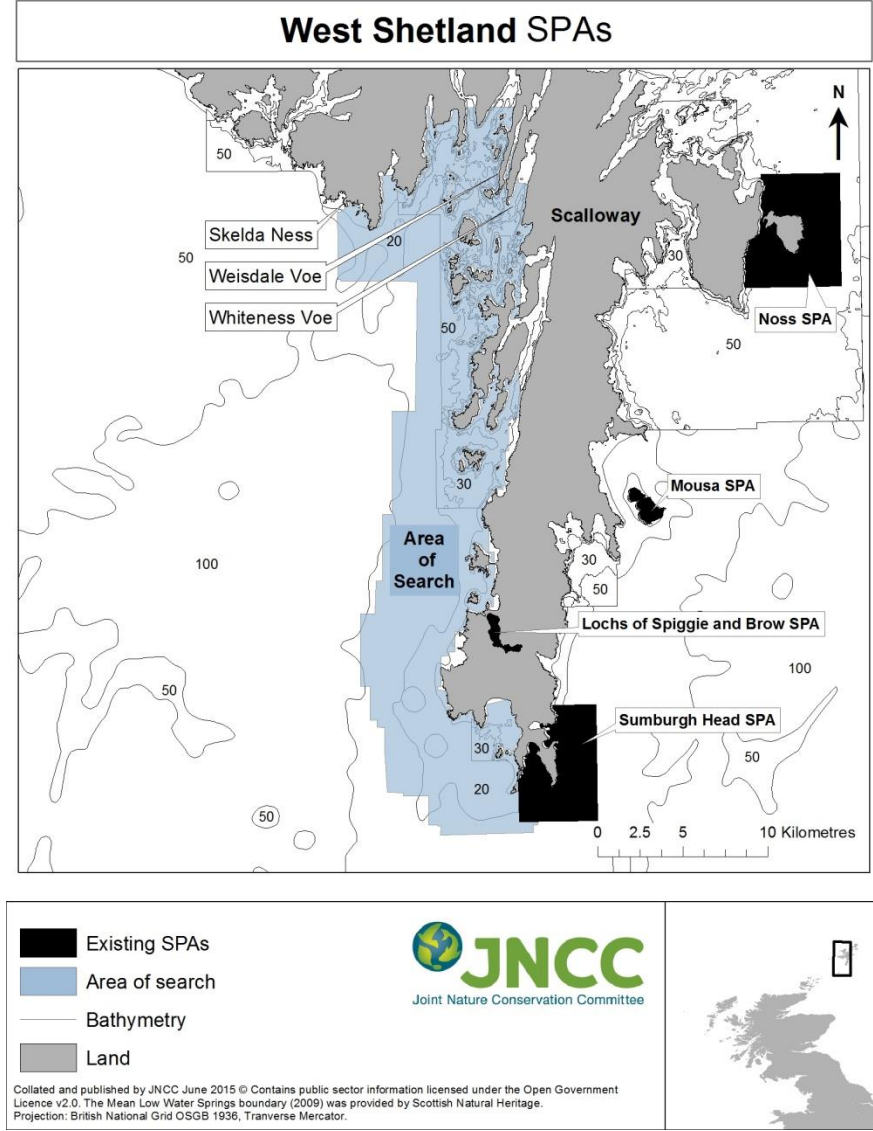


Figure 21. West Shetland survey area with bathymetry and existing SPAs.

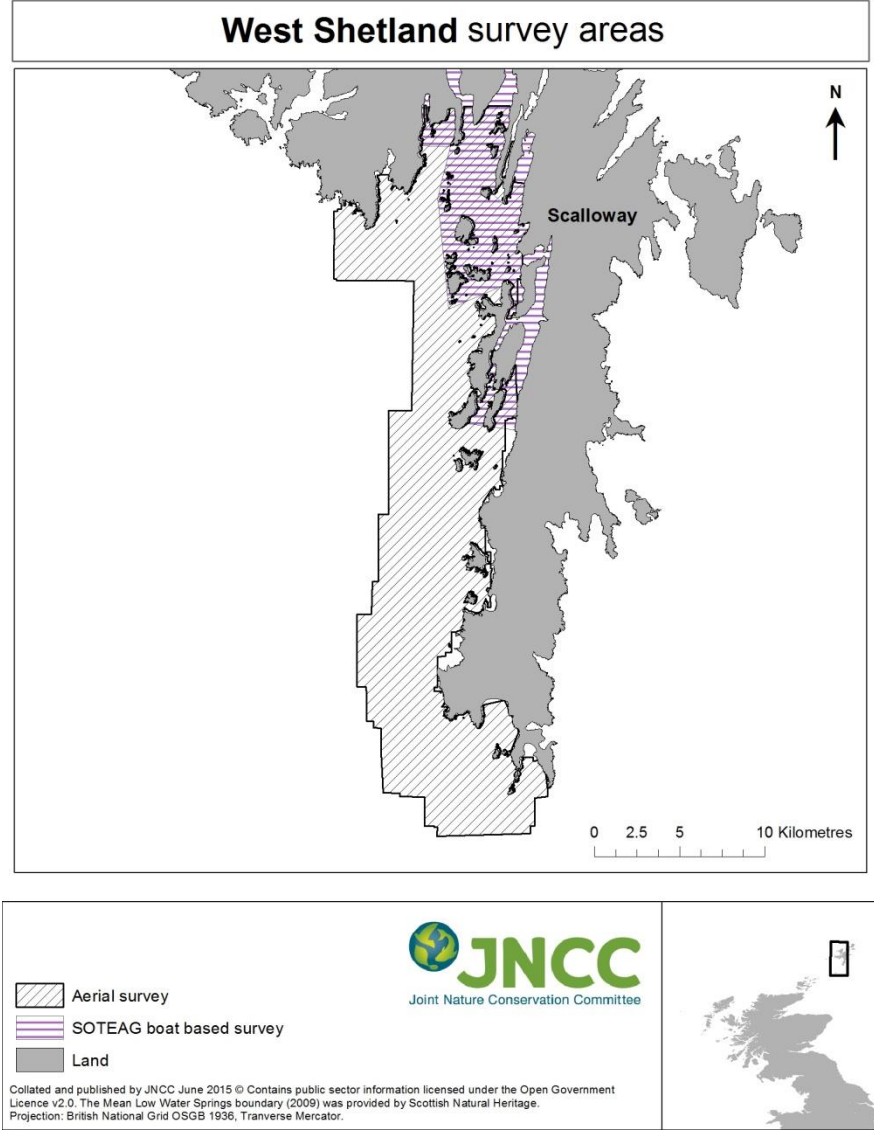


Figure 22. West Shetland area of search showing the areas surveyed by aerial survey and SOTEAG boat and land-based survey.

Results

Table 9 provides an overview of the West Shetland area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.7 of Appendix 1.

Numbers of the Annex I species Slavonian grebe regularly exceeded the minimum threshold of 50 individuals and their respective population thresholds under Stage 1.1 (Table 9). Great northern diver numbers exceeded the minimum threshold of 50 individuals in three of five years and therefore do not meet the criterion for regularity of occurrence.

Common eider ssp. *faeroensis* regularly occurred in numbers that were well in excess of the 1% population threshold under Stage 1.2.

Long-tailed duck and red-breasted merganser exceeded 1% of their respective UK wintering populations under Stage 1.4 and both of these species met the criterion for regularity of occurrence.

The population estimate for great northern divers was derived from both aerial survey and SOTEAG data. Each of the survey methods are likely to have underestimated numbers; aerial surveys were not able to cover some areas close inshore and SOTEAG surveys have extensive coverage of inshore areas but birds further offshore may go undetected. In addition, SOTEAG counts did not cover the whole of the mainland coastline section within the area of search. The population estimate for Slavonian grebe was derived from SOTEAG data. It includes at least some birds that were recorded from land-based counts in areas just outside the area of search within the inner parts of the voes (Harvey & Heubeck 2012).

There is some evidence from SOTEAG data that numbers of Slavonian grebes in the area of search increased in recent years (Harvey & Heubeck 2012). The mean of peak estimates for the entire 2000/01 to 2009/10 period is only 61 birds, and the three most recent counts have been higher than those recorded in earlier years.

Table 9. West Shetland area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details. SOTEAG = Shetland Oil Terminal Environmental Advisory Group.

Species		population thresholds (ind) 1% biog. % UK		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - Regularity - >50 individuals
great northern diver	(Annex 1)	(25)	50	SOTEAG boat and land-based counts and Aerial	52	1.1	Exceeds threshold in 3 of 5 seasons
Slavonian grebe	(Annex 1)	(11)	50	SOTEAG boat and land-based counts	78	1.1	✓
common eider, <i>faeroensis</i> ssp.	(migratory)	85	55	Aerial SOTEAG boat and land-based counts	0 1,021	1.2	✓
long-tailed duck	(migratory)	16,000	110	Aerial SOTEAG boat and land-based	420 162	1.4	✓

An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland

red-breasted merganser	(migratory)	1,700	84	counts Aerial SOTEAG boat and land-based counts	23 195	1.4	✓
greater scaup	(migratory)	3,100	52	counts Aerial SOTEAG boat and land-based counts	36 0		
common scoter	(migratory)	5,500	1,000	counts Aerial SOTEAG boat and land-based counts	0 3		
velvet scoter	(migratory)	4,500	(25) 50	counts Aerial SOTEAG boat and land-based counts	0 1		
common goldeneye	(migratory)	11,400	200	counts Aerial SOTEAG boat and land-based counts	0 69		
goosander	(migratory)	2,700	120	counts Aerial SOTEAG boat and land-based counts	0 0		
red-throated diver	(Annex 1)		170	counts Aerial SOTEAG boat and land-based counts	0 13		
black-throated diver	(Annex 1)		(6) 50	counts Aerial SOTEAG boat and land-based counts	0 0		
great crested grebe	(migratory)	3,500	190	counts Aerial SOTEAG boat and land-based counts	0 0		
red-necked grebe	(migratory)	500	(1) 50	counts Aerial SOTEAG boat and land-based counts	0 0		
little gull	(Annex 1)		50	counts Aerial SOTEAG boat and land-based counts	0 0		
European shag	(migratory)	2,000	1,100	counts Aerial SOTEAG boat and land-based counts	0 920		
great cormorant	(migratory)	1,200	350	counts Aerial SOTEAG boat and land-based counts	- 198		
				Aerial	-		

3.9 East Shetland

Introduction

The East Shetland area of search covers a stretch of the east coast of mainland Shetland from Mossbank, just north-west of the Lunna Ness peninsula, to the north coast of Bressay. The water depth is 30-35m in the coastal area and around the off-lying islands, but there is a deep trough of 150m depth north of Whalsay (Figure 23). The seabed substrate is rock or reef, with patches of coarse sediment.

Noss SPA overlaps with the southern tip of the east Shetland area of search. Noss SPA was classified in 1996 for its breeding populations of northern gannet *Morus bassanus*, great skua and common guillemot, and supporting an assemblage of more than 20,000 breeding seabirds. The SPA was extended by 2km into the marine environment in September 2009 to support maintenance behaviours of gannets and guillemots. Otterswick and Graveland SPA on the island of Yell, north of the area of search was classified in 2001 for breeding red-throated divers.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the East Shetland area of search were collected using boat-based survey and visual aerial survey; no WeBS count data were available (Figure 24). Boat-based surveys were carried out by the Shetland Oil Terminal Environmental Advisory Group (SOTEAG). The boat maintained a speed of 10 knots while 2-3 observers recorded all wintering waterbirds seen from a boat that stayed within 250m of the coast (Harvey & Heubeck 2012). The boat-based survey was split into four survey blocks: Dales Voe to Lunna Ness, Kirkabister to Gletness, Gletness to Rova Head and North Bressay. The five most recent years of boat-based surveys (2006/07 to 2010/11) were used to inform the mean of peak population estimates for each species. In some years, not all survey blocks were surveyed. To avoid underestimating the number of individuals in that year due to reduced survey coverage, a correction factor was applied. The number of individuals of that species that were in the survey block the last time it was counted was used in subsequent years as well, until the area was counted again. Two of the survey blocks (Kirkabister to Gletness and Gletness to Rova Head) were surveyed in each of the last two years and so required no correction factor. The other two survey blocks (Dales Voe to Lunna Ness and North Bressay) were surveyed twice in the last five years and so a correction factor was applied. These two years of survey showed that these two survey blocks supported fewer waterbirds than Kirkabister to Gletness and Gletness to Rova Head and so any potential bias in the correction factor will have only a minor influence on the population estimates. The boat-based counts surveyed the entire area and were counts of the total number of birds present. Visual aerial surveys were carried out using standard methods of flying east-west parallel line-transects spaced 2km apart with observers allocating bird records to one of four distance bands (Kahlert *et al* 2000). Five visual aerial surveys were carried out, two in the 2007/08 winter, two in the 2008/09 winter and one in the 2009/10 winter (Figure 25). These overlapped with the boat surveys to a small extent although aerial surveys had a more extensive seaward coverage and missed birds close inshore, where the aircraft could not fly (Figure 24). To provide a population estimate for each species data from both sources (aerial survey and SOTEAG survey) were used, which ever provided the highest estimate for each species in each season. Furness *et al* (2010) investigated eider species in the Shetland islands and found birds from the Shetlands should be classified as the subspecies of common eider *Somateria mollissima faeroensis* based on molecular data. Therefore in this report eider in the Shetland islands are classified as the subspecies of eider *Somateria mollissima faeroensis* and

are assessed against the relevant population thresholds for this subspecies. Under Stage 1.2 of the guidelines 1% of the biogeographic population of *Somateria mollissima faeroensis* is 85 individuals and under Stage 1.4 - 1% of the UK population is 55 individuals.

East Shetland existing SPAs

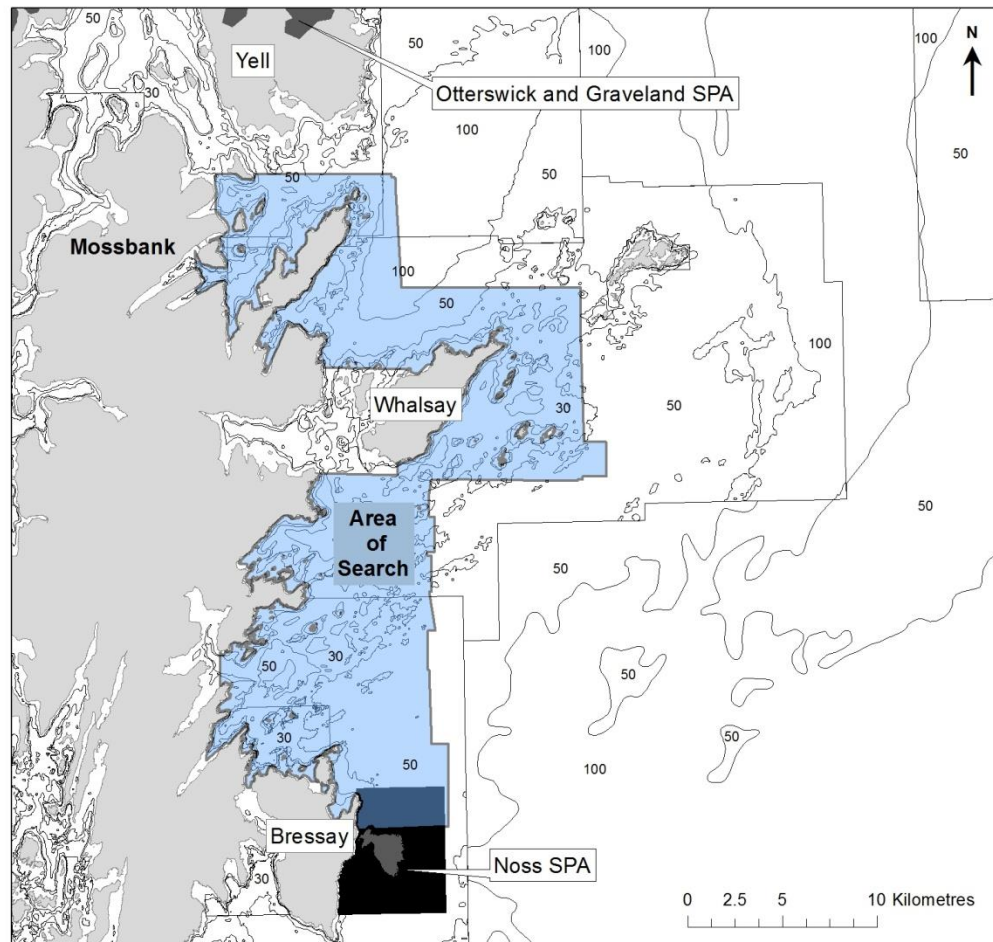


Figure 23. East Shetland survey area showing bathymetry and existing SPAs.

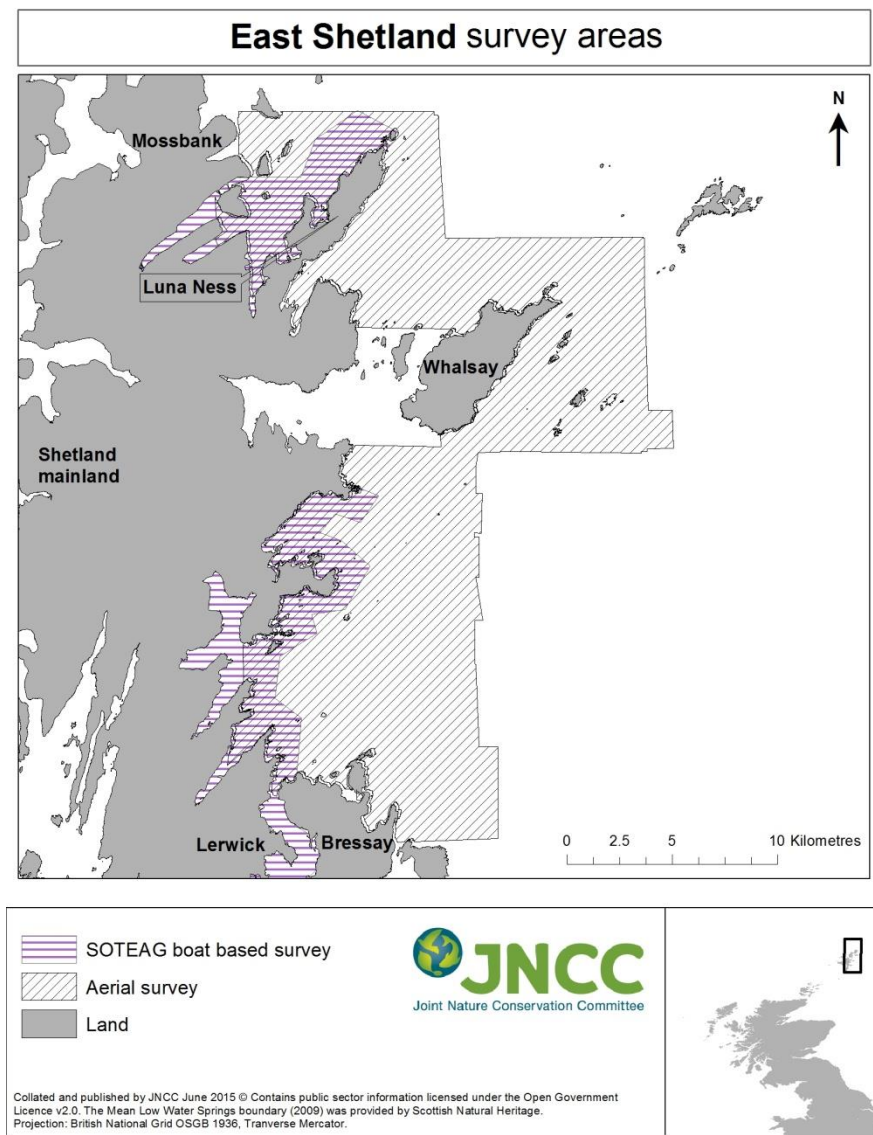


Figure 24. Map of East Shetland area of search showing areas surveyed by boat, land and air.

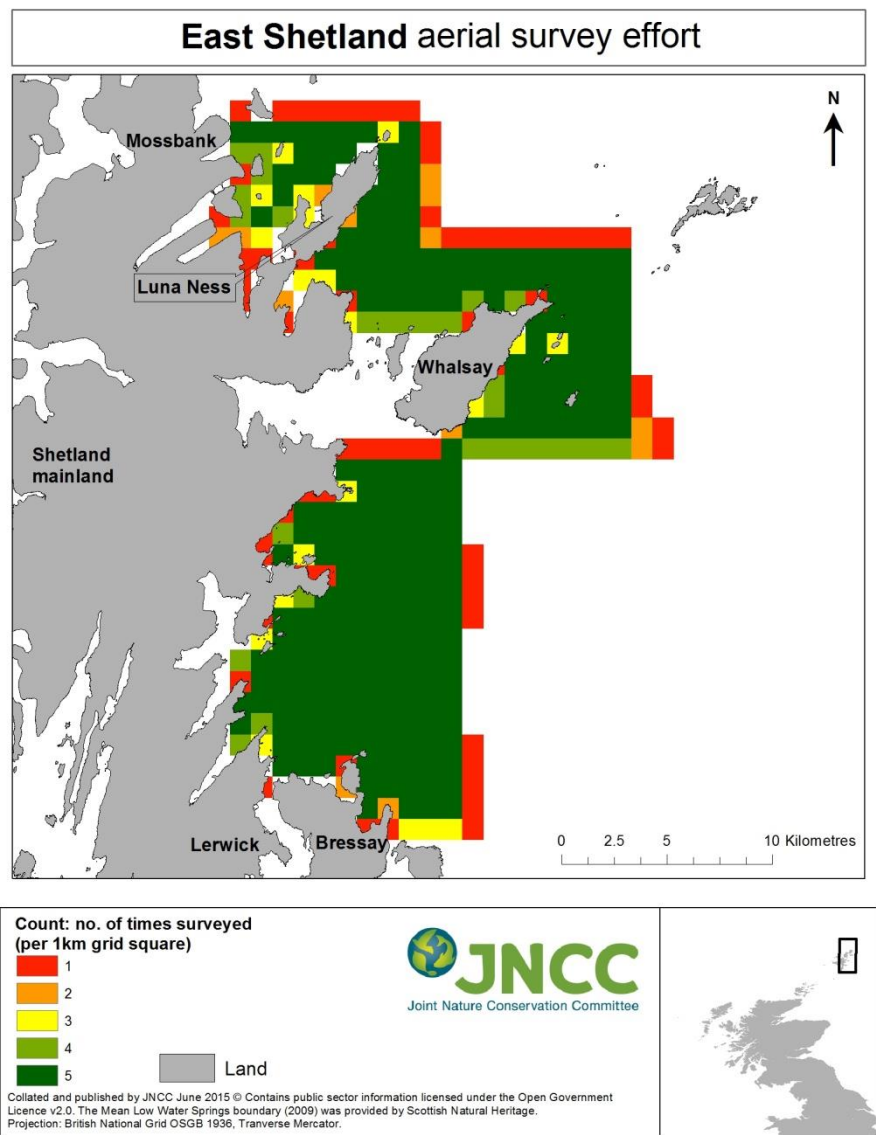


Figure 25. Survey effort for aerial survey in East Shetland displayed as the number of times each 1km grid cell was surveyed.

Results

Table 10 provides an overview of the East Shetland area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.8 of Appendix 1.

The East Shetland area of search supported numbers of the Annex I species great northern diver and Slavonian grebe that regularly exceed the Stage 1.1 threshold and the minimum of 50 birds.

Common eider ssp. *faeroensis* regularly occurred in numbers that exceeded their 1% population threshold under Stage 1.2.

Long-tailed duck and red-breasted merganser were regularly present in numbers that exceed 1% of the UK population, under Stage 1.4.

The mean of peaks estimate for great northern diver was based on three years of aerial survey data; while the estimates for Slavonian grebe, common eider ssp. *faeroensis*, long-tailed duck and red-breasted merganser were all based on five years of data, using the peak winter estimates from either aerial, boat survey data or a combination of these for common eider and long-tailed duck (Table A1.8 Appendix 1).

Table 10. East Shetland area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		(25) 50	Aerial	200	1.1	✓
Slavonian grebe	(Annex 1)		(11) 50	Boat	87		
				Boat	54	1.1	✓
				Aerial	0		
common eider, <i>faeroensis</i> ssp.	(migratory)	85	55	Boat and Aerial	252	1.2	✓
long-tailed duck	(migratory)	16,000	110	Boat and Aerial	166	1.4	✓
red-breasted merganser	(migratory)	1,700	84	Boat	234	1.4	✓
				Aerial	36		
greater scaup	(migratory)	3,100	52	Aerial	0		
				Boat	0		
common scoter	(migratory)	5,500	1,000	Boat	2		
				Aerial	0		
velvet scoter	(migratory)	4,500	(25) 50	Aerial	0		
				Boat	0		
common goldeneye	(migratory)	11,400	200	Boat	48		
				Aerial	8		
goosander	(migratory)	2,700	120	Aerial	0		
				Boat	0		
red-throated diver	(Annex 1)		170	Boat	24		
				Aerial	4		
black-throated diver	(Annex 1)		(6) 50	Aerial	0		
				Boat	0		
great crested grebe	(migratory)	3,500	190	Aerial	0		
				Boat	0		
red-necked grebe	(migratory)	500	(1) 50	Aerial	0		
				Boat	0		
little gull	(Annex 1)		50	Aerial	0		
				Boat	0		
European shag	(migratory)	2,000	1,100	Boat	817		
				Aerial	-		
great cormorant	(migratory)	1,200	350	Boat	76		
				Aerial	-		

3.10 Unst

Introduction

The island of Unst is the most north-easterly of the larger Shetland Islands and the northernmost point of the UK. The Unst area of search covers the entire east coast of the island (Figure 26). The waters along the east coast of Unst are mostly less than 30m deep but increase in depth quickly 1-2km from the coast. The sediment is predominately rock or reef and coarse sediment, with some small areas of sand (McBreen *et al* 2011).

Hermaness, Saxa Vord and Valla Field SPA overlaps slightly with the Unst area of search on the north coast of the island (Figure 26). The interior of the SPA comprises blanket bog, acid grassland and freshwater lochans that support at least 3% of the UK breeding population of red-throated diver (Stroud *et al* 2001). The SPA was extended by 2km into the marine environment in September 2009 to give additional protection to breeding seabirds, including northern gannet. Fetlar SPA is located just south of Unst area of search, but was not classified for populations of seaduck, divers or grebes (Stroud *et al* 2001).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes within Unst area of search were collected from three JNCC aerial surveys, supplemented by limited WeBS data that covered only part of the area of search. Line-transect aerial surveys of the area of search were carried out in March 2008, and February and March 2009. Observations were assigned to one of four distance bands. WeBS data were available for Nor Wick/Skaw and Haroldswick (Figure 27).

Only two years of aerial survey data were available but these data were used in preference to WeBS data as they provided higher population estimates for all species with the exception of red-breasted merganser, and covered a larger area. An additional year of WeBS data were required with the aerial survey data in order to assess regularity of occurrence. However for many species WeBS data were the only source of data available.

Results

Table 11 provides an overview of the Unst area of search showing the data available for each species. Numbers of all waterbird species were low in the Unst area of search and no species or assemblage of species occurred in numbers that exceeded the relevant UK SPA Selection Guidelines thresholds. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.9 of Appendix 1.

It is likely that the numbers presented here underestimate the number of species and individuals using the area of search, as several inshore areas were not covered by aerial surveys including all of Baltasound and the innermost part of Haroldswick.

Unst SPAs

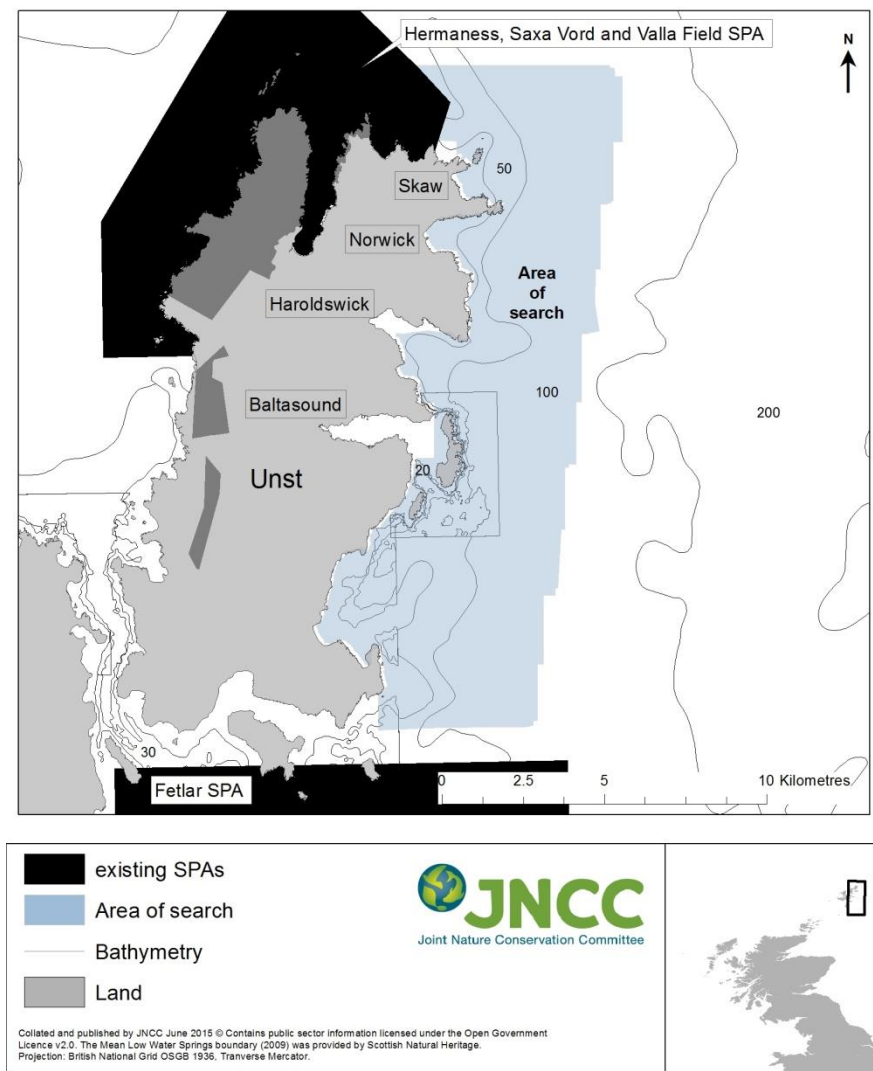


Figure 26. Unst survey area showing bathymetry and existing SPAs.

Unst survey area

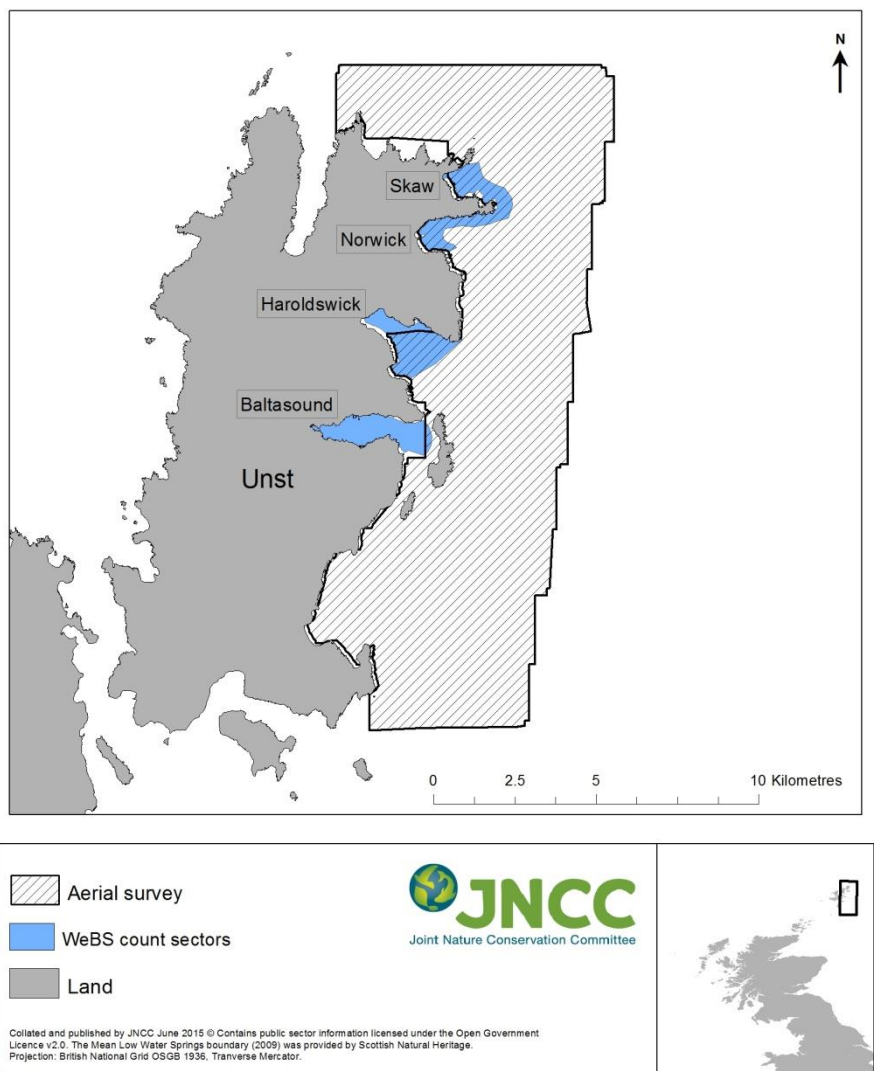


Figure 27. Unst, areas surveyed by aerial survey and WeBS counts.

Table 11. Unst area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

Species		population thresholds (ind) 1% biog. 1% UK		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
greater scaup	(migratory)	3,100	52	WeBS Aerial	0 0		
common eider, <i>faeroensis</i> ssp.	(migratory)	85	55	Aerial WeBS	20 3		
long-tailed duck	(migratory)	16,000	110	Aerial WeBS	12 1		
common scoter	(migratory)	5,500	1,000	WeBS Aerial	1 0		
velvet scoter	(migratory)	4,500	(25) 50	Aerial WeBS	0 0		
common goldeneye	(migratory)	11,400	200	WeBS Aerial	2 0		
red-breasted merganser	(migratory)	1,700	84	WeBS Aerial	24 6		
goosander	(migratory)	2,700	120	WeBS Aerial	0 0		
red-throated diver	(Annex 1)		170	Aerial WeBS	2 0		
black-throated diver	(Annex 1)		(6) 50	WeBS Aerial	0 0		
great northern diver	(Annex 1)		(25) 50	Aerial WeBS	14 1		
great crested grebe	(migratory)	3,500	190	WeBS Aerial	0 0		
red-necked grebe	(migratory)	500	(1) 50	WeBS Aerial	0 0		
Slavonian grebe	(Annex 1)		(11) 50	WeBS Aerial	1 0		
little gull	(Annex 1)		50	Aerial WeBS	0 0		
European shag	(migratory)	2,000	1,100	WeBS Aerial	0 -		
great cormorant	(migratory)	1,200	350	WeBS Aerial	0 -		

3.11 Loch Eriboll

Introduction

Loch Eriboll is a sea loch on the north coast of Scotland. The Loch Eriboll area of search covers an area stretching out from the inner part of the loch to approximately Faraid Head in the west and Whiten Head in the east (Figure 28).

The waters of loch Eriboll are less than 50m deep. The loch itself holds mainly sandy and muddy sediments while the opening to the Atlantic Ocean hosts more coarse sediments and rock or reef (McBreen *et al* 2011).

Caithness and Sutherland Peatlands SPA is adjacent to the area of search. It contains at least 16.3% and 9.5% of the UK breeding populations of black-throated and red-throated diver, respectively, as well as nationally important numbers of breeding common scoter. Cape Wrath SPA and Foinaven SPA are directly adjacent to the west and south of the area of search respectively, but neither site was classified for populations of seaduck, divers or grebes (Stroud *et al* 2001).

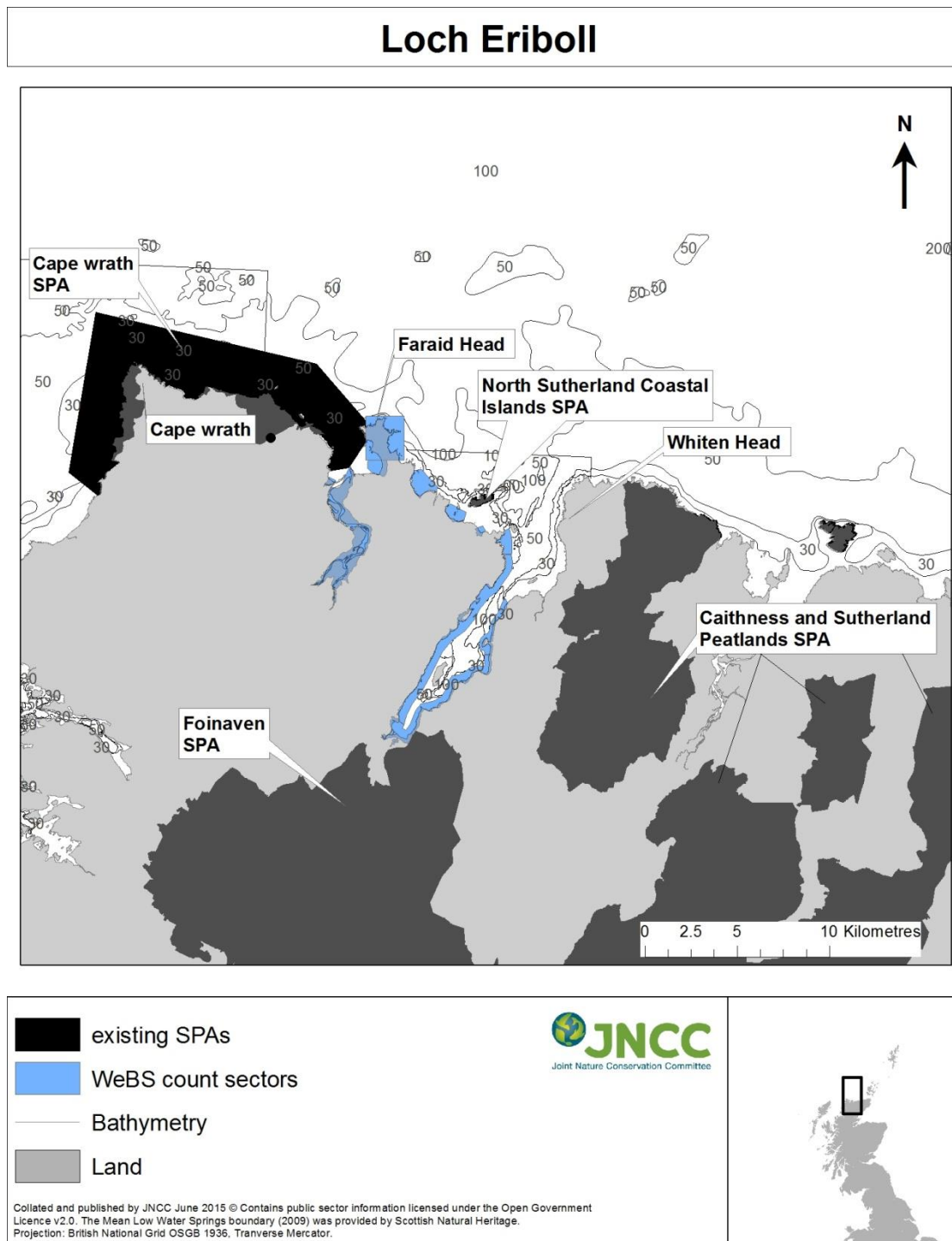


Figure 28. Loch Eriboll survey area showing the areas with WeBS count data, bathymetry and existing SPAs adjacent to the area of search.

Site specific methods

The numbers of birds using the Loch Eriboll area of search were estimated using the limited WeBS data available for the five consecutive winter seasons from 2005/06 to 2009/10. Data were only available for count sections between Faraid Head and Camas an Duin (half-way along

the eastern shore of the loch) (Figure 28). It is likely that the numbers from WeBS data are an underestimate of the total birds using the area of search as they miss individuals further offshore and no data were available for any count sections along the north-east shore of the loch from Camas an Duin to Whiten Head.

Results

Table 12 provides an overview of the Loch Eriboll area of search showing the data available for each species. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.10 of Appendix 1.

None of the seaduck, diver or grebe species within the Loch Eriboll area of search were regularly present in numbers that exceeded the relevant UK SPA Selection Guidelines thresholds (Table 12).

Great northern diver exceeded 1% of their UK wintering population under Stage 1.1; however, the numbers of great northern diver present were less than the minimum threshold of 50 individuals (Table 12). Due to the limited survey coverage this is likely to be an underestimate of the true numbers of great northern diver present within this site.

Table 12. Loch Eriboll area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

species		population thresholds (ind) 1% biog. 1% UK		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
great northern diver	(Annex 1)	(25)	50	WeBS	40	1.1	<50 ind
greater scaup	(migratory)	3,100	52	WeBS	0		
common eider	(migratory)	10,300	600	WeBS	34		
long-tailed duck	(migratory)	16,000	110	WeBS	13		
common scoter	(migratory)	5,500	1,000	WeBS	0		
velvet scoter	(migratory)	4,500	(25) 50	WeBS	0		
common goldeneye	(migratory)	11,400	200	WeBS	6		
red-breasted merganser	(migratory)	1,700	84	WeBS	29		
goosander	(migratory)	2,700	120	WeBS	1		
red-throated diver	(Annex 1)		170	WeBS	3		
black-throated diver	(Annex 1)		(6) 50	WeBS	5		
great crested grebe	(migratory)	3,500	190	WeBS	0		
red-necked grebe	(migratory)	500	(1) 50	WeBS	0		
Slavonian grebe	(Annex 1)		(11) 50	WeBS	10		
little gull	(Annex 1)		50	WeBS	0		
European shag	(migratory)	2,000	1,100	WeBS	76		
great cormorant	(migratory)	1,200	350	WeBS	12		

3.12 Wester Ross

Introduction

The Wester Ross area of search covers a series of sea lochs (Loch Broom, Little Loch Broom, Loch Ewe, Loch Gairloch and Loch Torridon) along the north-west coast of Scotland from Reiff in the north to Broadford Bay on the Isle of Skye in the south (Figure 29).

The waters of the Wester Ross area of search are relatively deep, in places reaching down to 200m just a few kilometres from the coast. The area hosts mainly sandy and muddy sediments while the coastline is made up of rock (McBreen *et al* 2011).

Of the seven SPAs located near to the Wester Ross area of search, three have been classified for their breeding populations of black-throated divers. Loch Maree SPA, Wester Ross Lochs SPA and Inverpolly, Loch Urigill and Nearby Lochs SPA contain a number of nutrient-poor freshwater lochs surrounded by a variety of habitats such as heath and blanket bog. These three SPAs support around 6.3%, 5% and 5.6% respectively of the UK population of breeding black-throated diver (Stroud *et al* 2001).

Wester Ross Survey area

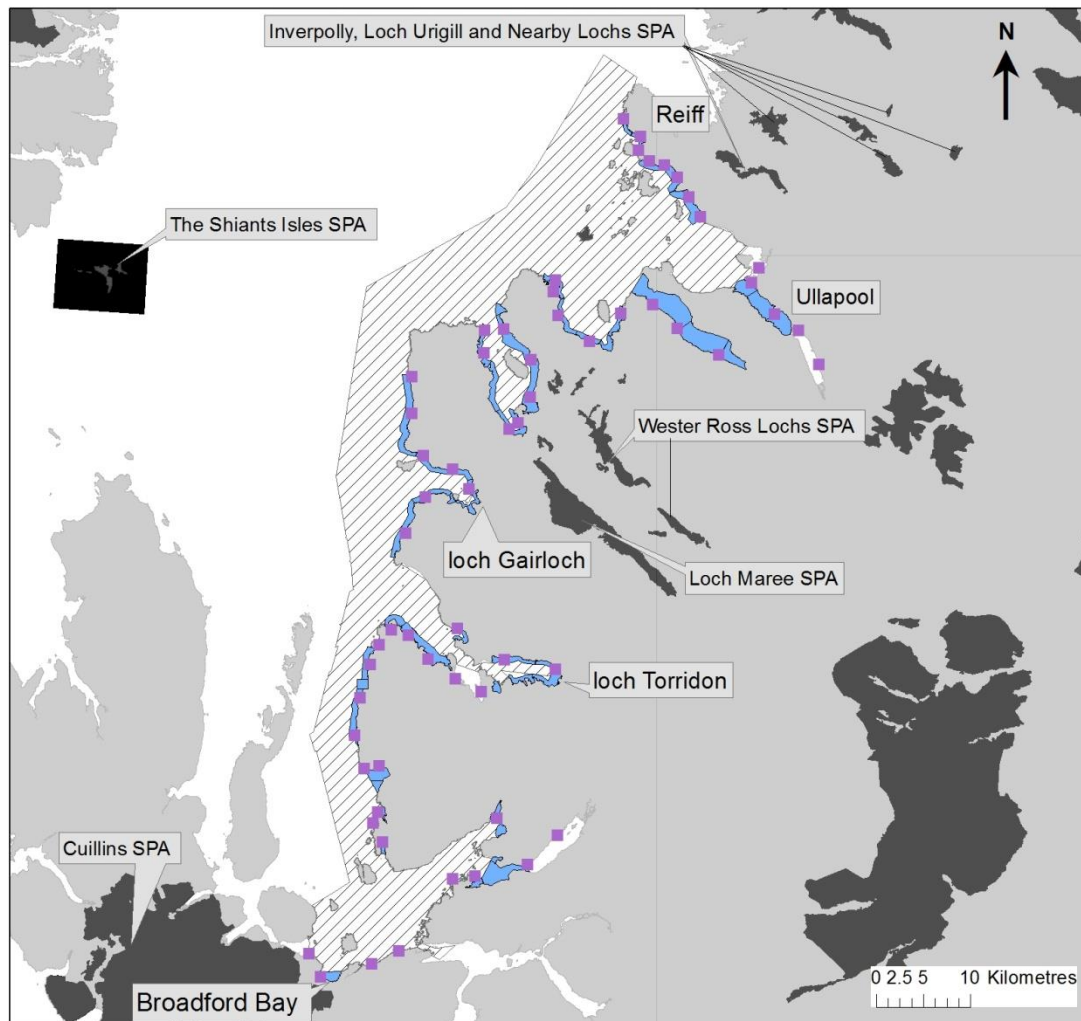


Figure 29. Wester Ross survey area showing the areas surveyed by aerial survey, WeBS counts and existing SPAs close to the area of search.

Site specific methods

The numbers of birds using the Wester Ross area of search were estimated from four JNCC aerial surveys, one JNCC land-based count survey and the most recent WeBS count data that were available (Figure 29).

Line-transect aerial surveys were carried out in January and March 2008, and February and March 2009. Observations were assigned to one of four distance bands. One complete land-based count survey of the area of search was made in January 2009. WeBS data were available for some count sectors within the area of search for the five consecutive winter seasons from 2006/07 to 2010/11.

Of the 104 divers that were recorded during the four aerial surveys, six were recorded only to genus. Since both black-throated and great northern divers were recorded during land-based counts, unidentified divers were not assigned to a particular species and had to be excluded from the analysis.

For many species WeBS data provided the highest population estimates within the area of search, as few years of aerial survey and land-based count data were available. Estimates from aerial survey and land-based counts were used where they provided a higher estimate than WeBS data.

Results

Table 13 provides an overview of the Wester Ross area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.11 of Appendix 1.

The Wester Ross area of search supported numbers of great northern divers and black-throated divers that regularly exceeded their thresholds under Stage 1.1 and the minimum threshold of 50 individuals. This was the largest wintering population of black-throated diver of all the inshore areas of search in Scotland.

Red-breasted merganser occurred in numbers that regularly exceeded 1% of the UK wintering population under Stage 1.4 (Table 13).

The mean of peak estimates for these species were based on five years of land-based count data and all three met the criterion for regularity of occurrence under the UK SPA Selection Guidelines.

The numbers of Slavonian grebe within the area of search exceeded the 1% threshold under Stage 1.1. However the numbers did not exceed the minimum threshold of 50 birds in any of the surveys.

Table 13. Wester Ross area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
black-throated diver	(Annex 1)	(6)	50	WeBS LBC Aerial	61 45 3	1.1	✓
great northern diver	(Annex 1)	(25)	50	WeBS LBC Aerial	153 79 130	1.1	✓
red-breasted merganser	(migratory)	1,700	84	LBC, WeBS Aerial	135 50	1.4	✓
Slavonian grebe	(Annex 1)	(11)	50	WeBS, LBC Aerial	27 0	1.1	<50 ind
greater scaup	(migratory)	3,100	52	WeBS, LBC Aerial	1 0		
common eider	(migratory)	10,300	600	LBC, WeBS Aerial	127 124		
long-tailed duck	(migratory)	16,000	110	Aerial WeBS LBC	28 4 1		
common scoter	(migratory)	5,500	1,000	WeBS Aerial LBC	22 0 0		
velvet scoter	(migratory)	4,500	50	WeBS Aerial LBC	0 0 0		
common goldeneye	(migratory)	11,400	200	WeBS LBC Aerial	194 29 2		
goosander	(migratory)	2,700	120	WeBS, LBC Aerial	1 0		
red-throated diver	(Annex 1)		170	Aerial, WeBS LBC	9 7		
great crested grebe	(migratory)	3,500	190	Aerial LBC WeBS	0 0 0		
red-necked grebe	(migratory)	500	(1) 50	WeBS Aerial WeBS	0 0 0		
little gull	(Annex 1)		50	Aerial LBC WeBS	0 0 0		
European shag	(migratory)	2,000	1,100	WeBS Aerial LBC	501 - 0		
great cormorant	(migratory)	1,200	350	WeBS Aerial WeBS	14 - 0		

3.13 Broad Bay

Introduction

The Broad Bay area of search is a sheltered bay facing north-east on the east coast of the Isle of Lewis in the Outer Hebrides. Broad Bay area of search includes the outer bay up to 6.5km east of a line from Tolsta Head south to Tiumpnan Head.

Broad Bay itself is only up to 30m deep while the out parts of the area of search are up to 100m deep. The coastline is rock while the bay is covered in sand, with patches of more coarse sediments in the centre of the bay (McBreen *et al* 2011).

The Lewis Peatlands SPA, located near the Broad Bay area of search, contains almost 590km² of blanket bog and freshwater lochs (Figure 30). This SPA supports important breeding populations of several species, including c.6.9% and 6.4% of the UK breeding populations of black-throated and red-throated diver, respectively (Stroud *et al* 2001).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Broad Bay area of search were collected from three JNCC aerial surveys and six JNCC contracted land-based counts. Line-transect aerial surveys were carried out in February and March 2009 and February 2010. Observations were assigned to one of four distance bands. JNCC land-based counts were made in December and February of 2007/08, 2008/09 and 2009/10. The coverage of WeBS data was limited (Figure 30).

Ten divers were only recorded to genus level from a total of 81 divers recorded during the aerial surveys. It is most likely that these individuals were great northern divers, as this species was seen most frequently during both aerial surveys and land-based counts. However, red-throated divers were recorded during aerial surveys, and both red-throated and black-throated divers were recorded during land-based counts. Therefore unidentified divers were not assigned to a particular diver species and were excluded from the analysis.

Broad Bay survey area

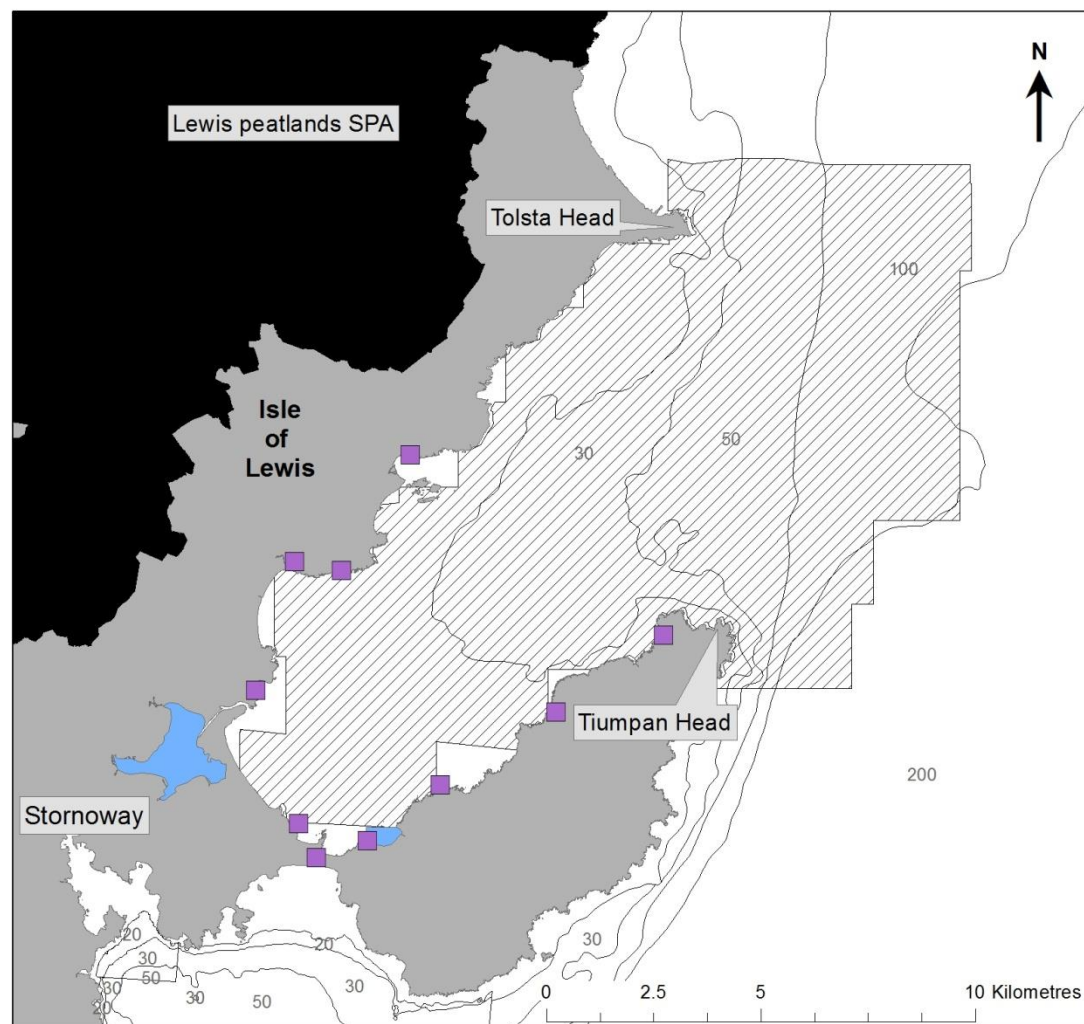


Figure 30. Broad Bay survey area showing the areas surveyed by aerial survey, WeBS counts and Land-based Counts and existing SPAs adjacent to the site.

Results

Table 14 provides an overview of the Broad Bay area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.12 of Appendix 1.

The Broad Bay area of search regularly supported numbers of great northern diver that exceeded the 1% threshold under Stage 1.1 and the minimum threshold of 50 individuals.

The mean of peak population estimate for great northern diver was based on three years of land-based count data and the peak winter counts exceeded the threshold in all three years. Aerial survey data produced a mean of peak estimate of 160 great northern divers within the area of search, compared to 440 from land-based counts. The difference between these estimates could be attributed to surveys being carried out on different days, but may be due to aerial surveys missing large aggregations of great northern divers very close inshore (Table 14).

Common eider and long-tailed duck regularly exceeded 1% of their UK wintering populations, the threshold population size under stage 1.4.

Although Slavonian grebe exceeded their respective population threshold under Stage 1.1 the numbers present were less than the minimum threshold of 50 individuals.

Table 14. Broad Bay area of search showing the data available for each species, and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		50	LBC	440	1.1	✓
				Aerial	160		
				WeBS	3		
common eider	(migratory)	10,300	600	LBC	729	1.4	✓
				WeBS	142		
				Aerial	131		
long-tailed duck	(migratory)	16,000	110	LBC	346	1.4	✓
				WeBS	58		
				Aerial	33		
Slavonian grebe	(Annex 1)		50	LBC	16	1.1	<50 ind
				WeBS	0		
				Aerial	0		
common scoter	(migratory)	5,500	1,000	LBC	117		
				Aerial	39		
				WeBS	0		
velvet scoter	(migratory)	4,500	50	LBC	2		
				Aerial	0		
				WeBS	0		
common goldeneye	(migratory)	11,400	200	LBC	3		
				Aerial	0		
				WeBS	0		
red-breasted merganser	(migratory)	1,700	84	WeBS	30		
				LBC	29		
				Aerial	0		
goosander	(migratory)	2,700	120	WeBS	0		
				LBC	0		
				Aerial	0		
red-throated diver	(Annex 1)		170	Aerial	41		
				LBC	36		
				WeBS	0		
black-throated diver	(Annex 1)		50	LBC	3		
				Aerial	0		
				WeBS	0		
great crested grebe	(migratory)	3,500	190	LBC	0		
				Aerial	0		
				WeBS	0		
red-necked grebe	(migratory)	500	50	LBC	0		
				Aerial	0		
				WeBS	0		
little gull	(Annex 1)		50	Aerial	0		
				LBC	0		
				WeBS	0		
European shag	(migratory)	2,000	1,100	WeBS	34		
				Aerial	-		
				LBC	-		
great cormorant	(migratory)	1,200	350	WeBS	2		
				Aerial	-		
				LBC	-		

3.14 Outer Hebrides

Introduction

The Outer Hebrides are located west of the north-west coast of Scotland. The Outer Hebrides area of search extends from the west of Harris to south of Berneray on the west coast of the Hebrides. The southern parts of the islands are surrounded by shallow (0-30m deep) inshore areas whilst the northwest coast is bordered by much deeper water. The sediment along the east coast is predominately gravel; the sediment along the west coast is dominated by sand (McBreen *et al* 2011).

There are 14 existing terrestrial SPAs around the Outer Hebrides. Two of these, Lewis Peatlands SPA and Mointeach Scadabhaigh SPA, provide protection for red-throated diver and black-throated diver, though this covers their breeding season not overwintering aggregations (Figure 31).

The Mointeach Scadabhaigh SPA on North Uist is characterised by bogs and moorland and was classified in 1999 for breeding populations of black-throated divers and red-throated divers. Lewis Peatlands SPA, classified in 2000, also supports breeding populations of black-throated divers and red-throated divers among other species. It covers habitats such as deep blanket bog and heath, interspersed with inland water bodies.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Outer Hebrides area of search were collected from five line-transect aerial survey in the winter seasons of March 2003, February 2004, March 2005, January 2006 and March 2007. Land-based counts were conducted each winter over three seasons 2007/08, 2008/09 and 2009/10, and WeBS count data were collated from the most recent five years of available data (2006/07 to 2010/11) (Figure 32).

Due to the large size of the survey area and lack of suitable airports for refuelling, the aerial survey line-transects were spaced 4km apart instead of 2km as for all other areas of search. Transects were flown perpendicular to the coast along the depth gradient. Observations were assigned to one of four distance bands and for consistency these data were analysed in the same way as all other sites, using a 3km bandwidth for KDE. This bandwidth was equally applicable to a 4km transect width as individual transect lines did not show in the KDE surface.

Greater scaup, common goldeneye, black-throated diver or grebes were rarely detected by observers during aerial survey (Wilson *et al* 2006; Söhle *et al* 2006; Lewis *et al* 2008, 2009). The inshore waters around the Outer Hebrides are known to host significant numbers of Slavonian grebes, great northern divers and black-throated divers. Three land-based count surveys were carried out between November 2007 and February 2010 to provide additional data for these species as their numbers may be underestimated from aerial survey. Grebes are not easily detected during aerial surveys and divers can be difficult to identify to species level particularly where several species may be present. The land-based count sectors were chosen on the basis that they were thought to hold relatively large numbers of Slavonian grebes and black-throated divers (as determined from WeBS counts and local expert knowledge). As far as possible, count sections within each survey area were surveyed in sequence and care was taken to avoid double counting of birds.

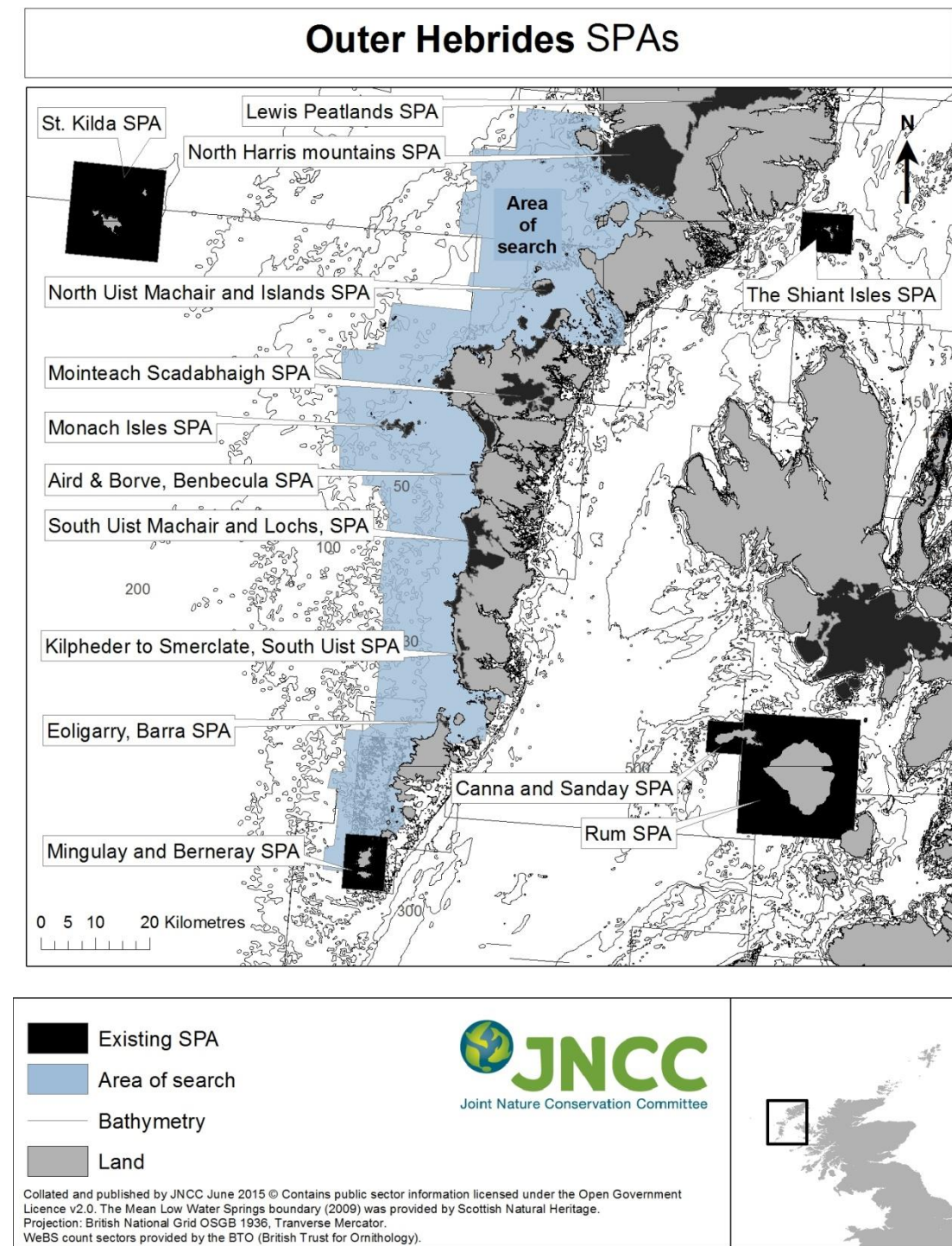


Figure 31. Existing SPAs and bathymetry around the Outer Hebrides area of search.

The following decisions were taken regarding data that were available for the Outer Hebrides area of search. The line-transect aerial surveys all had good spatial coverage of the area of search (Figure 33) and therefore data from all these surveys were assessed to calculate the mean of peak estimates. Any unidentified divers were not included in the analyses as more than one species of diver were present in this area of search.

Few WeBS count data were available for the Outer Hebrides area of search and the spatial coverage was limited. Therefore, data from land-based counts or aerial survey were used in preference to WeBS counts where they were available. WeBS counts were used to provide population estimates for European shag and great cormorant as these were the only data available for these species.

Results

Table 15 presents a summary of the species that exceeded the thresholds under the UK SPA Selection Guidelines. Great northern diver occurred in numbers that regularly exceeded the threshold of the UK SPA Selection Guidelines under Stage 1.1. This was the largest population of great northern divers of the areas surveyed in Scotland. High numbers of great northern diver were recorded from both the aerial survey and the land-based counts. One survey, on 17 February 2004, estimated 3,093 (2,307 LCL to 4,145 UCL, Table A2.12) individual great northern divers present in the survey area (Table A1.13). This estimate is in excess of the current UK wintering population estimate of 2,500 individuals. A review of the total UK wintering population estimate for great northern divers is therefore recommended.

Common eider, long-tailed duck and red-breasted merganser regularly occurred in numbers that exceeded 1% of their respective UK wintering populations, the threshold population required under Stage 1.4.

No black-throated divers were observed during the aerial surveys, although some may have been recorded as unidentified divers. In contrast, the limited land-based counts recorded a mean of 43 black-throated divers, which may be an underestimate of the true number present. This is below the minimum default number of 50 individual's for consideration in an SPA context. Slavonian grebe also exceeded the threshold population under Stage 1.1 but were not regularly occurring in these numbers.

Table 15 provides an overview of the Outer Hebrides area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A13 of Appendix 1.

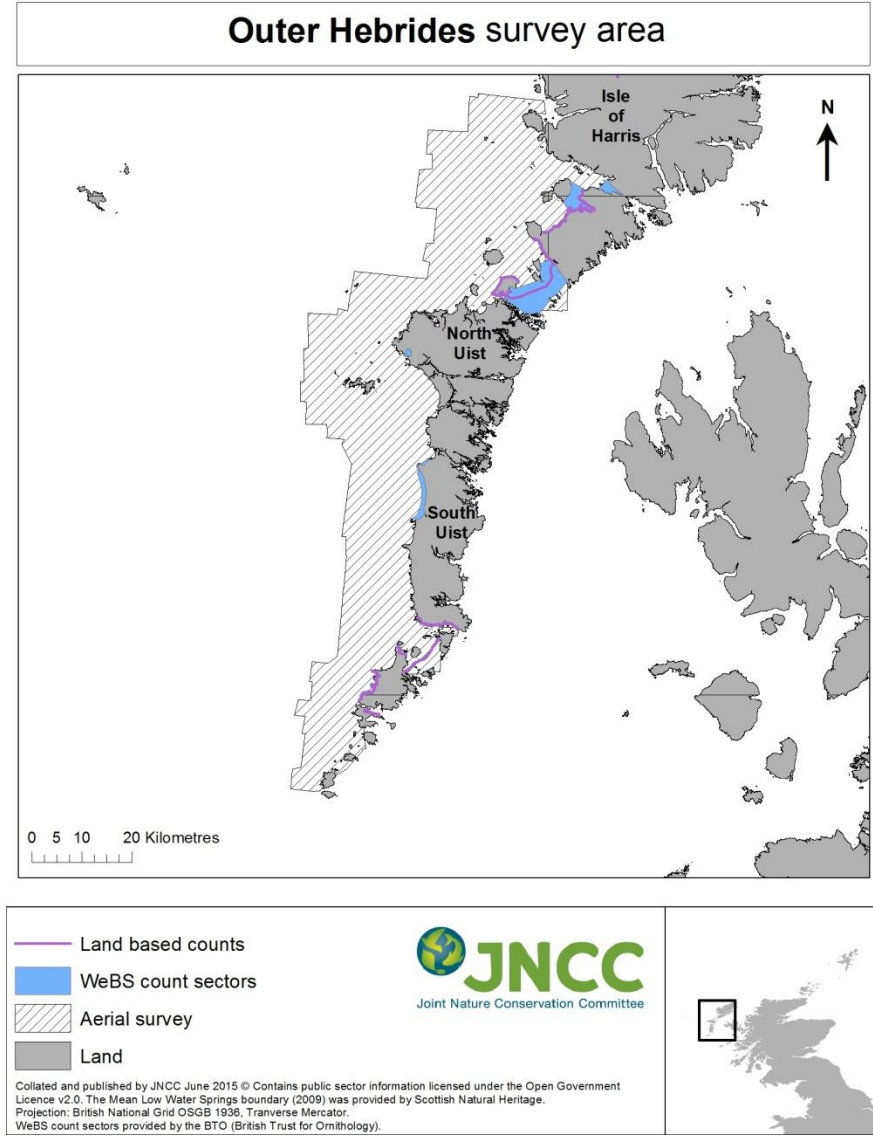


Figure 32. Map of the Outer Hebrides showing the areas surveyed by aerial survey, land-based counts and WeBS count sectors.

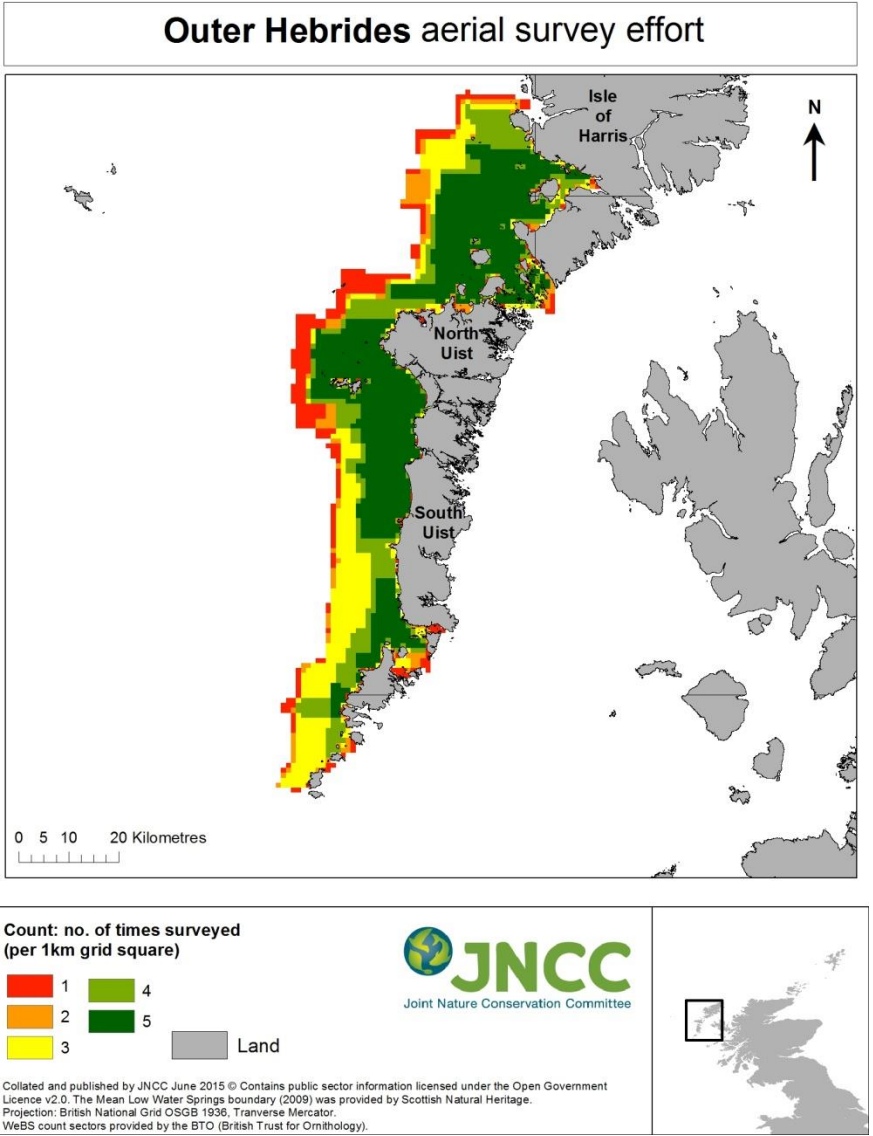


Figure 33. Survey effort for aerial survey in the Outer Hebrides is displayed as the number of times each 1km grid cell was surveyed.

Table 15. Outer Hebrides area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = Land-based Counts. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		50	Aerial WeBS LBC	1,400 21 458	1.1	✓
Slavonian grebe	(Annex 1)		50	LBC WeBS Aerial	51 2 0	1.1	Exceeds 1% threshold in 1 of 3 years, not regular. <50 ind
black-throated diver	(Annex 1)		50	LBC WeBS Aerial	43 0 0	1.1	
common eider	(migratory)	10,300	600	Aerial LBC WeBS	5,414 1,906 19	1.4	✓
long-tailed duck	(migratory)	16,000	110	Aerial LBC WeBS	842 563 29	1.4	✓
red-breasted merganser	(migratory)	1,700	84	LBC WeBS Aerial	239 2 200	1.4	✓
greater scaup	(migratory)	3,100	52	WeBS LBC Aerial	0 0 0		
common scoter	(migratory)	5,500	1,000	LBC Aerial WeBS	88 21 18		
velvet scoter	(migratory)	4,500	50	LBC Aerial WeBS	1 0 0		
common goldeneye	(migratory)	11,400	200	WeBS Aerial LBC	3 0 0		
goosander	(migratory)	2,700	120	WeBS Aerial LBC	0 0 0		
red-throated diver	(Annex 1)		170	LBC Aerial WeBS	59 20 1		
great crested grebe	(migratory)	3,500	190	WeBS Aerial LBC	0 0 0		
red-necked grebe	(migratory)	500	50	WeBS Aerial LBC	0 0 0		
little gull	(Annex 1)		50	Aerial SBC WeBS	0 0 0		
European shag	(migratory)	2,000	1,100	WeBS Aerial LBC	10 - -		
great cormorant	(migratory)	1,200	350	WeBS Aerial LBC	16 - -		

3.15 Coll and Tiree

Introduction

The islands of Coll and Tiree are situated on the west coast of Scotland and lie to the west of Mull in the Inner Hebrides. The area of search around the islands of Coll and Tiree includes the inshore areas stretching from north-east of Coll to south-west of Tiree (Figure 34). The islands are surrounded by an extensive shelf of shallow water (0-50m deep), however, Coll also features areas of deeper water (to 200m) along the south-east coast. The subtidal area has coarse and mixed sediment close inshore, while the extensive shallow shelf area is rock or reef (McBreen *et al* 2011).

There are four terrestrial SPAs classified on Coll and Tiree (Coll SPA, Coll (corncrake) SPA, Tiree (corncrake) SPA and Sléibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) SPA), however none of these sites were classified for divers, grebes or seaducks (Figure 34).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes around Coll and Tiree were collected from six aerial line-transect surveys conducted between February 2004 and March 2008. The line-transect surveys assigned observations to one of four distance bands. No land-based count data were available and no WeBS data were available since 1986/87.

Supplementary observations on the numbers and distributions of non-breeding waterbirds were provided by the RSPB but are not presented here as they were not used to calculate the population estimates.

The following decisions were taken regarding data that were available for the Coll and Tiree area of search. The line-transect aerial surveys all had good spatial coverage of the area of search (Figure 35) and therefore all surveys were assessed to calculate the mean of peak estimates.

Only seven divers could not be identified to species level, of the 472 recorded during the six aerial surveys. It is likely these were great northern divers, as this species was seen most frequently, but red-throated divers were also occasionally recorded (four individuals) so it could not be assumed that all unidentified divers were great northern divers and these unidentified diver records were not used in the analyses.

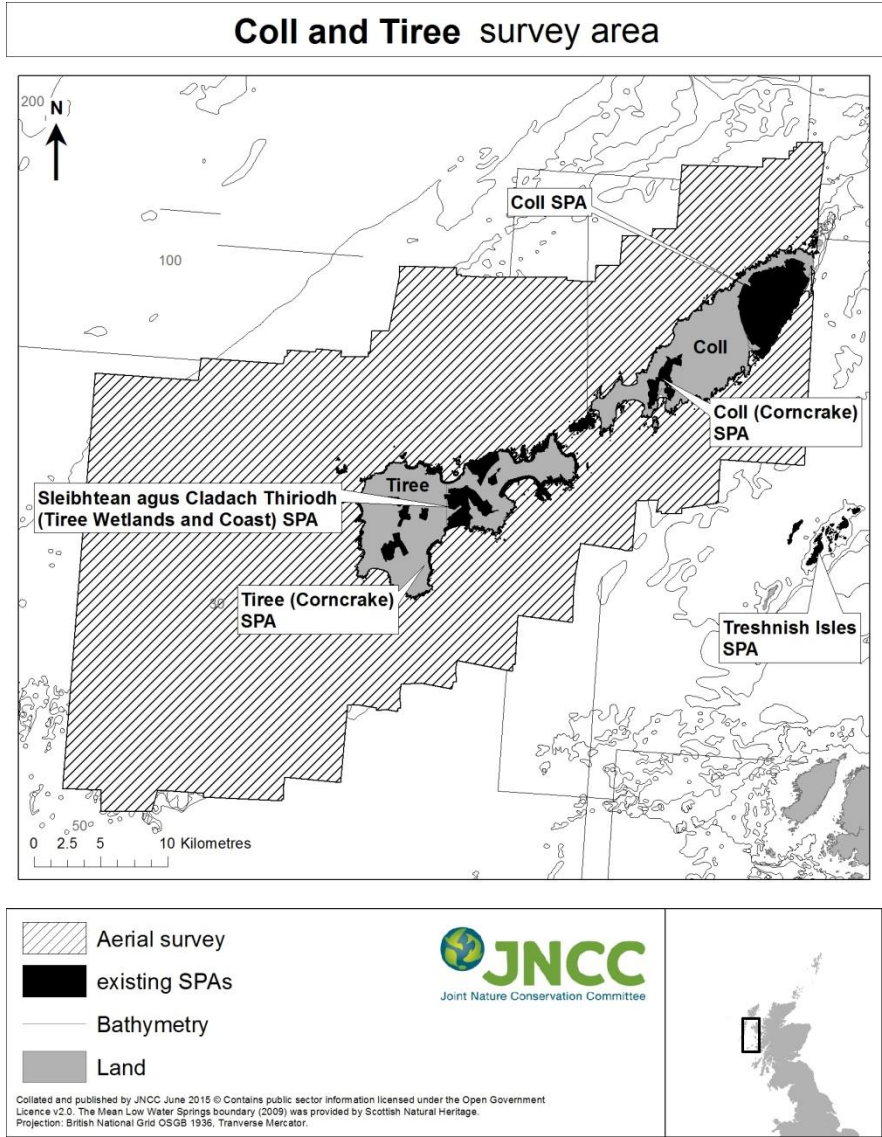


Figure 34. Coll and Tiree area of search showing the areas surveyed by aerial survey and existing SPAs.

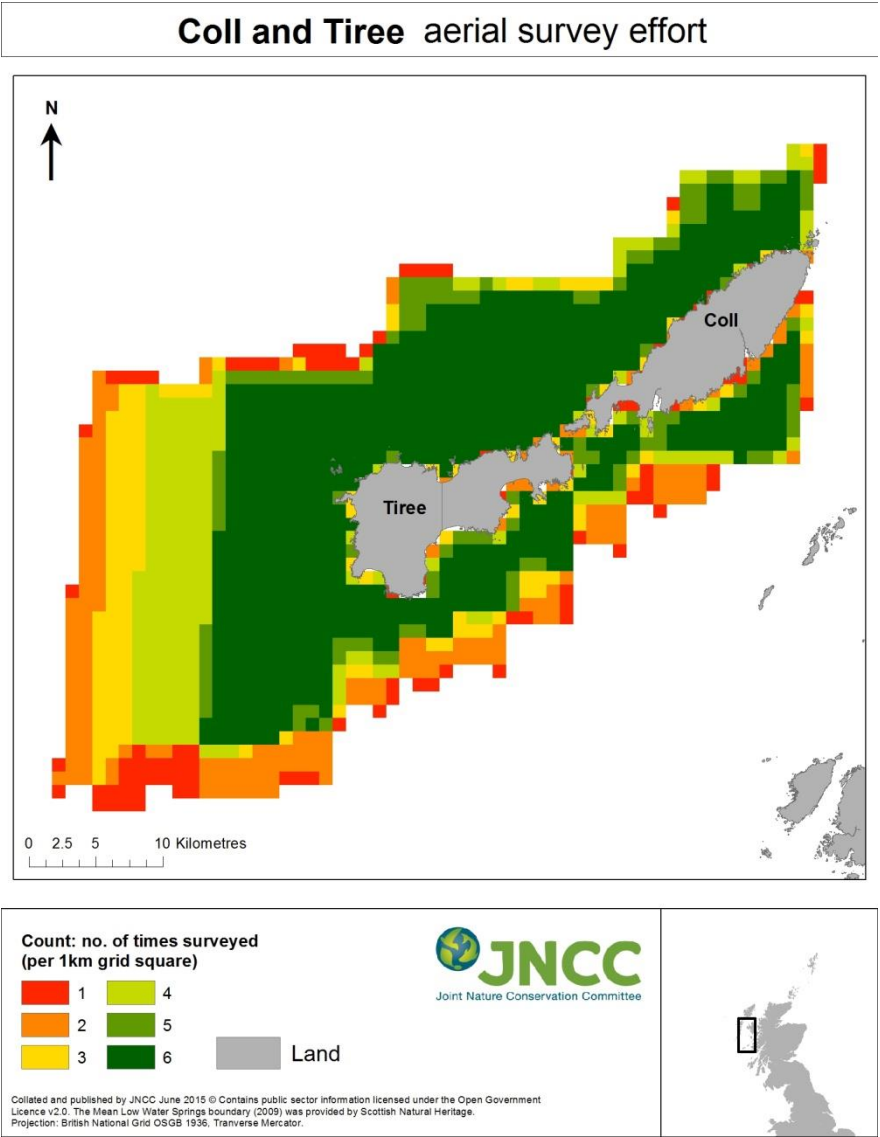


Figure 35. The survey effort for aerial survey around Coll and Tiree is displayed as the number of times each 1km grid cell was surveyed.

Results

Table 16 provides an overview of the Coll and Tiree area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.14 of Appendix 1.

Great northern diver exceeded their UK SPA Selection Guidelines threshold under Stage 1.1.

Common eider exceeded 1% of their UK wintering population estimate, the threshold set by SNH under Stage 1.4. The mean of peak population estimates for both these species were based on five years of data and met the criterion for regularity of occurrence.

Table 16. Coll and Tiree area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog. 1% UK					
great northern diver	(Annex 1)	(25)	50	Aerial	496	1.1	✓
common eider	(migratory)	10,300	600	Aerial	1,483	1.4	✓
greater scaup	(migratory)	3,100	52	Aerial	12		
long-tailed duck	(migratory)	16,000	110	Aerial	108		
red-breasted merganser	(migratory)	1,700	84	Aerial	41		
red-throated diver	(Annex 1)		170	Aerial	7		
common scoter	(migratory)	5,500	1,000	Aerial	0		
velvet scoter	(migratory)	4,500	50	Aerial	0		
goldeneye	(migratory)	11,400	200	Aerial	0		
goosander	(migratory)	2,700	120	Aerial	0		
great-crested grebe	(migratory)	3,500	190	Aerial	0		
red-necked grebe	(migratory)	500	50	Aerial	0		
Slavonian grebe	(Annex 1)	55	50	Aerial	0		
little gull	(Annex 1)	1,100	50	Aerial	0		
European shag	(migratory)	2,000	1,100	Aerial	-		
great cormorant	(migratory)	1,200	350	Aerial	-		

3.16 Mull

Introduction

The Mull area of search encompasses the inshore area stretching west towards Coll, from the point of Ardnamurchan, south to the Isle of Iona, and eastwards into Loch Scridain (Figure 36). The inshore waters within the Mull area of search reach down to a depth of 50m while the area south-east of the Treshnish Isles are up to 100m deep. The coastline around the Island of Mull is rocky with a few sandy areas at the loch mouths, coarse sediment to the north of the isle and a mixture of sediment types in the south (McBreen *et al* 2011).

West of Mull, the Treshnish Isles SPA hosts one of the largest colonies of European storm petrel *Hydrobates pelagicus* in the world, 5.9% of the UK breeding population, as well as 0.3% of the UK wintering population of barnacle goose *Branta leucopsis*.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes within Mull area of search were collected from five JNCC aerial surveys carried out over four winters between February 2004 and March 2007, observations were allocated to one of four distance bands. Land-based count data were available for red-throated diver, black-throated diver, great northern diver and Slavonian grebe between 2006/07 and 2010/11. In addition, great northern diver roost counts were available for March 2010 (Shackleton & Boston 2010). Four years of WeBS count data were available from between 2006/07 and 2009/10 (Figure 37).

The following decisions were taken regarding data that were available for the Mull area of search:

The aerial survey from February 2004 was incomplete and only covered a small part of the area of search. Data from this survey were not used in assessing the mean of peak population estimates. Roost count data were used to calculate the mean of peak population estimate for great northern diver as this provided the peak count for 2009/10 winter season. Roost counts may provide a more accurate estimate of the number of great northern divers within a large area, but it can be difficult to assess the distance birds have travelled to reach a roost site and hence make inferences about the marine areas they use during the day.

One unidentified diver from aerial survey was excluded from the analyses as both red-throated diver and great northern divers were recorded and it could not be assigned to a particular species.

Mull SPAs

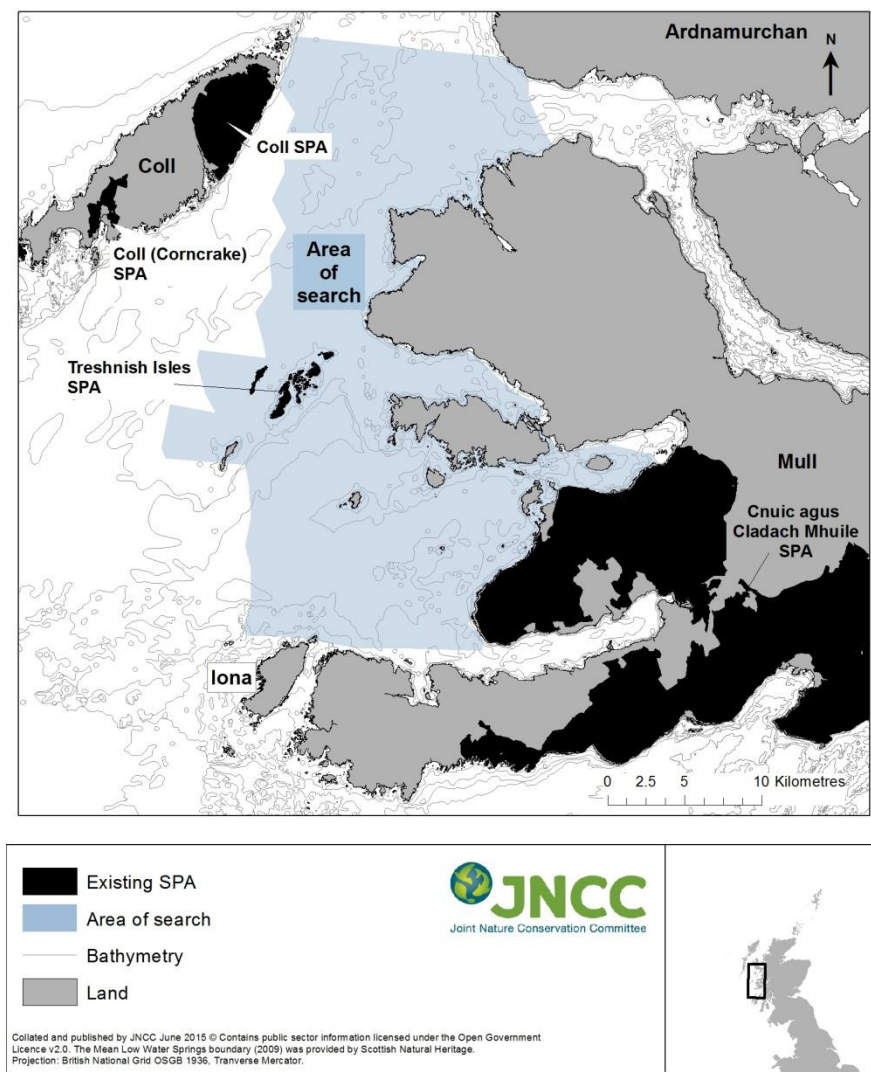


Figure 36. Existing SPAs and bathymetry around the Mull area of search.

Mull Survey area

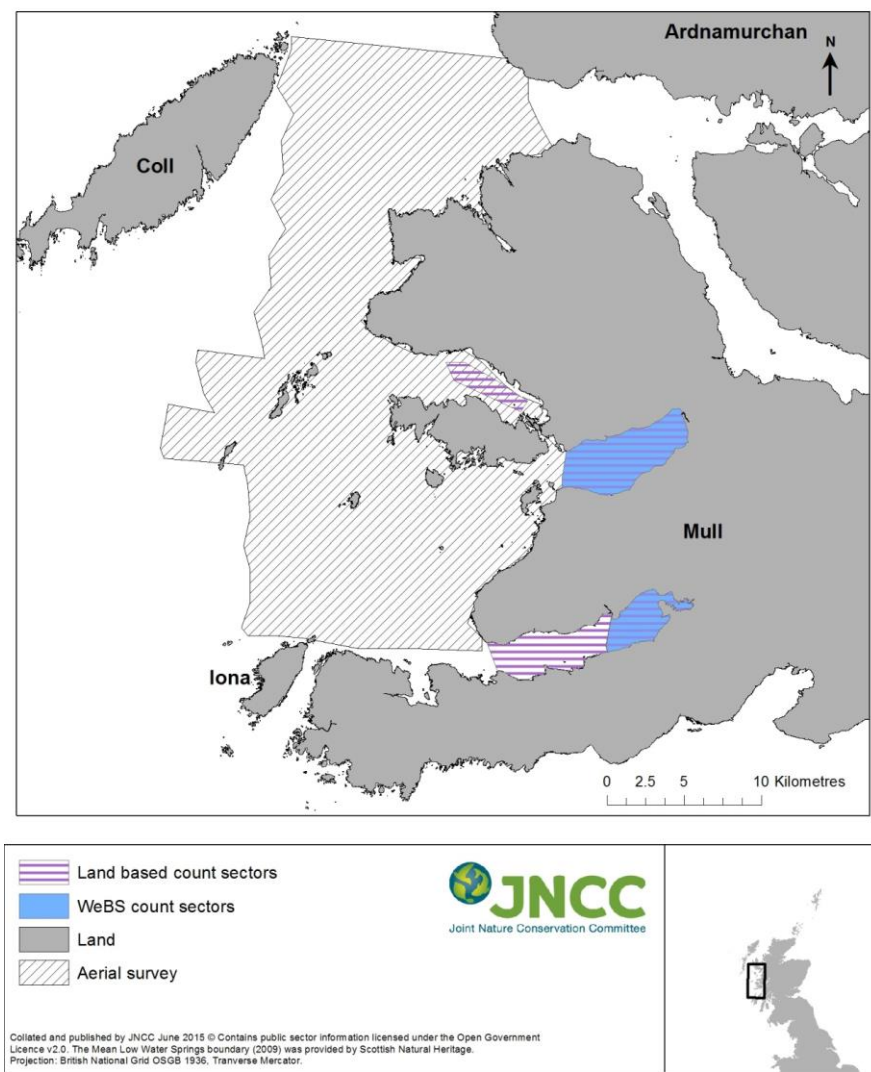


Figure 37. Mull area of search showing the areas surveyed by aerial survey, land-based counts and WeBS counts.

Results

Table 17 presents a summary of the species that exceeded the thresholds under the UK SPA Selection Guidelines. Great northern divers were present in numbers that exceeded the UK SPA Selection Guideline threshold under Stage 1.1, but were not regularly occurring. The threshold of 50 individuals was exceeded in three of five years. The mean of peak estimate for great northern divers in the Mull area of search is likely to be an underestimate. Roost counts carried out in March 2010 suggest that more great northern divers occur in the area of search than were detected by aerial surveys; potentially up to 247 individuals (Shackleton & Boston 2010).

Slavonian grebe were present in numbers in excess of the 1% threshold under Stage 1.1, however this was less than the generally applied minimum threshold of 50 individuals. The survey coverage from WeBS and land-based counts was limited so these numbers are likely to be an underestimate.

Table 17 provides an overview of the Mull area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.15 of Appendix 1.

Table 17. Mull area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = Land-based Counts. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
great northern diver	(Annex 1)	50		WeBS, LBC	67	1.1	Exceeds threshold in 3 of 5 seasons <50 ind
				Aerial	52		
Slavonian grebe	(Annex 1)	(11)50		WeBS, LBC	26	1.1	
				Aerial	0		
greater scaup	(migratory)	3,100	52	Aerial	0		
				WeBS	0		
				LBC	-		
common eider	(migratory)	10,300	600	Aerial	118		
				WeBS	34		
				LBC	0		
long-tailed duck	(migratory)	16,000	110	Aerial	30		
				LBC	-		
				WeBS	0		
common scoter	(migratory)	5,500	1,000	Aerial	0		
				WeBS	0		
				LBC	-		
velvet scoter	(migratory)	4,500	50	Aerial	0		
				LBC	-		
				WeBS	0		
common goldeneye	(migratory)	11,400	200	WeBS	19		
				Aerial	0		
				LBC	-		
red-breasted merganser	(migratory)	1,700	84	Aerial	21		
				WeBS	15		
				LBC	-		
goosander	(migratory)	2,700	120	Aerial	0		
				LBC	-		
				WeBS	0		
red-throated diver	(Annex 1)	170		LBC	11		
				WeBS	5		
				Aerial	2		
black-throated diver	(Annex 1)	50		WeBS	1		
				Aerial	0		
				LBC	0		
great crested grebe	(migratory)	3,500	190	Aerial	0		
				LBC	0		
				WeBS	0		
red-necked grebe	(migratory)	500	50	WeBS	0		
				LBC	0		
				Aerial	0		
little gull	(Annex 1)	50		Aerial	0		
				LBC	-		
				WeBS	0		
European shag	(migratory)	2,000	1,100	WeBS	47		
				LBC	-		
				Aerial	-		
great cormorant	(migratory)	1,200	350	WeBS	0		
				LBC	-		
				Aerial	-		

3.17 Loch Indaal

Introduction

Loch Indaal is a large sea loch on the island of Islay. The Loch Indaal area of search covers the entire loch up to 3km offshore from Portnahaven in a straight line across to Rhuba nan Leacan. At the mouth of Loch Indaal the water depth is approximately 40m, becoming shallower towards the north-east of the area of search, reaching a depth of barely 10m between Laggan Point and Port Charlotte. The western and eastern shores of the loch are rock or reef. The dominated sediment type in the shallow areas is sand, becoming coarser sediment towards the opening of the loch (McBreen *et al* 2011).

The area of search is surrounded by four terrestrial SPAs, Laggan SPA, Oa SPA, Bridgend Flats SPA and Rhinns of Islay SPA (Figure 38). Rhinns of Islay SPA is the only one of these that includes waterbirds, and hosts 13.2% of the UK breeding population of common scoter under Article 4.2 of the Birds Directive (79/409/EEC).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Loch Indaal area of search are provided by four JNCC aerial surveys collected over three winters between February 2001 and March 2009 (Figure 39). One strip transect aerial survey was conducted in February 2001. This was not included in the mean of peak calculations as strip transects underestimate the true numbers of birds because they cannot be corrected using distance sampling. The three subsequent surveys in February 2008, February 2009 and March 2009 were line-transect surveys, observations were allocated to one of four distance bands. Seaduck counts were recorded between 2004/05 and 2008/09 within Inner Loch Indaal. WeBS core count data were available from 2002/03 to 2005/06 and 2009/10, though the sectors counted were not consistent between years. Outer Loch Indaal was surveyed in 2004/05 and 2005/06, while Inner Loch Indaal was only surveyed 2009/10. Despite this, WeBS data from 2009/10 and seaduck counts from 2005/06 were used as these data provided the highest population estimates from these seasons. They are likely to underestimate the true number of birds within the area of search due to limited survey coverage (Figure 39).

Results

Table 18 provides an overview of the Loch Indaal area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.16 of Appendix 1.

The Loch Indaal area of search did not support any species that exceeded the population thresholds at Stage 1.1 or 1.2 of the UK SPA Selection Guidelines on a regular basis (Table 18).

Great northern divers exceeded the 1% threshold under Stage 1.1 and the minimum of 50 individuals, however, the estimate was based on just two years of aerial survey data, hence regularity of occurrence could not be established (Table A1.16 of Appendix 1).

Loch Indaal SPAs

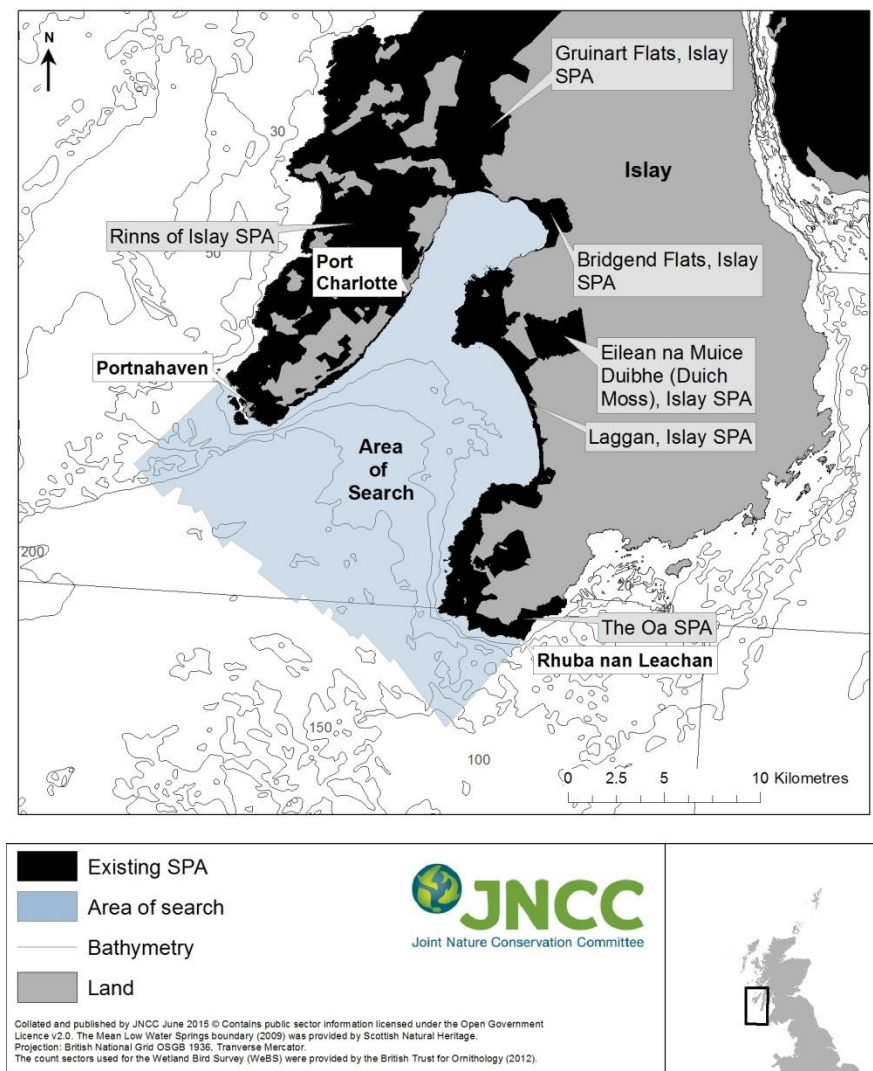


Figure 38. Existing SPAs and bathymetry around Loch Indaal area of search.

Loch Indaal survey area

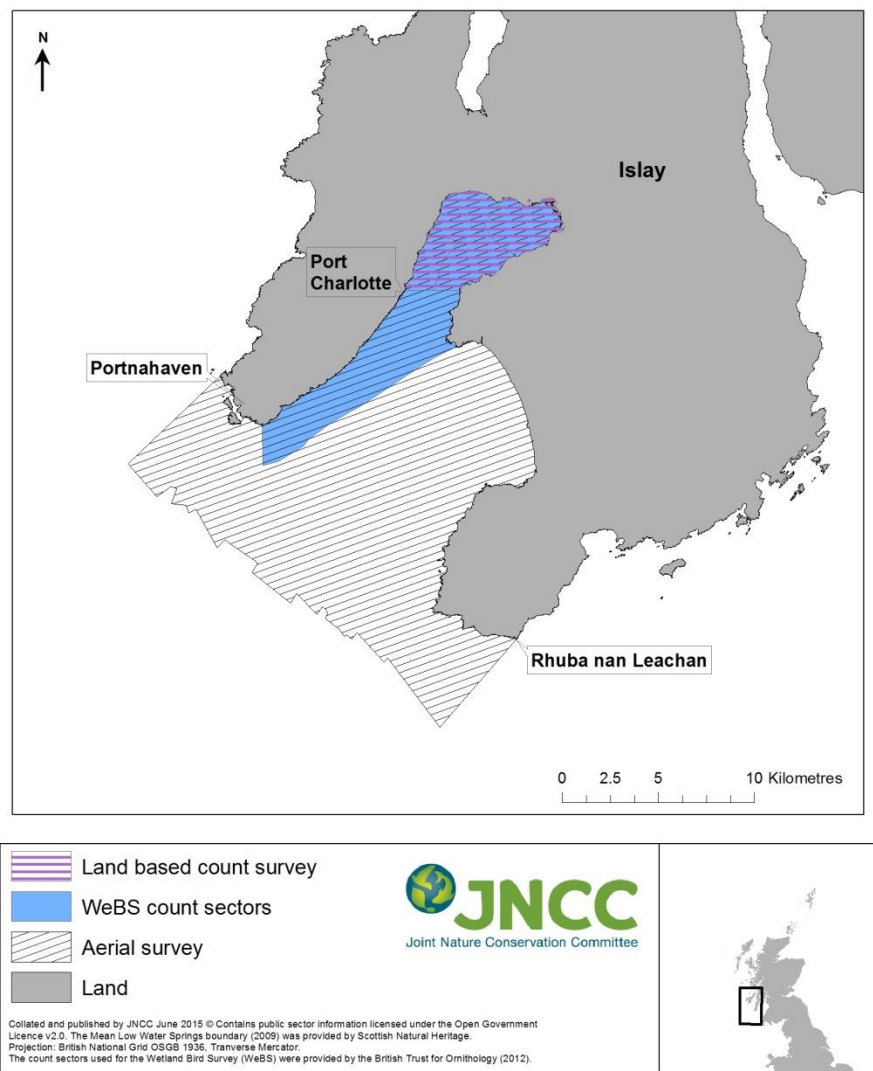


Figure 39. Loch Indaal, showing the areas surveyed by aerial survey, WeBS counts and land-based counts.

Greater scaup was the most frequently recorded species in this area of search, with numbers regularly exceeding 1% of the UK wintering population, the threshold considered by SNH under Stage 1.4 of the Guidelines. This is supported by Gregory *et al* (2002) who state that Loch Indaal supported around 8% of the UK wintering greater scaup population.

The mean of peak population estimate for Slavonian grebe, based on four years of WeBS seaduck count data and one year of WeBS core count data, did not meet the minimum threshold of 50 birds. Other species were recorded in low numbers and none exceeded their relevant 1% thresholds. Slavonian grebe numbers are likely to be an underestimate due to the limited survey coverage of the WeBS count sectors.

Table 18. Loch Indaal area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = land-based count. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)	50		Aerial LBC WeBS	56 17 34	1.1	Based on 2yrs aerial survey data
Slavonian grebe	(Annex 1)	50		LBC, WeBS	22	1.1	<50 ind
greater scaup	(migratory)	3,100	52	Aerial, WeBS and LBC	1,059	1.4	✓
common eider	(migratory)	10,300	600	Aerial, WeBS and LBC	143		
long-tailed duck	(migratory)	16,000	110	LBC WeBS Aerial	6 3 0		
common scoter	(migratory)	5,500	1,000	LBC, WeBS Aerial	43 0		
velvet scoter	(migratory)	4,500	50	Aerial LBC WeBS	0 0 0		
common goldeneye	(migratory)	11,400	200	LBC, WeBS	11		
red-breasted merganser	(migratory)	1,700	84	Aerial LBC, Aerial & WeBS	0 60		
goosander	(migratory)	2,700	120	WeBS LBC Aerial	0 0 0		
red-throated diver	(Annex 1)		170	LBC, WeBS Aerial	17 0		
black-throated diver	(Annex 1)		50	LBC, WeBS Aerial	3 0		
great crested grebe	(migratory)	3,500	190	WeBS Aerial LBC	0 0 0		
red-necked grebe	(migratory)	500	50	WeBS Aerial LBC	0 0 0		
little gull	(Annex 1)		50	Aerial LBC	0 0		

An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland

			WeBS	0		
European shag (migratory)	2,000	1,100	LBC, WeBS	33		
			Aerial	0		
great (migratory)	1,200	350	LBC, WeBS	11		
cormorant			Aerial	0		

3.18 Sound of Gigha

Introduction

The Sound of Gigha area of search encompasses the inshore area on the west coast of Kintyre, stretching from Kilmory in the north to Earadale Point in the south, including West Loch Tarbert. The inshore areas are characterised by shallow sandy sediments (McBreen *et al* 2011) in waters of less than 30m depth.

There are two SPAs on the Kintyre peninsula, east of the area of search. Knapdale Lochs SPA in the north of the area was classified in 2001 and supports breeding black-throated diver and The Kintyre Goose Roosts SPA which encompasses five distinct locations and protects Greenland white-fronted goose (Figure 40).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Sound of Gigha were collected from five aerial line-transect surveys carried out in March 2005, December and March 2005/06, March 2007 and February 2008; observations were assigned to one of four distance bands. Additional land and boat based count data for great northern diver and Slavonian grebe were recorded by Paul Daw (Argyll Bird Club) between 2000/01 and 2006/07. Data from land-based WeBS counts within the Sound of Gigha area of search were collated from the most recent five years of available data, 2008/09 to 2012/13 (Figure 41).

The following decisions were taken regarding data that were available for the Sound of Gigha area of search. The line-transect aerial surveys all had good spatial coverage of the area of search (Figure 42) and therefore surveys from all four winter seasons were assessed to calculate the mean of peak population estimates. The population estimates from WeBS data were used in preference to those from land and boat based counts as they provided higher population estimates. WeBS counts provide more recent data (2008/09 to 2012/13) compared to the data from aerial survey 2004/05 to 2007/08, however the spatial coverage from WeBS count data was limited and concentrated around the area of West Loch Tarbert so it is likely these underestimate the true numbers of birds within the area of search (Figure 41).

Sound of Gigha SPAs

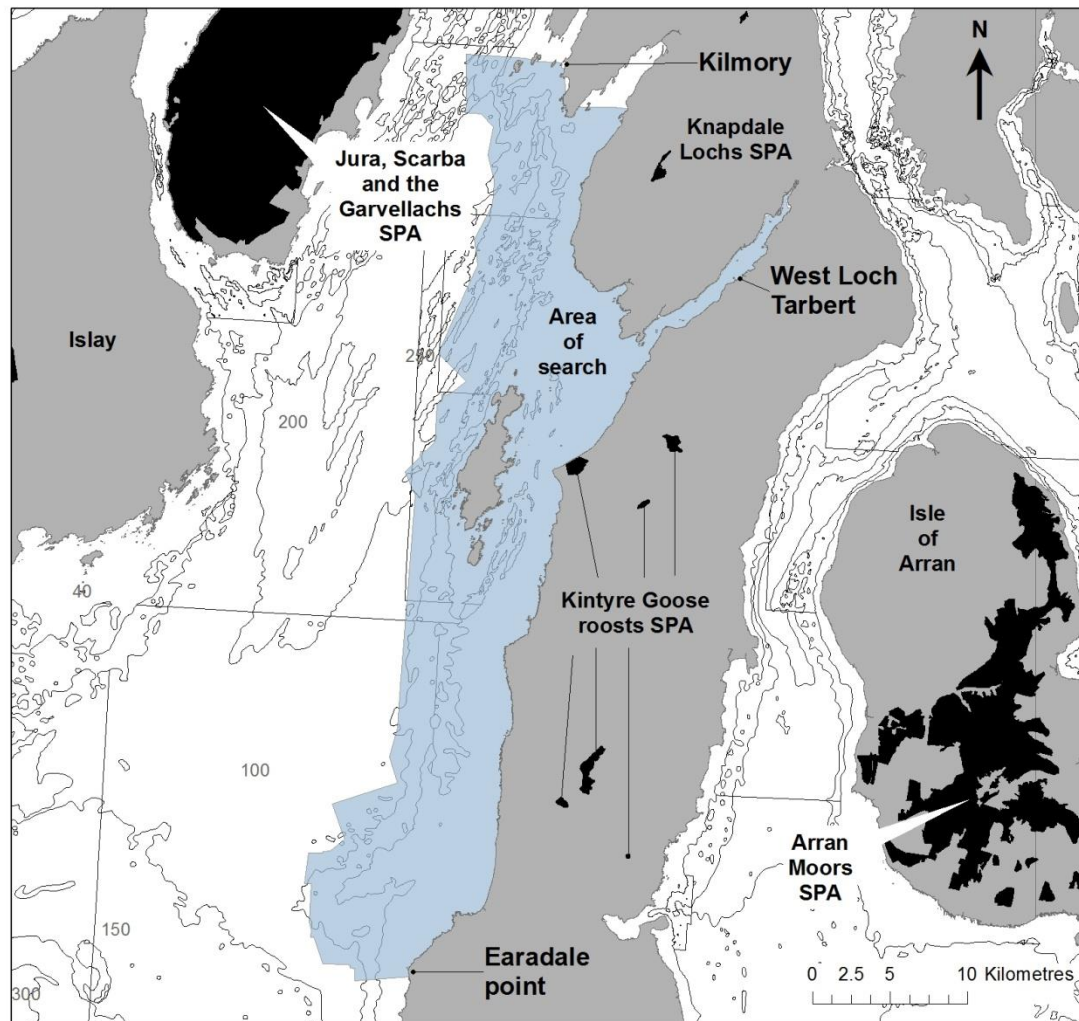


Figure 40. Existing SPAs and bathymetry around the Sound of Gigha area of search.

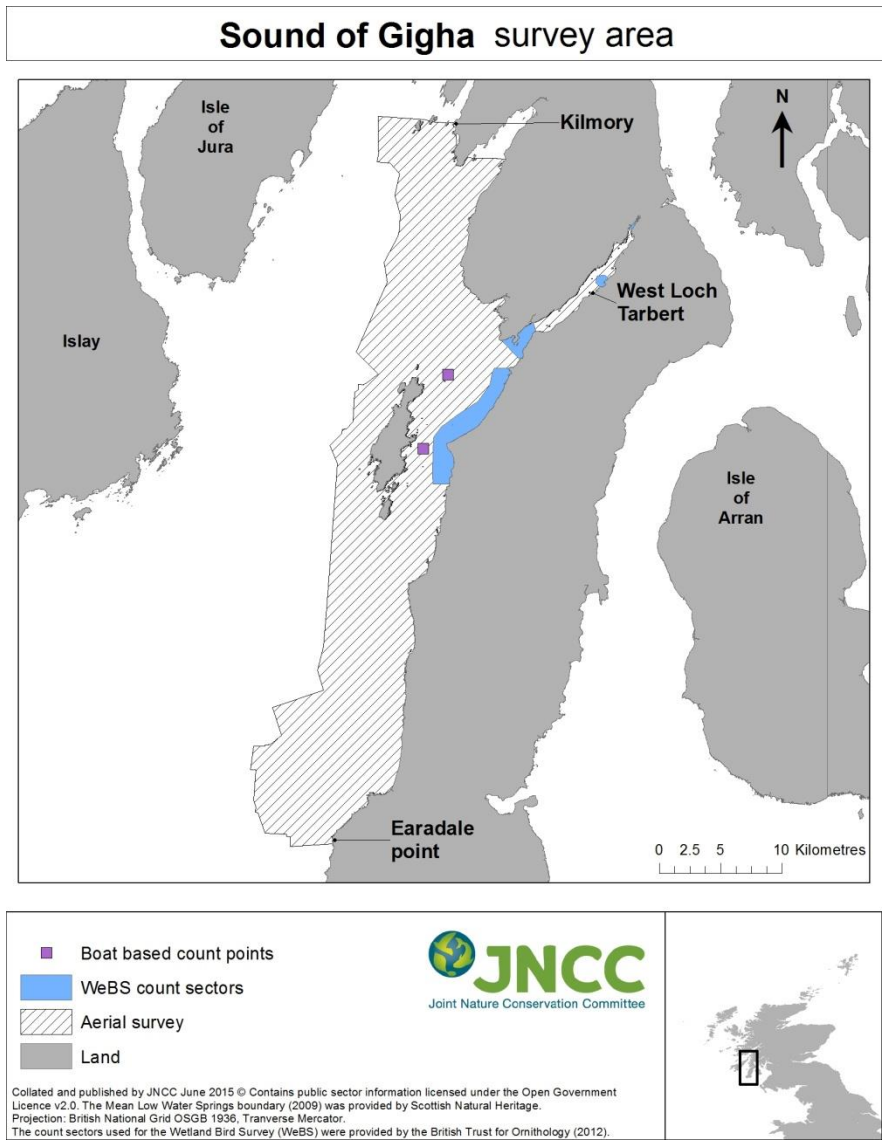


Figure 41. The Sound of Gigha showing the areas surveyed by aerial survey, WeBS counts, and boat based counts.

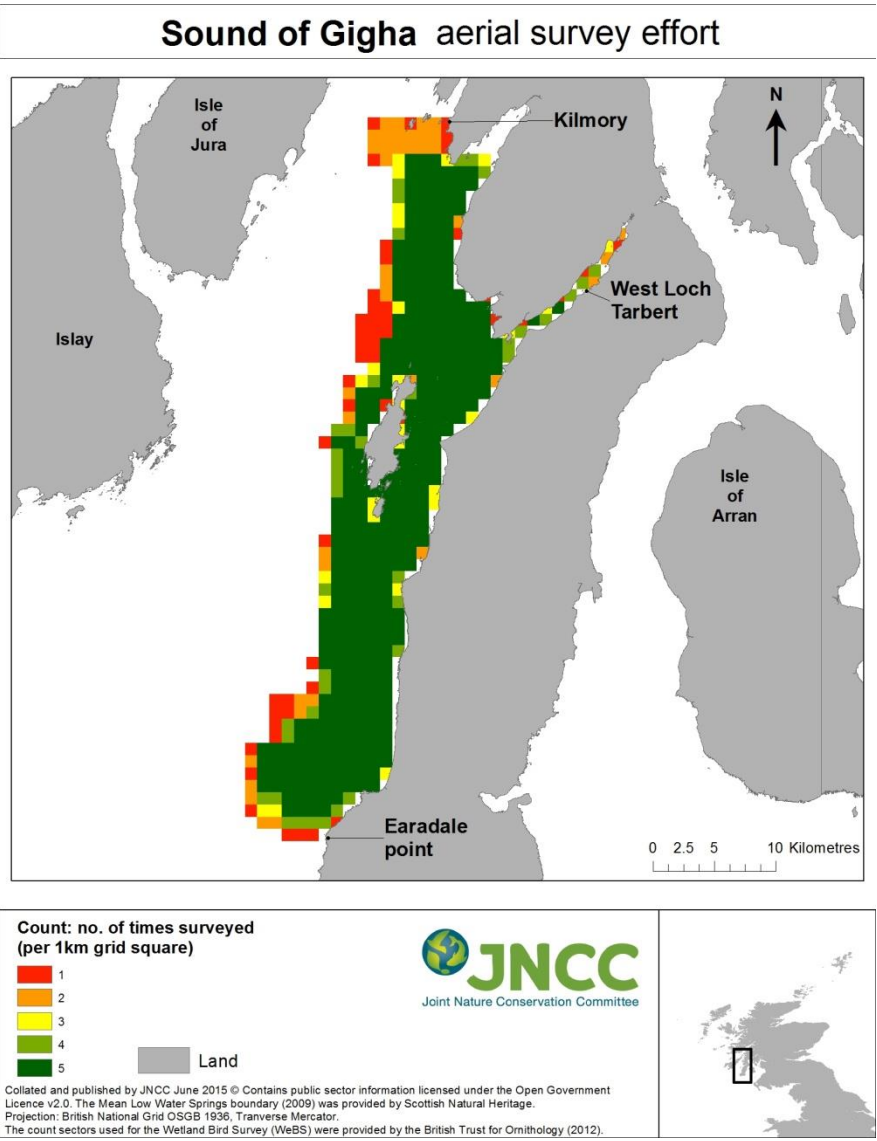


Figure 42. The survey effort for aerial survey in the Sound of Gigha is displayed as the number of times each 1km grid cell was surveyed.

Results

Table 19 provides an overview of the Sound of Gigha area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.17 of Appendix 1. The Sound of Gigha area of search regularly supported great northern divers in excess of their population threshold under Stage 1.1 of the guidelines. This is the second highest population of all areas surveyed in Scotland, after the Outer Hebrides. The Stage 1.1 threshold for great northern diver is based on the minimum default of 50 individuals, as 1% of the UK wintering population is currently estimated as 25 individuals (Musgrove *et al* 2013). It is recommended to revise the UK wintering population estimate, given that ostensibly more than 100% of the estimated UK wintering population of great northern divers were present within the Outer Hebrides survey area on one date.

Common eider regularly occurred in numbers that exceeded 1% of their UK wintering population, the threshold considered by SNH under Stage 1.4.

The population estimates for species with a predominantly coastal distribution that are best surveyed from land-based counts such as black-throated diver; Slavonian grebe and red-breasted merganser are likely to be underestimated, as the areas counted by WeBS in particular were very limited.

Slavonian grebe, and black-throated diver also exceeded their respective 1% population thresholds under Stage 1.1, but their numbers were below the 50 individuals required as a minimum for SPA consideration.

Red-breasted merganser - although exceeding their 1% population threshold - were not regularly present in these numbers. The WeBS count from 2008/09 could be included into the mean of peak calculations to provide a five year mean of peak estimate that exceeds 1% of the UK wintering population. However, given the limited spatial coverage of WeBS counts within the area of search the mean of peaks population based on four years of aerial survey data is considered a more representative estimate of the numbers of red-breasted merganser within the area of search (Table A1.17 of Appendix 1).

Table 19. Sound of Gigha area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = Land-based Counts. See Appendix 1 for further details.

Species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	1% UK				
great northern diver	(Annex 1)		50	Aerial WeBS LBC	539 72 69	1.1	✓
black-throated diver	(Annex 1)		50	WeBS Aerial LBC	12 0 0	1.1	<50 ind
Slavonian grebe	(Annex 1)		50	WeBS Aerial LBC	37 0 26	1.1	<50 ind
common eider	(migratory)	10,300	600	Aerial LBC WeBS	1,339 0 137	1.4	✓
red-breasted merganser	(migratory)	1,700	84	Aerial WeBS LBC	121 41 0	1.4	Exceeded threshold in 2 of 4 seasons.
greater scaup	(migratory)	3,100	52	WeBS LBC Aerial	0 0 0		
long-tailed duck	(migratory)	16,000	110	Aerial LBC WeBS	73 0 15		
common scoter	(migratory)	5,500	1,000	WeBS Aerial LBC	44 27 0		
velvet scoter	(migratory)	4,500	50	Aerial WeBS LBC	6 2 0		
common goldeneye	(migratory)	11,400	200	Aerial WeBS LBC	31 4 0		
goosander	(migratory)	2,700	120	WeBS Aerial LBC	1 0 0		
red-throated diver	(Annex 1)		170	WeBS Aerial LBC	8 0 0		
great crested grebe	(migratory)	3,500	190	WeBS Aerial LBC	0 0 0		
red-necked grebe	(migratory)	500	50	WeBS Aerial LBC	0 0 0		
little gull	(Annex 1)		50	Aerial LBC WeBS	0 0 0		
European shag	(migratory)	2,000	1,100	WeBS Aerial LBC	61 - 0		
great cormorant	(migratory)	1,200	350	WeBS Aerial LBC	4 - 0		

3.19 Firth of Clyde

Introduction

The Firth of Clyde area of search encompasses the inshore areas from Garroch Head in the north to Doonan Bay, and includes the inner firth of Clyde to Cowlport and Dumbarton (Figure 43). The area of search contains large areas of shallow water, 0 to 50m depth. The lochs and river Clyde hold muddy sediments while in the Greater Clyde sediment types range from sand to gravel (McBreen *et al* 2011). Tidal mudflats in the numerous bays of the firth support a high abundance of intertidal fauna and algae. Blue mussels *Mytilus edulis* occur along the eastern shores of the firth, which attract wintering waterbirds. Throughout the year the Firth of Clyde provides sheltered foraging for numerous species of seaduck, divers and grebes (Rheinallt *et al* 2007).

Terrestrial SPAs are located around the Firth of Clyde but only one, Ailsa Craig SPA, has seabirds as an interest feature (Figure 43). Ailsa Craig SPA was classified in 1990 for breeding gannet and lesser black-backed gull *Larus fuscus*, and a seabird assemblage of international importance. The SPA was extended by 2km into the marine environment in September 2009.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Firth of Clyde area of search were collected from five JNCC aerial line-transect surveys, six JNCC land-based counts and the most recent five years of WeBS count data that were available (Figure 44).

Aerial survey was carried out over three winters, in February and March 2006, January and March 2007 and December 2007. All bird observations were allocated to one of four distance bands (A=44-162m, B=163-282m, C=283-426m and D=427-1000m) according to the perpendicular distance of the birds from the transect line. Aerial surveys were not able to cover some parts of the area of search that were close inshore, such as the inner Firth of Clyde and the airspace control zone above West Kilbride, so the population estimates derived from aerial survey data will underestimate the true number of birds within the area of search. Three out of the 152 diver individuals could not be assigned to a particular species and were excluded from the analysis as both red-throated diver and great northern diver were present at this site.

Six JNCC land-based counts were carried out over three winter seasons, March 2007, January and February 2008, December and March 2008/09, however the limited spatial coverage of these counts in the inner Firth of Clyde will underestimate the number of birds present within the area of search.

WeBS count data from the most recent five years 2005/06 to 2009/10 were collated however the survey coverage was limited and will likely underestimate numbers (Figure 44).

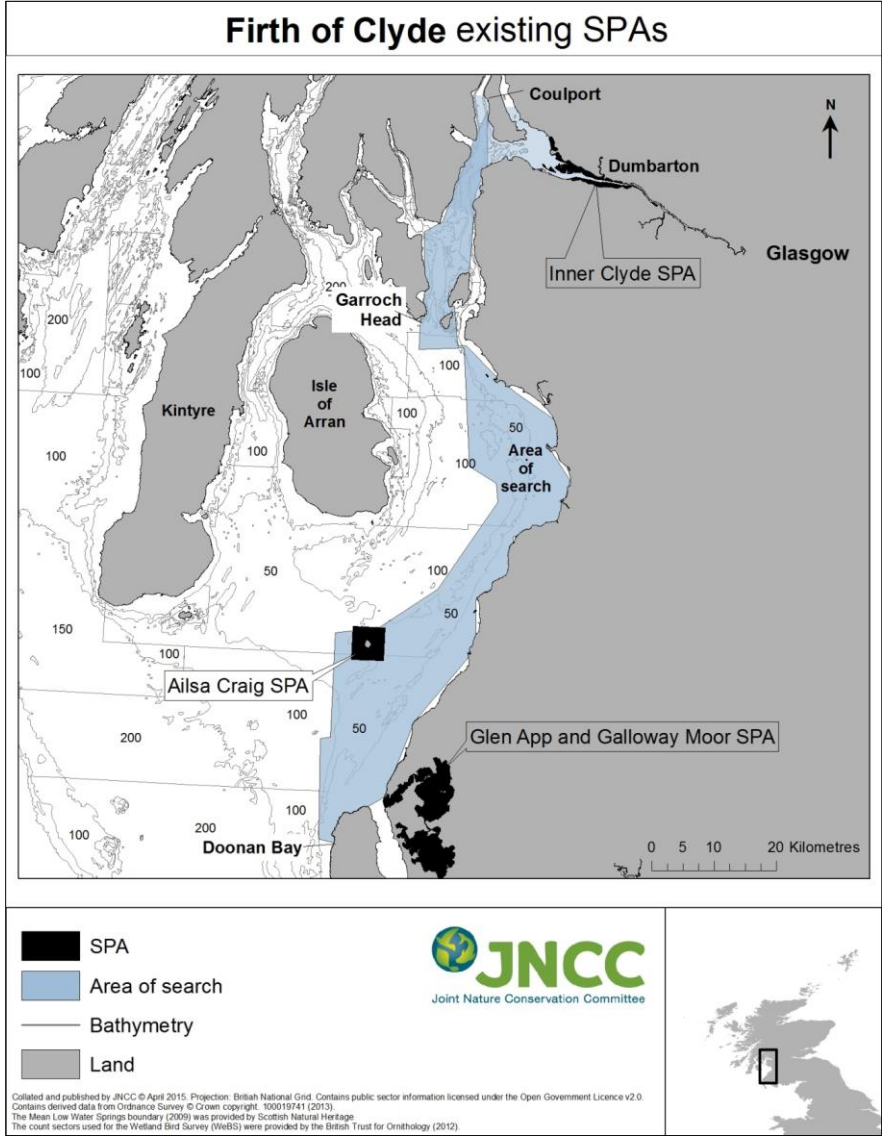


Figure 43. The Firth of Clyde showing the area of search, existing SPAs, and bathymetry.

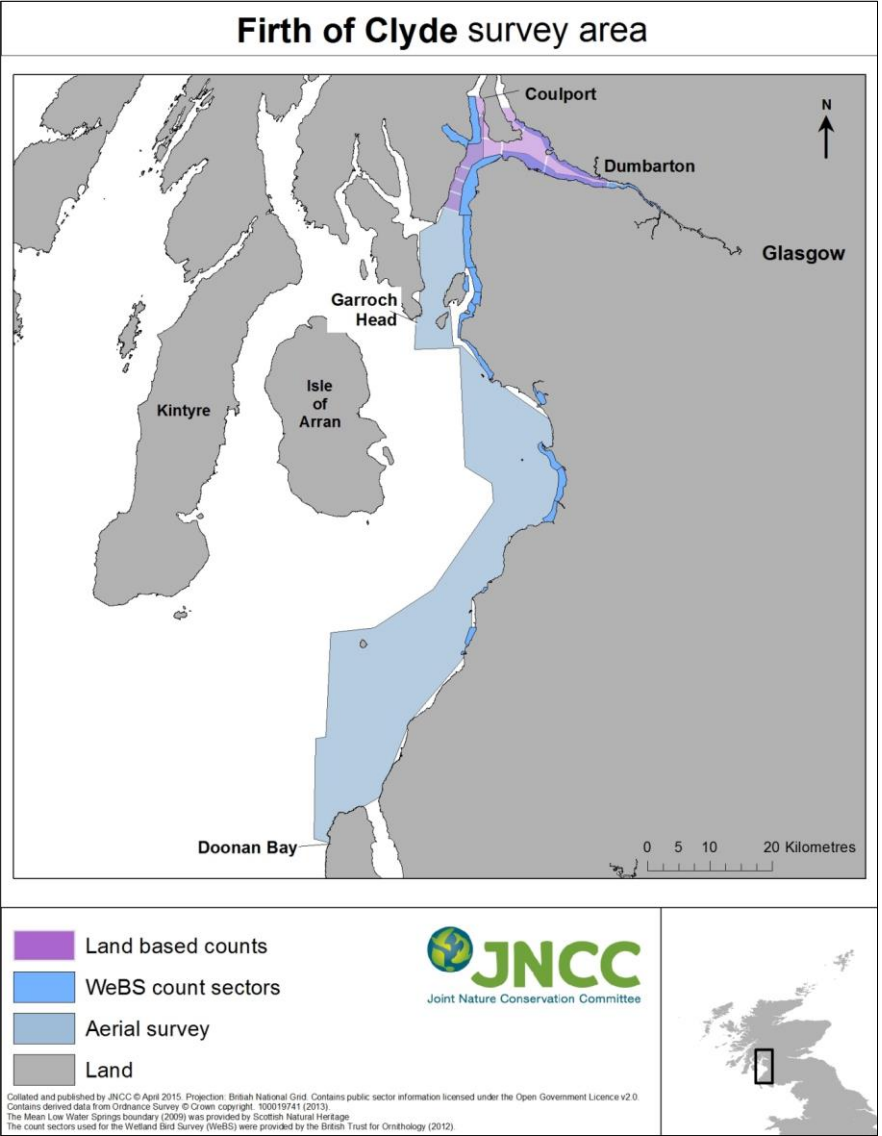


Figure 44. The Firth of Clyde showing the areas surveyed by aerial survey, WeBS counts, and land-based counts.

Results

Table 20 provides an overview of the Firth of Clyde area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.18 of Appendix 1. Red-throated diver were regularly present in numbers that exceeded the 1% population threshold under Stage 1.1 of the guidelines.

Slavonian grebe were present in numbers that exceeded the SPA threshold under Stage 1.1, 59 individuals, but did not meet the criterion for regularity, numbers exceeded 50 individuals in three of five seasons.

Black-throated diver and great northern diver also exceeded their respective 1% population thresholds under Stage 1.1 but their numbers were below 50 individuals.

Common eider, common goldeneye and red-breasted merganser were regularly present in numbers that exceeded 1% of their respective UK wintering population estimates and can be considered under Stage 1.4 of the UK SPA Selection guidelines.

Great crested grebe and great cormorant were recorded in the highest numbers at this site of all the areas surveyed in Scotland but did not exceed the relevant 1% thresholds under Stage 1.2 or 1.4.

Table 20. Firth of Clyde area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. LBC = Land-based Counts. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog.	% UK				
red-throated diver	(Annex 1)	170		Aerial WeBS LBC	233 156 139	1.1	✓
Slavonian grebe	(Annex 1)	50		WeBS LBC Aerial	59 33 0	1.1	>50 ind. in 3 of 5 years
black-throated diver	(Annex 1)	(6) 50		WeBS LBC Aerial	14 0 0	1.1	<50 ind
great northern diver	(Annex 1)	(25) 50		Aerial and WeBS LBC	31 0 0	1.1	<50 ind
common eider	(migratory)	10,300	600	Aerial and WeBS LBC	2,651 1,296	1.4	✓
common goldeneye	(migratory)	11,400	200	WeBS LBC Aerial	457 111 0	1.4	✓
red-breasted merganser	(migratory)	1,700	84	WeBS LBC Aerial	164 125 61	1.4	✓
greater scaup	(migratory)	3,100	52	WeBS Aerial LBC	16 14 0		
long-tailed duck	(migratory)	16,000	110	Aerial WeBS LBC	53 2 0		
common scoter	(migratory)	5,500	1,000	WeBS Aerial LBC	18 12 2		
velvet scoter	(migratory)	4,500	50	Aerial WeBS LBC	3 0 0		
goosander	(migratory)	2,700	120	WeBS LBC Aerial	4 0 0		
great crested grebe	(migratory)	3,500	190	WeBS, LBC Aerial	132 0 0		
red-necked grebe	(migratory)	500	50	Aerial LBC WeBS	0 0 0		
little gull	(Annex 1)	50		Aerial LBC WeBS	0 0 0		
European shag	(migratory)	2,000	1,100	WeBS LBC Aerial	258 137 -		
great cormorant	(migratory)	1,200	350	WeBS LBC Aerial	269 0 -		

3.20 Loch Ryan

Introduction

Loch Ryan is a shallow sea loch at the south of the Greater Firth of Clyde area of search. It is approximately 13km long and the maximum water depth is 16m (Figure 45). Sediment types of Loch Ryan range from sand to gravel (McBreen *et al* 2011).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Loch Ryan area of search were collected from four line-transect aerial surveys over two winter seasons in January and March 2006 and January and March 2007. All bird observations were allocated to one of four distance bands (A=44-162m, B=163-282m, C=283-426m and D=427-1000m) according to the perpendicular distance of the birds from the transect line. In addition, five winters of WeBS count data were available (2005/06 to 2009/10) (Figure 45).

Results

Table 21 provides an overview of the Loch Ryan area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.19 of Appendix 1. Loch Ryan supported a population of Slavonian grebe in excess of the 1% threshold under Stage 1.1, but less than 50 individuals.

Greater scaup and red-breasted merganser both exceeded 1% of their respective UK wintering populations under Stage 1.4 of the UK SPA Selection Guidelines on a regular basis. Common eider exceeded the 1% biogeographic threshold but not on a regular basis (two of five years).

The Loch Ryan area of search supported the second largest wintering population of greater scaup of all the Scottish areas of search (the largest was recorded on Loch Indaal). The second largest wintering population of great-crested grebe was found in Loch Ryan, although the mean of peak estimates for this species was well below the SPA Stage 1.2 threshold of 3,600 birds. The Firth of Clyde supported the highest population.

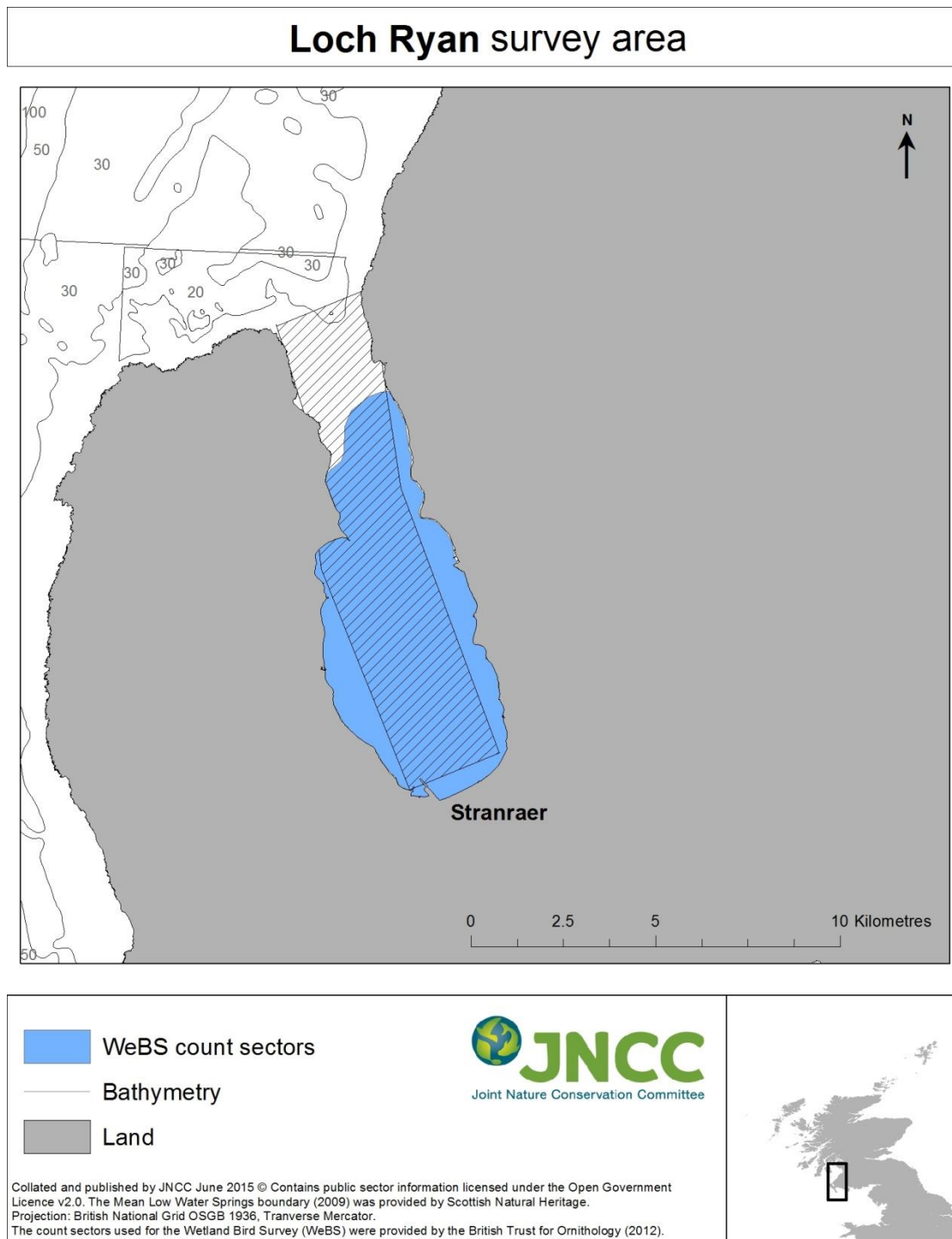


Figure 45. Areas surveyed by aerial survey and WeBS counts at the Loch Ryan and area of search.

Table 21. Loch Ryan area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - regular - >50 ind
		1% biog. 1% UK					
Slavonian grebe	(Annex 1)		50	WeBS	36	1.1	<50 ind
greater scaup	(migratory)	3,100	52	Aerial WeBS	0 1,027	1.4	✓
red-breasted merganser	(migratory)	1,700	84	Aerial WeBS	653 101	1.4	✓
				Aerial	52		
common eider	(migratory)	10,300	600	WeBS, aerial	672	1.4	Not regular exceeds threshold in 2 of 5 years
long-tailed duck	(migratory)	16,000	110	Aerial, WeBS	13		
common scoter	(migratory)	5,500	1,000	WeBS	160		
				Aerial	78		
velvet scoter	(migratory)	4,500	50	WeBS	0		
				Aerial	0		
common goldeneye	(migratory)	11,400	200	WeBS	147		
				Aerial	8		
goosander	(migratory)	2,700	120	WeBS	0		
				Aerial	0		
red-throated diver	(Annex 1)		170	WeBS, Aerial	77		
black-throated diver	(Annex 1)		50	WeBS	1		
				Aerial	0		
great northern diver	(Annex 1)		50	WeBS	6		
				Aerial	7*		
great crested grebe	(migratory)	3,500	190	WeBS	57		
				Aerial	0		
red-necked grebe	(migratory)	500	50	WeBS	0		
				Aerial	0		
little gull	(Annex 1)		50	Aerial	0		
				WeBS	0		
European shag	(migratory)	2,000	1,100	WeBS	49		
				Aerial	-		
great cormorant	(migratory)	1,200	350	WeBS	16		
				Aerial	-		

*The population estimate for great northern diver was higher from aerial survey but this was based on just two years of data therefore the WeBS estimate based on five years of data was used instead.

3.21 Luce Bay

Introduction

Luce Bay is a large inlet on the southern shore of Dumfries and Galloway that separates the southern peninsula of The Rhinns of Galloway from the Machars peninsula to the east (Figure 46). The inner bay is approximately 10km wide and extends to 31km between the outer points of the Mull of Galloway and Burrow Head headlands.

The bathymetry slopes gradually with shallow water less than 20m deep within the bay. Much of the head of Luce Bay is characterised by extensive intertidal sandy sediments (McBreen *et al* 2011), and is used by wintering wildfowl and waders for feeding and roosting (SNH 2006).

The Loch of Inch and Torrs Warren SPA is located directly adjacent to the north of the area of search. This SPA supports 3.9% of the biogeographical population of Greenland white-fronted goose during the winter season (Figure 46).

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in Luce Bay were collected from line-transect aerial surveys carried out over three winter seasons in February and March 2006, January and March 2007 and March 2008. All bird observations were allocated to one of four distance bands (A=44-162m, B=163-282m, C=283-426m and D=427-1000m) according to the perpendicular distance of the birds from the transect line. Only very limited WeBS data were available for the area of search both temporally and spatially (Figure 47). Mean of peak population estimates were derived from aerial survey data in most cases, however WeBS counts provided the only available data for greater scaup, red-necked grebe, Slavonian grebe, European shag and great cormorant (Table A1.20).

A total of 38 divers recorded as *Gavia spp.* were excluded from the analysis as great northern diver (182), black-throated divers (1) and red-throated divers (83) were all present within the area of search.

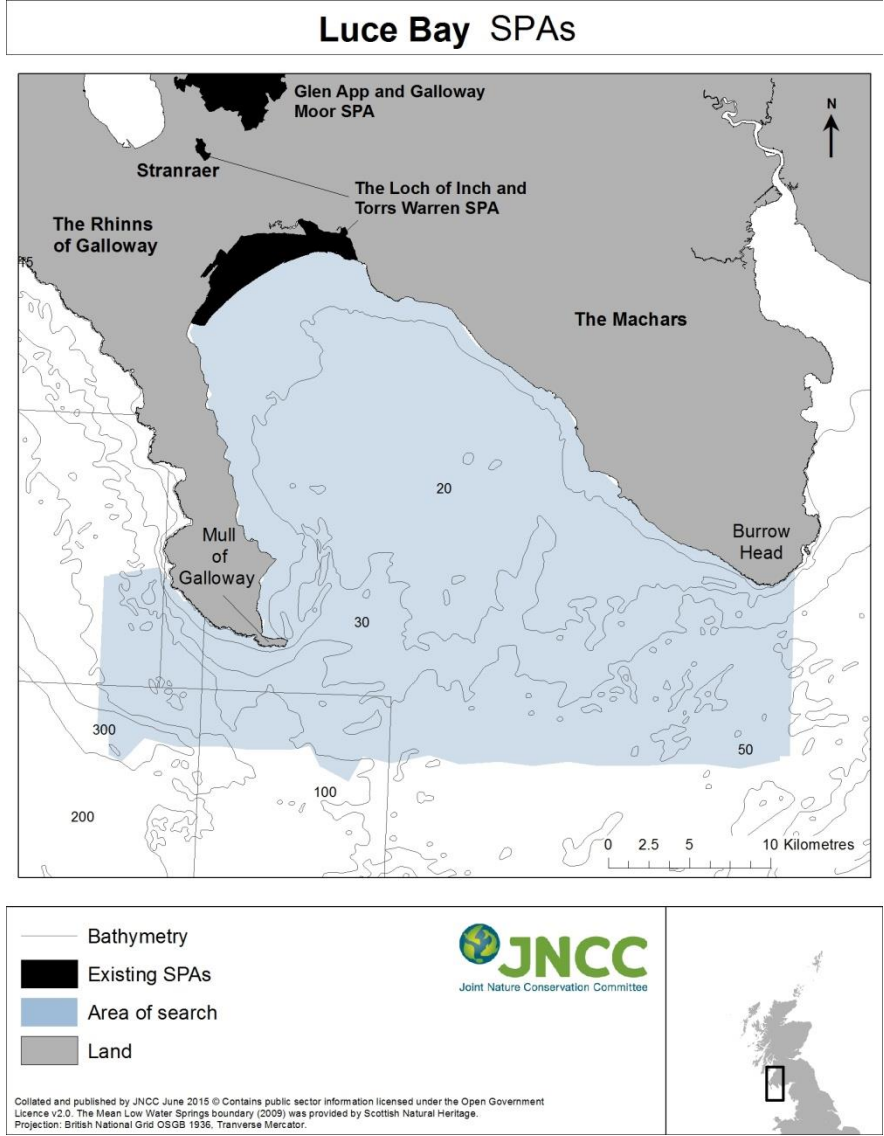


Figure 46. Bathymetry and existing SPAs adjacent to Luce Bay area of search.

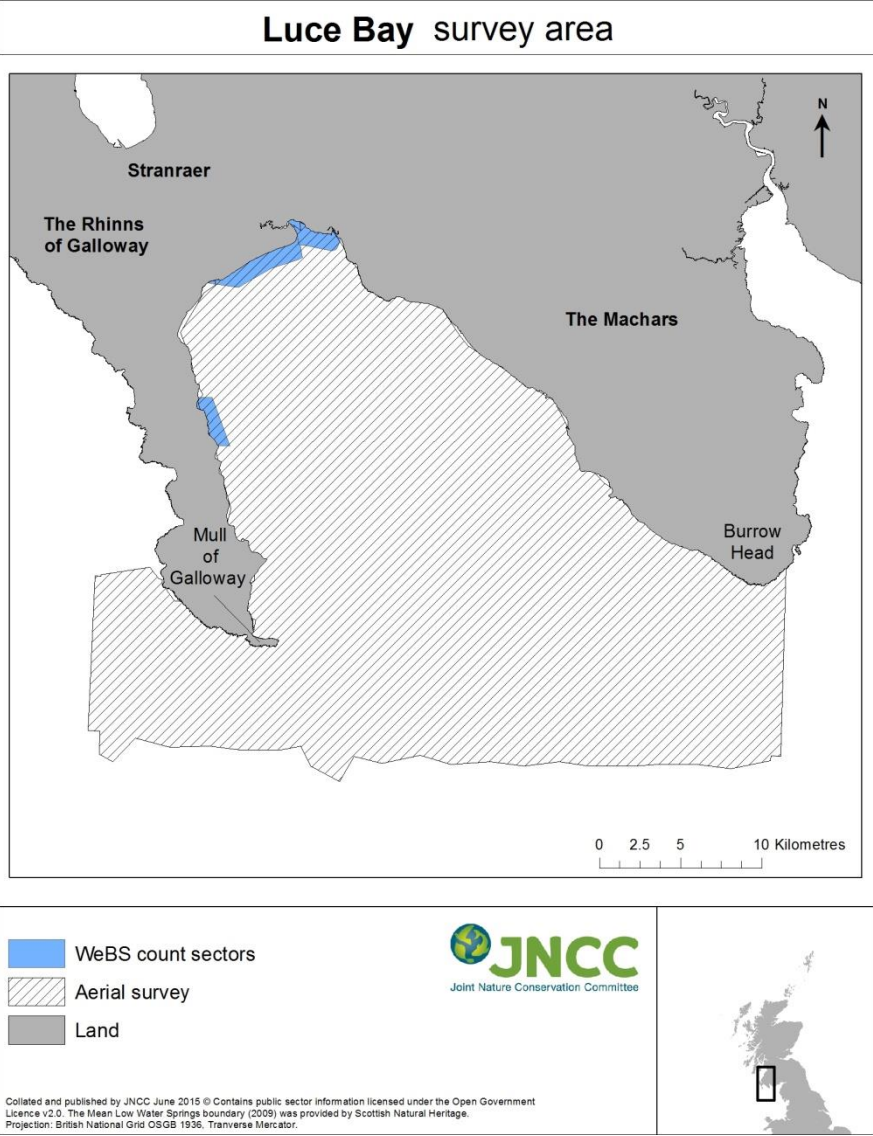


Figure 47. Areas surveyed by aerial survey and WeBS counts within Luce Bay area of search.

Results

Table 22 provides an overview of the Luce Bay area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.20 of Appendix 1.

Luce Bay regularly supported numbers of great northern divers that exceeded the Stage 1.1 threshold of the UK SPA Selection Guidelines. No other species were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds under Stage 1.2 or 1.4.

Table 22. Luce Bay area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold regular - >50 ind
		1% biog. 1% UK					
great northern diver	(Annex 1)	(25)	50	Aerial WeBS	204 0	1.1	✓
greater scaup	(migratory)	3,100	52	WeBS	0		
common eider	(migratory)	10,300	600	Aerial WeBS	369 6		
long-tailed duck	(migratory)	16,000	110	Aerial WeBS	25 0		
common scoter	(migratory)	5,500	1,000	Aerial WeBS	815 103		
velvet scoter	(migratory)	4,500	(25) 50	Aerial WeBS	6 0		
common goldeneye	(migratory)	11,400	200	Aerial WeBS	21 4		
red-breasted merganser	(migratory)	1,700	84	WeBS	46		
goosander	(migratory)	2,700	120	Aerial WeBS	33 0		
red-throated diver	(Annex 1)		170	Aerial WeBS	142 0		
black-throated diver	(Annex 1)		(6) 50	WeBS	0		
great crested grebe	(migratory)	3,500	190	Aerial WeBS	0 0		
red-necked grebe	(migratory)	500	(1) 50	WeBS	0		
Slavonian grebe	(Annex 1)		(11) 50	Aerial WeBS	0 1		
little gull	(Annex 1)		50	Aerial WeBS	0 0		
European shag	(migratory)	2,000	1,100	WeBS	3		
great cormorant	(migratory)	1,200	350	Aerial WeBS	- 6		
				Aerial	-		

3.22 Solway Firth

Introduction

The Solway Firth area of search is an area shared between England and Scotland. It includes part of the Upper Solway Firth Flats and Marshes SPA, and extends out to Whitehaven on the south coast and Stein Head on the north coast. Most of the Inner Solway Firth is less than 10m deep while the outer part of the area of search reaches depths of 10-30m. The seabed substrate consists of sand and muddy sand in the inner part of the area of search, changing to mud and sandy mud in the outer area (McBreen *et al* 2011). The coastal area includes a range of habitats including mudflats and sandflats, lagoons, salt marshes and inland water bodies.

The Solway Firth area of search partially overlaps an existing intertidal SPA, Upper Solway Firth Flats and Marshes SPA (Figure 48). This intertidal SPA was classified in 1992 for wintering greater scaup and common goldeneye amongst other species, and the area regularly supports an internationally important assemblage of overwintering birds to which greater scaup and common goldeneye contribute. The same area is covered by an SAC designation for Annex 1 habitat including large areas of intertidal sandflat and mudflat.

Site specific methods

Data on the numbers and distribution of seaduck, divers and grebes in the Solway Firth area of search are based on aerial survey data collected by the Wildfowl and Wetlands Trust (WWT) and land-based counts from WeBS. Aerial surveys were undertaken during the winter seasons of 2000/01, 2001/02, 2004/05 and 2005/06. The two surveys in 2000/01 were conducted as strip transects but the eleven subsequent surveys were line-transect surveys. Line-transect surveys in 2001/02 assigned observations to three distance bands, subsequent surveys used four distance bands. Data from land-based WeBS counts within the Solway Firth area of search were collated from the five most recent years of available data (2006/07 to 2010/11). Land-based counts of red-throated divers in the Solway Estuary from 2009-2011 were provided by David Shackelton, in addition to roost counts which provided numbers comparable to those estimated by aerial surveys. Aerial survey data were used to provide population estimates.

The following decisions were taken regarding the data available for the Solway Firth area of search: strip transect aerial survey under estimate the true number of birds as they cannot be corrected using distance sampling. For this reason the counts from the strip transects were not included in the mean of peak estimates for the aerial survey data. Not all of the line-transect aerial surveys covered the full area of search (Figure 49), some of the surveys in the 2001/02 and 2004/05 winter seasons only covered a portion of the area of search. However, the counts from these surveys were high compared to surveys with more complete spatial coverage and they were therefore retained in the analysis, though it is likely these underestimate the numbers that were present within the area of search in those seasons.

All divers observed during aerial surveys were recorded either as red-throated diver or unidentified diver species, with the exception of one great northern diver. Consequently, unidentified diver observations were assumed to be red-throated divers and analyses were performed on combined red-throated and unidentified diver data.

The spatial and temporal coverage of data from land-based WeBS counts was poor. Few count sectors were surveyed consistently over this time period (2006/07 to 2010/11) although the

number of sectors surveyed increased in the 2009/10 and 2010/11 seasons. Consequently, estimates from land-based WeBS count data are likely to underestimate the true numbers of birds present within the area of search. Despite this poor coverage the population estimates for some species within the Solway Firth area of search were higher from WeBS data than aerial survey, hence for some species WeBS data were considered to be the best estimate available.

Results

Table 23 provides an overview of the Solway Firth area of search showing the survey data that were available for each species and where they were present in sufficient numbers to exceed the thresholds under the UK SPA Selection Guidelines. Further detail of the individual survey estimates used to calculate the mean of peak is provided in Table A1.21 of Appendix 1.

Aerial survey data were used for red-throated diver, greater scaup and common scoter within the Solway Firth area of search as these data provided the higher population estimates and provided better spatial coverage of the area of search than WeBS.

Red-throated divers were regularly occurring within Solway Firth, and the estimated populations exceeded the 1% threshold under stage 1.1 of the UK SPA Selection Guidelines in the three winter seasons for which data were available. Land-based counts and roost counts of red-throated divers in the Solway Estuary from 2009-2013 (Shackleton 2013) were in the same range as those provided by aerial surveys. Aerial survey data were used to provide population estimates, however the data from these roost counts provide additional information to support these estimates.

Common scoter and greater scaup were present in numbers that exceeded 1% of the UK wintering population estimates, under Stage 1.4 of the UK SPA Selection Guidelines though greater scaup did not meet the criterion for regularity of occurrence.

Inshore areas of search around England and Wales (the Greater Wash, Outer Thames Estuary and Liverpool Bay/Bae Lerpwl) support higher numbers of red-throated diver than the Solway Firth. However, the Solway Firth area of search supports the second highest population of red-throated diver of all areas of search in Scotland, after the Firth of Tay. It also supports the highest population estimates of goosander of all areas of search in Scotland, though the numbers present did not exceed the relevant 1% population threshold.

The area surveyed by aerial survey overlaps partly with the existing Upper Solway Firth Flats and Marshes SPA. Therefore birds recorded within the Solway Firth area of search might include the same aggregations that occur within the existing SPA.

Solway Firth survey area

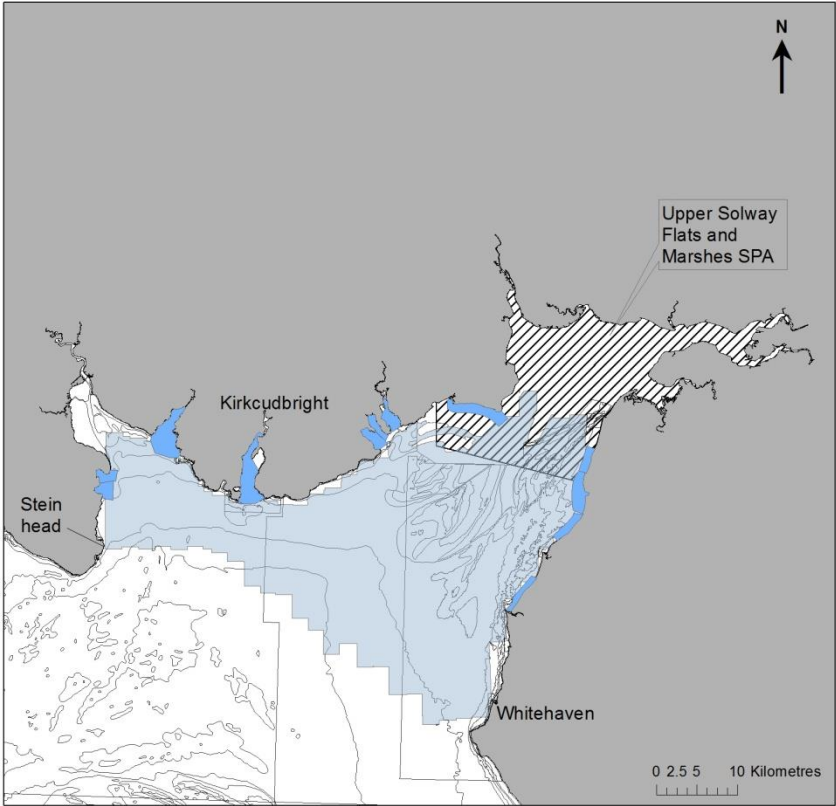


Figure 48. Areas surveyed by aerial survey and WeBS counts within the Solway Firth Area of search, and the existing SPA.

Solway Firth aerial survey effort

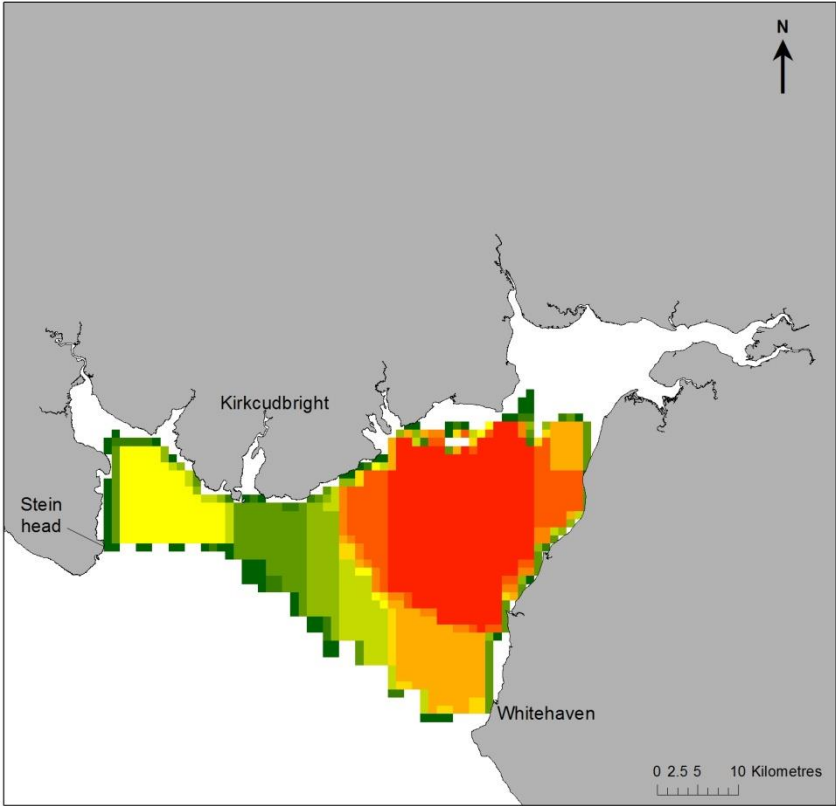


Figure 49. Aerial survey effort within the Solway Firth area of search.

Table 23. Solway Firth area of search showing the data available for each species and where they were present in sufficient numbers to exceed the UK SPA Selection Guidelines thresholds. See Appendix 1 for further details.

species		population thresholds (ind)		data available	population size (ind)	Exceeds guideline population threshold under:	Meets all criteria: - 1% threshold - Regular - >50 ind
		1% biog.	1% UK				
red-throated diver	(Annex 1)		170	Aerial WeBS	540 1	1.1	✓
greater scaup	(migratory)	3,100	52	Aerial WeBS	95 25	1.4	exceeds threshold in 1 of 3 years ✓
common scoter	(migratory)	5,500	1,000	Aerial WeBS	1,592 2	1.4	
common eider	(migratory)	10,300	550	Aerial WeBS	14 0		
long-tailed duck	(migratory)	16,000	110	Aerial WeBS	0 0		
velvet scoter	(migratory)	4,500	50	WeBS Aerial	0 0		
common goldeneye	(migratory)	11,400	200	WeBS Aerial	10 0		
red-breasted merganser	(migratory)	1,700	84	WeBS Aerial	12 4		
goosander	(migratory)	2,700	120	WeBS Aerial	110 0		
black-throated diver	(Annex 1)		50	WeBS Aerial	0 0		
great northern diver	(Annex 1)		50	Aerial WeBS	4 1		
great crested grebe	(migratory)	3,500	190	WeBS Aerial	17 0		
red-necked grebe	(migratory)	500	50	WeBS Aerial	0 0		
Slavonian grebe	Annex 1		50	WeBS Aerial	0 0		
little gull	Annex 1		50	Aerial WeBS	0 0		
European shag	(migratory)	2,000	1,100	Aerial WeBS	0 0		
great cormorant	(migratory)	1,200	350	Aerial WeBS	224 98		

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6 Appendix 1

Abbreviations of species names used in the tables below: GS = greater scaup, E = common eider, Ef = subspecies of the common eider *Somateria mollissima faeroensis*, LTD = long-tailed duck, CS = common scoter, VS = velvet scoter, GE = common goldeneye, RBM = red-breasted merganser, G = goosander, RTD = red-throated diver, BTD = black-throated diver, GND = great northern diver, GCG = great crested grebe, RNG = red-necked grebe, SG = Slavonian grebe, LG = little gull, S = European shag, C = great cormorant.

Table A1.1. Survey data and mean of peak calculations for the Firth of Forth. Data used for mean of peak calculations are bold.

Boat survey data	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
1998 01 25-29		0	5,363	874	1226	1,513	0	427	0	158	0	0	0	0	0	15	Not surveyed	Not surveyed
Aerial surveys data	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
14 December 2001	2001/02	0	10,996	173	5,121	534	0	177	0	150	0	0	0	0	0	0	-	-
26 February 2002	2001/02	0	9,416	455	2,066	680	0	175	0	140	0	0	0	0	0	0	-	-
05 December 2003	2003/04	0	3,560	225	86	46	0	43	0	36	0	0	0	0	0	317	-	-
16 February 2004	2003/04	0	9,771	813	1,240	55	0	119	0	144	0	0	0	0	0	0	-	-
12 December 2004	2004/05	0	8,767	1,667	149	115	0	460	0	512	0	0	0	0	0	0	-	-
03 February 2005	2004/05	0	4,304	311	294	262	0	169	0	29	0	0	0	0	0	0	-	-
(3 seasons) mean of peak		0	9,845	978	2,218	332	0	252	0	269	0	0	0	0	0	106	-	-
WeBS data	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	1	3,671	210	594	926	244	253	5	35	0	1	40	4	40	0	200	183
	2007/08	0	2,708	105	772	467	447	179	11	18	3	2	19	12	28	0	163	129
	2008/09	0	3,462	141	676	728	325	185	21	17	2	2	16	7	26	1	91	113
	2009/10	0	3,244	181	669	424	1,123	179	12	38	5	1	25	7	20	0	136	179
	2010/11	0	3,562	165	348	338	593	147	8	11	1	1	10	3	14	1	174	139
(5 seasons) mean of peak		0	3,329	160	612	577	546	189	11	24	2	1	22	7	26	0	153	149
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	9,845	978	2,218	577	546	189	11	269	2	1	22	7	26	106	153	149
data source	WeBS		AS	AS	AS	WeBS	WeBS	WeBS	WeBS	AS	WeBS	WeBS	WeBS	WeBS	WeBS	AS	WeBS	WeBS
meeting SPA selection guideline			1.4	1.4	1.4	1.4	1.4	1.4		1.1					1.1	1.1		
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.2. Survey data and mean of peak calculations for the Firth of Tay. Data used for mean of peak calculations are bold.

Boat surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
24 & 25 January 1998	1997/98	0	5,300	111	1,474	280	0	3	0	387	0	0	0	0	0	216	-	-
Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
13 & 15 December 2001	2001/02	0	1,804	1,254	3,049	23	0	206	0	54	0	0	0	0	0	0	-	-
26 February 2002	2001/02	0	4,486	722	3,634	15	0	32	0	55	0	0	0	0	0	0	-	-
04 December 2003	2003/04	0	20,333	705	1,028	566	0	98	0	517	0	0	0	0	0	16	-	-
29 February 2004	2003/04	0	16,180	1,436	2,165	0	0	287	0	1,589	0	0	0	0	0	44	-	-
12 December 2004	2004/05	0	10,398	235	360	0	0	46	0	115	0	0	0	0	0	15	-	-
02 February 2005	2004/05	0	3,665	293	1,134	0	0	25	0	258	0	0	0	0	0	0	-	-
18 March 2005	2004/05	0	2,270	272	1,647	4	0	0	0	126	0	0	0	0	0	0	-	-
(3 seasons) mean of peak		0	11,739	994	2,482	198	0	180	0	634	0	0	0	0	0	20	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	9,246	9	22	0	37	28	8	1	0	0	2	0	6	0	2	120
	2007/08	6	7,531	22	7	0	42	47	3	3	1	0	1	0	2	0	6	105
	2008/09	0	3,061	40	255	2	35	152	3	4	0	0	2	0	9	0	0	110
	2009/10	8	5,280	18	54	0	37	71	2	5	0	0	3	0	4	0	10	104
	2010/11	0	1,685	50	409	8	66	70	2	7	0	0	7	0	1	0	12	64
(5 seasons) mean of peak		3	5,361	28	149	2	43	74	4	4	0	0	3	0	4	0	6	101
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		3	11,739	994	2,482	198	43	180	4	634	0	0	3	0	4	20	6	101
data source		WeBS	AS	AS	AS	AS	WeBS	AS	WeBS	AS	-	-	WeBS	-	WeBS	AS	WeBS	WeBS
meeting SPA selection guideline			1.2	1.4	1.4	1.4		1.4		1.1								
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.3. Survey data and mean of peak calculations for Aberdeen Bay. Data used for mean of peak calculations are bold.

Aerial survey	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG
Survey date																
12 March 2003	2003/04	0	129	6	103	0	0	0	0	26	0	0	0	0	0	0
11 February 2004	2003/04	0	705	0	60	0	0	8	0	158	0	0	0	0	0	0
11 December 2004	2004/05	0	42	19	212	8	0	0	0	261	0	0	0	0	0	0
17 February 2005	2004/05	0	322	0	770	8	0	0	0	39	0	0	0	0	0	0
08 December 2005	2005/06	0	1,091	8	8	0	0	0	0	53	0	0	0	0	0	0
24 January 2006	2005/06	0	426	0	776	0	0	0	0	98	0	0	0	0	0	0
(3 seasons) mean of peak		0	706	11	550	3	0	3	0	172	0	0	0	0	0	0
Land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG
Survey date																
14 & 15 February 2004	2003/04	0	796	6	189	0	0	28	0	189	0	0	0	0	0	0
29 March 2004	2003/04	0	1,078	11	134	1	0	48	0	97	0	0	0	0	0	0
23 November 2004	2004/05	0	250	52	514	3	0	17	0	70	0	0	0	0	0	0
31 December 2004	2004/05	0	363	17	493	0	0	20	0	129	0	0	0	0	0	0
17 November 2005	2005/06	4	185	28	326	0	19	6	0	86	0	0	0	0	0	0
06 & 07 December 2005	2005/06	0	430	27	306	1	0	10	0	48	0	0	0	0	0	0
04 & 08 January 2006	2005/06	0	454	11	19	0	0	12	0	159	0	0	0	0	0	0
03 & 04 February 2006	2005/06	0	818	19	140	0	2	29	0	152	0	0	2	0	0	0
21 & 22 March 2006	2005/06	0	1,013	30	97	0	0	32	0	62	0	0	0	0	0	0
03 November 2006	2006/07	0	262	0	879	0	3	12	0	72	0	0	0	0	0	0
05 & 06 December 2006	2006/07	0	233	10	629	0	0	11	0	45	0	0	0	0	0	0
13 & 14 February 2007	2006/07	0	442	25	193	0	0	5	0	50	0	0	0	0	0	0
(4 seasons) mean of peak		1	724	30	477	1	6	28		137	0	0	1	0	0	0
MoP within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG
estimate used		1	724	30	550	3	6	28	0	172	0	0	1	0	0	0
data source		LBC	LBC	LBC	AS	AS	LBC	LBC	-	AS	-	-	LBC	-	-	-
meeting SPA selection guideline			1.4							1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,700	3,500	50	3,500	500	55	1,100
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50

Table A1.4. Survey data and mean of peak calculations for the Moray Firth. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
January 2002	2001/02	0	1,559	4,626	2,749	0	0	99	0	505	0	16	0	0	0	0	-	-
February 2002	2001/02	0	1,703	2,428	1,279	175	65	94	0	195	0	280	0	0	0	0	-	-
December 2002 (area coverage insufficient)	2002/03	0	537	747	2,787	0	16	4	0	161	0	12	0	0	0	0	-	-
March 2003 (area coverage insufficient)	2002/03	0	221	202	3,091	0	0	15	0	67	0	34	0	0	0	0	-	-
December 2003	2003/04	0	1003	4,624	1,875	188	0	299	0	464	0	20	0	0	0	0	-	-
February 2004	2003/04	0	2,513	6,155	3,845	707	197	58	0	277	0	242	0	0	0	0	-	-
March 2005	2004/05	0	1,287	2,279	3,022	26	69	35	0	137	0	22	0	0	0	0	-	-
January 2006	2005/06	0	1,599	1,678	1,264	0	41	16	0	565	0	62	0	0	0	0	-	-
February 2007	2006/07	0	1,622	1,095	1,839	337	0	0	0	159	0	204	0	0	0	0	-	-
(5 seasons) mean of peak		0	1,745	3,167	2,544	249	74	90	0	366	0	162	0	0	0	0	-	-
RSPB seaduck, land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2001/02	309	1,565	3,272	3,381	1,083	1,547	209	0	185	43	128	1	0	73	15	-	-
	2002/03	998	1,033	3,566	8,333	2,574	808	129	0	116	18	60	1	0	39	9	-	-
	2003/04	480	1,639	3,214	4,576	2,093	774	181	0	132	9	57	1	1	50	3	-	-
	2004/05	2,641	1,586	6,322	4,265	1,169	1,182	126	0	102	5	36	2	1	26	3	-	-
	2005/06	223	1,352	8,630	6,842	523	222	108	0	59	3	14	8	6	27	6	-	-
(5 seasons) mean of peak		930	1,435	5,001	5,479	1,488	907	151	0	119	16	59	3	2	43	7	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	688	1,169	10,748	1,908	689	191	79	5	43	9	1	0	1	31	3	181	176
	2007/08	452	1,015	2,594	3,590	104	175	88	3	47	4	4	0	0	17	1	121	169
	2008/09	489	1,288	766	757	17	91	68	1	16	1	1	2	0	3	0	68	170
	2009/10	386	733	916	559	82	213	160	0	19	6	1	4	0	44	0	101	280
	2010/11	444	646	568	396	140	176	58	1	17	1	3	0	0	36	0	53	239
(5 seasons) mean of peak		492	970	3,118	1,442	206	169	91	2	28	4	2	1	0	26	1	105	207
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		930	1,745	5,001	5,479	1,488	907	151	2	366	16	162	3	2	43	7	105	207
data source		RSPB	AS	RSPB	RSPB	RSPB	RSPB	RSPB	WeBS	AS	RSPB	AS	RSPB	RSPB	RSPB	RSPB	WeBS	WeBS
meeting SPA selection guideline		1.4	1.4	1.4	1.4	1.4	1.4	1.4		1.1	1.1	1.1			1.1			
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1100	350

Table A1.5. Survey data and mean of peak calculations for Scapa Flow. Data used for mean of peak calculations are bold. E = Undifferentiated common eider and uses *S.m. mollissima* population thresholds.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
12 December 2002 (area coverage insufficient)	2002/03	0	721	96	26	0	0	49	0	0	0	40	0	0	0	0	-	-
12 February 2004	2003/04	0	2,555	614	413	0	0	123	0	8	0	269	0	0	0	0	-	-
07 March 2005	2004/05	0	1,659	450	0	0	0	45	0	32	0	165	0	0	0	0	-	-
29 January 2006	2005/06	0	1,335	828	0	0	0	134	0	7	0	275	0	0	0	0	-	-
22 February 2006	2005/06	0	1,097	511	32	0	38	72	0	20	0	121	0	0	0	0	-	-
(3 seasons) mean of peak		0	1,850	631	148	0	13	101	0	20	0	236	0	0	0	0	-	-
Land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
01 November 1998 (RSPB)	1998/99	0	2,308	1,224	3	7	71	628	1	59	49	540	0	3	102	0	3,393	92
01 December 1998 (RSPB)	1998/99	0	1,792	1,433	0	9	248	477	0	26	57	644	0	4	91	0	2,276	50
01 January 1999 (RSPB)	1998/99	0	1,680	1,582	2	19	282	477	3	29	47	145	0	21	124	0	2,154	55
01 March 1999 (RSPB)	1998/99	0	2,038	1,246	2	7	231	324	1	38	42	781	0	23	74	0	744	32
01 November 2000 (RSPB)	2000/01	0	1,980	1,184	7	11	40	488	0	82	58	438	0	10	74	0	3,161	87
01 January 2001 (RSPB)	2000/01	0	1,809	1,474	3	9	254	388	0	22	54	411	0	3	141	0	1,593	68
01 March 2001 (RSPB)	2000/01	0	1,635	993	6	6	199	292	0	20	18	359	0	1	59	0	629	8
01 November 2006 (JNCC)	2006/07	0	1,441	834	3	5	38	501	0	56	25	288	0	0	83	0	2,233	52
01 February 2007 (JNCC)	2006/07	0	1,693	1,122	6	10	121	437	0	15	57	298	0	2	139	0	706	31
(3 seasons) mean of peak		0	1,994	1,393	5	13	219	539	1	66	57	506	0	12	135	0	2,929	77
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	0	0	0	0	21	0	0	0	0	0	0	0	1	0	151	13
	2007/08	0	0	0	0	0	10	0	0	0	0	0	0	0	2	0	402	10
	2008/09	0	0	0	0	0	53	0	0	0	0	0	0	0	9	0	191	10
	2009/10	0	0	0	0	0	57	0	0	0	1	0	0	0	3	0	72	12
	2010/11	0	0	0	0	0	42	0	0	0	2	0	0	0	39	0	132	21
(5 seasons) mean of peak		0	0	0	0	0	37	0	0	0	1	0	0	0	11	0	190	13
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	1,994	1,393	148	13	219	539	1	66	57	506	0	12	135	0	2,929	77
data source		-	LBC	LBC	AS	LBC	LBC	LBC	LBC	LBC	LBC	LBC	NA	LBC	LBC	-	LBC	LBC
meeting SPA selection guideline			1.4	1.4			1.4	1.4			1.1	1.1		1.1	1.1		1.2	
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1,100	350

Table A1.6. Survey data and mean of peak calculations for North Orkney. * indicates less than three years of data. Data used for mean of peak calculations are bold. E = Undifferentiated common eider and uses *S.m. mollissima* population thresholds.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
29 January 2006	2005/06	0	544	541	0	0	0	87	0	7	0	87	0	0	0	0	-	-
22 February 2006	2005/06	0	279	174	8	0	3	19	0	0	0	85	0	0	0	0	-	-
18 February 2007	2006/07	0	1,890	1,018	133	0	0	149	0	46	0	415	0	0	0	0	-	-
15 March 2008	2007/08	0	1,174	920	0	0	0	72	0	0	0	111	0	0	0	0	-	-
(2 seasons) mean of peak		0	1,532	969	67	0	0	111	0	23	0	263	0	0	0	0	-	-
JNCC land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2007/08	0	1,156	897	12	165	51	278	0	119	1	250	0	1	131	0	1,856	49
	2008/09	0	1,349	919	34	129	36	409	0	30	6	286	0	0	109	0	1,628	239
(2 seasons) mean of peak		0	1,253	908	23	147	44	344	0	75	4	268	0	1	120	0	1,742	144
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	35	6	0	3	55	25	0	5	0	8	0	0	1	0	18	4
	2007/08	1	41	32	0	2	46	13	0	1	0	18	0	0	2	0	13	1
	2008/09	5	55	87	0	2	25	46	0	0	0	7	0	0	1	0	31	4
	2009/10	3	62	28	2	0	38	73	0	0	0	6	0	0	2	0	28	3
	2010/11	0	50	254	0	1	42	19	0	1	0	3	0	0	1	0	23	4
(5 seasons) mean of peak		2	49	81	0	2	41	35	0	1	0	8	0	0	1	0	23	3
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		2	1,471	952	60	147*	42	279	0	65	4*	317	0	1*	120*	0	1,742*	144*
data source		WeBS	AS, LBC	AS, LBC	AS, LBC	LBC	LBC, WeBS	LBC, AS	WeBS	LBC, AS	LBC	AS, LBC	WeBS	LBC	LBC	AS	LBC	LBC
meeting SPA selection guideline			1.4	1.4		1.4		1.4				1.1		1.2	1.1		1.4	
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2000	1200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1100	350

Table A1.7. Survey data and mean of peak calculations for West Shetland. Data used for mean of peak calculations are bold. Eiders identified are of the subspecies of Common eider ssp. faeroensis.

Corrected boat and land-based counts (SOTEAG)	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2004/05	0	904	190	0	0	36	119	0	53	0	50	0	0	67	0	893	309
	2005/06	0	922	150	1	0	64	179	0	7	0	42	0	0	57	0	975	150
	2006/07	0	959	158	1	0	67	168	0	10	0	45	0	0	72	0	933	151
	2007/08	0	1,192	186	0	2	41	263	0	44	0	61	0	0	72	0	680	165
	2008/09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2009/10	0	1,031	164	6	1	99	220	0	2	0	41	0	0	96	0	1,005	269
	2010/11	0	999	151	5	1	75	147	0	3	0	52	0	0	92	0	1,007	257
(5 seasons) mean of peak		0	1,021	162	3	1	69	195	0	13	0	48	0	0	78	0	920	198
Aerial surveys	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
13 February 2008	2007/08	0	679	17	0	0	0	0	0	0	0	21	0	0	0	0	-	-
10 February 2009	2008/09	0	341	27	0	0	0	12	0	0	0	63	0	0	0	0	-	-
20 March 2009	2008/09	0	83	0	0	0	0	8	0	0	0	12	0	0	0	0	-	-
10 February 2010	2009/10	0	241	24	0	0	0	97	0	0	0	35	0	0	0	0	-	-
(3 seasons) mean of peak		0	420	23	0	0	0	36	0	0	0	40	0	0	0	0	-	-
mean of peak within AoS		GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	1,021	162	3	1	69	195	0	13	0	52	0	0	78	0	920	198
data source		soteag	soteag	soteag	soteag	soteag	soteag	soteag	soteag	soteag	soteag	AS & soteag	soteag	soteag	soteag	AS	soteag	soteag
meeting SPA selection guideline			1.2	1.4				1.4				1.1			1.1			
1% biogeographic population		3,100	85	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	55	110	1,000	(25)50	200	84	120	170	(6) 50	(25)50	190	(1)50	(11)50	50	1,100	350

Table A1.8. Survey data and mean of peak calculations for East Shetland. Data used for mean of peak calculations are bold. Eiders identified are of the subspecies of Common eider ssp. faeroensis.

Aerial surveys	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
13 February 2008	2007/08	0	146	226	0	0	0	0	0	0	0	49	0	0	0	0	-	-
26 March 2008	2007/08	0	110	72	0	0	0	19	0	8	0	218	0	0	0	0	-	-
09 February 2009	2008/09	0	318	8	0	0	23	50	0	4	0	171	0	0	0	0	-	-
20 March 2009	2008/09	0	228	17	0	0	0	30	0	0	0	151	0	0	0	0	-	-
10 February 2010	2009/10	0	47	183	0	0	0	39	0	0	0	212	0	0	0	0	-	-
(3 seasons) mean of peak		0	170	142	0	0	8	36	0	4	0	200	0	0	0	0	-	-

Corrected boat based counts SOTEAG	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	302	116	0	0	34	216	0	24	0	69	0	0	37	0	975	76
	2007/08	0	191	186	3	2	41	183	0	71	0	96	0	0	51	0	861	23
	2008/09	0	218	192	2	0	50	288	0	19	0	106	0	0	52	0	968	111
	2009/10	0	263	181	5	0	54	241	0	0	0	116	0	0	59	0	730	30
	2010/11	0	184	115	1	0	63	240	0	5	0	48	0	0	71	0	550	140
(5 seasons) mean of peak		0	232	158	2	0	48	234	0	24	0	87	0	0	54	0	817	76

mean of peak within AoS	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used	0	252	166	2	0	48	234	0	24	0	200	0	0	54	0	817	76
data source	soteag	AS, soteag	AS, soteag	soteag	soteag	soteag	soteag	soteag	soteag	soteag	AS	soteag	soteag	soteag	AS	soteag	soteag
meeting SPA selection guideline		1.2	1.4				1.4				1.1			1.1			
1% biogeographic population	3,100	85	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population	52	55	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.9. Survey data and mean of peak calculations for Unst. Data used for mean of peak calculations are bold. Eiders are the subspecies of common eider *ssp. faeroensis*.

Aerial surveys	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
26 March 2008	2007/08	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	-	-
09 February 2009	2008/09	0	40	24	0	0	0	12	0	0	0	16	0	0	0	0	-	-
19 March 2009	2008/09	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	-	-
(2 seasons) mean of peak		0	20	12	0	0	0	6	0	2	0	14	0	0	0	0	-	-
WeBS	Winter season	GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2005/06	0	14	5	0	0	4	23	0	0	0	0	0	0	0	0	0	0
	2006/07	0	0	0	0	0	1	28	0	0	0	0	0	0	0	0	0	0
	2007/08	0	0	0	0	0	2	26	2	2	0	2	0	0	3	0	0	1
	2008/09	0	1	0	0	0	2	25	0	0	0	3	0	0	1	0	0	0
	2009/10	0	0	0	5	0	0	16	0	0	0	1	0	0	2	0	0	0
(5 seasons) mean of peak		0	3	1	1	0	2	24	0	0	0	1	0	0	1	0	0	0
mean of peak within AoS		GS	E ssp. f	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	20	12	1	0	2	24	0	2	0	14	0	0	1	0	0	0
data source			AS	AS	WeBS	WeBS	WeBS	WeBS	WeBS	AS		AS			WeBS		WeBS	WeBS
meeting SPA selection guideline																		
1% biogeographic population		3,100	85	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	55	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.10. Survey data and mean of peak calculations for Loch Eriboll. Data used for mean of peak calculations are bold.

WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
	2005/06	0	3	12	0	0	1	8	0	1	0	4	0	0	0	0	68	22
	2006/07	0	59	9	0	0	8	15	3	4	3	40	0	0	4	0	53	18
	2007/08	0	22	29	0	0	11	54	4	7	7	90	0	0	21	0	68	8
	2008/09	0	33	10	0	0	6	40	0	2	3	18	0	0	5	0	93	10
	2009/10	0	51	4	0	0	3	30	0	3	14	50	0	0	20	0	99	0
(5 seasons) mean of peak		0	34	13	0	0	6	29	1	3	5	40	0	0	10	0	76	12
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	34	13	0	0	6	29	1	3	5	40	0	0	10	0	76	12
data source		AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS
meeting SPA selection guideline																		
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1,100	350

Table A1.11. Survey data and mean of peak calculations for Wester Ross. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTd	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
21 & 20 January 2008	2007/08	0	106	47	0	0	0	74	0	0	0	116	0	0	0	0	-	-
16 March 2008	2007/08	0	136	19	0	0	0	47	0	0	5	47	0	0	0	0	-	-
02 & 01 February 2009	2008/09	0	103	9	0	0	3	26	0	0	0	111	0	0	0	0	-	-
21 March 2009	2008/09	0	111	0	0	0	0	23	0	9	0	144	0	0	0	0	-	-
(2 seasons) mean of peak		0	124	28	0	0	2	50	0	5	3	130	0	0	0	0	-	-
Land-based counts JNCC	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTd	GND	GCG	RNG	SG	LG	S	C
Survey date																		
25 & 28 January 2009	2008/09	4	198	1	0	0	29	145	3	7	45	79	0	0	26	0	0	0
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTd	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	152	1	3	1	180	158	0	20	97	137	0	0	38	0	720	8
	2007/08	0	134	13	15	0	248	174	0	11	75	235	0	0	18	0	561	33
	2008/09	0	119	2	69	0	235	88	2	4	56	170	0	0	9	0	603	10
	2009/10	0	104	3	22	0	188	137	3	3	73	192	0	1	39	0	420	12
	2010/11	0	45	0	0	0	120	63	0	2	3	30	0	0	14	0	200	8
(5 seasons) mean of peak		0	111	4	22	0	194	135	1	8	61	153	0	0	27	0	501	14
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTd	GND	GCG	RNG	SG	LG	S	C
estimate used		1	127	28	22	0	194	135	1	9	61	153	0	0	27	0	501	14
data source		WeBS, LBC	LBC, WeBS	AS	WeBS	WeBS	WeBS	WeBS, LBC	WeBS, LBC	AS, WeBS	WeBS	WeBS	WeBS	WeBS	WeBS, LBC	WeBS	WeBS	WeBS
meeting SPA selection guideline								1.4			1.1	1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6) 50	(25)50	190	(1) 50	(11) 50	50	1100	350

Table A1.12. Survey data and mean of peak calculations for Broad Bay. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
01 February 2009	2008/09	0	0	0	0	0	0	0	0	4	0	7	0	0	0	0	-	-
20 March 2009	2008/09	0	73	15	77	0	0	0	0	81	0	77	0	0	0	0	-	-
11 February 2010	2009/10	0	188	50	0	0	0	0	0	0	0	243	0	0	0	0	-	-
(2 seasons) mean of peak		0	131	33	39	0	0	0	0	41	0	160	0	0	0	0	-	-
Land-based counts JNCC	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
18 December 2007	2007/08	0	529	325	90	3	1	30	0	38	2	294	0	0	8	-	-	-
14 February 2008	2007/08	0	529	350	71	0	2	43	0	43	4	357	0	0	16	-	-	-
03 December 2008	2008/09	0	700	343	94	0	0	7	0	19	2	216	0	0	5	-	-	-
08 February 2009	2008/09	0	763	396	100	0	3	2	0	26	1	458	0	0	12	-	-	-
13 December 2009	2009/10	0	575	292	161	0	4	36	0	39	1	483	0	0	19	-	-	-
10 February 2010	2009/10	0	894	285	132	3	0	28	0	17	2	504	0	0	17	-	-	-
(3 seasons) mean of peak		0	729	346	117	2	3	29	0	36	3	440	0	0	16	-	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	11	121	0	0	1	31	0	0	0	3	0	0	1	0	9	1
	2007/08	0	458	144	0	0	0	47	0	0	0	1	0	0	0	0	14	1
	2008/09	0	230	1	0	0	0	24	0	0	0	3	0	0	0	0	137	2
	2009/10	0	7	8	0	0	0	19	0	0	0	4	0	0	0	0	2	2
	2010/11	0	4	18	0	0	0	29	0	1	0	6	0	0	0	0	8	3
(5 seasons) mean of peak		0	142	58	0	0	0	30	0	0	0	3	0	0	0	0	34	2
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	729	346	117	2	3	33	0	54	3	440	0	0	16	0	34	2
data source		-	LBC	LBC	LBC	LBC	LBC	WeBS, LBC	-	AS, LBC	LBC	LBC	-	-	LBC	-	WeBS	WeBS
meeting SPA selection guideline			1.4	1.4								1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	3,000	3,750	50	3,500	500	1,230	50	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1,100	350

Table A1.13. Survey data and mean of peak calculations for the Outer Hebrides. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
18 March 2003	2002/03	0	4,064	1,018	0	0	0	154	0	0	0	717	0	0	0	0	-	-
17 February 2004	2003/04	0	8,927	1,118	0	0	0	409	0	101	0	3,093	0	0	0	0	-	-
07 & 08 March 2005	2004/05	0	4,504	859	0	0	0	66	0	0	0	432	0	0	0	0	-	-
28 & 31 January 2006	2005/06	0	4,822	574	0	0	0	130	0	0	0	1,290	0	0	0	0	-	-
25 & 26 March 2007	2006/07	0	4,751	643	107	0	0	243	0	0	0	1,467	0	0	0	0	-	-
(5 seasons) mean of peak		0	5,414	842	21	0	0	200	0	20	0	1,400	0	0	0	0	-	-
Land-based counts JNCC	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2007/08	0	2,184	595	82	1	1	276	0	72	28	479	0	1	75	-	-	-
	2008/09	0	2,342	669	83	0	0	239	0	55	64	426	0	0	35	-	-	-
	2009/10	0	1,191	424	100	1	0	203	0	51	37	468	0	0	42	-	-	-
(3 seasons) mean of peak		0	1,906	563	88	1	0	239	0	59	43	458	0	0	51	-	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	0	37	76	0	0	1	0	0	0	59	0	0	6	0	0	0
	2007/08	0	12	11	12	0	0	2	0	0	0	6	0	0	3	0	0	0
	2008/09	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
	2009/10	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
	2010/11	0	83	97	0	0	14	8	0	5	1	34	0	0	1	0	51	82
(5 seasons) mean of peak		0	19	29	18	0	3	2	0	1	0	21	0	0	2	0	10	16
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	5,414	842	88	1	3	239	0	59	43	1,400	0	0	51	0	10	16
data source	WeBS		AS	AS	LBC	LBC	WeBS	LBC	WeBS	LBC	LBC	AS	WeBS	LBC	LBC	AS	WeBS	WeBS
meeting SPA selection guideline			1.4	1.4				1.4				1.1			1.1			
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1100	350

Table A1.14. Survey data and mean of peak calculations for Coll and Tiree. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
18 February 2004	2003/04	0	3,029	428	0	0	0	101	0	0	0	1,273	0	0	0	0	-	-
26 March 2005	2004/05	0	730	71	0	0	0	34	0	16	0	560	0	0	0	0	-	-
10 & 18 February 2006	2005/06	0	1,334	0	0	0	0	64	0	0	0	202	0	0	0	0	-	-
21 March 2006	2005/06	60	597	40	0	0	0	15	0	10	0	175	0	0	0	0	-	-
24 March 2007	2006/07	0	1,092	0	0	0	0	0	0	0	0	253	0	0	0	0	-	-
17 March 2008	2007/08	0	1,232	0	0	0	0	8	0	8	0	193	0	0	0	0	-	-
(5 seasons) mean of peak		12	1,483	108	0	0	0	41	0	7	0	496	0	0	0	0	-	-
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		12	1,483	108	0	0	0	41	0	7	0	496	0	0	0	0	-	-
data source		AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	-	-
meeting SPA selection guideline			1.4									1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.15. Survey data and mean of peak calculations for Mull. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
18 February 2004	2003/04	0	69	112	0	0	0	0	0	0	0	58	0	0	0	0	-	-
25 March 2005	2004/05	0	246	8	0	0	0	4	0	8	0	95	0	0	0	0	-	-
09 February 2006	2005/06	0	24	0	0	0	0	0	0	0	0	24	0	0	0	0	-	-
20 & 21 March 2006	2005/06	0	116	0	0	0	0	38	0	0	0	10	0	0	0	0	-	-
23 March 2007	2006/07	0	39	0	0	0	0	43	0	0	0	43	0	0	0	0	-	-
(3 seasons) mean of peak		0	118	30	0	0	0	21	0	2	0	52	0	0	0	0	-	-
Land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Loch Scridain, Loch na Keal, Loch Tuath	2006/07	-	-	-	-	-	-	-	-	0	0	15	0	0	-	-	-	-
Loch Scridain, Loch na Keal, Loch Tuath	2007/08	-	-	-	-	-	-	-	-	13	0	44	0	0	41	-	-	-
Loch Scridain, Loch na Keal, Loch Tuath	2008/09	-	-	-	-	-	-	-	-	6	2	61	0	0	21	-	-	-
Loch Scridain, Loch na Keal, Loch Tuath	2009/10	-	-	-	-	-	-	-	-	14	0	56	0	0	33	-	-	-
Loch Scridain, Loch na Keal, Loch Tuath	2010/11	-	-	-	-	-	-	-	-	24	0	50	0	0	34	-	-	-
(5 seasons) mean of peak		-	-	-	-	-	-	-	-	11	0	45	0	0	32	-	-	-
Roost counts of GND	Winter season																	
1 & 4 March 2010 roost + not associated day counts (AOS)	2009/10	-	-	-	-	-	-	-	-	-	-	163	-	-	-	-	-	-
1 & 4 March 2010 roost counts	2009/10	-	-	-	-	-	-	-	-	-	-	138	-	-	-	-	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2005/06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2006/07	0	135	0	0	0	0	0	0	0	0	16	0	0	0	0	92	0
	2007/08	0	0	0	0	0	0	0	0	3	0	44	0	0	41	0	0	0
	2008/09	0	0	0	0	0	23	37	0	6	2	61	0	0	21	0	38	0
	2009/10	0	0	0	0	0	51	22	0	9	0	94	0	0	32	0	59	0
(3-4 seasons) mean of peak		0	34	0	0	0	19	15	0	5	1	62	0	0	24	0	47	0
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	118	30	0	0	19	21	0	11	1	67	0	0	26	0	47	0
data source		WeBS	AS	AS	WeBS	WeBS	WeBS	AS	WeBS	LBC	WeBS	LBC, WeBS	WeBS	WeBS	LBC, WeBS	AS	WeBS	WeBS
meeting SPA selection guideline												1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1100	350

Table A1.16. Survey data and mean of peak calculations for Loch Indaal.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
11 February 2008	2007/08	2,392	87	0	0	0	0	0	0	0	0	59	0	0	0	0	0	0
02 February 2009	2008/09	0	144	0	0	0	0	83	0	0	0	46	0	0	0	0	0	0
21 March 2009	2008/09	89	289	0	0	0	0	63	0	0	0	53	0	0	0	0	0	0
(2 seasons) mean of peak		1,241	188	0	0	0	0	32	0	0	0	56	0	0	0	0	0	0
Land-based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2004/05	1,010	181	5	47	0	12	69	0	23	5	15	0	0	30	0	42	12
	2005/06	960	135	7	43	0	13	58	0	20	4	14	0	0	25	0	40	12
	2006/07	810	140	5	38	0	14	66	0	16	4	18	0	0	21	0	29	11
	2007/08	870	151	6	52	0	16	78	0	20	3	16	0	0	28	0	32	17
	2008/09	650	165	6	58	0	14	56	0	26	4	20	0	0	30	0	45	11
(5 seasons) mean of peak		860	154	6	48	0	14	65	0	21	4	17	0	0	27	0	38	13
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2002/03	755	165	6	52	0	11	68	0	23	4	22	0	0	31	0	40	11
	2003/04	1003	151	5	61	0	12	57	0	20	5	18	0	0	27	0	40	10
	2004/05	0	6	0	0	0	0	0	0	9	0	20	0	0	0	0	20	2
	2005/06	0	22	0	50	0	0	5	0	7	2	108	0	0	0	0	32	1
	2009/10	485	0	6	24	0	0	15	0	4	0	3	0	0	5	0	20	5
(5 seasons) mean of peak		449	69	3	39	0	5	29	0	13	2	34	0	0	13	0	30	6
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		1,059	143	6	43	0	11	60	0	17	3	56	0	0	22	0	33	11
data source		AS, LBC, WeBS	AS, LBC, WeBS	LBC, WeBS	LBC, WeBS	-	LBC, WeBS	AS, LBC, WeBS	-	LBC, WeBS	LBC, WeBS	AS	-	-	LBC, WeBS	AS	LBC, WeBS	LBC, WeBS
meeting SPA selection guideline		1.4										1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25)50	190	(1)50	(11) 50	50	1,100	350

Table A1.17. Survey data and mean of peak calculations for the Sound of Gigha. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
09 March 2005	2004/05	0	1,054	16	0	0	0	70	0	0	0	475	0	0	0	0	-	-
12 December 2005	2005/06	0	1,658	205	0	0	8	219	0	0	0	505	0	0	0	0	-	-
18 & 20 March 2006	2005/06	0	1,072	12	90	0	8	90	0	0	0	186	0	0	0	0	-	-
23 March 2007	2006/07	0	907	18	17	0	0	57	0	0	0	460	0	0	0	0	-	-
11 February 2008	2007/08	0	1,737	51	0	22	116	137	0	0	0	717	0	0	0	0	-	-
(4 seasons) mean of peak		0	1,339	73	27	6	31	121	0	0	0	539	0	0	0	0	-	-
Boat based counts	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2000/01											70			22			
	2001/02											22			-			
	2002/03											-			51			
	2003/04											43			-			
	2004/05											-			-			
	2005/06											70			30			
	2006/07											139			1			
(5 seasons) mean of peak												69			26			
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2008/09	0	87	13	82	7	3	76	0	7	22	223	0	0	99	0	56	9
	2009/10	0	350	30	29	1	4	31	3	11	0	19	0	0	27	0	51	2
	2010/11	1	69	17	31	0	11	54	0	14	5	32	0	0	13	0	96	8
	2011/12	1	87	9	35	0	2	26	0	1	9	65	0	0	7	0	62	0
	2012/13	0	94	5	42	0	1	20	0	5	22	23	0	0	38	0	42	3
(5 seasons) mean of peak		0	137	15	44	2	4	41	1	8	12	72	0	0	37	0	61	4
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	1,339	73	44	6	31	121	1	8	12	539	0	0	37	0	61	4
data source		WeBS	AS	AS	WeBS	AS	AS	AS	WeBS	WeBS	WeBS	AS	WeBS	WeBS	WeBS	AS	WeBS	WeBS
meeting SPA selection guideline			1.4					1.4				1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1100	350

Table A1.18. Survey data and mean of peak calculations for the Firth of Clyde. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
01 February 2006	2005/06	0	397	32	0	0	0	0	0	9	0	2	0	0	0	0	-	-
19 March 2006	2005/06	43	1,867	13	37	9	0	0	0	238	0	39	0	0	0	0	-	-
23 & 25 January 2007	2006/07	0	2,444	31	0	0	0	61	0	279	0	50	0	0	0	0	-	-
27 March 2007	2006/07	0	3,943	33	0	0	0	71	0	203	0	38	0	0	0	0	-	-
19 December 2007	2007/08	0	1,566	95	0	0	0	111	0	182	0	0	0	0	0	0	-	-
(3 seasons) mean of peak		14	2,459	53	12	3	0	61	0	233	0	30	0	0	0	0	-	-
Land-based counts (JNCC)	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
24 March 2007	2006/07	0	653	0	1	0	120	149	0	117	0	0	5	0	13	0	70	0
27 March 2007	2006/07	0	485	0	0	0	102	94	0	103	0	0	32	0	3	0	51	0
11 & 12 January 2008	2007/08	0	2,493	0	0	0	105	106	0	95	0	0	54	0	35	0	164	0
10 & 13 February 2008	2007/08	0	1,729	0	4	0	199	136	0	204	0	0	92	0	73	0	285	0
26 December 2008	2008/09	0	742	0	0	0	3	22	0	76	0	0	5	0	10	0	158	0
17, 28, 29 March 2009	2008/09	0	415	0	0	0	13	91	0	95	0	0	5	0	12	0	55	0
(3 seasons) mean of peak		0	1,296	0	2	0	111	125	0	139	0	0	43	0	33	0	137	0
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	22	2,026	1	2	0	706	189	5	171	1	1	128	0	41	1	269	308
	2007/08	22	2,144	2	26	0	796	150	4	267	7	5	69	0	73	1	349	324
	2008/09	24	1,193	1	52	0	261	171	4	58	20	2	125	0	53	0	233	308
	2009/10	9	1,581	1	9	0	294	165	1	120	25	6	130	0	45	0	186	263
	2010/11	1	1,386	3	1	0	228	143	5	162	16	2	184	0	82	0	251	142
(5 seasons) mean of peak		16	1,666	2	18	0	457	164	4	156	14	3	127	0	59	0	258	269
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		16	2,651	53	18	3	457	164	4	233	14	31	132	0	59	0	258	269
data source		WeBS	AS, WeBS	AS	WeBS	AS	WeBS	WeBS	WeBS	AS	WeBS	AS, WeBS	LBC, WeBS		WeBS		WeBS	WeBS
meeting SPA selection guideline		1.4					1.4	1.4		1.1	1.1	1.1			1.1			
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6) 50	(25) 50	190	(1) 50	(11) 50	50	1,100	350

Table A1.19. Survey data and mean of peak calculations for Loch Ryan. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
02 January 2006	2005/06	576	551	0	14	0	0	14	0	7	0	0	0	0	0	0	-	-
19 March 2006	2005/06	251	177	0	21	0	3	63	0	3	0	7	0	0	0	0	-	-
23 & 25 January 2007	2006/07	729	582	6	135	0	13	41	0	53	0	6	0	0	0	0	-	-
27 March 2007	2006/07	135	386	27	34	0	0	27	0	78	0	0	0	0	0	0	-	-
(2 seasons) mean of peak		653	567	14	78	0	8	52	0	43	0	7	0	0	0	0	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2005/06	1,020	522	11	244	0	229	123	0	49	0	12	56	0	23	0	74	20
	2006/07	1,047	369	8	139	0	97	106	0	49	0	12	72	0	35	0	37	12
	2007/08	1,654	772	5	162	0	95	67	0	43	1	1	45	0	11	0	75	35
	2008/09	705	429	13	106	0	137	101	0	97	0	1	34	0	40	0	19	5
	2009/10	709	1,025	10	150	0	175	106	0	116	2	3	78	0	69	0	39	7
(5 seasons) mean of peak		1,027	623	9	160	0	147	101	0	71	1	6	57	0	36	0	49	16
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		1,027	672	13	160	0	147	101	0	77	1	6	57	0	36	0	49	16
data source	WeBS		AS, WeBS	AS, WeBS	WeBS	WeBS	WeBS	WeBS		AS, WeBS	WeBS	WeBS	WeBS		WeBS		WeBS	WeBS
meeting SPA selection guideline		1.4	1.4					1.4										
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6) 0	(25)50	190	(1)50	(11)50	50	1,100	350

Table A1.20. Survey data and mean of peak calculations for Luce Bay. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																	Not surveyed	Not surveyed
01 February 2006	2005/06	0	668	35	744	0	0	0	0	26	0	140	0	0	0	0	-	-
18 March 2006	2005/06	0	4	9	554	9	0	0	0	9	0	134	0	0	0	0	-	-
22 & 23 January 2007	2006/07	0	57	39	161	0	0	4	0	9	0	78	0	0	0	0	-	-
26 March 2007	2006/07	0	112	0	364	9	63	18	0	214	0	162	0	0	0	0	-	-
18 March 2008	2007/08	0	328	0	1,336	0	0	82	0	186	0	309	0	0	0	0	-	-
(3 seasons) mean of peak		0	369	25	815	6	21	33	0	142	0	204	0	0	0	0	-	-
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2008/09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2009/10	0	0	0	0	0	5	17	0	0	0	0	0	0	1	0	1	12
	2010/11	1	18	0	200	0	7	119	0	0	0	0	0	0	2	0	4	7
	2011/12	0	0	0	108	0	1	2	0	0	0	0	0	0	0	0	3	0
(3 seasons) mean of peak		0	6	0	103	0	4	46	0	0	0	0	0	0	1	0	3	6
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		0	369	25	815	6	21	46	0	142	0	204	0	0	1	0	3	6
data source		WeBS	AS	AS	AS	AS	AS	WeBS	WeBS	AS	WeBS	AS	WeBS	WeBS	WeBS	AS	WeBS	WeBS
meeting SPA selection guideline												1.1						
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25) 50	200	84	120	170	(6)50	(25) 50	190	(1) 0	(11)50	50	1100	350

Table A1.21. Survey data and mean of peak calculations for the Solway Firth. Data used for mean of peak calculations are bold.

Aerial surveys	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
Survey date																		
05 November 2001	2001/02	0	0	0	972	0	0	0	0	9	0	0	0	0	0	0	0	0
11 December 2001	2001/02	244	13	0	1,536	0	0	3	0	602	0	5	0	0	0	0	0	39
13 March 2002	2001/02	0	0	0	751	0	0	3	0	110	0	0	0	0	0	0	0	0
10 November 2004	2004/05	0	0	0	429	0	0	0	0	444	0	0	0	0	0	0	0	6
28 November 2004	2004/05	0	0	0	1,271	0	0	0	0	261	0	4	0	0	0	0	0	0
22 January 2005	2004/05	0	9	0	1,069	0	0	0	0	109	0	0	0	0	0	0	0	545
16 February 2005	2004/05	0	30	0	1,287	0	0	0	0	164	0	0	0	0	0	0	0	92
08 November 2005	2005/06	40	0	0	1,719	0	0	8	0	575	0	0	0	0	0	0	0	89
13 December 2005	2005/06	4	0	0	788	0	0	9	0	218	0	0	0	0	0	0	0	0
02 February 2006	2005/06	0	0	0	1,545	0	0	9	0	171	0	0	0	0	0	0	0	0
20 February 2006	2005/06	0	0	0	1,953	0	0	0	0	185	0	4	0	0	0	0	0	0
(3 seasons) mean of peak		95	14	0	1,592	0	0	4	0	540	0	4	0	0	0	0	0	224
WeBS	Winter season	GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
	2006/07	0	0	0	0	0	4	14	2	0	0	0	3	0	0	0	0	77
	2007/08	0	0	0	0	0	0	10	0	0	0	0	1	0	0	0	0	104
	2008/09	7	0	0	0	0	10	7	1	0	0	0	12	0	0	0	0	70
	2009/10	56	0	0	0	0	29	20	1	4	0	3	5	0	0	0	0	104
	2010/11	64	0	0	8	0	5	7	547	0	0	0	66	0	0	0	0	136
(5 seasons) mean of peak		25	0	0	2	0	10	12	110	1	0	1	17	0	0	0	0	98
mean of peak within AoS		GS	E	LTD	CS	VS	GE	RBM	G	RTD	BTD	GND	GCG	RNG	SG	LG	S	C
estimate used		95	14	0	1,592	0	10	12	110	540	0	4	17	0	0	0	0	224
data source		AS	AS		AS		WeBS	WeBS	WeBS	AS		AS	WeBS					AS
meeting SPA selection guideline		1.4			1.4					1.1								
1% biogeographic population		3,100	10,300	16,000	5,500	4,500	11,400	1,700	2,700	2,600	3,500	50	3,500	500	55	1,100	2,000	1,200
1% UK population		52	600	110	1,000	(25)50	200	84	120	170	(6)50	(25)50	190	(1)50	(11)50	50	1100	350

7 Appendix 2: Distance estimates confidence intervals

Extr in the tables refers to where population estimates were calculated by extrapolation. This was done when a detection function (which is necessary in order to produce a Distance corrected estimate) could not be generated, for example when too few observations were recorded. Extrapolated estimates were calculated directly from raw count data, using only bands A and B. The more distant bands C and D were excluded to avoid underestimating density as detection was much lower in these bands. Transect widths were therefore assumed to be 476m wide, i.e. $2 \times (118 + 120)$. This was multiplied by the length of the total survey transects flown to give the area over which observers counted. The number of birds observed in bands A and B was divided by the area over which observers counted to give an estimated bird density. This density was then extrapolated across the entire study area to estimate total numbers.

Table A2.1. Population estimates and confidence intervals from aerial survey data in the Firth of Forth area of search produced from Distance analysis.

	2001/02 14 December 2001			2001/02 26 February 2002			2003/04 05 December 2003			2003/04 16 February 2004			2004/05 12 December 2004			2004/05 03 February 2005		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	7,436	10,996	16,260	6,679	9,416	13,274	2,277	3,560	5,567	6,895	9,771	13,846	6,317	8,767	12,168	2,905	4,304	6,054
long tailed duck	66	173	310	222	455	736	67	225	395	421	813	1,854	776	1,667	3,005	166	311	534
common scoter	2,000	5,121	9,004	817	2,066	3,986	extr	86	extr	368	1,240	2,057	extr	149	extr	extr	294	extr
velvet scoter	extr	534	extr	224	680	1,062	extr	46	extr	extr	55	extr	extr	115	extr	67	262	481
red-breasted merganser	extr	177	extr	extr	175	extr	extr	43	extr	extr	119	extr	extr	460	extr	76	169	299
red-throated diver	63	150	288	extr	140	extr	extr	36	extr	72	144	289	361	512	727	extr	29	extr
little gull	-	0	-	-	0	-	79	317	563	-	0	-	-	0	-	-	0	-

Table A2.2. Population estimates and confidence intervals from aerial survey data in the Firth of Tay area of search produced from Distance analysis.

	2001/02			2001/02			2003/04			2003/04			2004/05		
	13 & 15 December 2001			26 February 2002			04 December 2003			29 February 2004			12 December 2004		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
eider	956	1,804	3,406	2,451	4,486	8,211	5,191	20,333	63,347	8,634	16,180	30,319	3,271	10,398	23,127
long tailed duck	466	1,254	3,376	216	722	1,362	253	705	1,964	605	1,436	3,407	101	235	546
common scoter	732	3,049	7,123	1,583	3,634	7,025	235	1,028	1,186	768	2,165	4,923	63	360	2,068
velvet scoter	extr	23	extr	extr	15	extr	extr	566	extr	extr	0	extr	extr	0	extr
red-breasted merganser	extr	206	extr	extr	32	extr	extr	98	extr	0	287	817	extr	46	extr
red-throated diver	20	54	101	24	55	123	256	517	1,045	1,127	1,589	2,240	57	115	231
little gull	-	0	-	-	0	-	extr	16	extr	extr	44	extr	extr	15	extr

	2004/05			2004/05		
	02 February 2005			18 March 2005		
	LCL	Estimate	UCL	LCL	Estimate	UCL
eider	1,788	3,665	7,511	1,343	2,270	3,836
long tailed duck	128	293	673	111	272	671
common scoter	479	1,134	2,685	764	1,647	2,654
velvet scoter	extr	0	extr	extr	4	extr
red-breasted merganser	extr	25	extr	extr	0	extr
red-throated diver	114	258	421	58	126	275
little gull		-			-	

Table A2.3. Population estimates and confidence intervals from aerial survey data in the Aberdeen Bay area of search produced from Distance analysis. (*Large flocks >150 individuals, were excluded from the distance analysis, and added separately on to the resulting distance-generated estimate to give a total number).

	2003/04 12 March 2003			2003/04 11 February 2004			2004/05 11 December 2004			2004/05 17 February 2005			2005/06 08 December 2005			2005/06 24 January 2006		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider					705*													
	extr	129	extr	195	(635 plus 70)	2,060	extr	42	extr	58	(219 plus 103)	534	368	1,091	2,070	165	426	1,097
long tailed duck	extr	6	extr		0		extr	19	extr		0		extr	8	extr		0	
common scoter	extr	103	extr	extr	60	extr	extr	212	extr	extr	770	extr	extr	8	extr	extr	776	extr
velvet scoter					0		extr	8	extr	extr	8	extr		0				
red-breasted merganser				extr	8	extr												
red-throated diver	extr	26	extr	94	158	264	159	261	422	extr	39	extr	extr	53	extr	51	98	135

Table A2.4. Population estimates and confidence intervals from aerial survey data in the Moray Firth area of search produced from Distance analysis.

	2001/02 8 & 9 January 2002			2001/02 24 & 25 February 2002			2002/03 11 December 2002			2002/03 17 March 2003			2003/04 6 & 7 December 2003		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	910	1,559	2,479	905	1,703	3,203	141	537	1,098	extr	221	extr	281	1,003	2,283
long tailed duck	3,013	4,626	7,104	1,311	2,428	4,497	197	747	1,595	extr	202	extr	2,778	4,624	7,698
common scoter	1,074	2,749	7,035	545	1,279	4,774	extr	2,787	extr	extr	3,091	extr	extr	1,875	extr
velvet scoter		0		extr	175	extr		0			0		extr	188	extr
common goldeneye		0		extr	65	extr	extr	16	extr		0			0	
red-breasted merganser	extr	99	extr	extr	94	extr	extr	4	extr	extr	15	extr	146	299	534
red-throated diver	314	505	813	105	195	360	81	161	320	extr	67	extr	278	464	774
black-throated diver		0			0			0			0			0	
great northern diver	extr	16	extr	123	280	575	extr	12	extr	extr	34	extr	extr	20	extr

	2003/04 15 February 2004			2004/05 6 March 2005			2005/06 30 Jan & 4 Feb 2006			2006/07 3 & 18 February 2007		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	1,459	2,513	4,328	780	1,287	2,124	605	1,599	3,042	380	1,622, (1,122 plus 500)	2,208
long tailed duck	3,763	6,155	10,069	816	2,279	4,377	963	1,678	2,924	283	1,095	2,442
common scoter	631	3,845	5,389	extr	3,022	extr	extr	1,264	extr	extr	1,839	extr
velvet scoter	extr	707	extr	extr	26	extr		0		extr	337	extr
common goldeneye	extr	197	extr	extr	69	extr	extr	41	extr		0	
red-breasted merganser	extr	58	extr	extr	35	extr	extr	16	extr		0	
red-throated diver	148	277	518	68	137	278	350	565	911	77	159	326
black-throated diver		0			0			0			0	
great northern diver	129	242	454	extr	22	extr	32	62	105	102	204	372

Table A2.5. Population estimates and confidence intervals from aerial survey data in the Scapa Flow area of search produced from Distance analysis.

	2002/03			2003/04			2004/05			2005/06			2005/06		
	12 December 2002			12 February 2004			07 March 2005			29 January 2006			22 February 2006		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
Undifferentiated common eider	327	721	1,591	1,666	2,555	3,918	1,160	1,659	3,285	884	1,335	2,351	390	1,097	1,226
long tailed duck	44	96	162	447	614	1,269	155	450	860	302	828	1,517	230	511	1,137
common scoter	extr	26	extr	extr	413	extr		0			0		extr	32	extr
common goldeneye		0			0			0			0		extr	38	extr
red-breasted merganser	extr	49	extr	46	123	227	extr	45	extr	extr	134	extr	extr	72	extr
red-throated diver		0		extr	8	extr	extr	32	extr	extr	7	extr	extr	20	extr
great northern diver	extr	40	extr	142	269	536	74	165	245	135	275	462	62	121	195

Table A2.6. Population estimates and confidence intervals from aerial survey data in the North Orkney area of search produced from Distance analysis.

	2005/06			2005/06			2006/07			2007/08		
	29 January 2006			22 February 2006			18 February 2007			15 March 2008		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
Undifferentiated common eider		544 ^a			279 ^a		722	1,890	3,548	420	1,174	1,994
long tailed duck		541 ^a		63	174	478	397	1,018	1,620	219	920	1,624
common scoter		0		extr	8 ^b	extr	extr	133 ^b	extr		0	
common goldeneye		0		extr	3 ^b	extr		0			0	
red-breasted merganser	extr	87 ^b	extr	extr	19 ^b	extr	extr	149 ^b	extr	extr	72 ^b	extr
red-throated diver	extr	7 ^b	extr		0		extr	46 ^b	extr		0	
great northern diver	29	87	178	22	85	203	247	415	538	43	111	182

^a no confidence interval available for this number. To improve the model fit for these estimates, big flocks were excluded from the distance calculations and the model was fitted without them. The excluded flocks were then added again to the model output to obtain a population estimate for the area. While the model output has got confidence intervals, the final population estimate has not.

^b the sample sizes were too small for obtaining distance estimates.

Table A2.7. Population estimates and confidence intervals from aerial survey data in the West Shetland area of search produced from Distance analysis.

	2007/08			2008/09			2008/09			2009/10		
	13 February 2008			10 February 2009			20 March 2009			10 February 2010		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider ssp. <i>faeroensis</i>	252	679	1828	170	341	684	22	83	319	77	241	472
long tailed duck	3	17	99	2	27	305		0		8	24	65
red-breasted merganser		0		3	12	50	1	8	47	14	97	692
great northern diver	7	21	67	32	63	124	3	12	51	16	35	79

Table A2.8. Population estimates and confidence intervals from aerial survey data in the East Shetland area of search produced from Distance analysis.

	2007/08			2007/08			2008/09			2008/09			2009/10		
	13 February 2008			26 March 2008			09 February 2009			20 March 2009			10 February 2010		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider ssp. <i>faeroensis</i>	59	146	358	51	110	238	101	318	997	64	228	494	20	47	115
long tailed duck	82	226	623	32	72	165	1	8	43	3	17	101	86	183	390
common goldeneye	-	0	-	-	0	-	2	23	215	-	0	-	-	0	-
red-breasted merganser	-	0	-	5	19	70	16	50	159	2	30	364	7	39	230
red-throated diver	-	0	-	2	8	27	1	4	23	-	0	-	-	0	-
great northern diver	26	49	90	130	218	316	93	171	313	90	151	248	112	212	324

Table A2.9. Population estimates and confidence intervals from aerial survey data in the Unst area of search produced from Distance analysis.

	2007/08			2008/09			2008/09		
	26 March 2008			09 February 2009			19 March 2009		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider ssp. <i>faeroensis</i>		0		6	40	252		0	
long tailed duck		0		4	24	159		0	
red-breasted merganser		0		2	12	76		0	
red-throated diver		0			0		1	4	26
great northern diver	3	12	54	4	16	70	1	4	26

Table A2. 10. Population estimates and confidence intervals from aerial survey data in the Wester Ross area of search produced from Distance analysis.

	2007/08			2007/08			2008/09			2008/09		
	21 & 20 January 2008			16 March 2008			02 & 01 February 2009			21 March 2009		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	37	106	302	51	136	361	43	103	244	29	111	285
long tailed duck	11	47	210	3	19	104	2	9	47			
common goldeneye					0		1	3	14			
red-breasted merganser	27	74	203	19	47	117	9	26	74	4	23	125
red-throated diver					0					2	9	48
black-throated diver				1	5	25		0				
great northern diver	63	116	178	23	47	96	65	111	169	71	144	293

Table A2.11. Population estimates and confidence intervals from aerial survey data in the Broad Bay area of search produced from Distance analysis.

	2008/09			2008/09			2009/10		
	01 February 2009			20 March 2009			11 February 2010		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
eider		0		12	73	438	24	188	677
long tailed duck		0		1	15	166	6	50	402
common scoter		0		4	77	1,483		0	
red-throated diver	0	4	68	5	81	1,346		0	
great northern diver	1	7	40	33	77	184	162	243	363

Table A2.12. Population estimates and confidence intervals from aerial survey data in the Outer Hebrides area of search produced from Distance analysis.

	2002/03			2003/04			2004/05			2005/06		
	18 March 2003			17 February 2004			07 & 08 March 2005			28 & 31 January 2006		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	2,292	4,064	5,947	5,559	8,927	14,335	2,166	4,504	7,255	3,094	4,822	7,513
long tailed duck	110	1,018	2,371	531	1,118	4,751	420	859	1,758	155	574	1049
common scoter	0	0	0	0	0	0	0	0	0	0	0	0
red-breasted merganser	4	154	389	1	409	1,042	7	66	155	31	130	250
red-throated diver	0	0	0	43	101	171	0	0	0	0	0	0
great northern diver	446	717	1,032	2,307	3,093	4,145	284	432	606	840	1,290	1,911

	2006/07		
	25 & 26 March 2007		
	LCL	Estimate	UCL
common eider	3,102	4,751	7,278
long tailed duck	110	643	1508
common scoter	7	107	317
red-breasted merganser	3	243	667
red-throated diver	0	0	0
great northern diver	841	1,467	1,911

Table A2.13. Population estimates and confidence intervals from aerial survey data in the Coll and Tiree area of search produced from Distance analysis.

	2003/04			2004/05			2005/06			2005/06			2006/07			2007/08		
	18 February 2004			26 March 2005			10 & 18 February 2006			21 March 2006			24 March 2007			17 March 2008		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup	-	0	-	-	0	-	-	0	-	extr.	60	extr.	-	0	-	-	0	-
common eider	1,642	3,029	5,587	337	730	1,347	609	1,334	2,422	254	597	1,172	670	1,092	1,778	432	1,232	2,717
long tailed duck	extr.	428	extr.	extr.	71	extr.	0	0		extr.	40	extr.	-	0	-	-	0	-
red-breasted merganser	extr.	101	extr.	extr.	34	extr.	extr.	64	extr.	extr.	15	extr.	-	0	-	extr.	8	extr.
red-throated diver	-	0	-	extr.	16	extr.	-	0	-	extr.	10	extr.	-	0	-	extr.	8	extr.
great northern diver	939	1,273	1,727	325	560	854	96	202	343	101	175	274	140	253	458	95	193	289

Table A2.14. Population estimates and confidence intervals from aerial survey data in the Mull area of search produced from Distance analysis.

	2003/04			2004/05			2005/06			2005/06			2006/07		
	18 February 2004			25 March 2005			09 February 2006			20 & 21 March 2006			23 March 2007		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
common eider	24	69	205	96	246	633	7	24	82	39	116	345	12	39	132
long tailed duck	41	112	307	1	8	24	0	0	0	0	0	0	0	0	0
red-breasted merganser	0	0	0	1	4	23	0	0	0	7	38	211	13	43	145
red-throated diver	0	0	0	1	8	44	0	0	0	0	0	0	0	0	0
great northern diver	21	58	161	47	95	103	9	24	63	2	10	55	21	43	89

Table A2.15. Population estimates and confidence intervals from aerial survey data in the Loch Indaal area of search produced from Distance analysis.

	2007/08 11 February 2008			2008/09 02 February 2009			2008/09 21 March 2009		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup	216	2,392	5,494	0	0	0	16	89	500
eider	28	87	395	46	144	458	69	289	1,206
common scoter		0			0			0	
red-breasted merganser	0	0	0	13	83	535	18	63	224
great northern diver	38	59	239	14	46	158	29	53	98

Table A2.16. Population estimates and confidence intervals from aerial survey data in the Sound of Gigha area of search produced from Distance analysis.

	2004/05 09 March 2005			2005/06 12 December 2005			2005/06 18 & 20 March 2006			2006/07 23 March 2007			2007/08 11 February 2008		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
eider	619	1,054	1,573	985	1,658	2,794	490	1,072	2,128	454	907	1,485	912	1,737	3,237
long tailed duck	3	16	85	83	205	381	3	12	49	5	18	6	19	51	135
common scoter	0	0	0	0	0	0	26	90	307	3	17	90	0	0	0
velvet scoter	0	0	0	0	0	0	0	0	0	0	0	0	5	22	91
common goldeneye	0	0	0	2	8	43	1	8	42	0	0	0	15	116	80
red-breasted merganser	0	70	0	69	219	698	26	90	313	17	57	190	32	137	589
great northern diver	325	475	708	325	505	716	123	186	322	341	460	621	383	717	1,192

Table A2.17. Population estimates and confidence intervals from aerial survey data in the Firth of Clyde area of search produced from Distance analysis.

	2005/06			2005/06			2006/07			2006/07			2007/08		
	01 February 2006			19 March 2006			23 & 25 January 2007			27 March 2007			19 December 2007		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup	0	0	0	8	43	239	162	0	4,891	0	0	0	0	0	0
eider	179	397	756	1,121	1,867	3,108	1,314	2,444	4,546	1,945	3,943	7,995	611	1,566	3,665
long tailed duck	11	32	89	2	13	70	11	31	82	8	33	140	31	95	288
common scoter	0	0	0	7	37	206	40	0	679	0	0	0	0	0	0
velvet scoter	0	0	0	0	9	29	0	0	0	0	0	0	0	0	0
red-breasted merganser	0	0	0	0	0	0	16	61	240	21	71	249	52	111	239
red-throated diver	3	9	32	112	238	507	91	279	529	112	203	369	63	182	356
great northern diver	0	2	12	17	39	88	24	50	105	17	38	85	0	0	0

Table A2.18. Population estimates and confidence intervals from aerial survey data in the Loch Ryan area of search produced from Distance analysis.

	2005/06			2005/06			2006/07			2006/07		
	02 January 2006			19 March 2006			23 & 25 January 2007			27 March 2007		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup	36	576	9,322	31	251	2,008	151	729	3,527	12	135	55,269
eider	328	551	926	165	177	199	490	582	774	255	386	459
long tailed duck	0	0	0	0	0	0	6	6	2,084	4	27	111,475
common scoter	2	14	9,909,609	2	21	6,654,753	5	135	3,548	2	34	92
common goldeneye	0	0	0	1	3	1,099,805	2	13	0	0	0	0
red-breasted merganser	1	14	11,526	3	63	1,420	11	41	158	4	27	6,889,280
red-throated diver	1	7	0	1	3	1,099,805	2	53	1,778	26	78	230
great northern diver	0	0	0	2	7	20,530	0	6	0	0	0	0

Table A2.19. Population estimates and confidence intervals from aerial survey data in the Luce Bay area of search produced from Distance analysis.

	2005/06 01 February 2006			2005/06 18 March 2006			2006/07 22 & 23 January 2007			2006/07 26 March 2007			2007/08 18 March 2008		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
eider	118	668	3,764	1	4	24	18	57	180	28	112	450	90	328	1,200
long tailed duck	6	35	193	2	9	48	8	39	187	163	0	815	0	0	0
common scoter	155	744	1,573	2	554	30	47	161	556	2	364	51	483	1,336	2,428
velvet scoter	0	0	0	2	9	30	0	0	0	2	9	51	0	0	0
common goldeneye	0	0	0	0	0	0	0	0	0	11	63	352	0	0	0
red-breasted merganser	0	0	0	0	0	0	1	4	24	3	18	101	25	82	269
red-throated diver	12	26	56	2	9	31	2	9	32	109	214	421	73	186	470
great northern diver	50	140	244	60	134	227	37	78	166	81	162	277	132	309	502

Table A2.20. Population estimates and confidence intervals from aerial survey data in the Solway Firth area of search produced from Distance analysis.

	2001/02 05 November 2001			2001/02 11 December 2001			2001/02 13 March 2002			2004/05 10 November 2004		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup		0		6	244	1190		0			0	
common eider				2	13	84						
common scoter	132	972	1679	95	1536	2278	355	751	1071	110	429	952
red-breasted merganser				0	3	15	0	3	14		0	
red-throated diver	2	9	38	377	602	825	55	110	172	223	444	703
great northern diver				1	5	19						
cormorant					39						6	

An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland

	2004/05 28 November 2004			2004/05 22 January 2005			2004/05 16 February 2005			2005/06 08 November 2005		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup		0			0			0		5	40	293
common eider				1	9	55	5	30	175		0	
common scoter	619	1271	2074	160	1069	1202	531	1287	1905	756	1719	2225
red-breasted merganser										1	8	48
red-throated diver	114	261	450	36	109	211	70	164	383	401	575	763
great northern diver	1	4	26									
cormorant					545			92			89	

	2005/06 13 December 2005			2005/06 02 February 2006			2005/06 20 February 2006		
	LCL	Estimate	UCL	LCL	Estimate	UCL	LCL	Estimate	UCL
greater scaup	1	4	25		0			0	
common eider		0			0			0	
common scoter	105	788	1558	886	1545	2694	706	1953	2969
red-breasted merganser	2	9	47	2	9	46			
red-throated diver	110	218	435	94	171	311	95	185	358
great northern diver							1	4	23
cormorant									