



**Cyfoeth  
Naturiol**  
Cymru  
**Natural  
Resources**  
Wales

## **NORTHERN CARDIGAN BAY / GOGLEDD BAE CEREDIGION**

### **Draft Special Protection Area**

#### **Advice to the Welsh Government**

#### **NATURAL RESOURCES WALES**

**June 2015**

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## Crynodeb

Mae'r ddogfen hon yn cynnwys argymhellion Cyfoeth Naturiol Cymru i Lywodraeth Cymru ynglŷn â chynigion i ddsbarthu Northern Cardigan Bay / Gogledd Bae Ceredigion yn Ardal Gwarchodaeth Arbennig (AGA) o dan Gyfarwyddeb Adar yr UE (2009/147/EC). Mae'r argymhellion hyn wedi'u bwriadu i helpu i gyflawni rhwymedigaethau'r Deyrnas Unedig o dan Erthygl 4 o'r Gyfarwyddeb, sy'n ei gwneud yn ofynnol i Aelod Wladwriaethau ddsbarthu fel AGA y tiriogaethau mwyaf addas ar dir a môr i rywogaethau adar a restrir yn Atodiad 1 at y Gyfarwyddeb ac i rywogaethau mudol a welir yn rheolaidd. Mae'r canllawiau ar ddethol safleoedd yn AGA yn y Deyrnas Unedig wedi'u nodi yng nghanllawiau dethol AGA y Deyrnas Unedig a gyhoeddwyd gan y Cydbwyllgor Cadwraeth Natur.

Fel rhan o'r gwaith hwn, nododd y Cydbwyllgor Cadwraeth Natur oddeutu 50 o Ardaloedd Chwilio o amgylch y Deyrnas Unedig a chynhaliodd arolygon ym mhob un ohonynt i nodi safleoedd a allai ddal niferoedd pwysig o adar dŵr y glannau yn ystod y tymor pan nad ydynt yn bridio. Roedd Bae Ceredigion yn un o'r rhain.

*Diddordeb cymhwys*

Fel sy'n ofynnol yn ôl Erthygl 4 o'r Gyfarwyddeb Adar, diben AGA yw ei gwneud yn bosibl rhoi mesurau cadwraeth arbennig ar waith yn ymwneud â chynefin(oedd) rhywogaethau Atodiad 1 a/neu rywogaethau mudol a welir yn rheolaidd (ar wahân i'r rhai sydd wedi'u rhestru yn Atodiad 1) i sicrhau eu bod yn goroesi ac atgenhedlu yn eu hardal ddsbarthiad.

Mae AGA ddrafft Northern Cardigan Bay / Gogledd Bae Ceredigion yn cymhwyso o dan Erthygl 4.1 o'r Gyfarwyddeb Adar gan ei bod yn rheolaidd yn cynnal mwy nag 1% o boblogaeth Prydain Fawr o'r trochydd gyddfgoch *Gavia stellata* – gweler Tabl 1. Felly, mae'r safle hwn yn gymwys i'w ddynodi'n AGA yn unol â Cham 1.1 o ganllawiau dethol AGA y Deyrnas Unedig (y Cydbwyllgor Cadwraeth Natur 1999).

### *Ffiniau'r safle*

Mae'r Cydbwyllgor Cadwraeth Natur wedi bod yn gweithio dros y degawd diwethaf ar ran holl Gyrrff Cadwraeth Natur Statudol y Deyrnas Unedig i gwblhau rhaglen casglu a dadansoddi data er mwyn nodi cyfres o ardaloedd pwysig i adar môr yn nyfroedd y Deyrnas Unedig.

Roedd proses bedwar cam er mwyn nodi safleoedd, sef: 1) dadansoddi data arolwg o'r awyr a gasglwyd rhwng 2001/02 a 2003/04, 2) Amcangyfrif Dwysedd Cnewyll i greu map wyneb dwysedd, 3) dadansoddiad crymedd mwyaf i nodi dwysedd trothwy, a 4) crynodiadau wedi'u profi yn erbyn canllawiau dethol AGA y Deyrnas Unedig. Cyflwynwyd y gwaith hwn gan y Cydbwyllgor Cadwraeth Natur (O'Brien *et al.* 2010) a dangosai fod crynodiadau'r trochydd gyddfgoch yn AGA ddrafft Northern Cardigan Bay / Gogledd Bae Ceredigion yn bodloni canllawiau dethol AGA y Deyrnas Unedig (y Cydbwyllgor Cadwraeth Natur 1999).

**Tabl 1.** Crynodeb o'r diddordeb adaregol cymhwyso yn AGA ddrafft Northern Cardigan Bay / Gogledd Bae Ceredigion.

Rhywogaeth	Cyfrif (cyfnod)	% o'r boblogaeth berthnasol	Math o ddiddordeb
Trochydd gyddfgoch <i>Gavia stellata</i>	1,186 unigolyn – gaeafu (2001/02 – 2003/04) <sup>1</sup>	7% o boblogaeth Prydain Fawr	Atodiad I

## Summary

This document contains Natural Resources Wales' recommendation to the Welsh Government regarding proposals to classify Northern Cardigan Bay / Gogledd Bae Ceredigion as a Special Protection Area (SPA) under the EU Birds Directive (2009/147/EC). These recommendations are intended to support the delivery of the UK's obligations under Article 4 of the Directive, which requires Member States to classify as SPAs the most suitable territories on land and at sea for bird species listed in Annex 1 of the Directive and for regularly occurring migratory species. The guidelines for the selection of sites as SPAs in the UK are set out in the SPA selection guidelines published by the JNCC.

As part of this work, JNCC identified approximately 50 Areas of Search around the UK and conducted surveys in all of them to identify sites that might hold important numbers of inshore waterbirds during the non-breeding season, one of which was Cardigan Bay.

<sup>1</sup> 1 Data o O'Brien *et al.* (2010) wedi'i seilio ar boblogaeth aeafu AGA ddrafft Northern Cardigan Bay / Gogledd Bae Ceredigion. Roedd y ffigur hwn yn cynnwys cyfrifon arolwg a labelwyd fel 'trochyddion anhysbys'; y rheswm am hynny yw nad oedd unrhyw rywogaeth arall o drochydd yn cael ei chofnodi'n rheolaidd. Gwnaed y rhagdybiaeth hon mewn manau eraill (mewn perthynas â Bae Lerpwl a moryd Tafwys Allanol (Webb *et al.* 2004, O'Brien *et al.* 2015)) lle'r oedd nifer fawr o drochyddion yr arsylwyd arnynt heb gael eu hadnabod yn ôl rhywogaeth ond lle'r oedd cofnodion o rywogaethau eraill ar wahân i'r trochydd gyddfgoch yn brin iawn.

### Qualifying Interest

As required by Article 4 of the Birds Directive, the purpose of SPAs is to enable the application of special conservation measures concerning the habitat(s) of Annex 1 species and/or regularly occurring migratory species (other than those listed in Annex 1) in order to ensure their survival and reproduction in their area of distribution.

Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA qualifies under Article 4.1 of the Birds Directive by regularly supporting more than 1% of the GB population of red-throated diver *Gavia stellata* see Table 1. Therefore, this site qualifies for SPA designation in accordance with Stage 1.1 of the UK SPA selection guidelines (JNCC 1999).

### Site boundary

JNCC has been working over the past decade on behalf of all the UK Statutory Nature Conservation Bodies (SNCBs) to complete a programme of data collection and analyses to identify a suite of important areas for seabirds within UK waters. Site identification involved a four-step process of: 1) analysis of aerial survey data collected from 2001/02 to 2003/04, 2) Kernel Density Estimation to create a density surface map, 3) maximum curvature analysis to identify a threshold density, and 4) concentrations tested against UK SPA selection guidelines. This work was presented by JNCC (O'Brien *et al.* 2010) and identified that the concentrations of red-throated diver in Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA meet the UK SPA selection guidelines (JNCC 1999).

**Table 1.** Summary of qualifying ornithological interest in Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA.

Species	Count (period)	% of subspecies or population	Interest type
Red-throated diver <i>Gavia stellata</i>	1,186 individuals – wintering (2001/02 – 2003/04) <sup>2</sup>	7% GB	Annex I

## 1 Introduction and background

The UK is of outstanding international importance for waterbirds, because it lies on some of the major flyways for Arctic-nesting species. A large number of waterbirds are attracted to inshore areas of Wales due to the relatively mild climate and extensive estuarine areas. Wales holds internationally important numbers of wintering red-throated divers.

As part of the UK's obligation to identify important marine areas for birds, an analysis of seabirds in UK waters was undertaken. The Joint Nature Conservation Committee (JNCC) identified important wintering concentrations and breeding aggregations of seabirds and waterbirds in the marine environment (Kober *et al.* 2010). In order to facilitate analysis across differing ecologies, survey and analysis was conducted under four themes in order to capture the most important seasons for the relevant Annex 1 and regularly occurring migratory species. These were, 1) Marine extensions to existing seabird breeding colonies

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<sup>2</sup> Data from O'Brien *et al.* (2010) based on the wintering population for the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA. This figure included survey counts labelled as 'unidentified divers', this was due to no other diver species being regularly recorded. This assumption was made elsewhere (in relation to Liverpool Bay and the Outer Thames estuary (Webb *et al.* 2004, O'Brien *et al.* 2015)) where a large number of diver observations were not identified to species but where records of other species besides red-throated diver were very rare.

on the coast, 2) inshore aggregations of non-breeding waterbirds, 3) inshore and offshore seabird aggregations occurring at any time of year and 4) Other types of marine SPA.

JNCC has determined a protocol whereby data describing the distribution of red-throated divers can be analysed and a boundary drawn that represents the optimal solution between including significant aggregations of the species while avoiding the inclusion of areas which appear to be of relatively lesser importance (see section 3.5).

## 1.1 The legal framework

The EU Birds Directive (2009/147/EEC<sup>3</sup>) provides a legislative framework for the protection, management and control of naturally occurring wild birds of EU Member States. Article 4 of the Birds Directive requires Member States to classify the 'most suitable territories in number and size' as Special Protection Areas for the conservation of species listed in Annex I to the Directive, and to take similar measures for 'regularly occurring migratory species'. The classification of SPAs is to take into account the species' protection requirements in the geographical sea and land area where the Directive applies. According to case law of the European Court of Justice, the selection of areas as SPAs and the determination of their boundaries should not take account of social or economic considerations, but reflect only ornithological information.

SPAs in Wales (including Welsh territorial waters) are classified by the Welsh Ministers under section 2 of the European Communities Act 1972. Decisions to classify SPAs in England and Wales must be preceded by consultation, in accordance with Regulation 12B of the Conservation of Habitats and Species Regulations 2010, as substituted.

Once classified, SPAs become 'European sites' or 'European marine sites' under the 2010 Conservation Regulations. From that point they are subject to the provisions of the Regulations and Articles 6(2) to 6(4) of the Habitats and Species Directive<sup>2</sup>. According to Welsh Government policy, potential SPAs (that is proposed SPAs that are the subject of consultation prior to a decision on whether to formally classify them) should have the same degree of protection as classified SPAs.

Once sites have been formally proposed to Ministers by the SNCBs and until such time as proposed sites are approved by Ministers for formal consultation and become potential SPAs (pSPA), they are normally referred to as **draft SPAs**.

## 1.2 Inshore aggregations of non-breeding waterbirds

The Review of the UK SPA network (Stroud *et al.* 2001) did not consider marine SPAs, other than in relation to coastal and estuarine sites designated on the basis of their breeding seabird and wintering waterbird interests. Accordingly, the JNCC, on behalf of the UK conservation agencies, considered the requirements of four types of marine SPAs: 1. Marine extensions to existing seabird colony SPAs (McSorley *et al.* 2006)

2. Inshore areas used by waterbirds (e.g. seaduck, divers and grebes) outside the breeding season.
3. Inshore and offshore areas used by seabirds for feeding and other activities throughout the year (Kober *et al.* 2010, Kober *et al.* 2012); and

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<sup>3</sup> Formerly 79/409/EEC 2  
92/43/EEC

4. Other types of marine SPA not covered by the above types, e.g. foraging areas for breeding terns, wintering areas for Balearic shearwater *Puffinus mauretanicus* and feeding areas for breeding red-throated diver *Gavia stellata*.

The proposals in this document are based only on outputs of work carried out under (2) above.

## 2 Location and Habitats

Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA, as the name suggests occupies the northern half of Cardigan Bay on the west coast of Wales.

Several rivers flow into the northern part of Cardigan Bay including the Dwyfach, Glaslyn/Dwryd, Wnion, Dysynni, Leri, Mawddach and Dyfi. The coastline is dominated by rocky cliffs and shores with occasional sandy beaches and estuaries. Where estuaries flow into northern Cardigan Bay, the sea quickly becomes more than 20 metres deep, but elsewhere remains shallow (less than 10 m deep) for up to 20 km offshore. These shallow areas are sub-tidal shingle reefs, known as the sarnau. All three of the sarnau lie roughly north-east to south-west and are presumed to be formed from glacial deposits left at the end of the last ice age. Sarn Badrig is the largest and most northerly sarn, running parallel with the Llŷn Peninsula from Harlech up to 24 km offshore. Sarn y Bwlch is the smallest sarn, starting from near Tywyn. Sarn Cynfelyn, the most southerly sarn, starts from north of Aberystwyth. These shallow reefs are important ecological habitats within the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA and are important features of the Pen Llŷn a'r Sarnau Special Area of Conservation (SAC), designated under the EC Habitats and Species Directive.

The two tidal streams that enter the Irish Sea, from the north near the Isle of Man and the south through the St George's Channel, meet in the vicinity of Cardigan Bay resulting in weak tidal currents in the area. The tidal range in the bay is up to 4m at a spring tide.

## 4 Assessment of ornithological interest

### 3.1 Site status and boundary

The Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA has been identified by Natural Resources Wales (NRW) as potentially qualifying as a SPA, based on data collected from aerial surveys during the winters of 2000/01 to 2003/04 and analysed by JNCC Seabirds Team. These data demonstrate that the area regularly supports wintering redthroated diver in numbers of European importance, as defined in the UK SPA selection guidelines (JNCC 1999), namely more than 1% of the GB population.

Article 4 of the Birds Directive (2009/147/EC) requires Member States to classify the most suitable territories for species listed in Annex I of the Directive (Article 4.1) and regularly occurring migratory species (Article 4.2) in the geographical sea and land area to which the Directive applies. The boundary of the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA has been proposed using the analyses of aerial survey data carried out by JNCC Seabirds Team. The draft SPA is a geographically contiguous area stretching from near Criccieth in the north southwards to near Aberystwyth.

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<sup>4</sup> Convention of Migratory Species 1999) [http://www.cms.int/species/aewa/aew\\_ap.htm](http://www.cms.int/species/aewa/aew_ap.htm),

## 3.2 Target species

The target species for aerial surveys carried out by JNCC Seabirds Team were those inshore waterbirds that: 1) spend the winter period within coastal areas of the UK and are listed in Table 1 of the African-Eurasian Waterbird Agreement Action Plan<sup>3</sup> and 2) are listed in Annex I of the EC Birds Directive (2009/147/EC), or are migratory species that occur regularly in the UK. On this basis, red-throated diver were a target species for the surveys.

## 3.3 Red-throated diver

### 3.3.1 Population status and range

Although not regarded as threatened within the EU, the conservation status of this species is regarded as unfavourable because of declines in the European breeding populations between 1970-1990. The population is now considered stable though depleted.

The Great Britain population of wintering red-throated diver was previously estimated to be c.4,850 birds (Danielsen *et al.* 1993). A more recent estimate has been derived using a combination of shore-based observations and aerial and boat surveys. Such surveys from boats and planes have been responsible for identifying much larger numbers wintering in British coastal waters than previously known. The GB wintering population is now estimated to be around 17,000 individuals (O'Brien *et al.* 2008) representing about 0.5-4.9% of the NW Europe non-breeding population (Wetlands International, 2002).

In Great Britain, wintering red-throated divers are associated with inshore waters, often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used (Skov *et al.*, 1995; Stone *et al.*, 1995). The GB wintering population is aggregated in substantial numbers in several areas including the Moray Firth and south western North Sea, with almost 50% of the North Sea population in the Outer Thames Estuary. Ring recoveries suggest that birds wintering in Great Britain are largely birds which breed in the UK, Greenland, Iceland and Scandinavia (O'Brien *et al.* 2008). Wintering red-throated divers start to arrive in UK coastal waters from September, with numbers peaking during the winter and declining in Welsh waters from late February.

### 3.3.2 Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA population size and density

Based on aerial survey data, the population of red-throated divers of Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA is estimated as 1,186 birds (O'Brien *et al.* 2010). This figure includes survey counts labelled as 'unidentified divers', this was due to no other diver species being regularly recorded. A similar assumption was made elsewhere (in relation to Liverpool Bay (Webb *et al.* 2004) the Outer Thames estuary (O'Brien *et al.* 2015)) where a large number of diver observations were not identified to particular species but where records of diver species other than red-throated diver are very rare.

Densities of wintering red-throated divers range between 0.01 birds/km<sup>2</sup> at the edges of the site up to 2.75 birds/km<sup>2</sup> in the core areas. As a result of the relatively high abundance of red-throated diver in Cardigan Bay, the approach to boundary setting (explained further in section 3.5 below) resulted in the density threshold used to draw the boundary at this site (0.53 birds per km<sup>2</sup>) being high compared to that used for Liverpool Bay, the only other SPA on the west coast of Great Britain designated for red-throated diver (at 0.21 birds per km<sup>2</sup>). For comparison, the Outer Thames Estuary density threshold was 0.62 bird's km<sup>2</sup>.

### 3.3.3 History of occupancy

Although full aerial surveys have only been carried out in recent years, significant numbers of red-throated divers have been recorded from vantage points along Cardigan Bay since at least the early 1990s (Lovegrove *et al.* 1994).

### 3.4 Survey information

The data used in the analysis originate from one strip transect aerial survey (carried out in 2000/01 by JNCC) and six line transect aerial surveys (carried out from 2001/02 to 2003/04 by the Wildfowl and Wetlands Trust (WWT)). The surveys were conducted between 1 November and the 28 February to enable an assessment of the numbers and distribution of non-breeding waterbirds to be made. Two of the surveys were carried out on 28 October and 5 March but were considered appropriate to be included in the analysis for wintering waterbirds as the survey dates were considered sufficiently close the wintering period to be included. Apart from these two surveys, no data were collected during migration periods, or for aggregations of moulting birds (O'Brien *et al.* 2010).

Aerial surveys were carried out from an aircraft flown at 76m (250ft) above the sea, at a speed of 185 km per hour (100 knots). Transects were spaced 2km apart, with the exception of the first survey in January 2001, when transects were spaced 1km apart. Following Kahlert *et al.* (2000) a 2km distance between transects was chosen to maximise the detection of birds, or of flocks of birds located between transects, while minimising the risk of double counting. Observers recorded numbers of birds and time of observation from both sides of the aircraft. A Global Positioning System (GPS) continuously recorded the location of the aircraft. Data were collected to the nearest second of longitude and latitude. Full descriptions of the methods used are described in Dean *et al.* (2003), Dean *et al.* (2004) and O'Brien *et al.* (2010).

### 3.5 Method for boundary setting

In the absence of obvious fixed geographic features, identification of potential SPAs at sea relies primarily on defining areas on the basis of where the birds are distributed. The basic principle is that the areas where birds occur at the highest average densities or the greatest frequency, over a number of years, are likely to be the 'most suitable territories' as required by the Birds Directive. Where the spatial distribution of a species varies across a given area of sea, from its highest density down to zero birds, defining areas of 'high' density, for prospective inclusion within a proposed SPA boundary requires a density threshold to be defined. The key challenge in doing so is where there is no obvious 'cut off' between 'high' density areas and 'low' density areas, but where average density varies continuously across a given area.

The analysis for deriving areas where wintering red-throated diver are aggregated in Cardigan Bay, on which the seaward boundary of the draft SPA is based, followed six main steps:

- 1) The red-throated diver wintering population size, defined as the number of birds estimated to be using the total surveyed area of Cardigan Bay, was estimated for each of the aerial surveys. Figure 1a shows the survey area and the amount of survey effort. The population estimates were made using a technique called Distance Sampling, which accounts for the fact that the birds are harder to observe with increasing distance from the observer. Simply adding up the total number of all observed birds in a given survey, without correcting for the probability of missing birds that are further away, would underestimate the number of birds present in the survey area.

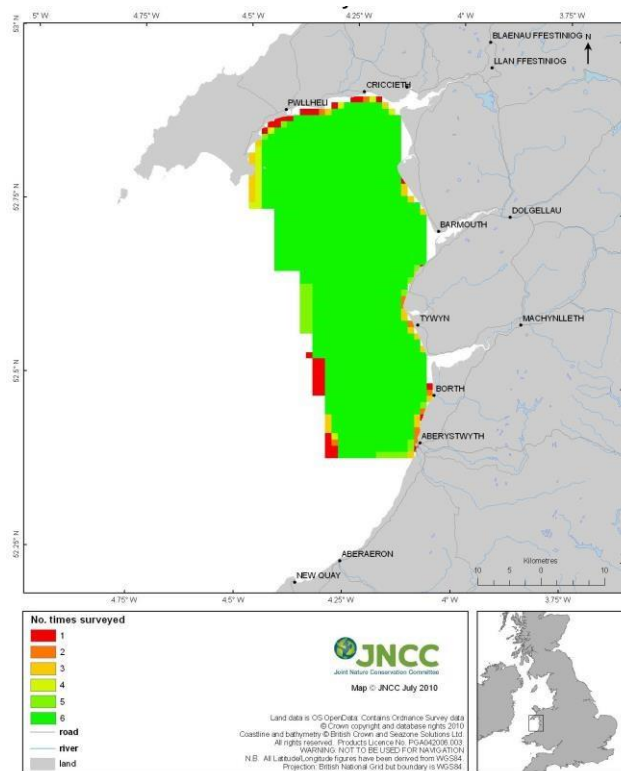


- 2) A 'minimum convex polygon' (MCP) was drawn around all raw observations of redthroated divers or unidentified divers from all surveys. The MCP was drawn to include the locations of all observations of divers within the smallest area possible while avoiding any concave sides to the polygon. (Figure 1b).
- 3) Taking the MCP as the area for further study, a map of modelled density of birds was produced from the data. The main challenge in producing a map showing the relative density of birds across the study area is that there are gaps in survey coverage, mainly due to the spacing of the aerial survey lines, which means that birds at some distance from the survey tracks may not have been observed (as mentioned in Step 1 above). Therefore, a statistical technique called Kernel Density Estimation (KDE) was used as a method to predict the likely occurrence of birds in areas between the survey tracks for which there were no observations, based on the distribution of actual observations. KDE enables a 'smoothed' map of estimated densities to be derived from point source data, and shown on a grid of defined cells (Silverman, 1986). The KDE used a grid of 1km x 1km cells to produce a modelled density map for each survey, showing the relative density of birds for each 1km x 1 km cell.
- 4) At this point, the density map from each survey shows relative density, that is, it shows which areas are higher and lower density than other areas, rather than the actual modelled density of birds. To give actual densities, the density map for each survey was scaled to the population estimate for that survey (as derived from Distance sampling in Step 1 above), so that the sum of all the 1km x 1km cells equalled the population estimate for that survey. Then, a single mean modelled density map for the area was created by calculating the average density across all surveys for each 1km x 1km grid cell. This is shown in Figure 1c.
- 5) While Figure 1c clearly shows how density varies across the study area, it does not provide a clear and objective basis for defining a boundary to include the high density areas, since this depends on what density threshold is taken as the cut off. A technique called 'Maximum curvature' was used to identify a threshold density. Maximum curvature is a way of defining the optimum trade-off between number of birds included and the area included. All grid cells within the MCP were ranked according to their mean density across all surveys (from Step 4). Starting with the highest density cell, cells are selected for inclusion in a draft SPA boundary in declining order of density. At first, because the analysis starts with the highest density cells, the number of birds selected increases rapidly compared to the increase in area selected. Then, as more lower density cells are added, the rate of increase in the number of birds starts to go down, while the area selected increases at the same rate (i.e. by 1 km<sup>2</sup> for each cell added). The point of maximum curvature is where the ratio of predicted bird numbers against the size of the area supporting that number of birds, changes the most rapidly (Webb *et al.* 2009). The density threshold identified by this method was at 0.53 birds per km<sup>2</sup>. All the cells above this predicted density were selected for inclusion. A boundary was then drawn to encompass these cells, with the following additional considerations applied:
  - a) The boundary was simplified by using straight lines (rather than to precisely follow the boundary of each 1km<sup>2</sup> cell, which would result in a complex 'jagged' boundary);
  - b) lines of latitude and longitude were used as much as possible without excluding selected cells or including large numbers of unselected cells;

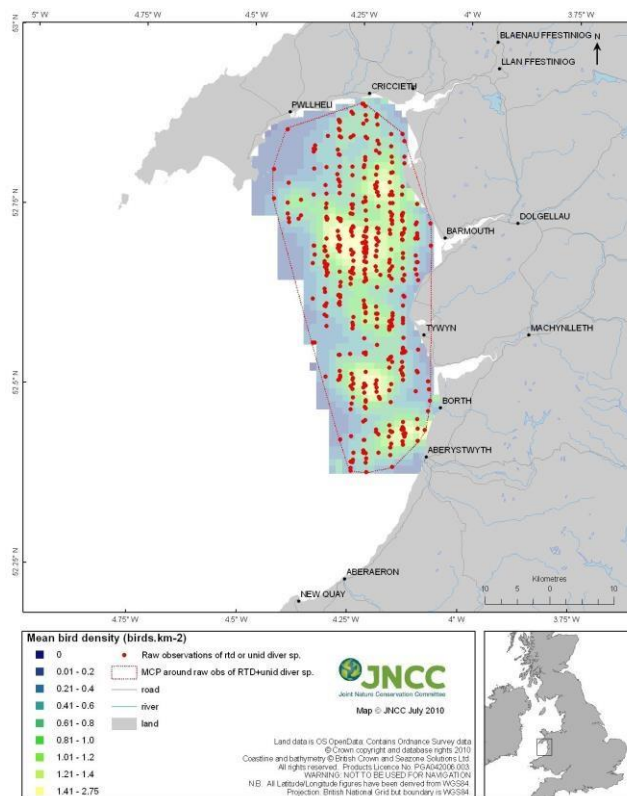
- c) the boundary was drawn so as to always be a minimum of 250m from any cell with a predicted density greater than the threshold density.

A possible boundary for Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA is shown in Figure 1d.

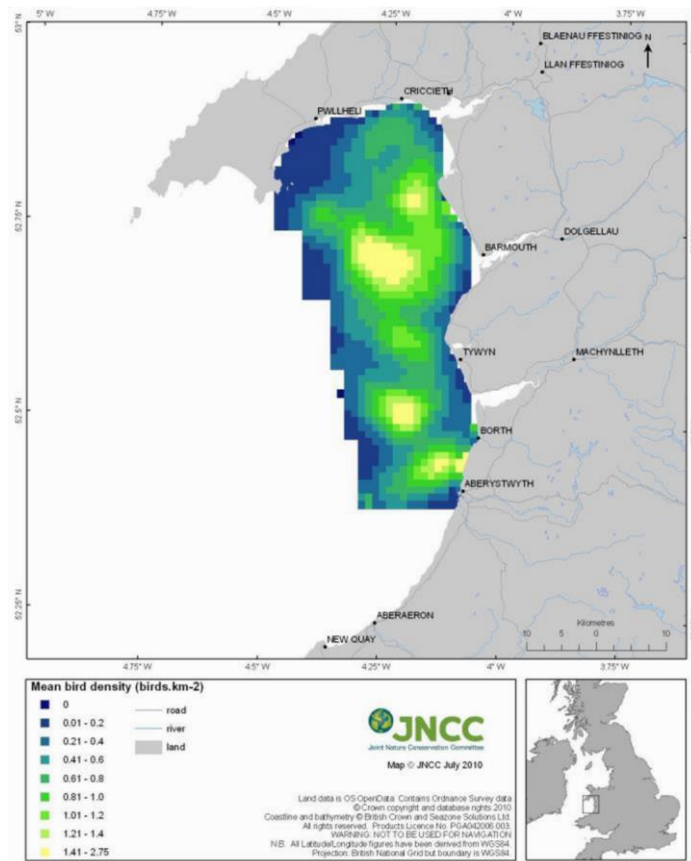
- 6) The peak estimate of numbers of red-throated diver within this boundary for each winter of the survey data was taken, and the mean of these peak estimates across all winters was calculated. This figure was taken as the number of birds considered to be regularly occurring within the boundary and was assessed against the UK SPA Selection Guidelines (see Table 2).



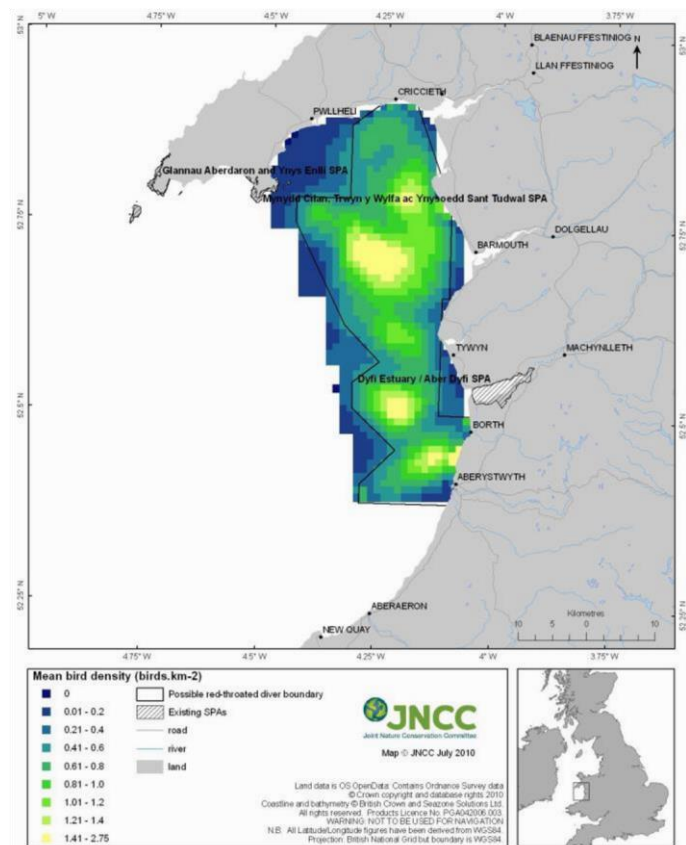
**Figure 1a.** Area surveyed, showing the number of surveys used to generate the estimated red-throated diver density surface.



**Figure 1b.** A minimum convex polygon (MCP) drawn around all raw observations of redthroated divers (including unidentified diver sp.).



**Figure 1c.** Mean estimated red-throated diver density surface generated by Kernel Density Estimation (KDE).



**Figure 1d.** A possible boundary fitted around red-throated diver aggregations

## 4. Assessments against the UK SPA selection guidelines

The SPA Selection Guidelines set out a two stage process for SPA identification in the UK (JNCC 1999). **Stage 1** identifies areas that are likely to qualify for SPA status based mainly on population size and regular usage (Table 2). **Stage 2** re-assesses the areas identified under Stage 1 to select from these the most suitable territories in number and size for SPA classification, based on ecological criteria (Table 3).

### Guidelines under Stage 1:

Stage 1.1. An area is used regularly by 1% or more of the GB (or if relevant the allIreland) population of a species listed in Annex 1 of the Birds Directive in any season.

Stage 1.2. An area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season.

Stage 1.3. An area is used regularly by an assemblage of over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) or 20,000 seabirds in any season.

Stage 1.4. Finally, where the application of stages 1.1-1.3 does not identify an adequate suite of most suitable sites for the conservation of that species, sites may be selected if they satisfy one or more of various ecological criteria listed under the Stage 2 guidelines in any season.

Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA qualifies under Stage 1 (1.1) because it regularly supports more than 1% of the GB population of wintering red-throated diver.

**Table 2.** Assessment of Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA against Stage 1 of the UK SPA selection guidelines.

Species	Season	Population size in Cardigan Bay	Relevant population threshold for qualification	Stage 1 guidelines
red-throated diver	wintering	1,186 <sup>1</sup>	170 <sup>2</sup>	1.1

<sup>1</sup> Based on the wintering red-throated diver population from O'Brien *et al.* (2010) for the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA. This figure included survey counts labelled as 'unidentified divers', this was due to no other diver species being regularly recorded. This assumption was made (in relation to Liverpool Bay and the Outer Thames estuary (Webb *et al.* 2004, O'Brien *et al.* 2015)) where a large number of diver observations were not identified to species but where records of other species besides red-throated diver were very rare.

<sup>2</sup> Based on 1% of GB wintering population of 17,000 birds (O'Brien *et al.* 2010; Musgrove *et al.* 2013).

### Guidelines under Stage 2:

**Stage 2.1.** Population size. Areas holding or supporting more birds than others and/or holding or supporting birds at higher concentrations are favoured for selection.

**Stage 2.2.** Species range. Areas selected for a given species provide as wide a geographic coverage across the species' range as possible.

**Stage 2.3.** Breeding success. Areas of higher breeding success than others are favoured for selection.

**Stage 2.4.** History of occupancy. Areas known to have a longer history of occupation or use by the relevant species are favoured for selection.

**Stage 2.5.** Multi-species areas. Areas holding or supporting the larger number of qualifying species under Article 4 of the Directive are favoured for selection.

**Stage 2.6.** Naturalness. Areas comprising natural or semi-natural habitat are favoured for selection over those which do not.

**Stage 2.7.** 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.

For species listed on Annex I of the Birds Directive, the appropriate population for comparison is the GB population see Musgrove *et al.* (2013) for wintering red-throated diver.

Webb & Reid (2004) considered definitions of regularity for inshore waterbird aggregations and suggested that the most appropriate definition to use is that of the Ramsar site selection criteria stated in The Convention on Wetlands (Criteria 5 & 6, Ramsar, 1971), where “*the requisite number of birds is known to have occurred in two thirds of the seasons for which adequate data are available*” and “*the mean of the maxima of those seasons in which the site is internationally important, taken over at least five years*”.

Under Stage 2 of the SPA selection guidelines, Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA meets most of the relevant Stage 2 guidelines, indicating the high value of the site (Table 3).

**Table 3.** Assessment of Northern Cardigan Bay / Gogledd Bae Ceredigion Bay draft SPA against Stage 2 of the UK SPA selection guidelines.

Feature	Qualification	Assessment
1. Population size & density	<b>Yes</b>	The site is one of the most important known wintering sites in the UK for red-throated diver (O'Brien <i>et al.</i> 2010).
2. Species range	<b>Yes</b>	The site is one of the main wintering areas on the west coast of Great Britain for red-throated diver. The nearest major concentration of red-throated diver is found in Liverpool Bay, which is the only other site on the West coast of GB classified as an SPA for wintering red-throated diver.
3. Breeding success	<b>No</b>	Not applicable as this site is selected only for its importance for birds in the non-breeding season.
4. History of occupancy	<b>Yes</b>	Although full aerial surveys have only been carried out in recent years, significant numbers of red-throated divers have been recorded from coastal locations in Cardigan Bay since at least the early 1990s (Lovegrove <i>et al.</i> 1994)

5. Multispecies area	<b>No</b>	Although many different bird species occur in the site, there is no evidence showing that the site supports internationally important numbers of any species other than red-throated diver.
6. Naturalness	<b>Yes</b>	Since it is entirely below mean low water mark, the site comprises natural habitat albeit locally modified by the effects of dredging, commercial fisheries and other human activities.
7. Severe weather refuge	<b>No</b>	No data are available to determine whether the site functions as a severe weather refuge.

## 5. Comparison with other sites in the UK

A comparison of Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA is made against other SPAs in the UK selected for wintering red-throated diver (Table 4).

**Table 4.** Comparison with other UK SPAs that support wintering red-throated diver.

Site	Individuals/count period	% of GB population <sup>5</sup>
Liverpool Bay SPA	922 (2001/02 – 2006/07) <sup>6</sup>	5.4%
Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA	1,186 (2000/01 – 2003/04) <sup>3</sup>	7%
Outer Thames SPA	6,466 (1989 – 2006/07) <sup>4</sup>	38%
Firth of Forth SPA	88 <sup>5</sup>	1.8%

<sup>1</sup> based on 1% of GB wintering population of 17,000 birds (O'Brien *et al.* 2010; Musgrove *et al.* 2013).

<sup>2</sup> Liverpool Bay / Bae Lerpwl Special Protection Area Advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended) Natural England Document.

<sup>3</sup> O'Brien *et al.* (2010)

<sup>4</sup> Danielsen *et al.* (1993)

<sup>5</sup> Stroud *et al.* (2001)

## 6. Recommendation

In light of the foregoing, Natural Resources Wales considers that the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA, as defined in Tables 5 and 6 and Figure 2, represents a 'most suitable territory' for the conservation of a species listed in Annex I of the Birds Directive, and satisfies the UK guidelines for identification of SPAs. The recommended boundary covers an area of 82,607 ha, all within Welsh territorial waters.

<sup>5</sup> 1 Article 4.1 species listed in Annex 1 of the Birds Directive

<sup>6</sup> Data from O'Brien *et al.* (2010) based on the wintering population for the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA, including the total for unidentified diver species (these were included as the site did not record any other diver species).

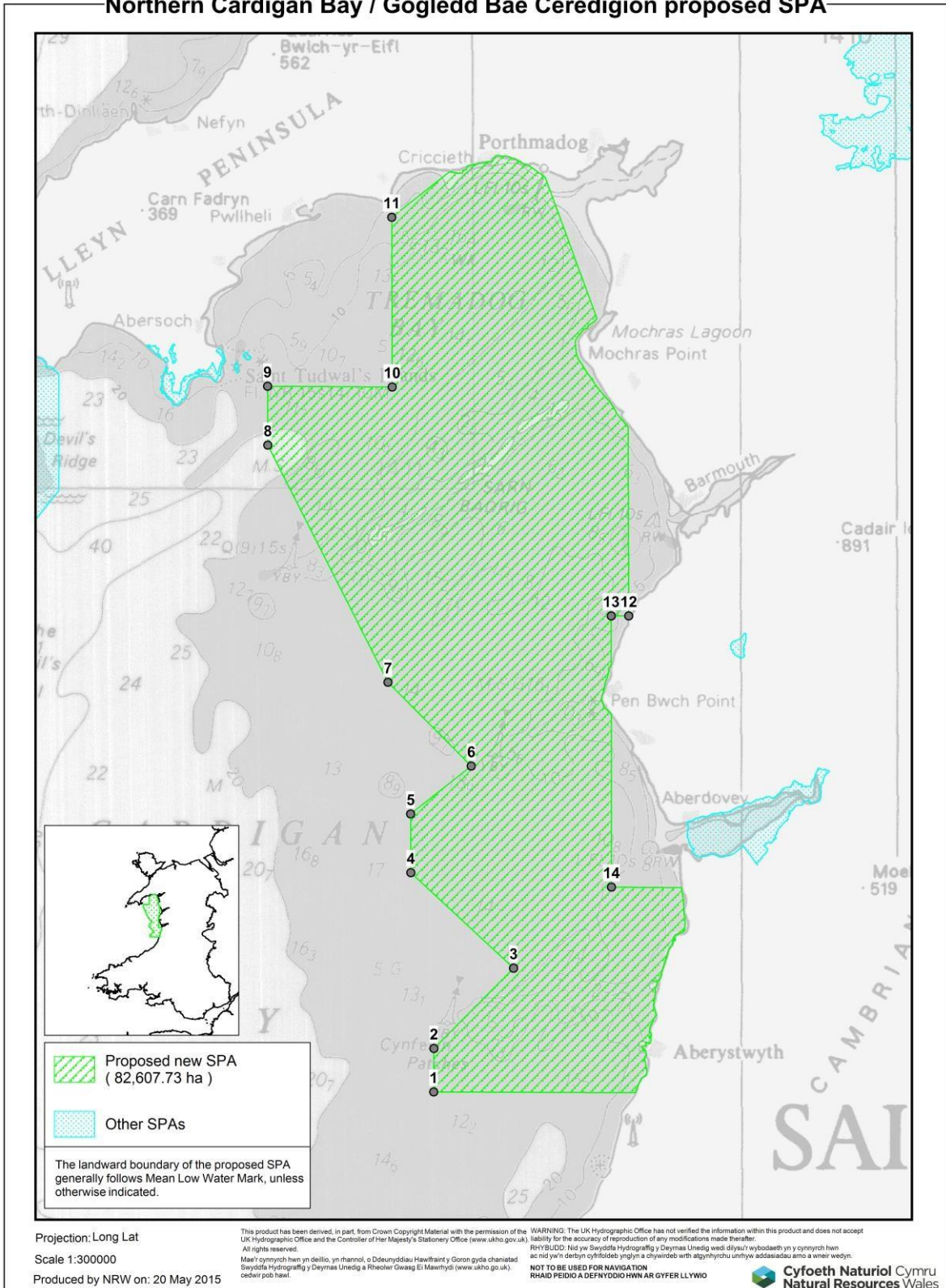
**Table 5.** Qualifying ornithological interest of Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA.

Species	Count (period)	% of subspecies or population	Interest type (relevant article of Birds Directive) <sup>1</sup>
red-throated diver <i>Gavia stellata</i>	1,186 individuals – wintering (2001/02 – 2003/04) <sup>2</sup>	7% GB	Annex I (4.1)

**Figure 2.** Recommended boundary for Northern Cardigan Bay / Gogledd Bae Ceredigion Bay draft SPA.



## Northern Cardigan Bay / Gogledd Bae Ceredigion proposed SPA



**Table 6.** Coordinates of proposed new boundary for the Northern Cardigan Bay / Gogledd Bae Ceredigion draft SPA.

<b>Point number in Figure 3</b>	<b>Longitude</b>	<b>Latitude</b>
1	-4.2881	52.3880
2	-4.2873	52.4126
3	-4.2138	52.4589
4	-4.3085	52.5125
5	-4.3085	52.5458
6	-4.2527	52.5735
7	-4.3294	52.6205
8	-4.4427	52.7551
9	-4.4427	52.7884
10	-4.3251	52.7875
11	-4.3262	52.8836
12	-4.1055	52.6587
13	-4.1218	52.6587
14	-4.1222	52.5050
Coordinates are shown in decimal degrees, to 4 decimal points. The boundary coordinates shown in Figure 2 were drawn to 8 decimal points.		

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