Census of grey seals (*Halichoerus grypus*) around Wales during August 2023 using aerial survey

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Roedd angen clir am gyfrifiad o forloi llwyd (*Halichoerus grypus*) dros yr haf, nad oedd yn ymwneud â magu, yn Uned Monitro Morloi Cymru i ddarparu dealltwriaeth well o ddosbarthiad a thoreithrwydd morloi llwyd yn y rhanbarth a galluogi Cyfoeth Naturiol Cymru (CNC) i bennu targedau rheoli priodol a thrwyddedu gweithgareddau a allai effeithio ar forloi llwyd ar sail gwybodaeth ddigonol.

Cynhaliwyd arolwg o holl arfordir Cymru o Bont Hafren i Ynys Hilbre yn aber afon Dyfrdwy ym mis Awst 2023 gan ddefnyddio awyren adenydd sefydlog ac awyrluniau ar osgo. Cynhaliwyd arolygon yn ystod ffenestri amser o 2 awr cyn y llanw isel lleol hyd at 2 awr ar ôl y llanw isel lleol, ar 8, 9, ac 11 Awst.

Tynnwyd ffotograffau o gyfanswm o 1313 o forloi llwyd ac un morlo cyffredin (*Phoca vitulina*) a chawsant eu cyfrif mewn 58 o wahanol safleoedd lle roedd y morloi'n dod i'r tir. Canfuwyd y rhan fwyaf o'r morloi (935, sy'n cyfateb i 70% o'r cyfanswm) ar hyd arfordir Gogledd Cymru rhwng Ynys Tudwal oddi ar Benrhyn Llŷn ac aber afon Dyfrdwy, ac roedd y 30% arall wedi'u crynhoi ar hyd arfordir Sir Benfro o Ynys Bŷr (ger Dinbych-y-pysgod) i Aberteifi. Y grwpiau unigol mwyaf o forloi llwyd ar y tir oedd: 318 ar fanc tywod ger Ynys Hilbre yn aber afon Dyfrdwy; 186 ar Ynys Dulas, oddi ar arfordir dwyreiniol Ynys Môn; 123 ar The Smalls, 25km i'r gorllewin o Ynys Sgomer.

Gwelwyd un morlo cyffredin llawn dwf, ar Ynys Tudwal ar gyrion grŵp mawr o forloi llwyd.

Yn anffodus, gan fod rhaid aildrefnu hediadau dro ar ôl tro oherwydd y tywydd, nid oedd yn bosibl cydgysylltu arolygon o'r awyr a chyfrifiadau ar y tir ar gyfer safleoedd yng Nghymru. Mae cyfrifiadau ar y tir yn Ynys Dewi ac yn Sgomer a Phenrhyn Marloes o fewn 3 diwrnod i'r arolygon o'r awyr yn dangos ei bod yn debygol fod mwyafrif y grwpiau oedd yn yr awyr agored wedi'u canfod. Fodd bynnag, ni fyddai grwpiau neu forloi unigol mewn gylïau bach ac ogofâu, yn enwedig ar hyd arfordir y gorllewin, wedi cael eu cyfrif yn ystod yr arolwg o'r awyr. Mae'r cyfrifiadau felly'n cynrychioli'r amcangyfrif lleiaf o boblogaeth y morloi llwyd a oedd wedi dod i'r tir o amgylch Cymru ym mis Awst 2023.

Roedd cyfrifiad yr arolwg o'r awyr, sy'n cynrychioli'r cyfrifiad synoptig cyntaf o boblogaeth morloi llwyd dros yr haf yng Nghymru, tua 64% yn uwch na'r amcangyfrif haf diweddaraf a gafwyd drwy gyfuno cyfrifiadau mewn ardaloedd lleol a gasglwyd ar wahanol adegau. Er nad oes cyfrifiadau synoptig blaenorol ar gael y gellir eu cymharu'n uniongyrchol, dangosodd cymhariaeth fesul safle â chyfrifiadau o arolygon safleoedd magu ym mis Awst 2002 gynnydd tebyg o 64% o amgylch arfordir Gogledd Cymru.

Mae'r canlyniadau hefyd yn rhoi disgrifiad manwl o ddosbarthiad morloi llwyd yng Nghymru a fydd yn gwella amcangyfrifon o ddwysedd morloi yn y môr sy'n defnyddio safleoedd tirio yn Uned Monitro Morloi Cymru, sy'n sicrhau eu bod yn unol â gweddill y DU, gan ddarparu data cymaradwy ar draws graddfeydd daearyddol.

Executive summary

There was a clear need for a summer, non-breeding census of grey seals (*Halichoerus grypus*) in the Wales Seal Monitoring Unit (SMU) to provide a fuller understanding of grey seal distribution and abundance in the region and enable Natural Resources Wales (NRW) to derive appropriate management targets and facilitate informed permitting of activities with potential impacts on grey seals.

A survey of the entire coast of Wales from the Severn Bridge to Hilbre Island in the Dee Estuary was carried out in August 2023 using a fixed-wing aircraft and oblique aerial photography. Surveys were carried out during time windows of 2 hrs before to 2 hrs after local low tide, on 8th, 9th, and 11th August.

A total of 1313 grey seals and one harbour seal (*Phoca vitulina*) were photographed and counted at 58 separate haulout sites. Most seals (935, equivalent to 70% of the total) were found along the North Wales coast between Ynys Tudwal off the Llŷn Peninsula and the Dee Estuary, and the remaining 30% were concentrated along the Pembrokeshire coast from Caldey Island (near Tenby) to Cardigan. The largest individual haulout groups of grey seals were: 318 on a sandbank near Hilbre Island in the Dee Estuary; 186 on Ynys Dulas, off the east coast of Anglesey; 123 on The Smalls, 25km west of Skomer Island.

One adult harbour seal was seen, on Ynys Tudwal on the periphery of a large group of grey seals.

Unfortunately, due to repeated, weather induced re-scheduling of flights it was not possible to co-ordinate aerial surveys and ground counts for sites in Wales. Ground counts at Ramsey Island and at Skomer and the Marloes Peninsula within 3 days of the aerial surveys show that the majority of open-air groups were likely to have been detected. However, groups or individual seals in small gullies and caves, particularly along the west coast, would not have been counted during the aerial survey. The counts therefore represent a minimum estimate of the population of grey seals hauled out around Wales in August 2023.

The aerial survey count, which represents the first synoptic census of the summer population of grey seals in Wales, was approximately 64% higher than the most recent summer estimate obtained by combining local area counts collected at different times. Although no directly comparable previous synoptic counts are available, site by site comparison with August counts from breeding site surveys in 2002 showed a similar 64% increase around the North Wales coast.

The results also provide a detailed description of the distribution of grey seals in Wales that will improve at-sea density estimates of seals using haulout sites in the Wales SMU, bringing them in line with the rest of the UK, providing comparable data across geographic scales.

Introduction

Grey seals are present around the coast of Wales and south-west England and are the primary feature in one and qualifying features in four UK Special Areas of Conservation (SACs) in Wales and Cornwall ranging from the Isles of Scilly to the Llŷn Peninsula (Pen Llŷn a'r Sarnau, Cardigan Bay, Pembrokeshire Marine, Lundy and Isles of Scilly). However, there is limited information on the grey seal population at the regional scale. Although there are detailed time series of pup production estimates from some of the larger breeding groups in Wales there is sparse information for the majority of sites, with no data since the 1990s for some. There have been some surveys of SACs but there is limited context in terms of how SACs are doing compared to neighbouring areas. Although it is generally accepted that the grey seal pup production in Wales has increased over recent decades, it is not possible to derive robust population estimates or reliable estimates of trends with existing data (Russell & Morris, 2020). It is therefore challenging to assess the impacts of local anthropogenic activities in the context of the overall population.

Grey seals disperse widely from their breeding sites, often spending the summer foraging season in different Seal Monitoring Units (SMUs), remote from their breeding sites. As interactions with human activities, and thus appropriate management actions, also occur while seals are dispersed outside the breeding season, there is a clear need for up-to-date population estimates to inform seal conservation and management appropriately across SMUs. Summer haulout counts are critical to supporting several conservation, management and reporting actions for grey seals that are introduced briefly below.

Potential Biological Removals (PBR)

Management of activities likely to impact seal populations through removals or mortality (e.g. fisheries bycatch) is largely based on the PBR method, which calculates an estimate for the number of seals that can be removed from a population while allowing that population to tend towards the optimum sustainable population size. SCOS (2022) recommended that as long as PBR is the accepted method for estimating ‘safe takes’ from UK seal populations, management of UK seals should, where possible, be based on the PBR estimates for individual SMUs, based on summer counts of hauled out seals. This is the case for the UK with the exception of the south-west UK SMUs where robust summer counts have been absent.

To date, there have been no synoptic, summer survey data for either the Wales or South-West England SMUs, and for many sites there are no recent counts. Unfortunately, this lack of abundance data coincides with a significant grey seal bycatch in the tangle net fisheries off the south-west UK, and Ireland (SCOS, 2022). The total bycatch has not been determined, but it is estimated that approximately 500 grey seals are removed from the population each year by UK registered vessels, and this is thought to significantly under-estimate the total bycatch (SCOS, 2022). Indeed, the estimated total annual bycatch of grey seals in the Celtic Sea Assessment Unit was 1632 in 2020 (Taylor et al., 2022). At the same time, inshore tidal energy generation and wind farm developments are being

planned at various sites in SW-UK, with potential impacts on seals. It is therefore imperative that seal management metrics such as PBR are based on robust, timely population indices derived from robust summer counts.

At Sea Distribution Maps

Maps of the distribution and density of grey seals at sea (Carter et al., 2022) are widely used by developers, advisors and regulators to plan and assess the potential for conflict with anthropogenic activities. These maps are based on a combination of at-sea location data from high resolution tracking devices attached to samples of seals at a wide range of haulout sites around the UK. The resulting seal distributions are scaled by local haulout numbers to derive high resolution, UK-wide at-sea density maps for grey seals. The maps are currently being updated., but the lack of a comprehensive, synoptic survey for SW UK impacts the robustness of the at-sea density estimates, particularly within the region and neighbouring SMUs.

OSPAR

An OSPAR assessment of the status of the grey seal in Europe was carried out in 2023 to meet obligations under the Convention for the Protection of the Marine Environment of the North-East Atlantic (Pup production (Banga et al., 2022a); Abundance and distribution (Banga et al., 2022b); Bycatch (Taylor et al., 2022)). Neither the Wales nor SW England SMUs were included in the OSPAR grey seal assessments and therefore the resulting UK Marine Strategy assessments, due to lack of long term population data collected at the regional scale. A time series of SMU wide surveys, on the same five yearly cycle as employed around Scotland, would make it possible to incorporate the Wales and SW England SMUs in future UK submissions to OSPAR.

Current state of knowledge

There are two comprehensive datasets relating to August counts in Wales: Bardsey Island (Porter unpub. data) and Hilbre Island (Hilbre Bird Observatory); counts at both sites have apparently been increasing, with mean counts in August 2019 of 174 and 285, respectively. For other areas, data are more sporadic with historic data indicating mean August counts of c. 100 and 57 for Ramsey (2014; Morgan unpub. data) and Skomer (2019; Wilkie and Zbijewska, 2020), respectively. Combined with mean August counts for North Wales (excluding Bardsey Island; Westcott, 2002; Westcott & Stringell, 2004), generates at total count of c. 800, though this is likely to be a gross underestimate given the lack of data from West Wales mainland, the age of data from some sites, and the upward trends at the two well-monitored sites.

The resulting composite ‘count’ of around 800 seals would represent a total population of approximately 3181 grey seals in Wales (based on a proportion hauled out of 0.2515; Russell & Carter, 2021). Current pup production in the Wales SMU is estimated at 2250 (SCOS, 2021). If the ratio of total population to pup production in Wales is similar to the

average ratio in the rest of the UK grey seal population (2.32:1; SCOS, 2021), the 1+ age population of grey seals breeding in Wales would be approximately 5220.

The composite 'count' data appears to suggest that the number of seals hauling out in Wales is lower than expected given the local pup production. This directly contradicts the recent suggestion that large numbers of seals are immigrating into the SW population, and that bycatch is influenced by that influx of seals (SCOS, 2022). The existing composite count data do not represent a synoptic or comprehensive survey and are thought to significantly under-estimate the summer haulout population.

To address these issues, NRW commissioned the Sea Mammal Research Unit (SMRU), University of St Andrews, to conduct a comprehensive synoptic survey of the coast of the Wales SMU to obtain a count of seals hauled out during the August survey window in 2023. This report describes the results of that survey and provides a preliminary description of the numbers and distribution of grey seals around Wales. The surveys of Wales were co-ordinated with a survey of the coast of south-west England from Exeter to the Severn Bridge, including the Isles of Scilly and Lundy Island. The results of the two survey programmes will be combined and used to provide a detailed report of the status of the grey seal population in the south-west of the UK, to generate detailed maps of seal distribution and at sea usage and estimate management targets. That report will be submitted to the 2024 meeting of the Natural Environment Research Council's Special Committee on Seals.

Methods

Aerial surveys of the coast from Exeter to the River Dee estuary, including the Isles of Scilly and Lundy and offshore islands in Wales (e.g. The Smalls, Grassholm, etc) was carried out in early August 2023, using a fixed-wing aircraft (a Cessna 172 aircraft based in Chester) and oblique aerial photography. Survey methodology followed the same protocols that are routinely used for surveys on the east coast of Scotland and England (Thompson et al., 2019).

The estuarine haulout sites on the east coast of Scotland and England, where seals are mainly found on sandbanks and are therefore relatively easily detected, are surveyed using fixed-wing aircraft. Seals are detected by eye and photographed using hand-held oblique photography. This survey method is highly cost-effective and routinely used for estuarine habitats and sections of rocky coast between estuaries. The grey seal counts from these surveys have been used elsewhere to inform the models used to estimate the total grey seal population size (Russell et al., 2016; Russell & Carter, 2021).

To maximise the counts of seals on shore and to minimise the effects of environmental variables, surveys are restricted to within two hours before and two hours after the time of local low tides (derived from POLTIPS, National Oceanographic Centre, NERC) occurring between approximately 10:00 and 19:00. Surveys are not carried out in persistent or moderate to heavy rain because seals will increasingly abandon their haulout sites and

return into the water. Because of the exposed nature of the coast and the difficulties of flying at low level in turbulent conditions near cliffs, surveys were restricted to days with wind speed of less than 10 m.s-1.

Coordinated counts by observers on the ground were attempted at a sample of sites on Ramsey Island (by RSPB), Skomer Island (by Wildlife Trust South and West Wales: WTSWW), the Marloes Peninsula (by NRW), and the south Pembrokeshire coast (by Pembrokeshire Coast National Ranger: PCNR). Unfortunately, rapidly changing weather conditions required short notice re-scheduling of flights and alterations of flight plans during surveys. As a consequence, no co-incident ground and aerial counts were obtained. Ground counts for dates closest to the aerial surveys were used to provide an indication of the likely effectiveness of the aerial surveys in terms of the proportion of groups detected and the proportion of seals counted within groups.

Results

An aerial survey of the entire coast, from the Severn Bridge to the Dee Estuary, was completed over three days in August 2023. Poor weather conditions meant that it was not possible to complete the survey on consecutive days. The North Wales coast from Porthmadog to Hilbre Island in the Dee Estuary was surveyed on 8/8/2023; Grassholm and The Smalls to the west of Skomer Island, parts of south Pembrokeshire, and the south Wales coast from the Mumbles to the Severn Bridge were surveyed on 9/8/2023; the south and west coasts from the Mumbles to Porthmadog were surveyed on 11/8/2023. Sections of coastline surveyed on each day are indicated by colour code on Figure 1.

Counts

A total of 1313 grey seals and one harbour seal (*Phoca vitulina*) were photographed and counted at 58 separate haulout sites in Wales. Figure 2 & Figure 3 show the locations of the 58 sites and the track of the survey aircraft and Figure 4 shows the distribution of seals at those sites. Most seals (935, equivalent to 70% of the total) were found along the North Wales coast between Ynys Tudwal off the Llŷn Peninsula and the Dee Estuary (Figure 5), and the remaining 30% were concentrated along the Pembrokeshire coast from Caldey Island (near Tenby) to Cardigan (Figure 6). The largest individual haulout groups of grey seals were: 318 on a sandbank near Hilbre Island in the Dee Estuary (site 57, 24% of total, Figure 3); 186 on Ynys Dulas, off the east coast of Anglesey (site 50, 14% of total, Figure 3); 123 on The Smalls, 25km west of Skomer Island (site 26, 9% of total, Figure 2).

This 2023 count was approximately 64% higher than the most recent previous summer haulout estimate of 800 (Russel & Morris, 2020). The difference is largely due to the aerial survey coverage of Pembrokeshire and west Wales mainland and offshore island sites such as The Smalls (see Figure 6) that were not included in previous estimate and the likely increase in numbers of hauled-out seals at previously included sites (Westcott & Stringell, 2004).

One adult harbour seal was observed on Ynys Tudwal off the Llŷn Peninsula. No other harbour seals were detected in the Wales or the SW England surveys.

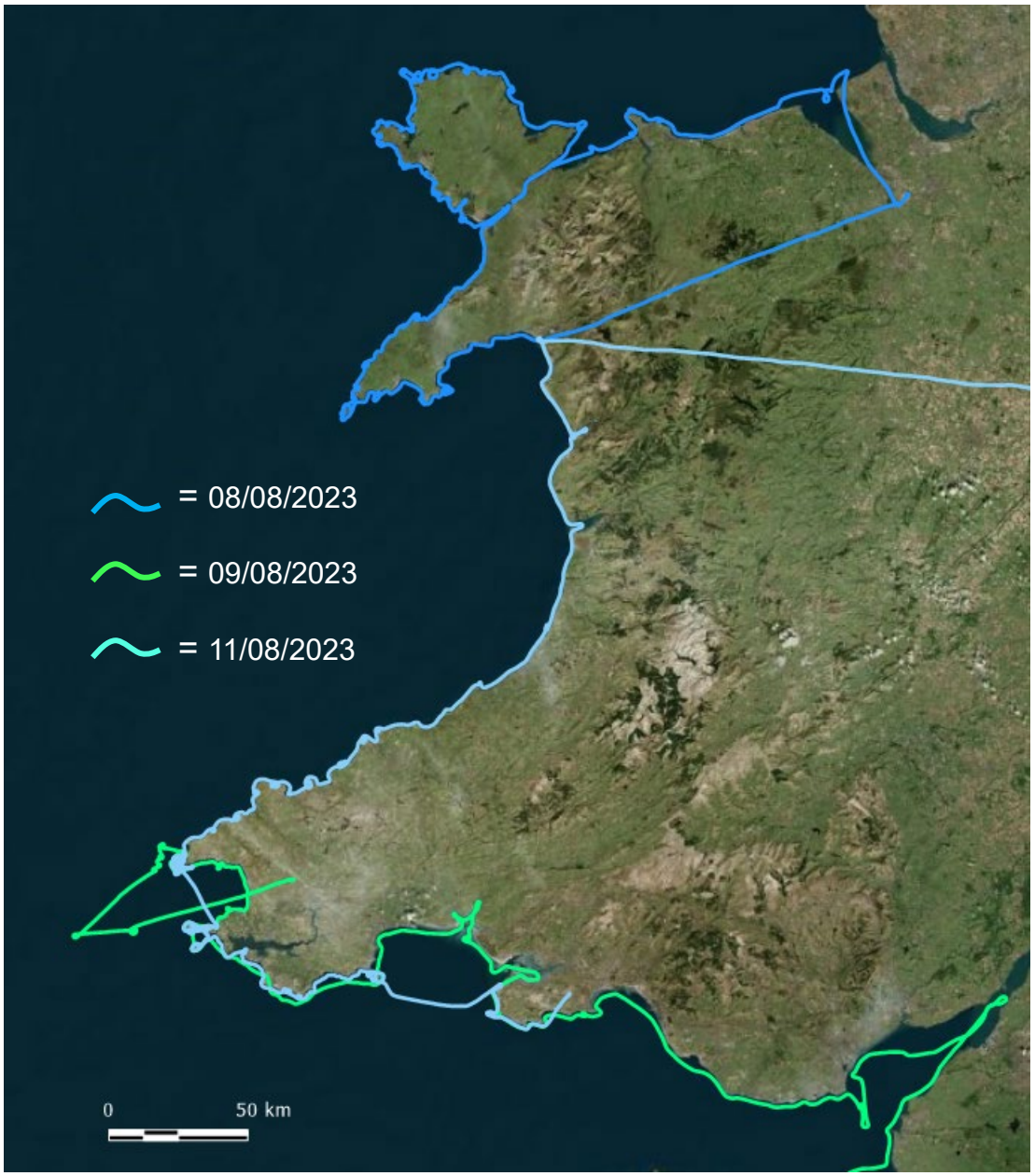

Figure 1 Survey flight paths for August 2023 grey seal surveys of Wales.

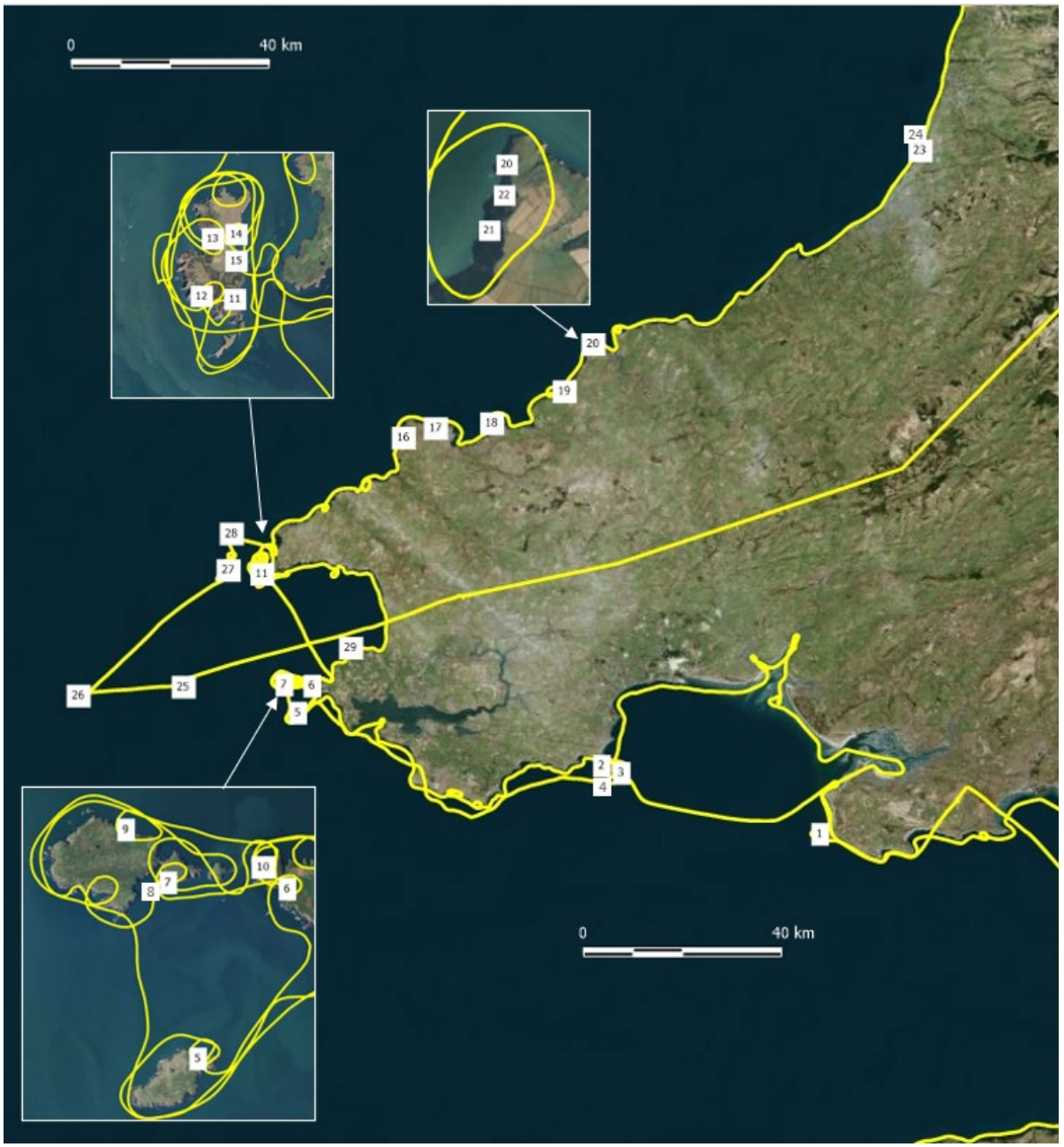

Figure 2 Locations and site identification numbers for grey seal haulout groups on the coast of South and West Wales. Site numbers refer to the identifiers in the associated spreadsheet. The yellow lines indicate the flight path of the survey aircraft. Where site labels overlap an expanded view of the site is shown in a box.

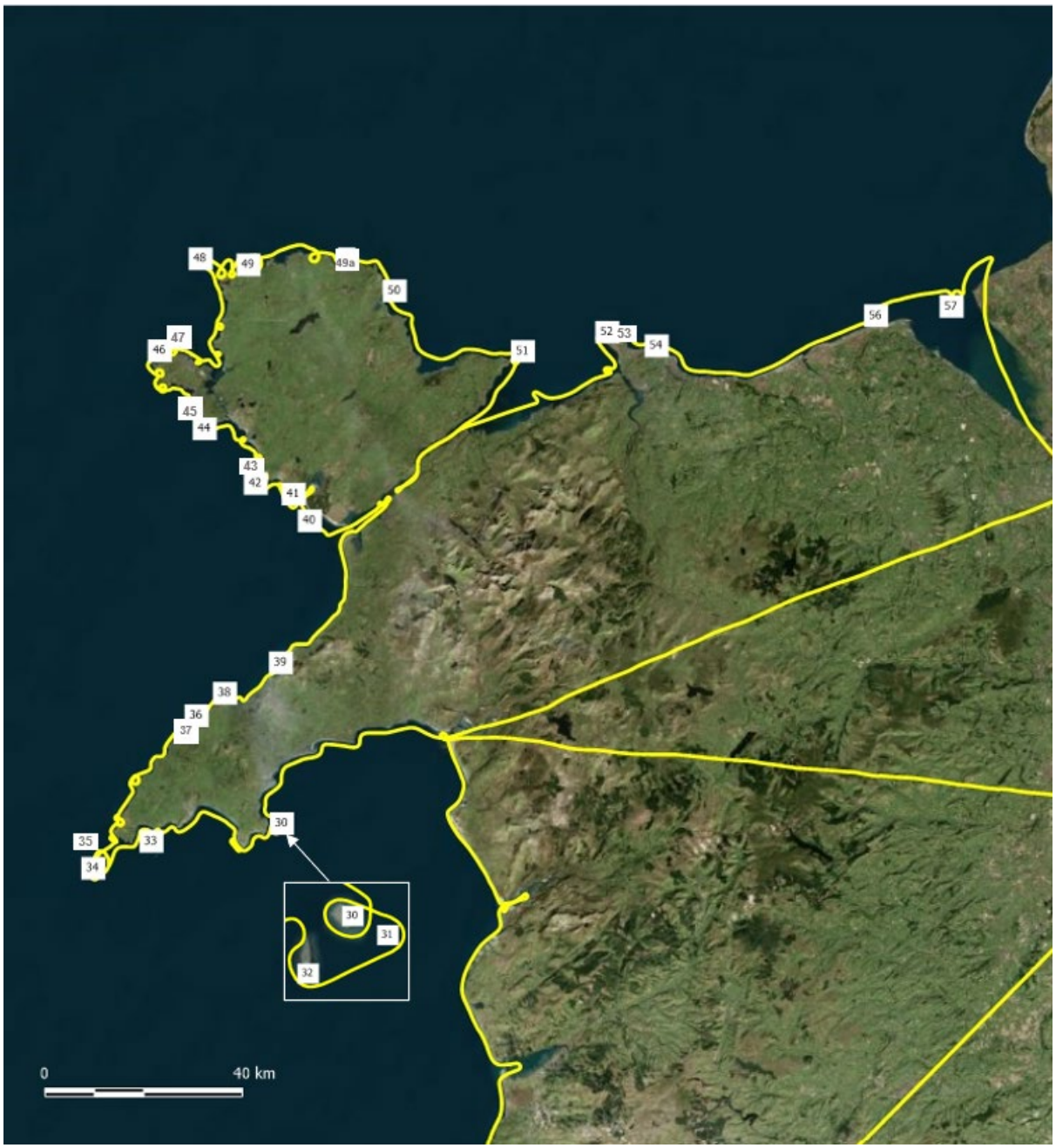

Figure 3 Locations and site identification numbers for grey seal haulout groups on the coast of North Wales. Site numbers refer to the identifiers in the associated spreadsheet. The yellow lines indicate the flight path of the survey aircraft. Where site labels overlap an expanded view of the site is shown in a box.

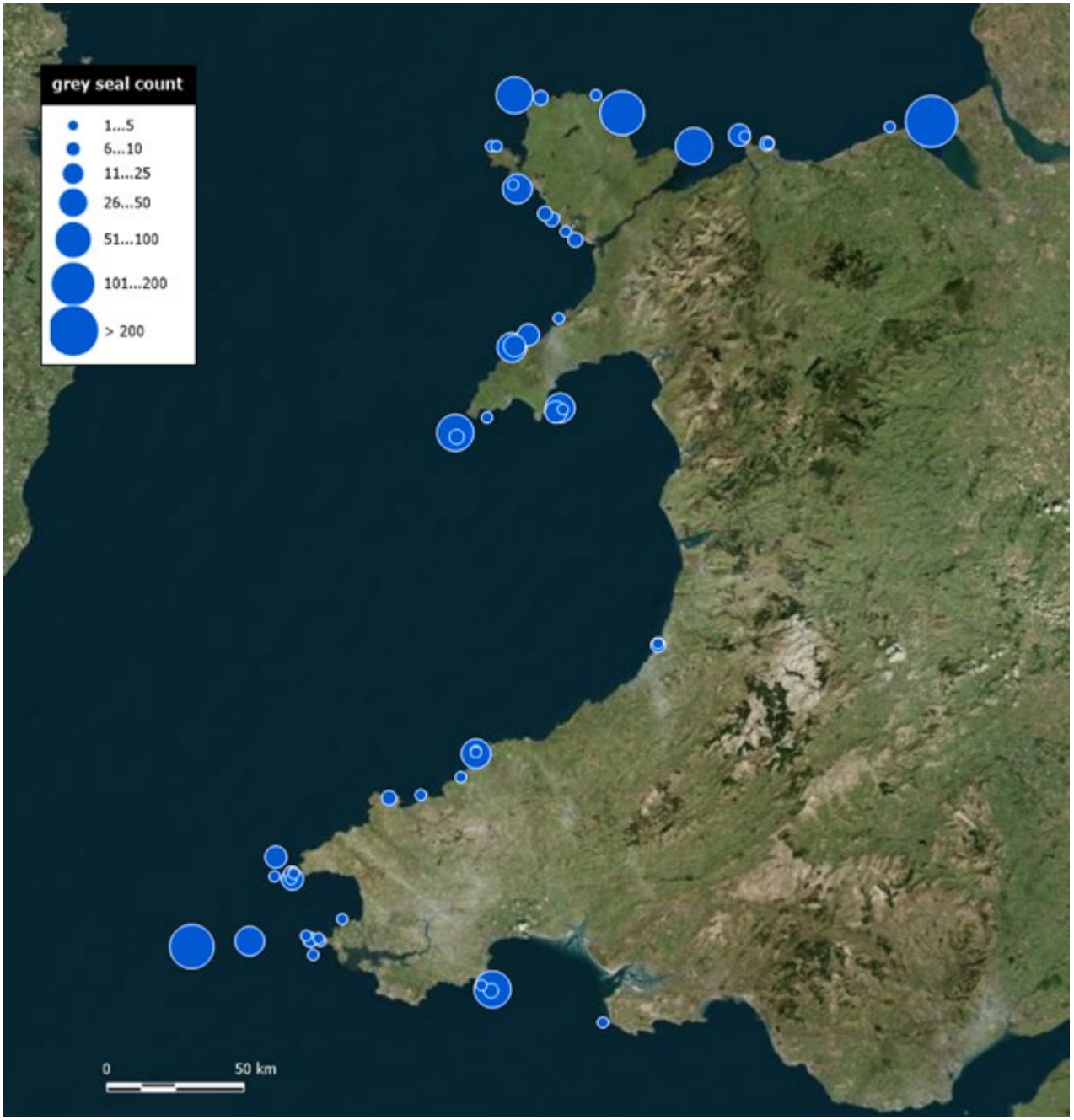

Figure 4 Distribution of grey seals counted during the August 2023 aerial surveys around the entire coast of Wales. Blue dots are centred on the haulout site and group size is indicated by the size of the dot. Sites named in the main text are labelled on Figures 4 and 5.

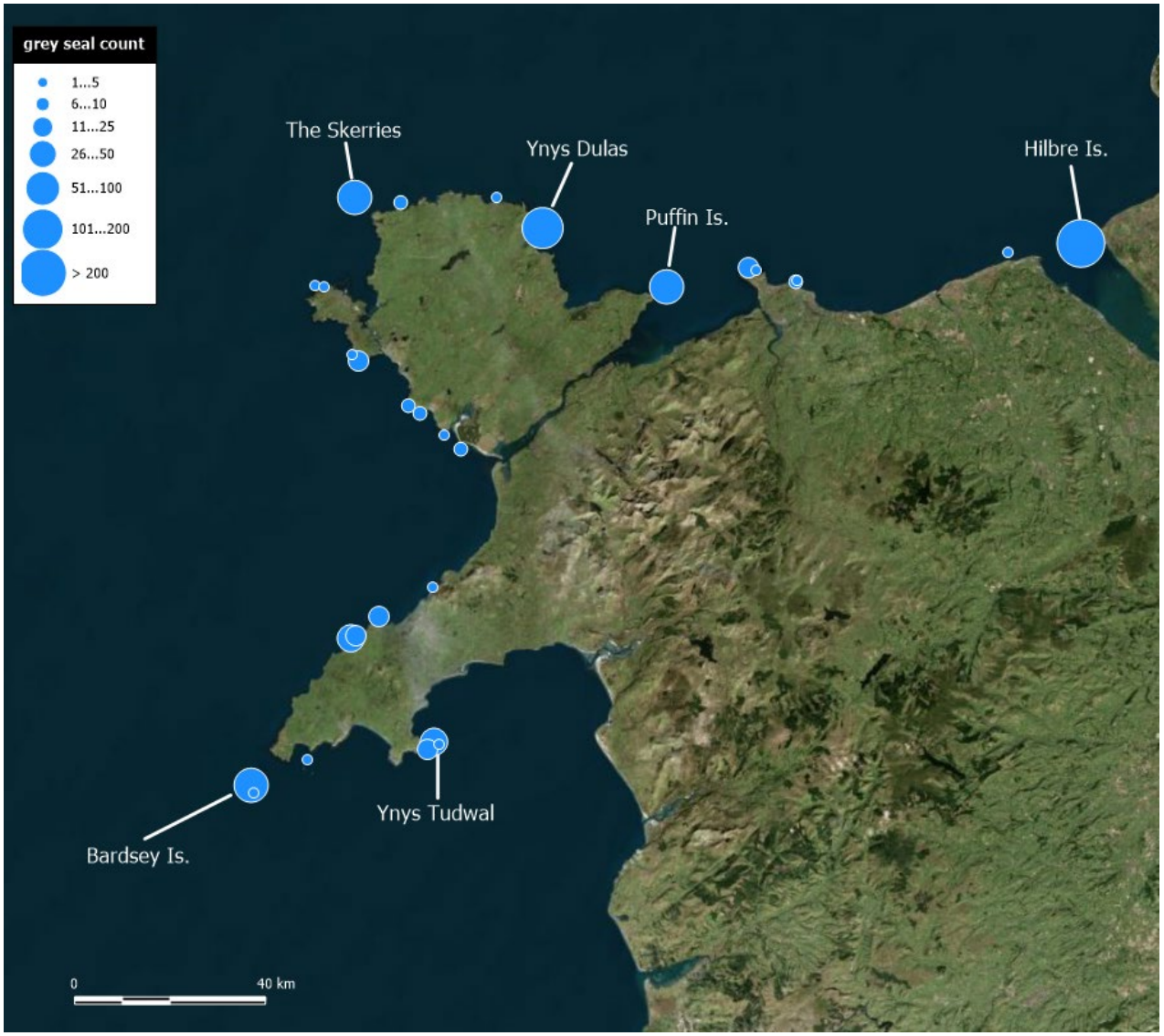

Figure 5 Distribution of grey seals counted during the August 2023 aerial surveys around the coast of North Wales. Blue dots are centred on the haulout site and group size is indicated by the size of the dot.

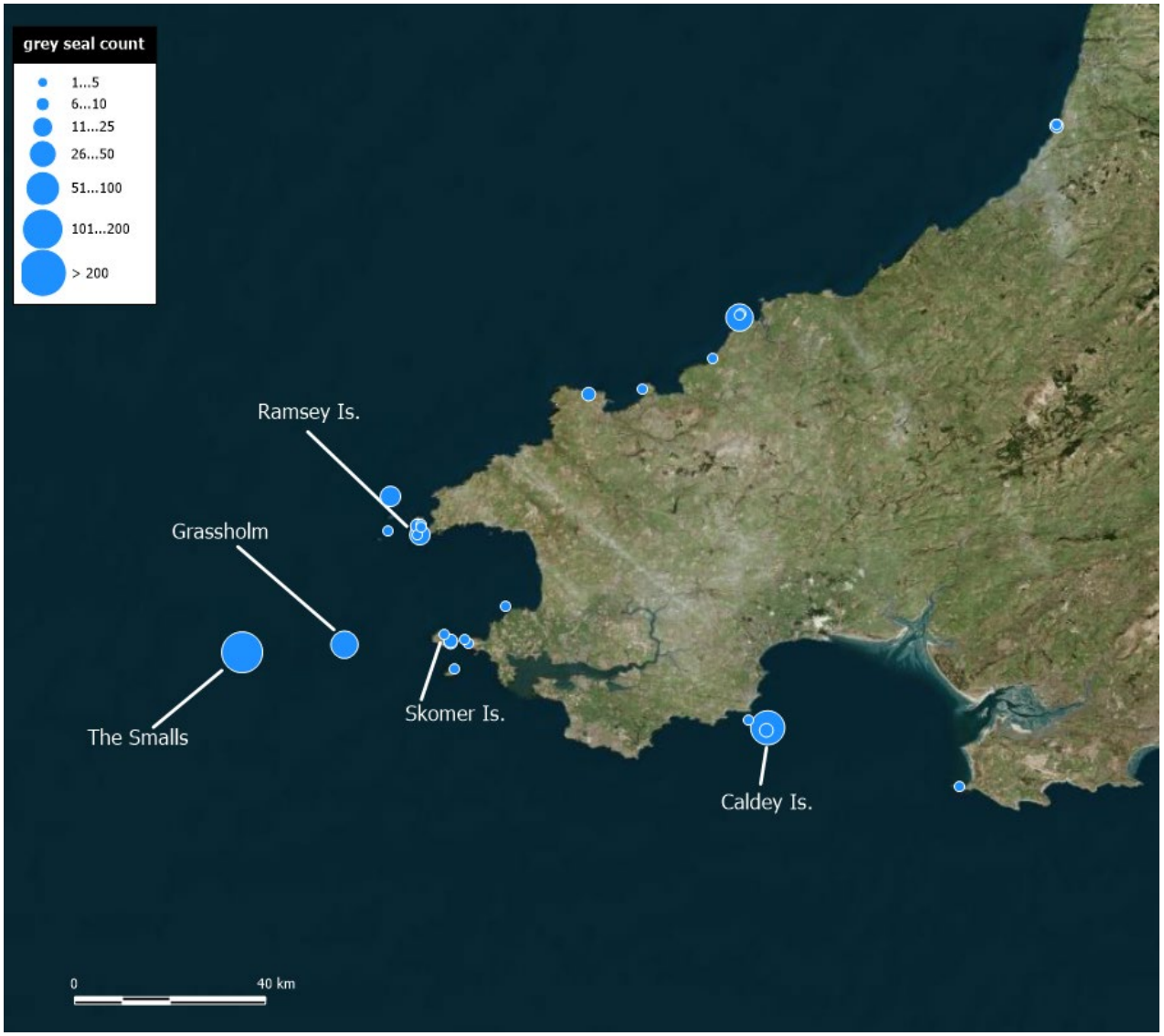

Figure 6 Distribution of grey seals counted during the August 2023 aerial surveys around the coast of South Wales. Blue dots are centred on the haulout site and group size is indicated by the size of the dot.

Survey Efficiency

Due to frequent weather induced delays and short notice rescheduling of flights, there were no ground counts coincident with the aerial surveys. However, ground counts of sites on Ramsey and Skomer Islands and on the mainland coast at the Marloes Peninsula and at sites in south Pembrokeshire near Castlemartin MOD Ranges provide some insight into the efficiency of aerial surveys. Table 1 shows the counts obtained by ground based observers on 8th and 9th August 2023 compared to aerial survey counts on 11th August 2023. Although it should be expected that seal numbers on any site could vary between dates, it is clear that the aerial surveys detected fewer groups (9 of 20) and fewer seals (54 of 113). Close inspection of the survey track shows that all sites were included and checked from the air, and in some cases, particularly at Ramsey and Skomer, repeated circuits were flown over sites (Figure 7). Despite this effort, a large proportion of the groups of seals in these small coves and gullies were either missed or under-counted. The two largest groups in the ground count data were at locations where seals could easily be detected, so the reduced count at Bachelor Pad on Ramsey Island and the absence of seals at Garland Stone on Skomer in the aerial survey data were assessed to be actual changes in numbers. However, even removing these counts from the comparison, the air survey counts represented only 48% of the ground counts over the previous days. Although this cannot be taken as a robust estimate of the undercounting for the air survey, it does indicate that on coastlines where seals haulout in small coves and narrow gullies with high, steep cliffs, the aerial count will be a significant underestimate.

Table 1 Ground counts and aerial survey counts of grey seals on haulout sites around Ramsey and Skomer Islands and on the mainland coast at the Marloes Peninsula and near Castlemartin MOD Ranges in south Pembrokeshire. Surveys were carried out on different dates due to scheduling difficulties.

Location	**Number of adults**	**Number of pups**	**Number of adults**	**Number of pups**
Ramsey Island	**RSPB ground counts** 09/08/2023	**RSPB ground counts** 09/08/2023	**SMRU aerial count** 11/08/2023	**SMRU aerial count** 11/08/2023
Bachelor Pad **	32	0	21	0
Porth Lleuog main	2	1	1	0
Porth Lleuog Cave	3	0	0	0
Waterings South	1	0	0	0
Waterings North	2	0	1	1
Rhod Uchaf	7	0	2	0
Abermawr	4	0	5	0
Skomer Island	**WTSWW ground counts** 08/08/2023	**WTSWW ground counts** 08/08/2023	**SMRU aerial count** 11/08/2023	**SMRU aerial count** 11/08/2023
North Haven	3	1	0	0
Driftwood Bay	0	1	0	0
Matthews Wick	4	2	6	4
Castle Bay	1	2	7	2
Garland Stone (9/8/23)**	12	0	0	0
Marloes Peninsula	**NRW ground counts** 08/08/2023	**NRW ground counts** 08/08/2023	**SMRU aerial count** 11/08/2023	**SMRU aerial count** 11/08/2023
Watery Bay	2	2	0	0
Little Castle	3	1	0	0
Rennys slip	1	1	1	1
Jeffery's Haven	3	2	1	1
Pebbly Beach (14/8/23)	6	0	0	0
South Pembrokeshire	**PCNR ground counts** 08/08/2023	**PCNR ground counts** 08/08/2023	**SMRU aerial count** 11/08/2023	**SMRU aerial count** 11/08/2023
Stack Rocks	4	2	0	0
Key Hole Zawn	1	0	0	0
Hobbyhorse Bay	6	1	0	0

** at these sites, the lower counts in the aerial survey data are assessed to represent real changes in numbers

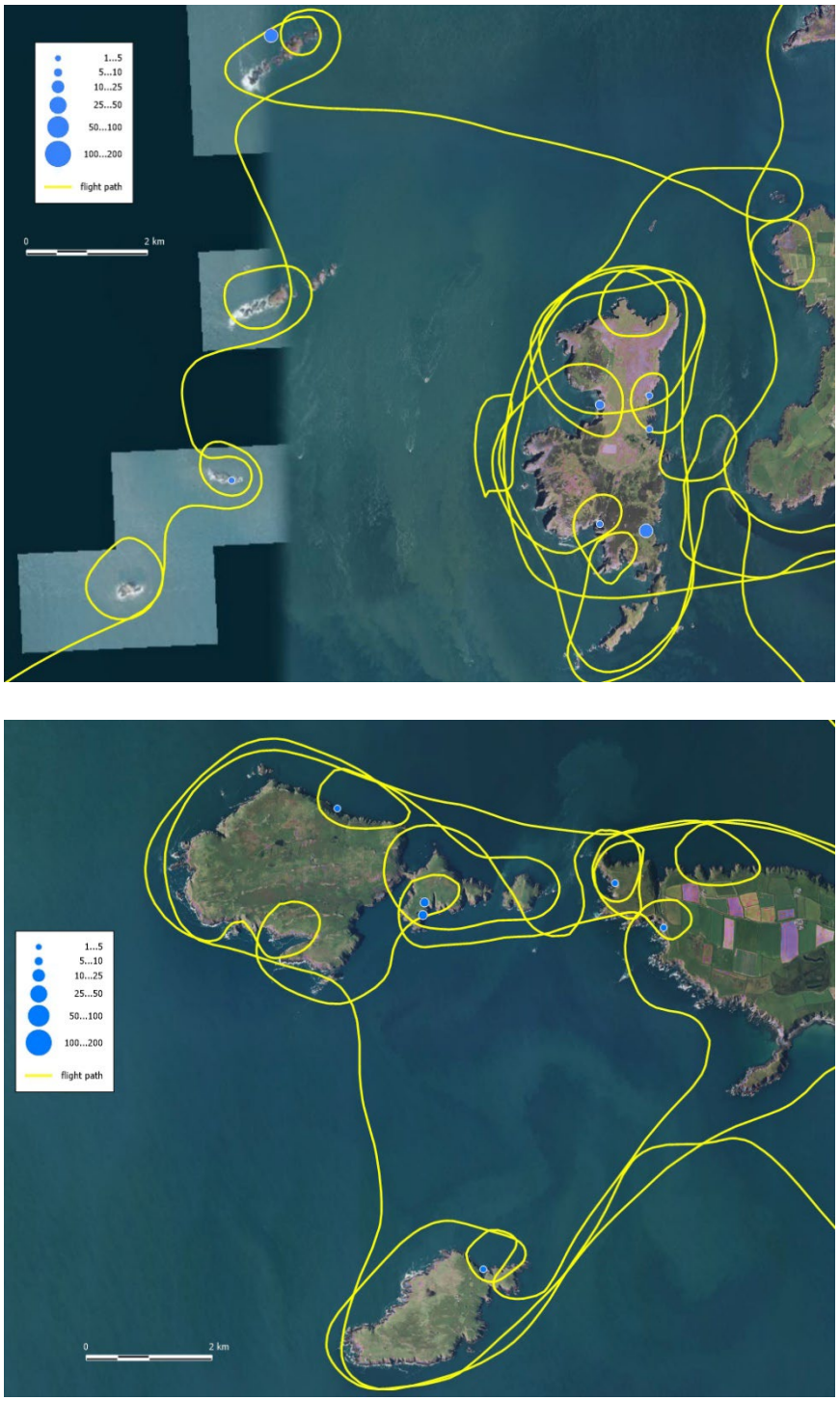

Figure 7 Distribution of grey seals counted during the August 2023 aerial surveys around the coast of Ramsey Island (top) and Skomer and Skokholm (bottom), Pembrokeshire. Blue dots are centred on the haulout site and group size is indicated by the size of the dot. Yellow lines show the survey flight path and indicate the intensity of survey effort required to identify and photograph seals along these complex coastlines.

However, the overall effect on the complete survey will be much lower. Table 2 shows the aerial survey counts of grey seals from sites which were on low-lying offshore skerries, sandbanks or open flat rock platforms on low-lying coastlines. At each of these sites we assess that the entire group was photographed and counted with a high degree of

confidence. These sites held 1176 out of the total survey count of 1313 grey seals. If the differences between ground and aerial counts is a reasonable index of the efficiency of the aerial survey at detecting seals along complex, cliff backed coastlines the overall under-estimation would be approximately 149 seals. Thus, the overall effect of missing cryptic groups of seals would have been relatively small, increasing the total estimate by approximately 11%. It must be borne in mind that the ground and aerial survey counts were not carried out on the same dates, so the correction factors should be treated with caution.

Table 2 Aerial survey counts of grey seals on open haulout sites on low-lying offshore skerries, on open rock platforms or on sandbanks around Wales in August 2023. The numbers in brackets refer to the site i.d. numbers in the associated data spreadsheet (Appendix 1).

Location (Site number)	Aerial survey count
Caldey Island (2-4)	94
Skokholm (5)	2
Bachelor Pad-Ramsay (11)	21
Grassholm (25)	48
The Smalls (26)	123
Bishops & Clerks (27-28)	15
Ynys Tudwal (30-32)	73
Bardsey Island (34-35)	61
Porthdinllaen (36-38)	71
SW Anglesey (40-45)	55
The Skerries (48)	58
Ynys Dulas (50)	186
Puffin Island (51)	51
Hilbre Island (57)	318
Total at open sites	1176

Summer haulout population estimate

The total count of 1313 hauled out seals can be used to generate an estimate of the total population in Wales during the summer, using an estimate of the proportion of the grey seal population that is hauled out during the August survey windows. Based on data from high resolution telemetry tracking devices fitted to 60 grey seals caught at sites around the UK, it is estimated that 25.15% (95% CI: 21.45-29.07%) of the total population will be hauled out and available to be counted (Russell & Carter, 2021) during the surveys. This can be used to generate an estimate of total population size by dividing the raw counts by 0.2515. Applying this correction factor to the Welsh counts produced a total population estimate of 5221 (95% CI: 4517-6121).

This is likely to be an under-estimate given the inability to count seals in caves and the known under-counting of seals in small coves and gullies, and it should be regarded as an absolute minimum number of seals associated with Welsh haulout sites during the summer.

This figure can be compared with an alternative population estimate, referred to as the 1+ age population, that is derived from a population dynamics model fitted to a long time series of grey seal pup production estimates (Thomas et al., 2019). It represents the number of seals alive on the first day of the pupping season and will include all the surviving pups from the previous breeding season. This will be very close to the August population, differing only by the number of seals that have survived from the previous breeding season to August, but then die between August and the start of the next breeding season, in September. This will be a very small proportion of the surviving pups and will represent a much smaller proportion of the total population. The 1+ age population estimates can therefore be regarded as being equivalent to the August population.

At the time of writing, the most recent composite pup production estimate for Wales was 2250 pups (Russell & Morris, 2020). This number was based on data from recent surveys at a small number of regularly monitored sites, combined with estimates from other colonies that have not been surveyed for >20 years which have been scaled by assumed rates of increase. The confidence in the pup production estimate is therefore low. However, notwithstanding these caveats, scaling this pup production by the ratio of pup production to total 1+ age population at regularly monitored colonies around Scotland and eastern England (1 : 2.32; SCOS, 2021), produces a 1+ population of 5,220, which is remarkably close to the total population estimate from scaled up air survey counts.

Table 3 Ground counts from August 2002 and aerial survey counts from 2023, and the percentage difference between years, of grey seals on haulout sites around the coast of North Wales. Site names from the 2002 survey (Westcott and Stringell, 2004) and site identification numbers from 2023 (Figure 3, this report) are shown for each comparison site. Percentage change at sites where seals were seen in 2023 but no seals were reported in 2002 are shown as ++++.

2002 site name	2023 site numbers	2002 mean August counts	2023 aerial count	% difference
Ynys Tudwal	30 - 32	39	73	87%
Gwylans coast	33	8	1	-88%
Trwyn Cilan	No data	0	0	No data
Porth Cadlan-Trwyn Talfarach	No data	0	0	No data
Bardsey Island	34-35	148	59	-60%
Porth Widlin-Traeth Penllech	No data	1	0	-100%
Rhosgor	36-37	5	54	938%
Carreg Ddū	38	1	17	1600%
Southwest Anglesey	40-43	0	22	++++
Ynys Llanddwyn	44-45	0	27	++++
Ynys Arw	46-47	0	5	++++
The Skerries	48	36	58	61%
Carmel Head	49	0	6	++++
Ynys Dulas	50	29	186	541%
Puffin Island	51	28	51	80%
West Hoyle	57	235	318	35%
Total		531	877	65%

Comparison with previous counts

No directly comparable previous surveys have been carried out of the grey seal population during the summer, so it is not possible to provide a robust estimate of the trend in seal numbers. However, Westcott and Stringell (2004) presented a series of ground counts of the grey seal haulout and breeding sites along the North Wales coastline during 2002. Many of those sites were visited in August, and those counts are presented in Table 3 together with the 2023 aerial survey counts for the same sections of coastline.

Although the methodologies differed, e.g. ground versus aerial surveys with the inclusion of some cryptic sites and caves in the 2002 ground surveys, it is clear that the numbers of grey seals hauling out at these sites has increased substantially since 2002. Overall, 65% more seals were counted in 2023 than in 2002. The numbers of seals were higher at 13 out of the 16 sites, and 60 seals were seen in 2023 along four sections of coast that had no recorded seals in August in 2002 (Table 3).

Discussion

This report presents a preliminary description of the results from the first synoptic census of the summer grey seal population around the entire coastline of Wales. The results of the survey produced a summer 2023 haulout count that was approximately 65% higher than the most recently published estimate derived from a combination of local summer counts from sites around the Welsh coast (Russell et al., 2021). To some extent this will be due to absence of data from some remote locations such as the Smalls in previous estimates. The lack of any previous synoptic summer surveys of seals in Wales means that it is not possible to use these data to identify or quantify population trends. Instead, the results should be used to update the current picture of the number and geographical distribution of grey seals around the coastline of Wales.

Although the results presented here must be regarded as a minimum estimate of the August population, and the 1+ age population is derived from estimated grey seal pup production for Wales that is based on variable quality data, it is interesting to note that these two data sources produce remarkably similar estimates of the total 1+ grey seal population associated with Wales.

The caveats on the summer survey results, and the low confidence in the pup production estimates, mean that this similarity should be treated with caution. A more extensive analysis has been undertaken in conjunction with the results of the co-ordinated surveys of the south-west England SMU. These results and analyses have been presented at the 2024 Special Committee on Seals meeting.

The numbers of seals counted can be used to provide minimum summer population estimates for calculating a PBR that will be consistent with the PBRs used for seal population management in Scotland and eastern England.

These results also provide the first synoptic picture of the geographical distribution of grey seals around the Welsh coast. This geographical distribution information together with the haulout counts are currently being used to update at-sea usage maps for grey seals. The data will also be used in conjunction with results of the co-ordinated surveys of the south-west England SMU to update the SMU status input to the next OSPAR Quality Status Report. A programme of regular surveys, at five year intervals to match the survey schedules in Scottish SMUs, would facilitate the inclusion of the Wales SMU in future OSPAR Quality Status Reports on grey seal indicators.

Efficiency of survey

A large proportion (90%) of the total count was found on offshore skerries and open coastlines where grey seals are relatively easy to detect. Confidence in efficiency of seal detection along long sections of cliff bound coastline around most of Wales was low. All coves and gullies were inspected wherever possible, and the manoeuvrability of the Cessna 172 and skill of the pilot meant that most sites could be seen either from an oblique angle while passing the entrance at low level, or vertically while the aircraft performed tight turns over the sites. However, at an unknown but potentially large number of locations, sections of potential haulout sites were obscured by overhanging rock and large boulders, and the large number of caves along much of the Welsh coastline could hold significant numbers of seals that were undetectable. The count obtained in the aerial surveys must therefore be regarded as a minimum estimate. Although there were no directly comparable, coincident counts from air and ground, the available data from ground counts within 2 or 3 days of the air survey give an indication of the likely scale of underestimation. This implies that something in the region of 50% of seals in coves were likely to have been missed. However, the effect on the overall survey count is relatively small because most seals were found on open haulout sites where all seals were easily detected. Although we have low confidence in the correction factor for missed seals, the available information suggests that it would add approximately 10% to the total.

While it may be possible to obtain some indication of the scale of under-counting of seals on open sites, there are no data to allow an estimate of the numbers of seals hauled out in caves. Surveys of seals in caves have so far been designed to estimate pup production, and many of those data are now over 30 years old (SCOS, 2021). However, frequent and widespread incidental observations of seals using caves during the spring and summer indicate that some hauled out seals will not be available to be counted. Large numbers of caves are used by grey seals at least during the breeding season. For example, Baines et al. (1995) identified more than 90 caves on the coastline between St Davids and Aberystwyth that were used by grey seals during breeding seasons in the early 1990s. Only eight haulout groups were identified along that section of coastline in the 2023 aerial survey.

It is not known how many of these caves are used as haulout sites in early August. Strong et al. (2006) monitored pupping at a sample of 30 sites along the north Pembrokeshire coast. Their first counts were on the 22nd of August when only 8 pups were recorded. Numbers rose rapidly, with 179 pups counted three weeks later. This suggests that use of these sites for pupping begins in mid-August and there may have been low numbers of

seals at those sites at the times of the aerial surveys. However, in the absence of independent information on cave use there is clearly a potentially large number of seals that could have been missed by the aerial survey. The magnitude of such a bias could only be addressed by means of a dedicated survey of a representative sample of caves.

Comparison to previous counts

Although it does not provide a robust estimate of trend, the clear increase in numbers of grey seals at the majority of sites for which August counts are available in North Wales suggests that the summer population of grey seals has increased over the past 20 years. Repeated synoptic summer surveys would be required to provide robust estimates of trends.

Appropriateness of the survey methodology

A large proportion of the coastline of Wales and southwest England is cliff-backed rocky shore, and as expected this coastline proved extremely difficult to survey using a fixed-wing aircraft. In other surveys where the main aim is to count harbour seals on rocky shores, the surveys are usually conducted using a thermal-imaging camera mounted externally on a helicopter. Harbour seals hauling out on rocky, or seaweed covered shores are well camouflaged and difficult to detect for visual observers, but the thermal imager enables rapid, thorough, and synoptic surveying of cryptic seals inhabiting complex coastlines. The coastline of Wales and south-west England would be amenable to helicopter thermal imagery surveys. However, as explained above, the likely scale of undercounting due to missing grey seals on these coastlines is relatively small, and helicopter based thermal imagery surveys would not overcome the problems of seals in caves or obscured from view at the back of narrow inlets. The estimated cost of conducting the survey of the Welsh coastline by helicopter would have been more than five times the cost of the fixed-wing survey, and SMRU's thermal imager/helicopter seal survey team were fully committed to harbour seal surveys in August 2023 and 2024. Although the resulting count would probably have been slightly higher had a helicopter with thermal imager been available, it would be difficult to justify the extra cost, and it was therefore deemed appropriate to carry out a fixed-wing, visual survey in this first instance.

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Appendices

Data Archive Appendix

Data outputs associated with this project are archived on server–based storage at Natural Resources Wales.

The data archive contains:

The final report in Microsoft Word and Adobe PDF formats.

A Microsoft Excel spreadsheet named “Wales seal counts 2023.xlsx”.

Metadata for this project is publicly accessible through Natural Resources Wales’ Data Discovery Service https://metadata.naturalresources.wales/geonetwork/srv (English version) and https://metadata.cyfoethnaturiol.cymru/geonetwork/cym/ (Welsh Version). The metadata is held as record no NRW_DS161361.

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