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Census of grey seals (*Halichoerus grypus*) around the Southwest England Seal Monitoring Unit by aerial survey during August 2023

Survey Report

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Sea Mammal Research Unit

University of St Andrews

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Summary

For the majority (approximately 95%) of the UK grey seal (*Halichoerus grypus)* population, abundance is monitored using a combination of pup production estimates and August haul out counts (surveyed during the harbour seal moult). Females aggregate at colonies to give birth to a single pup facilitating efficient monitoring of the majority of UK pup production, which is a key indicator of grey seal numbers and trends. Grey seals in the UK are part of a single metapopulation, exhibiting large scale inter-seasonal movements. As such, August counts provide the required indicator of the foraging distribution of grey seals.

The Southwest England Seal Monitoring Unit (SMU) accounts for up to 1% of the UK grey seal population. Nevertheless, it is an area of relatively high anthropogenic activity, and two Special Areas of Conservation for which grey seals are a qualifying feature. Most published data from the region are from surveys conducted by the Seal Research Trust (SRT; formerly Cornwall Seal Group). This data can provide important information on fine temporal and spatial scales and can contribute to the designation of regional protected sites and assessments, however there was a need for a SMU-wide August survey of grey seals to provide a synoptic picture of grey seal distribution and abundance in line with the rest of the UK. These data are required to enable Natural England (NE) and Joint Nature Conservation Committee (JNCC) to derive appropriate management targets and facilitate informed permitting of activities with potential impacts on grey seals in a manner that is consistent with all other SMUs in the UK.

A survey of the coast from Exeter to the Severn Bridge was carried out in August 2023 using a fixed-wing aircraft and oblique aerial photography. Low cloud prevented survey of planned sections of coast on specific days, but all sections of the coast were surveyed. Surveys were carried out during time windows of two hours before to two hours after local low tide, on 4, 9, 11 and 13 August.

A total of 756 grey seals were photographed and counted at 43 separate haul-out sites, including 39 extra seals counted by SRT at two sites. More than half of the seals were found on uninhabited offshore skerries in the Isles of Scilly Complex SAC, a tenth was recorded at Lundy Island SAC, and the remaining portion seals were recorded around the coast of mainland Cornwall, and Devon.

Simultaneous ground surveys were conducted by SRT at a small sample of mainland sites across west Cornwall. SRT counts being used in place of the SMRU counts at two open beach sites where seals were undetected by the aerial survey team. The vast majority of seals across the entire surveyed area were located on offshore skerries and open rock platforms. Similarly, along the mainland coast survey track, the majority of seals were observed on offshore rocks, skerries and small islands out to sea. Undercounting is estimated to have reduced the overall survey count by approximately 10%. It is therefore concluded that majority of open-air groups were likely to have been detected during the aerial survey, but some seals along the mainland coast and any seals in caves would not have been counted. As such, the counts presented represent a minimum estimate of the grey seals hauled out around the Southwest England SMU in August 2023.

The study demonstrates both the appropriateness of an aerial survey methodology to complete an SMU-wide aerial August census of grey seals, but also the added value of an integrated approach combining aerial methods with citizen science ground count methods. Due to the sensitive nature of the locations of seal haul out sites in the Southwest of England, reference to specific locations, and detailed maps of surveyed areas have not been included in this report.

Contents

1. Introduction

For the majority of the UK grey seal (*Halichoerus grypus)* population (approximately 95%), abundance is monitored using a combination of pup production estimates and August haul out counts (surveyed during the harbour seal moult). This monitoring is conducted by, or counts provided to, the Sea Mammal Research Unit (SMRU), University of St Andrews; counts and derived metrics reported annually through the Special Committee on Seals (SCOS).

Grey seals in the UK are part of a single metapopulation, exhibiting large scale inter-seasonal movements (Russell *et al.* 2013). Here, the term 'population' is used to denote spatial and temporal specific estimates of abundance rather than an independent breeding unit. Females aggregate at colonies to give birth to a single pup facilitating efficient monitoring of the majority of UK pup production, which is a key indicator of grey seal numbers and trends. However, there is a requirement for counts during the main summer foraging season where they accumulate resources for breeding. For the majority of the UK, the opportunity for such data collection is provided by surveys conducted in August to coincide with the harbour seal moult. It should be noted that the proportion of grey seals hauled out in August is relatively low due to the focus on foraging (compared to harbour seals, which are moulting at that time of year), and is also more variable. Indeed, based on telemetry data, it is estimated that 25.15% (95% CI: 21.45–29.07%) of the population is hauled out during the specific survey window and thus available to be counted (Russell & Carter 2021, updated from Lonergan *et al.* 2011). Nevertheless, such counts are critical as they provide a spatially resolved estimate of the foraging population size, and thus values for use in a range of management contexts including estimating Potential Biological Removal (PBR). On a UK scale, August counts can be used to estimate population size (independent from that derived from pup production).

The Southwest England Seal Monitoring Unit (SMU) accounts for up to 1% of the UK grey seal population. Nevertheless, it is an area of relatively high anthropogenic activity, and two Special Areas of Conservation for which grey seals are a qualifying feature. Most published data are from surveys conducted by the Seal Research Trust (SRT; formerly Cornwall Seal Group). Group). Whilst such data can provide important information on fine temporal and spatial scales and can contribute to the designation of regional protected sites and assessments, there was a need for a synoptic SMU-wide August survey of grey seals in Southwest England SMU. Given the potential for within season net movements of seals between SMUs, the use of August data (rather than other summer months) is required for consistency with the rest of the UK.

1.1. 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 so 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. PBR is presently applied across the UK except for the southwest UK SMUs where a paucity of published synoptic, August survey data for either the Southwest England or Wales SMUs limits application of the method of estimation. At the same time, there is known significant grey seal bycatch in the tangle net fisheries off the southwest UK, and Ireland (SCOS 2022). The total bycatch for the region 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 1,632 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 the southwest of the UK, with potential impacts on seals. It is therefore vital that seal management targets such as PBR are based on robust, timely population indices derived from robust summer counts.

1.2. 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 assess overlap and the potential for conflict with anthropogenic activities. In brief, seal telemetry data are combined with environmental data to model habitat association and predict at-sea distribution emanating from haul-outs. Such predictions are weighted by August haul-out count data to predict the population level at-sea distribution of seals. The maps are currently being updated, but the absence of an equivalent, synoptic August survey for southwest UK impacts the robustness of the at-sea density estimates within the region and for neighbouring SMUs. The foraging ranges of grey seals, means that the fine-scale day to day variation in August haul-out sites will not impact the robustness of the at-sea estimates.

1.3. 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. In the assessment, three grey seal indicators are currently assessed; Pup production (Banga *et al.* 2022a); Abundance and distribution (Banga *et al.* 2022b); Bycatch (Taylor *et al.* 2022). The assessments of the SW England region could not be carried out as part of the OSPAR grey seal assessments, due to limited long-term available 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 SW England SMU in future UK submissions to OSPAR, and provide further information to improve condition assessments for SACs.

1.4. Current state of knowledge

There are no presently published synoptic surveys of the seal population in the Southwest England SMU during August, but combining non-breeding season counts, from multiple sources from April to August (Leeney *et al.* 2010; Sayer 2011, Sayer 2012a, 2012b, 2012c; Sayer *et al.* 2012; Woodfin Jones 2019), generated a composite, summer ‘count’ of approximately 625 individuals based mainly on counts between 2007 and 2010 (Russell & Morris 2020).

The resulting composite count of around 625 seals would represent a total population of approximately 2500 grey seals in Southwest England (based on a proportion hauled out of 0.25 (SCOS 2021)). Based on available published data, current pup production in the Southwest England SMU is estimated to be approximately 450 (SCOS BP 20/04). If the ratio of total population to pup production in the Southwest England SMU 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 the Southwest England SMU would be approximately 1,044.

The composite count data appears to suggest that the number of seals hauling out in the Southwest England SMU is significantly higher than expected given the local pup

production. This implies that a proportion of the grey seals hauling out in August in the Southwest England SMU are moving into the area to forage in the summer, but do not breed in the area. The composite count did not represent a synoptic or comprehensive survey and is thought to significantly under-estimate the summer haul-out population. A more robust estimate of the August population in the Southwest England SMU is needed to assess the scale of this apparent seasonal immigration.

To address these challenges, JNCC commissioned the Sea Mammal Research Unit, University of St Andrews, to conduct a comprehensive synoptic survey of the coast of the Southwest England SMU to obtain a count of seals hauled out during the August survey window in 2023. This August survey window and methods align with those used to generate abundance estimates for grey and harbour seal populations in other areas of the UK. This report describes the results of that survey and provides a preliminary description of the numbers and distribution of grey seals around Devon and Cornwall. The survey of the Southwest England SMU was co-ordinated with a survey of the coast of the Wales SMU, from the Severn Bridge to the Dee estuary. The results of the two survey programmes will be combined and used to provide a report of the status of the grey seal population in the southwest of the UK in August, to generate detailed maps of seal distribution and at sea usage and estimate management targets.

2. 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, Grasholm, etc.) were 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 haul-out 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 haul-out 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}. One observer searched the coast using image stabilised binoculars and a second scanned by eye. All seals detected were photographed.

The latitude and longitude of 84 seal haul out site locations across Cornwall and Devon were provided to SMRU by the Seal Research Trust (formerly known as Cornish Seal Group Research Trust, and as Cornish Seal Group) in advance of the surveys. These sites were on the planned survey route, and thus no change to the survey plan was required. Coordinated ground counts by observers from SRT were planned at a sample of sites around Cornwall. Unfortunately, rapidly changing weather conditions required short notice re-scheduling of flights and alterations of flight plans during surveys. Consequently, only a small sample (n = 8) of co-incident ground and aerial counts were obtained from the first survey flight on 04/08/2023. These data can be used in conjunction with similar data from the survey of Wales to provide an indication of the likely effectiveness of the aerial surveys. At two well-known sites (air survey I.D. number 2 and 23, where SRT volunteer counts were higher than the aerial survey counts and there was evidence that groups of seals were missed by the aerial survey, the SRT counts were included in the survey total.

3. Results

An aerial survey of the entire coast of the Southwest England SMU, from Exeter to the Severn Bridge, was completed over four days in August 2023 (Figure 1). Poor weather conditions meant that it was not possible to complete the survey on consecutive days. The Isles of Scilly and West Cornwall, from Gull Rock/Nare Head to Port Isaac, were surveyed on 04/08/2023; the coast from the Severn Bridge to Watchet in Somerset was surveyed on 09/08/2023; the north coast from Penhale Point in Cornwall to Watchet in Somerset was surveyed on 11/08/2023 (but no seals detected); the river Fal estuary and the south coast from Gull Rock/Nare Head to Exeter were surveyed on 13/08/2023. The coast from Newquay to Port Isaac was surveyed twice because air traffic control restrictions on 04/08/2023 diverted the fight offshore in the vicinity of Newquay. Sections of coastline surveyed on each day are indicated by colour code on Figure 1.

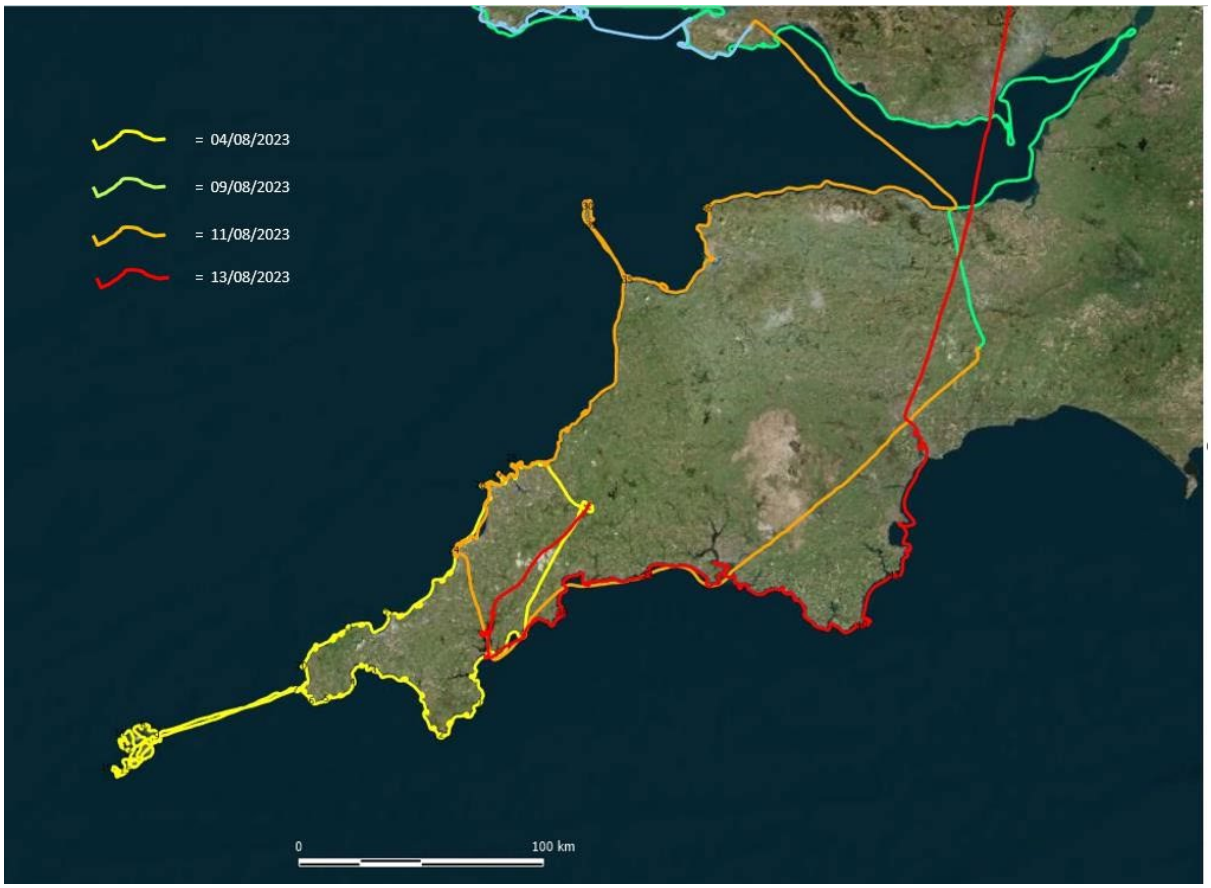

Figure 1. Survey flight paths for August 2023 grey seal surveys of Southwest England SMU (surveys extended north (Wales SMU) and east (South England SMU) are not considered here.

3.1. Overall counts

A total of 756 grey seals were photographed and counted at 43 separate haul-out sites around the Southwest England SMU. This figure includes a total of 39 seals that were not detected by the aerial survey at two sites but were counted by SRT volunteers (Table 1). Most seals (397, equivalent to 53% of the total) were found on offshore skerries in the Isles of Scilly Complex SAC. The seals were all on small uninhabited skerries, concentrated in the Eastern Isles, the Western Rocks and Norrard Rocks. Seventy-five seals were recorded at Lundy Island SAC and the remaining 284 seals were recorded

around the coast of mainland Cornwall (242) and Devon (42). Most of the seals around the mainland (18 groups with 194 seals) were on offshore rocks, skerries and small islands between 230 m and 2,300 m offshore (Table 1). Twenty-six of the Devon seals were recorded at four sites on the south coast that are within the South England SMU. As also observed in the surveys of the Wales SMU, no seals were seen hauled out in the Bristol Channel, east of Ilfracombe.

This 2023 August survey count was approximately 20% higher than the previously used summer haul-out estimate (or 'composite count') of 625 compiled from published data across spring and summer (Russell & Morris 2020).

Table 1. Aerial survey counts of grey seals in Cornwall and Devon in August 2023. Entries represent sites along open coastlines or on offshore skerries, with easily detectable seals that were counted with a high degree of confidence. The shaded cells (with an ǂ) represent sites that were more cryptic, where seals were more difficult to detect and count.

* SRT ground count of 12 seals included in survey total, air survey count was 2 seals.
** SRT ground count of 29 seals included in survey total, air survey count was 0 seals.
*** seals on offshore rocks, but at base of steep cliff.
**** total Includes seals from ground counts by SRT volunteers.

Air Survey I.D. Number	Seal Count	Region	Location Type	Distance from Mainland
1	5	Cornwall mainland	skerries	330
2 ǂ	2*	Cornwall mainland	cove/bay	n/a
3	2	Cornwall mainland	skerries	330
4	6	Cornwall mainland	skerries	300
5 ǂ	1	Cornwall mainland	cove/bay	n/a
6 ǂ	26	Cornwall mainland	cliff base	n/a
7	24	Cornwall mainland	skerries	1,000
8	8	Isles of Scilly	skerries	> 2,500
9	36	Isles of Scilly	skerries	> 2,500
10	132	Isles of Scilly	skerries	> 2,500
11	8	Isles of Scilly	skerries	> 2,500
12	17	Isles of Scilly	skerries	> 2,500
13	14	Isles of Scilly	skerries	> 2,500
14	13	Isles of Scilly	skerries	> 2,500
15	12	Isles of Scilly	skerries	> 2,500
16	16	Isles of Scilly	skerries	>2,500
17	39	Isles of Scilly	skerries	> 2,500
18	56	Isles of Scilly	skerries	> 2,500
19	46	Isles of Scilly	skerries	> 2,500
20 ǂ	3	Cornwall mainland	cliff base***	1,000
21	29	Cornwall mainland	skerries	250
22	38	Cornwall mainland	skerries	500

Air Survey I.D. Number	Seal Count	Region	Location Type	Distance from Mainland
23 ǂ	0**	Cornwall mainland	cove/bay	n/a
24	3	Cornwall mainland	skerries	300
25	17	Cornwall mainland	skerries	100
26	10	Cornwall mainland	skerries	1,500
27	4	Cornwall mainland	skerries	2,300
28	3	Cornwall mainland	skerries	1,100
29	5	Cornwall mainland	skerries	300
30 ǂ	5	Lundy Island	cove/bay	n/a.
31 ǂ	8	Lundy Island	cove/bay	n/a
32 ǂ	19	Lundy Island	cove/bay	n/a
33	6	Lundy Island	open coast	n/a
34	37	Lundy Island	open coast	n/a
35 ǂ	3	North Devon mainland	cove/bay	n/a
36	13	North Devon mainland	open coast	n/a
37	4	River Fal Estuary	floats	n/a
38	8	Cornwall mainland	skerries	900
39	13	Cornwall mainland	skerries	650
40	17	South Devon mainland	skerries	< 100
41	1	South Devon mainland	skerries	220
42 ǂ	1	South Devon mainland	cove/bay	n/a
43	7	South Devon mainland	skerries	250
Total air survey count on open sites			652	
Total air survey count on cryptic sites ǂ			65	
Total air survey count of seals			717	
Total survey count including SRT counts			756****	

3.2. Coordinated ground (SRT) and aerial survey counts

Table 2 shows the counts obtained by SRT ground based observers on 4 August 2023 compared to aerial survey counts on the same low tide period. Due to rapidly changing weather conditions requiring short notice re-scheduling of flights and alterations of flight plans during surveys, coordinated counts by aerial surveys and SRT volunteer observers on the ground were only possible on the first flight on 4 August. At one site (air survey I.D. 38) a ground count was carried out on 09/08/2023, however the air survey was delayed until 13/08/2023.

The ground-based observers recorded a total of eight sites with seals. All bar one of these groups were detected by the aerial survey. One group of 29 grey seals at the well-known site (air survey I.D. 23) was not detected by the aerial survey. Inspection of the survey

track shows that the aircraft came back to level flight after a series of tight turns over an island, before passing approximately 500 m offshore of the site at 150 m altitude, 1.25 hours after low water. Simultaneous ground counts carried out by SRT revealed that these 29 seals were hauled out on an intertidal rocky boulder area of the beach. In addition, although the haul-out group at air survey I.D. 2 was detected, the majority of seals (10 of 12) were not sighted by the aerial survey. At all sites surveyed by both air and ground-based observers, 35% of the seals hauled out were undetected by the aerial survey team, but this increases to 55% if only mainland sites are included in the comparison (Table 2).

Table 2. Ground counts and aerial survey counts of grey seals on haul-out sites around west Cornwall on 4/08/2023. Ground counts were carried out by SRT volunteers during the survey window. Entries represent sites along open coastlines or on offshore skerries, with easily detectable seals that were counted with a high degree of confidence. The shaded cells (marked with an ǂ) represent sites that were more cryptic, where seals were more difficult to detect and count.

* Ground count was carried out on 09/08/2023, but air survey was delayed until 13/08/2023.

Date	Air Survey I.D. Number	Location Type	Air Survey Count	SRT Ground Count
04/08/2023 ǂ	2	Cove/bay	2	12
04/08/2023	4	Skerries	6	5
04/08/2023 ǂ	6	Cliff base	26	26
04/08/2023	7	Skerries	24	25
04/08/2023 ǂ	20	Cliff base	3	2
04/08/2023	22	Skerries	37	41
04/08/2023 ǂ	23	Cove/Bay	0	29
09/08/2023 *	38	Skerries	8	7
Total count			106	147
Total count at cryptic sites (sites 2, 6, 20 & 23)			31	69

If the results of the comparison on 04/08/2023 are typical, the differences between ground and aerial counts can be taken as an index of the efficiency of the aerial survey at detecting seals along complex, cliff backed coastlines. The total aerial survey count on cryptic coastlines was 65. If the ground-aerial survey comparisons are representative, 55% of seals on cryptic sites were missed. This suggests that the overall aerial survey count could have under-estimated the numbers of grey seals hauled out in the Southwest England SMU by up to 80, equivalent to 11% of the total count for the Southwest England SMU. This correction is based on only a small number of sites and should therefore be treated with caution, but the correction is similar to the estimate for the concurrent Wales SMU survey. The inclusion of an additional 39 seals counted during the SRT ground counts at two sites (air survey I.D. 2 and 23) will have further reduced the negative bias due to under-counting of mainland shore sites during the aerial survey.

There were no estimates of the numbers of seals hauled out in caves and therefore the counts are not corrected for seals missed in caves.

3.3. Summer haul-out population estimate

The total August 2023 count of 756 hauled out seals can be used to generate an estimate of the total population in the Southwest England SMU 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 Southwest England SMU counts produced a total population estimate of approximately 3,006 (95% CI: 2,600–3,524). The relatively high variability in the proportion of the population hauled out is a consequence of early August being a key foraging period. The August surveys of the southwest UK will, when combined with data from SMRU and many other providers, for the first time allow a UK wide estimate of the UK population to be generated (independent from pup production).

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

This figure (3,006) can be compared with an alternative population estimate, referred to as the 1+ age population. This 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. For a closed population, this will be very close to the August population, differing only by the number of pups 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.

The most recent composite pup production estimate for the Southwest England SMU is 450 pups (see Russell & Morris 2020 for derivation). Scaling this pup production by the average ratio of pup production to total 1+ age population at the regularly monitored colonies around Scotland and eastern England (1: 2.32), produces a 1+ population of 1,040, which is only around a third of the total population estimate from scaled up air survey counts.

3.4. Discussion

This report presents a preliminary description of the results from the first August synoptic census of the grey seal population around the entire coastline of the Southwest England SMU. The results of the survey produced a summer 2023 haul-out count that was approximately 20% higher than the composite count used up until this point (SCOS 2022) derived from a combination of local summer and spring moult counts from sites around the Southwest England SMU coast (Russell & Morris 2020). The results can be used to update the current August picture of the number and geographical distribution of grey seals around the coastline of the Southwest England SMU in line with methods used as part of statutory scientific advice on seals provided by SCOS to UK Government bodies.

The results presented here must be regarded as a minimum estimate of the numbers of seals hauling out in the Southwest England SMU, so the estimated summer population of 3,006 (95% CI: 2,600–3,524 grey seals derived from these counts is also likely to be an underestimate. The summer grey seal population in the Southwest England SMU during August 2023 was approximately three times the size of the population required to produce the estimated pup production in the SMU. This implies that a large proportion of the grey seals observed in August in the Southwest England SMU do not breed there. This contrasts with the preliminary results of the concurrent survey in the Wales SMU where the overall population estimates derived from both the August count and the pup production were almost the same. Large scale movement of grey seals between breeding sites and distant foraging sites is well documented in the UK (Russell *et al,* 2013), and the most likely explanation is that there is substantial temporary immigration of seals that move into the Southwest England SMU to forage and haul out, but then leave to pup elsewhere.

The apparent similarity between population estimates derived from pup production and summer counts in the Wales SMU means that the Welsh population is not a likely source of these temporary immigrants. The results from Wales and Southwest England SMU will be combined and presented to 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 Southwest England SMU coast during August. The overall distribution is similar to that reported by Leeney *et al*. (2010) from a series of boat surveys carried out in April, at the end of the annual grey seal moult in 2007. One large group at on the north Cornwall coast, detected during the spring survey (Leeney *et al.* 2010) was not detected during the aerial survey. In August 2023, seals were counted at or close to all other haul-out groups recorded in April 2007, with a similar pattern of the largest concentration of seals in the Isles of Scilly. Direct comparison of numbers is confounded by the absence of a conversion factor to estimate population size from haul-out counts during or shortly after the annual moult, when haul-out behaviour is likely to differ from the behaviour during late summer.

This geographical distribution information together with the haul-out 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 coordinated surveys of the Wales SMU with the ambition of updating the SMU status in future reporting of OSPAR common indicators. A programme of regular surveys, at five-year intervals to match the survey schedules in Scottish SMUs, would facilitate the inclusion of the Southwest England SMU in future OSPAR Assessments on grey seals.

3.5. 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 much of the Devon and Cornwall 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 haul-out sites were obscured by overhanging rock and large boulders, and caves along much of the 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. The comparison between ground-based observer counts and the aerial survey counts implies that up to 50% of seals at cliff-backed cove/bay sites (n = 2) were likely undetected. The effect on the overall survey count however, is comparatively small because most seals were found on open haul-out sites where all seals were relatively easily detected. Although we have low confidence in the correction factor for missed seals, the available information suggests that it could add approximately 10 to 12% to the total.

The scale of under-counting at cryptic sites in Wales was similar to that observed in the Southwest England SMU surveys. Flight scheduling challenges during the surveys of the Wales SMU meant that coincident ground and aerial counts were not available for the Welsh surveys in the same way as was possible for some sites during the Southwest England SMU surveys. However, ground counts for dates close to the aerial surveys, including some sites with small coves and gullies at the bottom of cliffs, were used to provide an indication of the likely effectiveness of the Wales SMU aerial surveys in terms of the proportion of groups detected and the proportion of seals counted within groups.

Ground and aerial counts within a few days of each other suggested that seals in small coves and gullies at the bottom of cliffs were underestimated, possibly by as much as 50%. While this cannot be taken as a robust estimate of the undercounting for the air survey, it is similar to the estimate from the Southwest England SMU surveys, confirming that on coastlines where seals haul-out in small coves and narrow gullies with high, steep cliffs the aerial count will be a significant underestimate. Like the situation in the Southwest England SMU, the overall effect on the complete survey will be much lower as most seals were found on open haul-out sites where all seals were relatively easily detected.

3.6. Caves

While it may be possible to obtain some indication of the scale of under-counting of seals on open, and some cryptic sites, there are no data to allow an estimate of the numbers of seals hauled out in caves. Large numbers of caves are used by grey seals at least during the breeding season, and surveys of seals in caves in both Wales and Southwest England SMUs have so far been designed to estimate pup production (see SCOS 2020 for summary). 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 by aerial surveys.

It is not known how many caves are used as haul-out sites across Wales and Southwest England in the first half of August. Strong *et al*. (2005) monitored pupping at a sample of 30 sites along the north Pembrokeshire coast. Their first counts were on the 22 August when only 8 pups were recorded. Numbers rose rapidly, with 179 pups counted three weeks later. The number of seals born in Cornwall in August is reported to be very low. Sayer *et al.* (2016, 2019a, 2019b) found no pups during August surveys of the Isles of Scilly or mainland Cornwall in 2016, and their data indicates no pups born before the end of August at mainland Cornwall sites in 2019, however pups have been recorded as born in August 2023 on the mainland (pers. comms SRT). Overall, this suggests that use of these sites for pupping begins in the latter half of August and there may have been a low number of seals at those sites at the times of these aerial surveys. However, in the absence of independent information on cave use there is potential that a number of seals could have been missed by the aerial survey.

3.7. Disturbance

Seals at some sites may have been flushed from haul-out sites prior to the flypast by the survey aircraft. There is no way of correcting for any such disturbance effect in the absence of an area wide monitoring programme. However, SRT volunteers did visit eight sites prior to the flypast on 4/8/2023 and did not report any disturbance events. Tourist boats and small fishing vessels were seen at several sites, but in each case the operators appeared to be keeping a safe distance offshore and seals at those sites showed no signs of disturbance. It is therefore unlikely that a significant number of seals were missed due to disturbance.

3.8. Appropriateness of the aerial survey methodology

A large proportion of the coastline of the Wales and Southwest England SMUs 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 southwest 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 Southwest England and Wales SMU coastlines 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.

The data collected here will contribute to the generation of a synoptic August snapshot of UK-wide grey seal distribution and abundance and support efforts to integrate further data collected within the Southwest England SMU into these assessments.

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