

Monitoring grey seal (*Halichoerus grypus*) pupping sites in Cornwall 2016

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

Under the Conservation of Seals Act 1970, the Natural Environment Research Council (NERC) has a duty to provide scientific advice to government on matters related to the management of seal populations. NERC has appointed the Special Committee on Seals (SCOS) to formulate this advice. Formal advice is given annually based on the latest scientific information on abundance and distribution provided to SCOS by the Sea Mammal Research Unit (SMRU). The annual SCOS report provides the basis for various reporting requirements (such as MSFD) as well as underpinning Environmental Impact Assessments.

Currently, no data from SW England is provided to SCOS, as the SMRU methodology for data collection (aerial survey) is not appropriate for the region. This means SW England is under represented in the data and therefore within the subsequent SCOS annual report. The overall objective of this study was to look at the feasibility of the methods to allow a robust data set from SW England to be included within the SCOS dataset. The aims were to a) estimate pup production, b) estimate land-based pup count of the Cornish coast from volunteer surveyors, and c) establish the relationship between estimates of pups from direct cave visits versus counts of seal pups from high vantage points (cliff tops).

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Further information

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Natural England Commissioned Report (REDACTED)

Monitoring grey seal (*Halichoerus grypus*) pupping sites in Cornwall 2016

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Cornwall Seal Group Research Trust and the University of Exeter.

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Summary

Complementary boat and land-based surveys recorded 124 unique seals pups (121 grey and three common seal pups). Grey seal pups (n=113) were counted (at 39 sites) in Cornwall and eight (at five sites) in Devon.

The two most productive areas for pups were West Cornwall (n=56) and North Cornwall (n=29).

During the boat-based survey period only, 100 seal pups were recorded, from boat and land-based surveys combined, of which 26% were observed only from boat-based surveys, giving a potential error rate for land-based pup counts.

Disturbance of all but two adult and juvenile seals present in caves and on coves indicates that survey protocols should be amended for large caves to allow for high tide surveys. Some of the larger caves can be accessed safely under calm conditions over high tide. At such times, seals are hauled on small areas of beach at the back of caves. The inevitable disturbance caused by survey teams results in adult seals stampeding to the sea. Over a high tide this is only a short distance compared to the tens of metres over intertidal boulders which seals must stampede at low tide. Including surveys over high tide in the protocol will minimise the risk of injury to seals associated with stampedes without affecting the quality of the pup count data as pups remain hauled. Alternative survey methods using remote technology should also be revisited.

The West and North Cornwall sites that were most important for pup production during 2016 coincide with Sites of Special Scientific Interest where grey seals are a listed feature, therefore awareness of this could be raised.

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Aims and objectives

Aims

To build an evidence base on grey seal breeding activity (pupping) in Cornwall to inform the annual Special Committee on Seals (SCOS) report produced by the Sea Mammal Research Unit's (SMRU). Grey seals can be subject to human disturbance, as such the exact locations of seal caves and other data revealing specific locations have been redacted from this report.

Objectives

1. Conduct eight days of boat-based surveys in 2016 to establish presence and absence of grey seal pups in caves at three main pupping areas on the north and south coasts of Cornwall - North Cornwall (NC), West Cornwall (WC) and Lands End (LE).
2. To assess disturbance resulting from cave survey work.
3. Summarise Cornwall Seal Group Research Trust's (CSGRT) volunteer land-based surveys and ad hoc sightings to estimate cove-based pupping across Cornwall throughout the 2016 pupping season.

Method

Boat-based sea cave pup surveys

Given limited financial and logistical resources priority was given to areas where prior knowledge suggested pupping activity was prevalent (Westcott, 1999 (LE); Westcott, 1999 (LE and WC); Westcott 2007 (NC); Steven, 1936; Summers, 1974 and Prime, 1985). Areas were surveyed in order of challenge with the first caves accessed being ones with which the survey team were familiar and that were known to have safe and simple access.

Natural England provided maps of 54 cave systems drawn by Westcott (2005). These caves had been visited previously to ascertain the presence of seals. For surveying, these caves were grouped into the following geographical areas: North Cornwall, Other (St Agnes and Pentire), West Cornwall and Lands End (**Figure 1**).

To ensure safe operation when entering seal caves, organisations with experience of kayaking and coastering, accredited to Wildlife Safe standards, were engaged to develop health and safety protocols and to act as expert guides during all boat-based surveying.

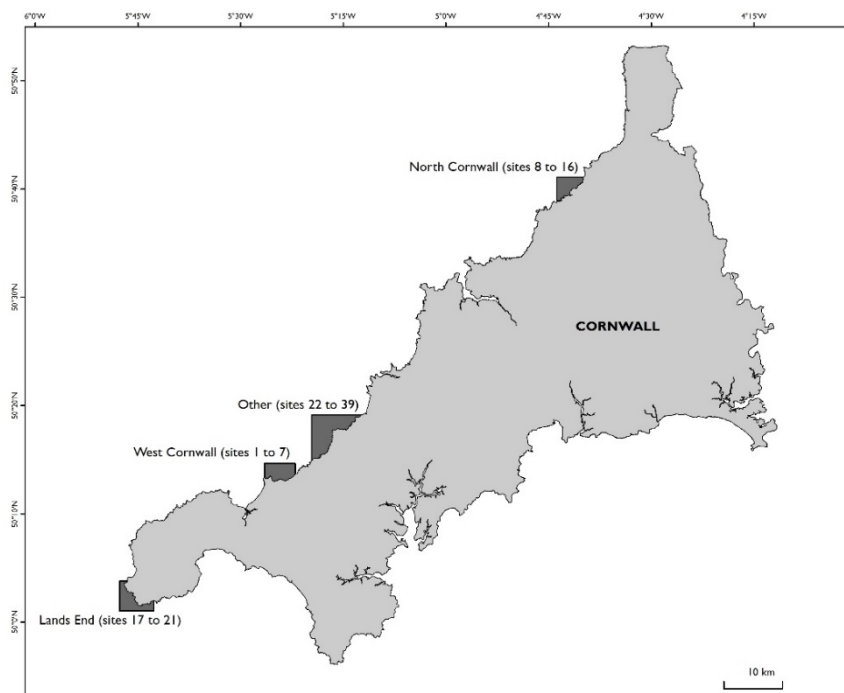


Figure 1. Locations of boat-based surveys for grey seal pups in coves and caves along the Cornwall coast.

Survey frequency

Surveys were governed by tide, sea and weather conditions. Most caves were accessible at low tide whilst the large caves at Lands End were surveyed near to high tide. All caves were surveyed over the shortest possible survey window (40 days) focused around the peak pupping month of October for Cornwall (Sayer 2015).

Safe access to shore

Coves and caves were accessed by two pairs of kayakers; each pair led by an expert kayak guide with a seal surveyor. Kayak guides deemed whether landing outside caves, or entering caves by boat, was safe. Despite several attempts on a variety of survey days, some coves and caves could not be accessed. A further single person kayak was readied upon the main survey vessel for emergency safety support. A FLIR Scout hand-held water resistant thermal infra-red camera was used in the deepest caves to reveal the presence of seals in poor light conditions. This improved the chances of seal detection at the earliest opportunity and ensured surveyors entering caves were prepared to minimise the impact of seals leaving caves at speed, representing a welfare issue to seals and a health and safety hazard to surveyors.

Pup recording

Each encountered pup was assigned a sequential unique number, a developmental code (**Figure 2**) according to Radford (1978) and was photographed (where conditions allowed). A GPS waypoint (latitude, longitude; decimal degrees, WGS84) was gathered at the entrance of each cave surveyed. Dead pups were classified according to their estimated age in weeks (**Figure 3**).



Figure 2. Examples of seal pup developmental stages from Radford (1978).



Figure 3. Examples of dead seal pups at stated developmental stages.

Land-based cove pup surveys

Counts of seals along the coast of Cornwall by volunteers of Cornwall Seal Group Research Trust commenced in 2000, with focus on West Cornwall. From 2008, systematic boat-based marine life coastal transect surveys by the organisation have revealed that seals are not seen along the entire coast of Cornwall, but sightings occur in hotspots where occupancy is prevalent. This pattern of distribution indicates land-based monitoring at key seal sites along the coast does provide meaningful data.

White coated pups have been identified along Cornwall's coast in every calendar month; yet most are born between 1st September and 31st December, with the annual peak in October (Sayer 2015).

In 2014 records of pup sightings were collected for other locations (in addition to West Cornwall) to develop a catalogue of pupping sites. By 2015, CSGRT had developed a good knowledge of Cornwall's pupping sites and these locations were surveyed systematically. By 2016, CSGRT were able to make an estimate of seal pup numbers at these sites.

Each pup identified during land-based surveys was assigned a unique alphanumeric code and the following information was recorded:

- Date of first sighting
- Location
- Recorder
- Status – whether alive, dead or rescued
- Estimated age
- Estimated date of birth
- Mothers identification (where possible)
- Photographic evidence (where possible)

CSGRT revisited pup locations during the lactation period and re-assessed pups from photos to avoid repeat counting. In some cases, it was possible to determine whether a pup was likely to have successfully weaned.

Survey frequency

CSGRT volunteers undertook surveys at varying frequencies for each site. Most data were submitted by surveyors who visited their chosen location at frequent intervals. Ideally pup surveys are conducted at the optimum minimum of once every 17 to 21 days.

Results

Boat-based pup counts

Eight boat-based seal cave survey days were completed between 22/09/16 and 01/11/16 (**Table 1**). Twenty five of 54 mapped seal caves and coves (Westcott 2010) were surveyed with an additional ten sites visited on route (**Table 1**).

Table 1. Survey dates and locations.

Survey	Date	Area	Site Number(s)
1	22/09/16	West Cornwall	1-4
2	23/09/16	West Cornwall & Other (St Agnes and Pentire)	5-7, 29 & 35
3	06/10/16	North Cornwall	8-13
4	07/10/16	North Cornwall	14-16
5	10/10/16	Lands End	17-21
6	11/10/16	(Other) St Agnes and Pentire	22-28
7	22/10/16	(Other) St Agnes and Pentire	29-33
8	01/11/16	(Other) St Agnes and Pentire	34-39

Forty four grey seal pups were counted at 22 (63%) sites (**Table 2; Figure 4**). Thirty nine older grey seals (34 hauled out on land and 5 in the sea) were present at 15 sites (**Figure 4**). All but two of the hauled seals were adults. All hauled out seals in the vicinity of caves and coves were females, potentially mothers to observed pups. Adult males were only encountered at sea and outside caves. Twenty five (57%) observed pups were found in caves, and 19 (43%) on open coves. Most pups were observed in North Cornwall (n=21), followed by West Cornwall (n=10), Lands End (n=7) and Other (n=6).

Eighteen (41%) of observed pups were classified as two weeks old, and 18 (41%) pups were considered to be three weeks old (seals in stages 3, 4 and 5). Two pups found at the end of a long deep narrow cave (in North Cornwall) could not be aged due to proximity of one of their assumed mothers. Two observed pups were dead (stage 1 emaciated white coat and stage 5 emaciated fully moulted). All but two of the 34 hauled adult female and juvenile seals encountered in caves and coves rapidly entered the sea having been disturbed by the survey team.

Table 2. Sites surveyed and seals observed. Lands End (LE), North Cornwall (NC), West Cornwall (WC). Other (St Agnes and Pentire) (O). Seal observed hauled on land (H), seal observed in the sea (S). *Seals disturbed into sea. Sites ordered alphabetically. Site numbers (shared from Table 1) that appear multiple times indicate site-revisits or complex topographic sites with multiple caves, coves or rock systems but share a common geographic place name.

Survey sites with pups	Region	Number of pups and (other seals)	Survey sites with no pups or not safe to survey	Region	Number of seals
17	LE	3 (2H* 1S)	17	LE	NS
8	NC	4	8	NC	8H* 1S
8	NC	2	8	NC	0
19	LE	1	37	O	0
1	WC	2	25	O	0
4	WC	1	4	WC	0
3	WC	2 (1H*)	34	O	NS
3	WC	1	22	O	NS
2	WC	2 (2H*)	26	O	0
5	WC	2 (2H*)	31	O	NS
27	O	2 (1H*)	28	O	0
12 & 14	NC	3 (1H*)	5	WC	7H*
12 & 14	NC	2 (1H 1S)	22	O	1S
12 & 14	NC	1	20	LE	2H*
21	LE	3 (3H*)	6	WC	NS
29 & 35	O	1	8	O	NS
29 & 35	O	2 (1S)	23	O	NS
29 & 35	O	1	38	O	0
9-11	NC	3 (2H*)	13	NC	NS
9-11	NC	2 (2H*)	33	O	NS
9-11	NC	2	30	O	NS
13 & 15	NC	2	24	O	0
			39	O	0
			18	LE	NS

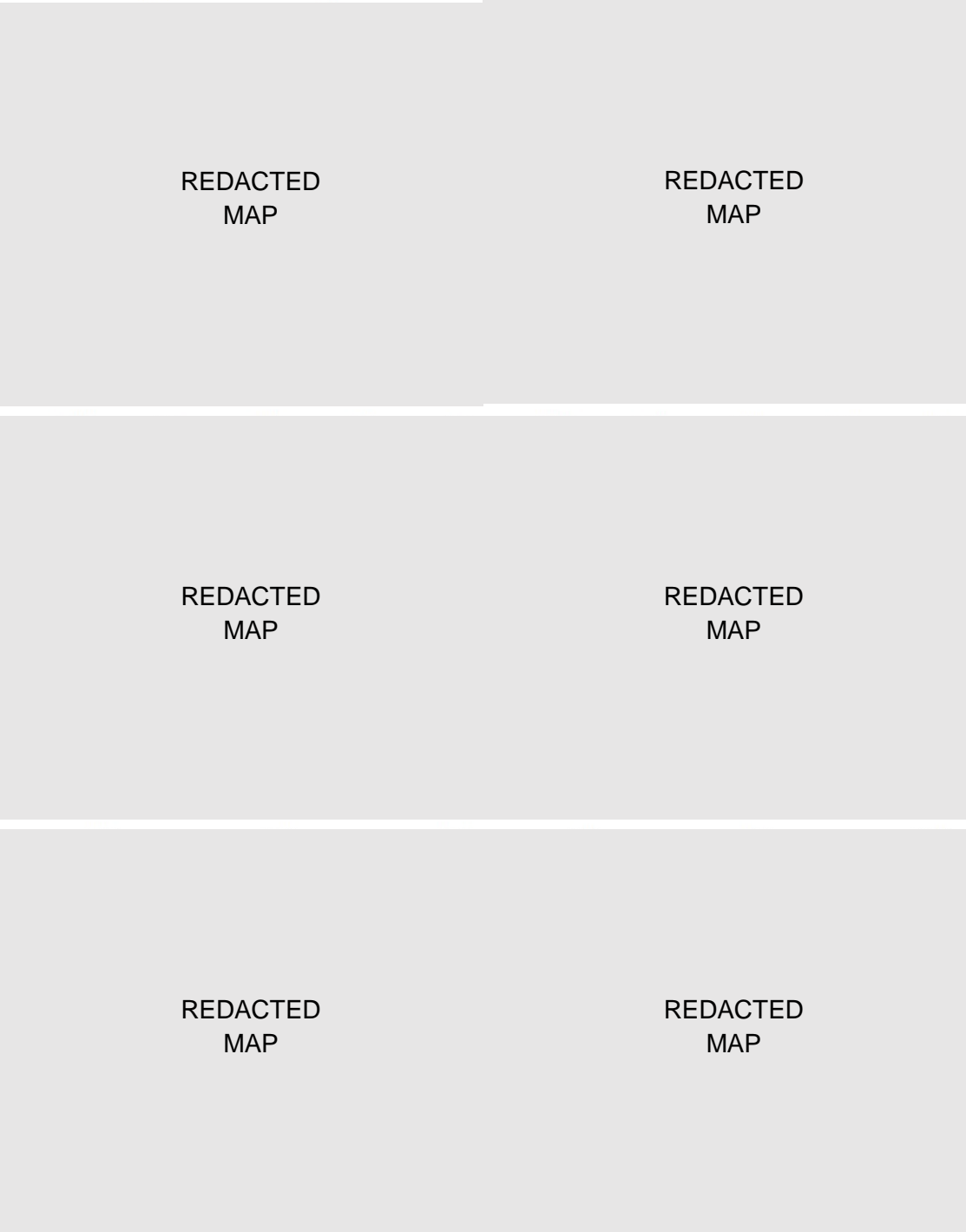


Figure 4. Numbers of seals observed during boat-based surveys.

Land-based pup counts

CSGRT volunteers systematically surveyed independently selected sites at least once per month. Many sites received more frequent survey effort and some were surveyed daily on an annual basis.

Volunteer effort was determined for 15 systematically surveyed sites for the assumed pupping season 1st September to 31st December 2016 (**Table 3**). Ten of these sites were surveyed more frequently than the optimal 21 day interval (duration from birth to weaning is between 17 and 23 days). Five sites were surveyed at durations between 24 days and 61 days. A further 24 sites with infrequent surveys gave rise to five pups. Ninety-two voluntary contributors provided data, as well as information from a range of organisations.

A total of 98 (95 grey and three common) seal pups were recorded between September and December 2016 across Cornwall and Devon (**Figure 5**). The first grey seal pup was recorded on 4th September (estimated date of birth 27th August) and the last recorded new white coated pup was reported on 26th November (estimated date of birth 5th November). Most grey seal pups (n=65) were identified at 15 systematically surveyed locations (**Figure 6, Table 3**), 25 pups were recorded at a further 19 sites with infrequent and irregular survey effort or ad hoc sightings and eight pups from five sites in Devon (**Table 4**). Most pups were observed in West Cornwall (n=42), followed by North Cornwall (n=28), the Lizard (n=10), Other (n=3), elsewhere in Cornwall (n=7) and Devon (n=8).

At systematic surveyed sites most pups were observed in September and October (**Table 3**). Systematic sites were occupied by mothers and pups for varying durations. One systematically surveyed site was used for pupping for three months; eight sites were used for two months and six sites for a single month (**Table 3**).

Eighty three percent of grey seal pups were aged at first sighting (n=82) and 66% (n=54) of these were less than one week old (i.e. stage 1).

Table 3. Sites of systematic land-based surveys for grey seal pups. Lands End (LE), North Cornwall (NC), West Cornwall (WC). Other (St Agnes and Pentire) (O). *Additional pups were reported by members of the public at this site.

Site code	Region	Total surveys	Mean duration between surveys (day)	Number of surveys on which pups observed	Total pups reported	Number of unique pups	Aug. 2016	Sep. 2016	Oct. 2016	Nov. 2016
A	WC	25	5	7	8	2	0	2	0	0
B	WC	34	4	19	36	9	0	7	2	0
C	WC	21	6	4	4	3	0	0	1	2
D	WC	27	4	10	16	13	0	3	10	0
E	LE	121	1	28	30	2	0	1	1	0
F	WC	51	2	11	17	5	0	2	3	0
G	NC	21	6	13	30	11	0	6	4	1
H	NC	2	61	2	3	2	0	2	0	0
I	NC	20	6	4	7	4	0	2	2	0
J	NC	11	11	1	2	2	0	0	2	0
K	NC	2	61	2	4	2	0	0	2	0
L	O	10	12	2	2	1	0	0	0	1
M	O	5	24	4	4	2	0	2	0	0
N	LE	3	40	2	3	5*	0	3	2	0
O	O	5	24	3	3	2	0	1	1	0
Total		358	18			65 pups				

Table 4. Opportunistic records (OR) of grey seal pups in Cornwall and Devon.

*Using boat-based reporting regions where applicable.

Site code	Region	Number of pups
OR-1	North Devon	1
OR-2	North Devon	1
OR-3	North Devon	3
OR-4	North Devon	2
OR-5	*North Cornwall	2
OR-6	*North Cornwall	3
OR-7	*North Cornwall	2
OR-8	*St Agnes & Pentire	2
OR-9	*St Agnes & Pentire	1
OR-10	*West Cornwall	1
OR-11	*West Cornwall	2
OR-12	*West Cornwall	1
OR-13	*West Cornwall	1
OR-14	Lizard	1
OR-15	Lizard	1
OR-16	East Cornwall	1
OR-17	East Cornwall	1
OR-18	East Cornwall	1
OR-19	East Cornwall	1
OR-20	East Cornwall	1
OR-21	East Cornwall	1
OR-22	East Cornwall	1
OR-23	East Cornwall	1
OR-24	South Devon	1
		33 (pups)

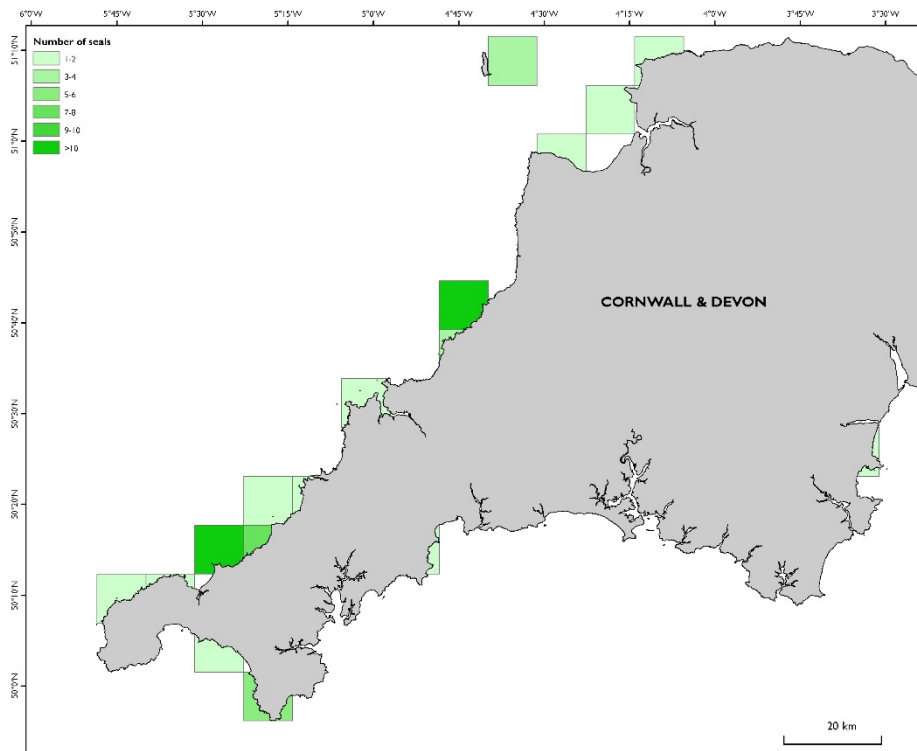


Figure 5. Count of grey seal pups observed in Cornwall and Devon from land-based surveys (systematic and ad hoc) shown using a 10 km x 10 km grid.

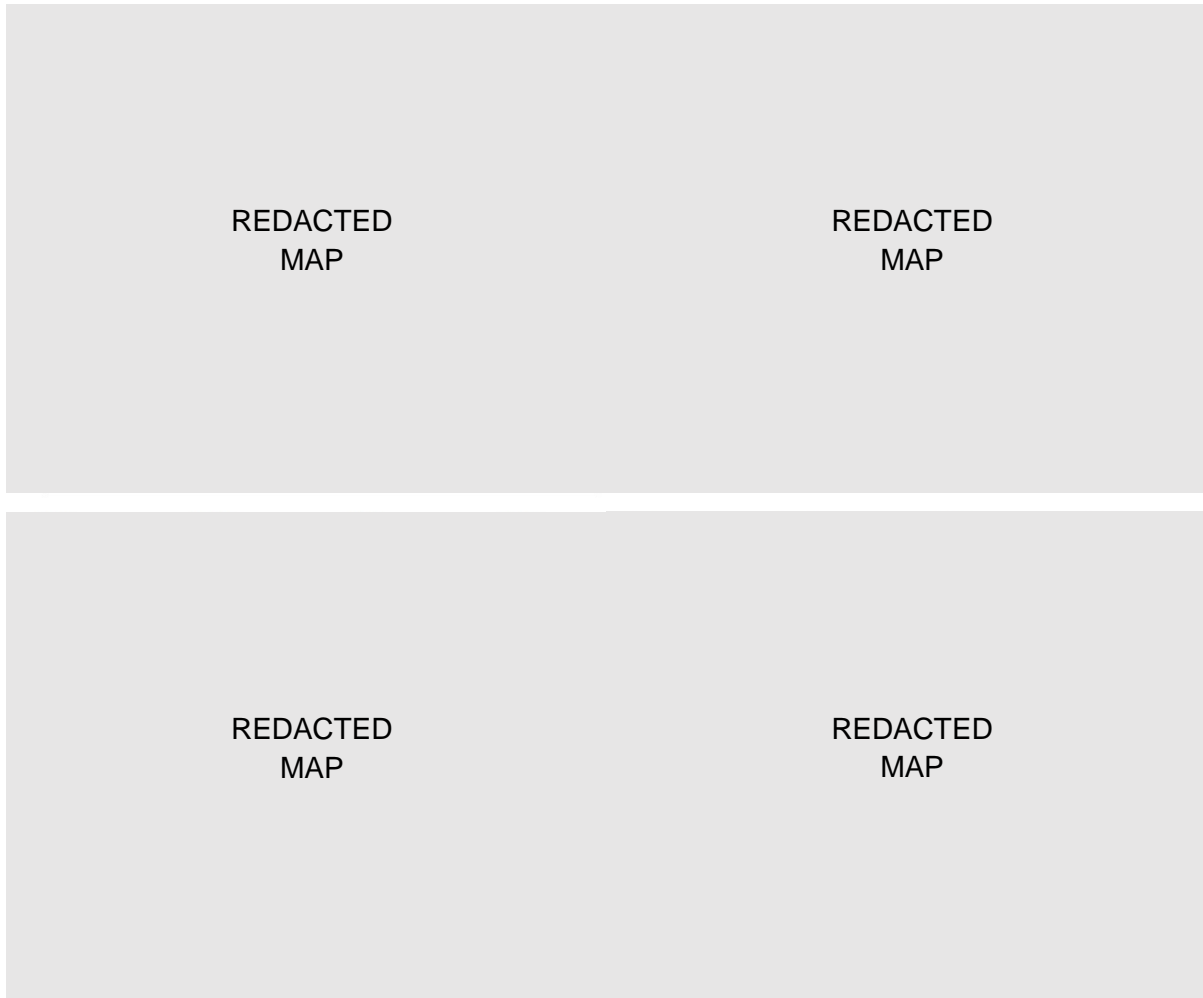


Figure 6. Location and seasonality of grey seal pups in Cornwall from land-based surveys (systematic).

Pup mortality rates during lactation

Thirty three percent of the pups observed were tracked to weaning for over 17 days or were considered sufficiently well fed to survive at the completion of weaning. Sixteen pups did not survive to weaning; the minimum estimated mortality rate during the first three weeks was 16%.

Combined boat and land-based surveys

Surveys of grey seal pups from boat and land-based surveys were combined to produce a minimum estimate of production for 2016. Data were corrected to eliminate potential repeated counts of pups that could have occurred at locations where boat surveys were undertaken but where these areas were visible from land-based observation points.

Table 5. Counts of greys seal pups from boat and land-based surveys.

Survey type	Pups
Boat-based counts	44
Land-based cove counts	98
Maximum number of pups visible from boat and land (minus)	-18
Minimum number of pups observed	124

Discussion

Boat-based surveys

Survey frequency

Caves were surveyed during late September, October and early November to ensure survey effort overlapped with the peak period of grey seal pupping in Cornwall. Survey effort was sufficient to provide simple presence and absence data in caves at a single time point within the pupping season. As such it was not possible to provide a more robust pup production estimate. This might be achievable with more frequent surveys but would likely result in more disturbance. A recommendation for the future might be entering select caves once per month through the season or revisiting an alternative methodology using cliff mounted cameras. Larger caves would be better accessed over high water when pups remain ashore relatively undisturbed by survey teams and mothers have short and easier access routes to the sea.

Pup counts

Most pups were recorded at North Cornwall sites contributing over twice as many as West Cornwall followed by Land's End and caves around St Agnes and Pentire. Twenty five pups were found in caves that would not have been visible from land-based surveys until pups departed caves to start their post weaning dispersal. Only one grey seal pup found in a cove was recorded during boat surveys that had not been seen from the land.

Seal counts

Two of the largest cave systems surveyed, contained no pups but 13 adult females and two juveniles hauled out. The role these caves play in pupping and non-breeding seal behaviour is unclear.

Mortality

Direct observations of two dead pups (of 65 pups) in caves suggests a possible minimum mortality rate of 3% compared to reported estimates of mortality prior to weaning of 15% (Davies 2001).

Disturbance

In all disturbance events the cave survey team's estimate of number of seals affected either matched or exceeded the number of seals recorded leaving caves made by those remaining on the main survey vessel. It seems plausible that some seals exit caves using submerged passages not visible to the boat survey team.

Thermal Infra-red technology

The use of a FLIR Scout thermal IR camera provided a useful technique for detecting seals prior to them being seen by the human eye under flood lighting conditions. Detecting the seals with this technology ensured the survey team had additional time to more effectively plan safe exit routes for seals enabling better disturbance management. In all cases seals were visible to the FLIR Scout and pups could be separated from adults and counted in most cases. The use of a handheld flood light and waterproof wrist mounted torches ensured the survey team was always visible to the seals.

Land-based surveys

Land-based surveying of seal pups provides a comprehensive coverage of the majority of seal pupping sites with the exception of Lands End. This exception is a reflection of the inaccessibility of coast and steep cliffs in this region that reduce pup visibility to coastal path walkers.

A total of 98 pups at 39 sites across Cornwall and Devon for 2016 was consistent with 90 pups recorded in 2015 (Sayer, 2015 unpublished raw data). The peak pupping month of September, followed by October, was one month earlier than that for Cornwall in previous years 2000 to 2013 (Sayer, 2015 unpublished raw data). The pupping season in 2016 occurred over a shorter duration than in previous years. Whilst it is not unusual to encounter few pups in August in Cornwall, the season usually extends into late November and December (Sayer, 2015 unpublished raw data).

Repeated land-based surveys were likely to have increased the probability of detecting all seal pups including dead ones. Pup mortality rates from land-based surveys was higher than recorded on the snapshot boat surveys. The minimum mortality rate of 16% was in line with mean rates of 15% (Davies 2001).

Boat and land-based surveys

A total of 124 unique seal pups were recorded from boat and land-based surveys – 121 grey seal pups (113 in Cornwall and eight in Devon) and three common seal pups. Two areas, West Cornwall (n=56 pups) and North Cornwall (n=29 pups), appeared the most productive for grey seal pupping. The boat and land-based surveys produced complementary results with more pups being recorded at North Cornwall from the boat-based surveys and more pups being recorded at West Cornwall from the land-based surveys.

To compare the contribution made by boat-based surveys, a comparison was made of pups sighted between 23/09/16 to 01/11/16 only (the duration of the boat surveys). Of the 100 seal pups recorded during this period – 26% resulted from boat-based surveys compared to 74% of pups observed from land.

Conclusion

It has taken 17 years for CSGRT to gain sufficient knowledge of putative pupping sites and to recruit a network of volunteers able to conduct suitable surveys across Cornwall.

One hundred and twenty four unique seal pups (121 grey and 3 common) were recorded during the 2016 pupping season. Of the 121 grey seal pups, 113 were recorded in Cornwall and eight in north and south Devon. Seal pups were recorded at 44 different cave and cove locations; 39 sites across Cornwall and five sites in Devon.

Eighty five grey seal pups were recorded at the West Cornwall and North Cornwall sites alone most likely making them the two most important grey seal pupping locations in mainland Cornwall in 2016 (the Isles of Scilly and Lundy being important offshore pupping sites and Special Areas of Conservation). Both West Cornwall and North Cornwall seal sites are within designated Sites of Special Scientific Interest (SSSI).

Boat based surveys contributed 26 grey seal pups that were not seen from land. Land based surveys recorded 80 pups that were not seen during boat surveys. 18 pups were thought to have been recorded on both boat and land-based surveys. Boat and land-based surveys provided complementary results, with the boat surveys providing a snapshot of data gaps in caves and land-based surveys providing wider spatial and temporal coverage of the pupping season.

The peak pupping season in 2016 was September followed by October and was a very compact season. It peaked earlier and ended earlier than in previous years (Sayer, 2015).

Recommendations

A more comprehensive survey project across Cornwall throughout the pupping season will be required to provide a more accurate estimate of pup production. The disturbance caused by surveyors accessing caves potentially highlights the need for a more remote and technology-focused solution to surveying to be revisited. As remote cameras in caves cannot easily cope with the darkness, remoteness, moisture and pressure, cameras on some of the larger cave entrances could quantify the adult females accessing and exiting caves. This coupled with photo identification would reveal more about the numbers of pups in caves. CSGRT have previously noted that the number of adult females just on and offshore at a pupping site closely corresponds to the number of pups present onshore. Pregnant females arrive shortly before giving birth and leave suddenly at weaning to feed. This pattern was also observed during these surveys as the number of females present on land, then disturbed into sea and remaining just offshore was typically the same as the number of pups present onshore.

Survey protocols could be further enhanced to allow for high tide access to larger caves where headroom enabled safe access. This would minimise the potential for injury to seals arising from long egress routes across boulder beaches. Surveying at a higher tide also ensures surveyors have less ground to cover to find pups that are typically located towards the back of the cave or cove.

The Cornwall Wildlife Trust's Marine Strandings Network hold data on pups under and over three weeks old (Crosby, 2015). An analysis of dead white coated pups from 2016 would increase understanding about grey seal pup mortality rates in comparison to pup production summarised in this report.

References

- CROSBY, A. et al. 2015. Marine Strandings in Cornwall and the Isles of Scilly. Cornwall Wildlife Trust Marine Strandings Network. Cetacean Strandings Investigation Programme.
- DAVIES, J. et al. 2001. Marine Monitoring Handbook, JNCC.
- FEDAK, M.A. and ANDERSON, S.S. 1982. The energetics of lactation: accurate measurements from a large wild mammal, the grey seal. *Journal of Zoology*, London 198: 473-479.
- PRIME, J.H. 1985. The current status of the grey seal (*Halichoerus grypus*) in Cornwall, England. Biological Conservation.
- RADFORD P.J. et al 1978. A statistical procedure for estimating grey seal pup production from a single census. *Mammal Review* 1978, Volume 8, Nos. 1 and 2, 35-42.
- SAYER, S. 2010. Grey seal pup numbers between Godrevy and Deadman's Cove on the north Cornish coast 2000 to 2010. Unpublished raw data.
- SAYER, S., HOCKLEY K., WITT M.J. (2012) Monitoring grey seals (*Halichoerus grypus*) in the Isles of Scilly during the 2010 pupping season. Natural England commissioned reports, Number 103 (NECR103).
- SAYER, S. 2015. CSGRT pup records. Unpublished raw data.
- STEVEN, G.A. 1934. A short investigation into the habits, abundance and species of seals on the north Cornwall Coast. Report to the Ministry of Agriculture and Fisheries.
- STEVEN, G.A. 1936. Seals (*Halichoerus grypus*) of Cornwall Coasts. Report to the Ministry of Agriculture and Fisheries.
- SUMMERS, C.F. 1974. The Grey Seal (*Halichoerus grypus*) in Cornwall and the Isles of Scilly. Biological Conservation.
- WESTCOTT, S.M. 1999. Grey seals of southwest England. Unpublished.
- WESTCOTT, S.M. 1999. Grey seal (*Halichoerus grypus*) pup production at Lands End (1994-1998) and Godrevy (1996 – 1998) sites in Cornwall, England. Unpublished.
- WESTCOTT, S.M. 2007. A baseline study of year-round grey seal use of Boscastle coast sites on the north coast of Cornwall. Unpublished.
- WESTCOTT, S.M. 2008. Procedural guidelines for studying grey seals in southwest England, 2006. ISSN 1754 1956. NERR017 Natural England.