Tees Estuary Seal Study (TESS)

I – Tees harbour seal pupping

TEES SEAL MONITORING – SEAL SANDS & GREATHAM CREEK

Photo count trial, June-July 2024

TESS seal photo-monitoring team 2024

Sue Wilson, Richard Wise, Imogen Crawford, Sally Bunce

Drone operator
Richard Wise

Funding
Seal Conservation Society

Report preparation
Sue Wilson

Acknowledgement
Our thanks to Venator for permitting and facilitating access across their site to the seal observation points.

Summary

Potential methods for re-starting the Tees Seal Monitoring Programme were trialled during the June-July harbour seal pupping season and August-September harbour seal moulting season. The intention was to develop a verifiable photographic method using a hand-held camera, supplemented where possible by drone survey.

Three hand-held camera surveys were carried out in late June and a further three in the first half of July. The maximum confirmed number of live harbour seal pups was 22 on July 10. 19 still with their mothers; two dead pups were recorded, one on June 27 and one on July 10. The maximum number of other harbour seal adults and subadults during the June/July counts was 127, also on July 10.

The first trial drone survey was carried out on July 10, and three further surveys between August 04 and September 03. The highest count from these surveys was 163 harbour seals and number of grey seals counted (including on site D) was 94 grey seals on September 03.

Counts and behavioural observations were also carried out over the high tide period at Greatham Creek to estimate the proportion of the seals using Greatham Creek, and to observe the behaviour of pups with their mothers. The highest number of mother-pup pairs was 15 on July 08, i.e. the same number as recorded at Seal Sands on the previous low tide.

Some recommendations were made for: the timing of monitoring, improving photo-monitoring methods, photo data analysis, Greatham Creek behaviour observations, method of abundance estimates for each species, and site success to facilitate comprehensive coverage of all Seal Sands seal haul-out areas.

1. INTRODUCTION

The Tees seal monitoring programme dates from 1989, when it was initiated – in the wake of the devastating harbour seal epidemic of phocine distemper virus (PDV) of 1988 – by David Bellamy Associates and funded by Teesside Development Corporation.

During the first eight years of monitoring at Seal Sands the maximum number of adult or subadult harbour seals counted during the June-July pupping season was 19 in 1989 rising to 39 in 1997. During the August-September moulting season the maximum numbers were 23 in 1989 rising to 49 by 1997 [i].

Total breeding failure was recorded in 1989–93 – although a single pup was born in 1989, 1991 and 1993, none survived more than a few days. Two pups were born in 1994 and both survived to weaning; two pups were born in 1995 and again in 1996, although one of the pups stranded in each year. In 1997 four pups were born, one was a still-birth, one was successfully weaned and two stranded.

The monitoring programme was subsequently taken over by INCA[ii], who recorded a gradual rise in adult/subadult harbour seal maximum counts in 2023 to 146 during the pupping season and 162 during the moulting season. The number of pup births has also grown steadily up to 27 reported in 2023 (although there was a "spike" maximum count of 36 pups reported in 2022). The INCA records indicated excellent survival of pups to weaning at Seal Sands, with 0–4 pups stranding or dying in any year between 1998 and 2023.

In 2023 INCA announced it would no longer be managing or supporting the seal monitoring programme and wished to hand the programme over after 2024. The TESS team, under the auspices of the Seal Conservation Society[iii] volunteered to initiate the re-setting of the monitoring programme, in conjunction with resetting investigations into the causes of seal stranding in the Tees Estuary and Bay area[iv].

The main aim of the 2024 trial was to introduce photo-counting to the visual monitoring programme to verify counts of seals (species, age-class and pups).

2. SEAL SITES AND METHODS

2.1 *The seal sites at Seal Sands*

Seals Sands is a low water (l.w.) haul-out site for seals, with the mudflats exposed from ~2h before high tide until ~2h after high tide (depending on the state of the tide). When the

monitoring programme began the seals used, almost exclusively, the sites A-D during the l.w. period (Fig. 1).

2.2 *The Seal Sands haul-out sites (1989–94)*

From 1989–1994 the seals hauled out at sites A–D (Fig. 2) and were observed using binoculars, telescope and camera with telephoto lens from the points marked with purple circle. Site A was generally the first to be exposed on the falling tide and to be occupied by harbour seals. As the tide receded the seals would move as a group from site A to B. Most seals then transferred from B to C, or directly to C, remaining on C until washed off by the rising tide. Site D is available for longer at each tide and was generally occupied by grey seals. Seals were mainly observed from the point **O1** opposite site C.

2.3 The Seal Sands haul-out sites at the present time.

Since the early days of the monitoring programme, the harbour seals' use of the Seal Sands habitat has changed. The mud-flat topography has changed slightly, with a "spit" now extending from site C across Seaton Channel. Seals are now also hauling out behind the mid-tide wall (as viewed from the Venator Hide, **O1**), now referred to as site E, extending along the channel edge. Seals are using the area close to Bailey's Bridge (site G) and an area along the north bank of Seaton Channel (site F), not visible from the Venator Hide, but clearly visible from observation point **O2**. Site A is now a more ill-defined area between sites E & G (Fig1, top). Site D, historically a grey seal site, is not visible from any of points **O1–O3**, and would require a dedicated observation point, not possible during the 2024 trial survey. However, site D was included in a drone survey on 03/09/24.

Some harbour seals are also using the tidal Greatham Creek, which is an extension of Seaton Channel penetrating the salt marsh to the west of Seal Sands (Fig. 1, bottom). However, the seals' water access to and from the salt-marsh haul-out sites at Greatham Creek is available only from ~2h after l.w. until ~2h before the next l.w. Further detailed views of each haul-out area A–G are given in Appendix B.

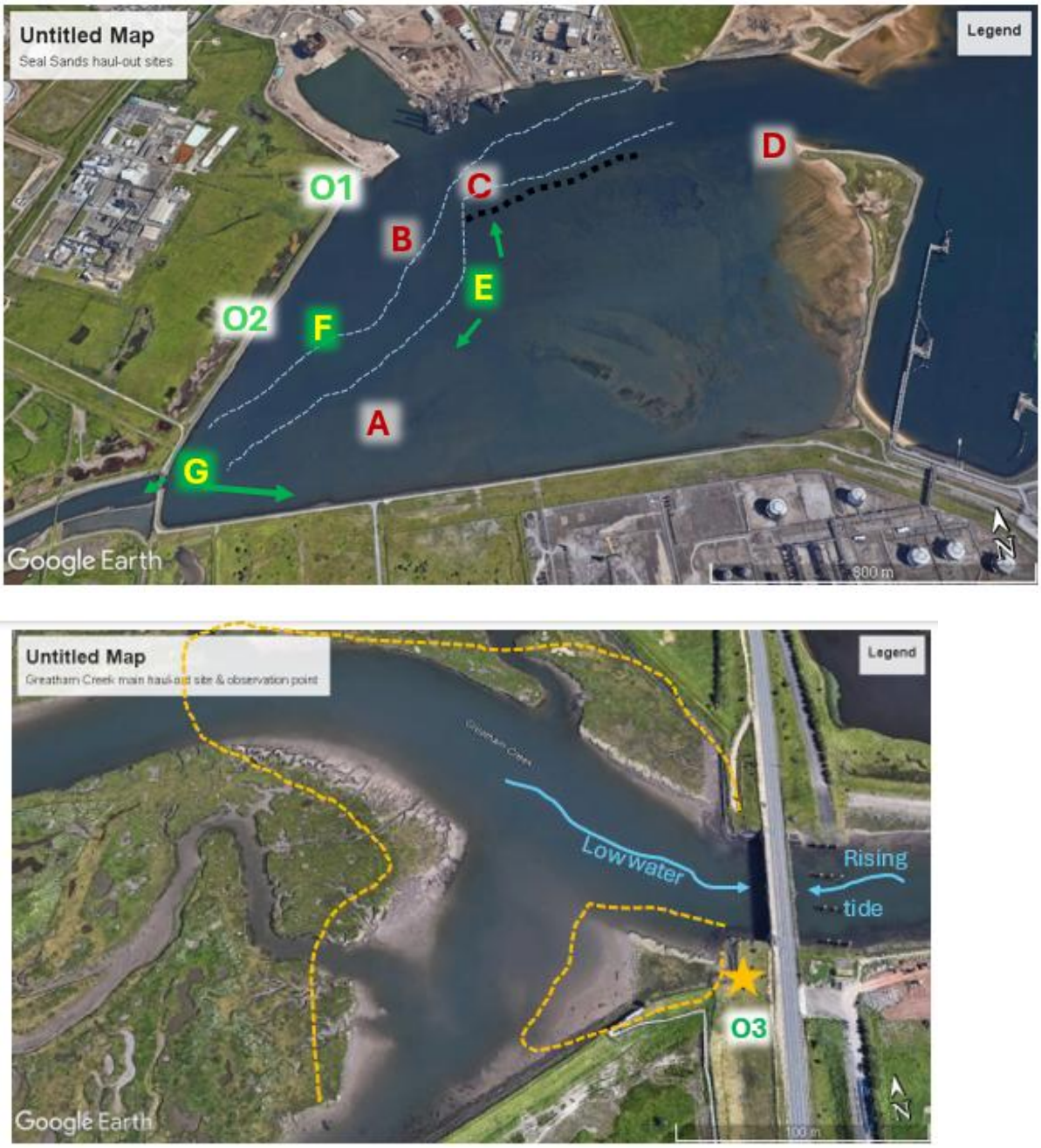

Fig. 1. Tees Estuary seal colony – harbour seal monitoring sites on Seal Sands (top) and Greatham Creek (bottom), indicating seal haul-out areas **A**–**G,** Greatham Creek, and observation points 2024 (**O1** – **O3**).

2.4 Hand-held photo counts 2024 – harbour seals

The focus of the Tees seal monitoring was harbour seal pupping; however, grey seals occurring at the monitored sites were also recorded (Fig. 2). The purpose of the counts at Seal Sands was to estimate-the total number of seals and pups present. The purpose of the counts at Greatham Creek on the rising or ebbing tides was to observe numbers using the Creek after tidal flooding of Seal Sands, as well as behaviour, habitat use and assessment of health of pups as they moved in and out of the water.

Fig. 2. Subadult harbour seal (left) and subadult grey seal female (right) on the "Spit" at site C.

In the 2024 pupping season (June 24–28 and July 08–11) photo counts at Seal Sands and Greatham Creek were trialled using a Panasonic Lumix camera with 60x zoom lens. Counts were carried out at Seal Sands and Greatham Creek at low water and at Greatham Creek either on the rising or ebbing tide.

A total of six l.w. seal counts at Seal Sands were made on 24th, 26th and 27th June and on 8th and 10-11th July. Photos for the counts were initially made only from the Venator hide (**O1**), close to the Observation point ("obs") from the 1989–94 observations (Fig. 1).

For each photo count a series ("sweep") of photos was taken, starting at one end of the colony and continuing (with overlapping shots where possible) to the other end of the colony; this was repeated up to four times and the maximum counts from the sweeps noted as the count for the day. This sweep included seals hauled out at A, B, & C. It included most of the seals at E (although seals hauled out immediately behind the wall could not be counted accurately or the species clearly distinguished) and most at G, although any seals at G on the far side of Bailey's Bridge were not regularly counted. Greatham Creek was surveyed from point O3 just before the Seal Sands count to include any seals remaining there over the low water (~4h) period.

However, it became clear that the seals no longer clustered into discrete areas **A–C** as in the early monitoring years. Seals now also haul out on the south side of the mid-tide wall and extend in small groups all along the edge of the channel (site "**E**" (Fig.3). towards Bailey's Bridge (site "**G**"; Fig. 1), and again on the north side of the channel along from Bailey's Bridge towards the original site **B** (pale purple line; Fig. 1). Seals hauling out on the nearside (north bank) of Seaton Channel (now denoted site "**F**") were noted on July 10 to be barely or not at all visible from **O1** (the Venator hide). On July 11, an additional photo count was therefore made from point **O2**, starting at Bailey's bridge (Fig. 1).

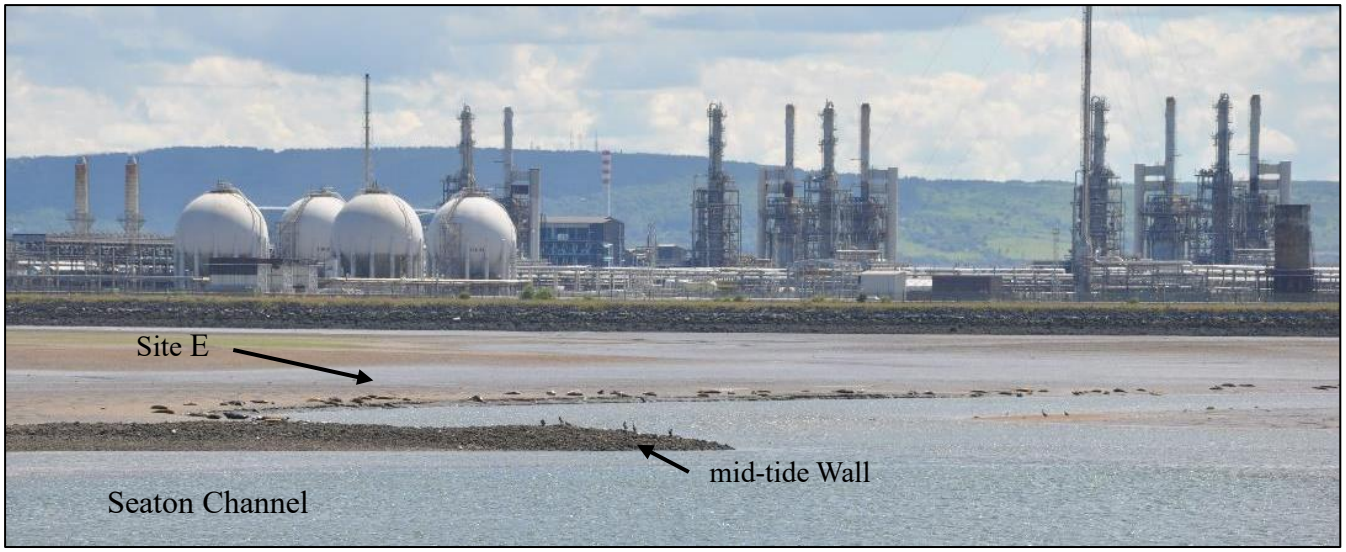

Fig. 3. View of mid-tide wall and site **E** from the Venator hide, July 2024 (photo from point **O1** using hand-held camera).

The no. of harbour seals at Greatham Creek on the rising and high tide following a Seal Sands count was recorded from the point **O3** on three dates (25-26th June and 8th July). The numbers remaining at Greatham Creek on the ebbing tide preceding a Seal Sands count were recorded on four dates (27-28th June and 10-11th July).

2.5 Drone trials

2.5.1 Drone trial – 11/07/24. The purpose of the drone survey trial was to compare counts from the drone images with those taken from the hand-held camera. The trial drone survey of Seal Sands was carried out on July 11, starting from the Bailey's Bridge end of Seal Sands. The trial focused on the harbour seal group at "**F**" along the north bank of the channel. The drone was flown four times along the group at **F,** during a 17-min period, with the fourth flight enabling a direct "top down" view of the seals. Screenshots were then made from the drone videos to enable counts to be made of adults/subadults (As/SAs), Mother-pup (MP) pairs and lone pups (LPs). A manual photo count of group **F** (13:40-13:41) was synchronised with the first of the drone flights (starting 13:38).

The drone also took video of the predominantly grey seal haul-out at the "**Wall**" site; seals counted from screenshots from this drone video were compared with manual photo shots.

2.5.2 Drone trial – August/September 2024. Further drone flights were made on August 4th & 19th and September 3rd. The drone was launched variously from points **O1** or **O2** (Fig. 1; Fig A1). The seals at some parts of sites **A**, **D** & **E** and Greatham Creek were too distant from any of these points for the drone's range; however, a drone count was achieved at site **D** on 03/09 from a closer launch point along the south edge of Seal Sands (Fig. 1).

3. RESULTS

3.1 Hand-held photo counts at Seal Sands – harbour seals

The photo counts at Seal Sands in late June identified between 10 and 16 harbour seal MP pairs and between 73 and 89 other adults/sub-adults (As/SAs) on different days (Fig. 4; Table A1). The counts in July were variable, with the highest harbour seal count on July 10 of 19 MP pairs and 3 lone pups (LPs - apparently healthy pups whose mother is absent), and 127 other (A/SAs) (Table A1).

The count on July 10 included 9 A/SAs and 2 MPs at site "**F**" photographed from the western end of Seal Sands (Fig. 5) - seals at this site will have been missed on previous counts from the Venator hide. A shape resembling a dead newborn pup was recorded on June 27 and (apparently same image in the same place) on July 10. Another dead pup was recorded on July 10 (Table A1).

Fig. 4. Harbour seal group at site E (July 2024). The group includes an MP pair with pup suckling and an SA in the right foreground. (Photo taken from O1 using hand-held camera and zoom lens)

Fig. 5. Harbour seal group at site F, taken from point O2 *without* and *with* using zoom lens (11/07/24)

3.2 Photo counts at Greatham Creek June-July 2024 – harbour seals

The counts of As/SAs at Greatham Creek were only 13–15% of the seals subsequently recorded at Seal Sands on the subsequent low tide, and apparently even fewer than those recorded at Seal Sands on the preceding low tide (1% & 6%; Table 2).

However, between half and the total number of pups counted at Seal Sands on the preceding tide were recorded at Greatham Creek of the subsequent rising or high tide (Table A2; 26/06 and 08/07) and between about half and the total number of pups recorded on the ebbing tide at Greatham Creek were recorded at the subsequent l.w, count at Seal Sands (Table A2; 27/06, 11/07). The smaller (35%) percentage of pups at Greatham Creek on 10/07 coincided with a preceding morning of heavy rain (Table A2).

3.3 Drone trial 10 July 2024

During the July 10 survey at l.w. there was considerable harbour seal activity on the western aspect of Seal Sands, with seals apparently moving from an initial haul-out at **Bailey's Bridge** to site **F**. Counts from the drone images ranged from 10-24 A/SAs and 6-7MPs, plus 1–2 LPs (Table A3). The final drone count, taken directly overhead of the seals (Fig. 6), was the clearest, facilitating the distinction between adults and pups and enabling pups to be seen which may have been "masked" by their mother lying between them and the camera on oblique shots from the drone or sideways shots from the hand-held camera.

Fig. 6. Example of view of harbour seals on site "**F**" from overhead drone (10/07/24). From left to right: lone pup (LP), mother-pup (MP) pair, single adult (A), MP pair.

At least 6 MP pairs were evident from all the drone counts, while only 3-4 were clearly seen from the manual camera images taken from **O2** – due to the pups being masked by their mothers or other seals between them and the camera (Table A3). However, by far the clearest drone images for detecting and identifying pups were on the last overhead flight (Drone 3; Table A3).

3.4 Drone trial surveys August-September 2024 (harbour seal moulting season)

The results of the drone trials on August 04, 19 & September 03 are summarised in Table A4. The maximum count of both harbour and grey seals was 163 harbour seals (including 5 SAs) and 1P, and 94 grey seals (03/09; Table A4).

The largest cluster (77) of the harbour seals on 03/09 was along the edge of Seaton Channel towards site D – harbour seals had not been recorded there earlier in the summer. The number (5) of visibly subadult (SA) harbour seals, i.e. <4 years old, was relatively low compared to the number of adults. Only one pup (of the 22 recorded on 10/07/24) is also low, although pups after weaning spend most of their time learning to forage. The pup seen on 03/09 hauling out at site **F** with its head up and mouth wide open (Fig. 5) indicates it had just been feeding.

Fig. 5. Harbour seal pup hauling out at site F with raised head an open-mouth gape (indicating recent feeding)

3.5 Grey seals

Grey seals may haul out anywhere alongside harbour seals at Seal Sands or Greatham Creek. However, during the June-July 2024 photo count trial from the Venator Hide they were almost all to be found near the mid-tide Wall – on the far side of the **Wall** from the Venator Hide. From the hide area they appear bunched together right behind the **Wall** (Fig. 6–Top) and impossible to count accurately. However, when viewed on 11/07/24, from between **Bailey's Bridge** and the Venator hide (Fig. 6-Centre), all individuals in the entire cluster were more clearly visible. A total of 62 grey seals were estimated from the camera footage but a 68 were more clearly visible from the drone images (Fig. 6–Bottom).

Fig. 6. Grey seals at site E (to south of mid-tide wall). Top: photo from Venator hide (**O1**) hand-held camera using zoom); middle: photo from **O2** (hand-held camera without zoom), and bottom: photo (enlarged) of part of group from overhead drone video (11/07/24).

However, grey seals are known "traditionally" to haul out on site D (a sand spit approximately opposite the power station, and not currently visible from the Venator hide). Site D was not included in the Jun-August surveys. However, a drone survey on 03/09/24 recorded ~63 grey seals at site D plus ~31 seals on the spit opposite the Venator hide (total on

03/09/24 of ~94 grey seals at Seal Sands). The drone video captured apparently playful behaviour of subadult grey seals at the edge of the site **C** "spit" (Fig. 7).

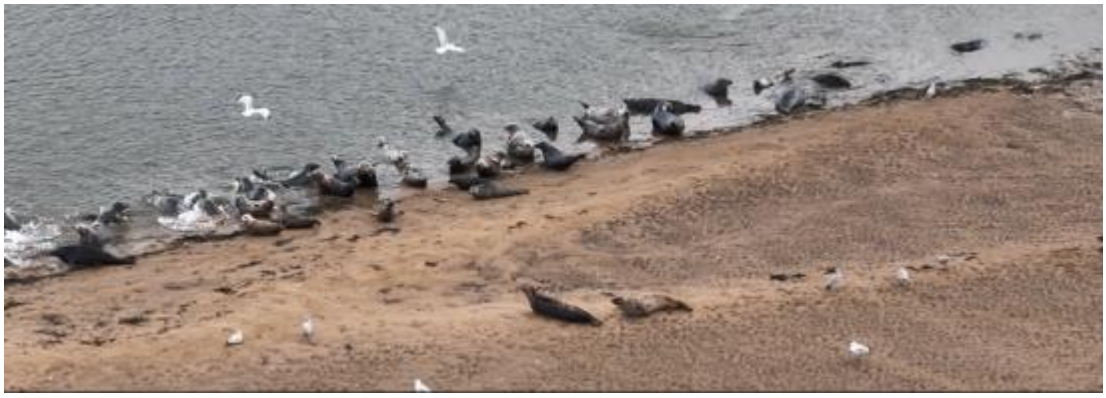

Fig. 7. Activity at the water's edge (apparently playful) by subadult grey seals (Site C "spit"). Two adult harbour seals (foreground) watch the commotion.

Grey seals only appeared occasionally at Greatham Creek during our June/July 2024 observations. However, a cluster of 15 grey seals were seen on June 27 at 11:30 am on the ebbing tide.

3.6 Observations at Greatham Creek

At Greatham Creek, in addition to photo counts, the relative proximity of the observation point **O3** and of site G from **Bailey's Bridge**, facilitates photo or video recording of harbour seal pup behaviour. Such records provide a record of the habitat use of Greatham Creek over the 8h high tide period and also an insight into pup health.

A greater proportion of harbour seal mothers and pups than of adults use Greatham Creek over the ~8h period when Seal Sands is covered by the tidal water, suggesting the benefits of the opportunity for a longer haul-out period for young pups. Indicators of habitat use include spacing between adjacent haul-out mother-pup pairs, and mother-pup (MP) pair use of the shallow water area surrounding the haul-out sites.

Signs of pup health may include suckling and both readiness and ability to follow their mothers, both onshore and in the water. A visibly well-grown "lone pup" (LP) hauled out or swimming without its mother in attendance (Fig. 8) is normal in late lactation, i.e. from about 10 days of age (a mother may leave her pup for up to several hours at a haul-out area safe from tidal cover such as Greatham Creek, returning to check it or reclaim it (Fig. 9). However, a small pup left alone for more than one tidal cycle, or onshore at an atypical area for haul-out, may be stranded and require close monitoring.

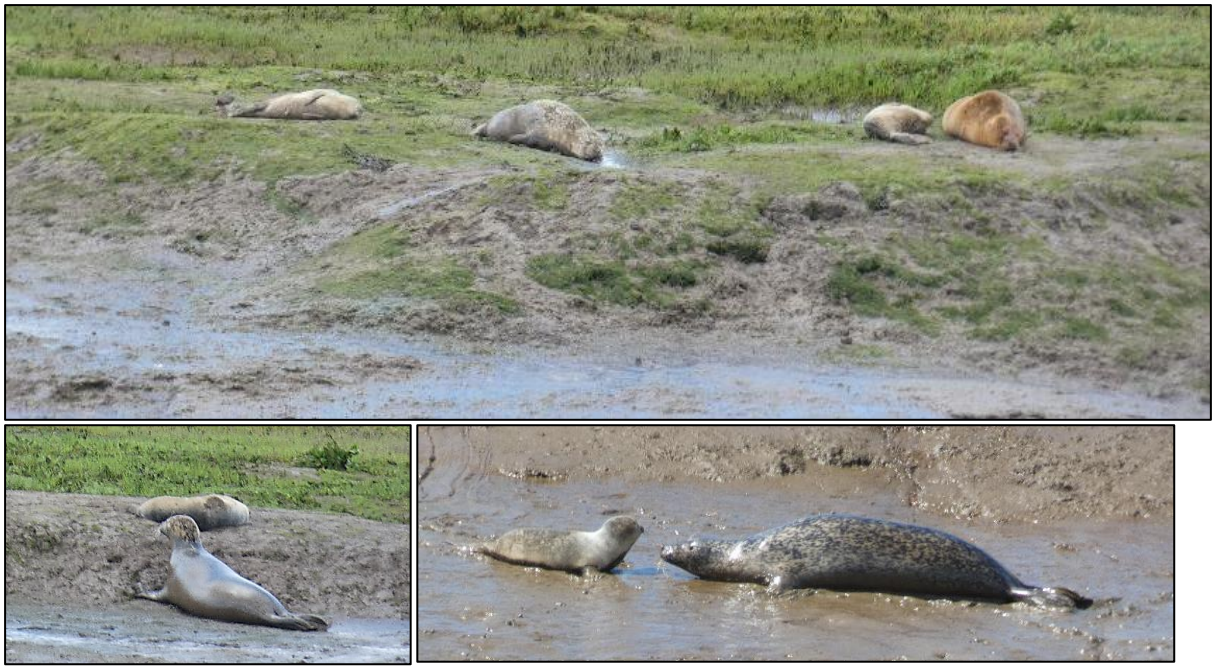

Fig. 8. Top–Mother leaves pup sleeping at Greatham Creek (11:54); Bottom left: Mother returns to check pup (11:58); Bottom right: pup has just woken up, descends into creek and rejoins mother (12:21).

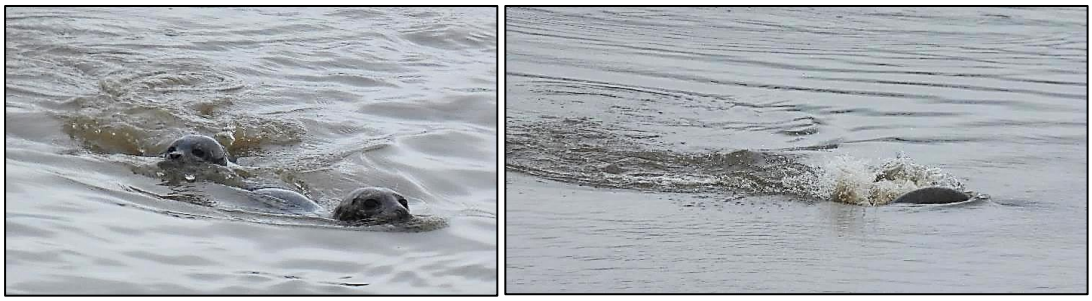

Fig. 9. Typical behaviour of pup in the water with its mother. Left: pup follows mother closely, Right: pup play-splashes beside mother (just below surface).

4. RECOMMENDATIONS

The aim of these trial photo and drone counts is to recommend seal monitoring methods for the 2025 season onwards. The tentative recommendations are:

4.1 Timing of colony monitoring

The seal monitoring is, at present, primarily aimed at assessing the numbers and health of the harbour seal population during the pupping and subsequent moulting seasons. The monitoring should start around the start of pupping mid-late June and through the moulting season from late July to mid–late September.

The pupping season should ideally be divided into periods each of e.g. 6 days, with counts made 2–3 times during fine weather (not strong winds or heavy rain) in each 6-day period. (After 2–3 years these counts should start to produce a harbour seal “pupping curve” with

average pup numbers for each 6-day period until the middle of August). If possible, counts should be continued into the moulting season up to about the 2nd week in September.

4.2 Photo-monitoring method at Seal Sands

Photo surveys, using a hand-held camera with a zoom lens, are carried out to provide a verifiable record of numbers of seals of each species, of harbour seal mother-pup pairs and lone pups. The photo survey should take place within an hour either side of low tide. Photos should be taken in a single "sweep" around the colony (Fig. 1). More than one "sweep" should be taken to improve accuracy (and incorporate seal movements around the site), and the highest daily counts used for the records.

The photo surveys from the Venator hide (**O1**) may cover site **C** "Spit", sites **A**, **B,** and much of **E.** Site **E** immediately behind (south) of the mid-tide Wall and site **F** are not clearly visible from **O1** and require photos from point **O2**; all of sites A and E may also be best recorded from **O2**. Seals in the vicinity of site G should be recorded from **Bailey's Bridge** (Fig. 1). A photo survey at Greatham Creek within 1h each side of l.w. should be carried out from **O3**.

Two survey observers would ideally be needed for each survey. The observer(s) will record – in a notebook - the time of each photo sweep, which haul-out sites are covered, any additional photos, observations or comments.

4.3 Drone surveys

The frequency and timing of drone surveys relative to the hand-held photo surveys are to be decided. If possible, a drone survey of all sites should be carried out approximately every 10 days over the survey period.

Further drone survey trials may be helpful (1) to ensure the footage is sufficiently clear for grey/harbour species distinction and identification of subadults and pups and (2) to develop a system for identifying Seal Sands locations **A–G** on each flight video. Drone footage may be unnecessary for Greatham Creek if a hand-held camera alternative is available.

A second drone operator working with the principal operator may be helpful to ensure coverage of all seal haul-out sites from different drone launch points.

4.4 Greatham Creek observations

A separate count and observation at higher states of the tide, or the ebbing tide preceding a low tide count, at Greatham Creek should be carried out as often as possible during the harbour seal pupping and moulting seasons (approx. mid-June to mid/late-September). This enables seal movement and behaviour to be monitored, and any health problems assessed.

4.5 Analysing the photos

Photos are then transferred to computer and detailed counts made from them. If there is any doubt over a particular count or seal ID, the photographs may be referenced again later. The count records should be transferred to an Excel file, with date, low tide time, count time,

number of seals of each species and harbour seal pups, and general observations or comments.

4.6. Estimating the abundance of seals (at the end of each pupping or moulting season)

The "abundance" of seals of each species (including all but dependent pups) at Seal Sands seasons may be estimated using the "Olesiuk" equation, using the highest, 2nd highest and mean counts in each season (pupping and moulting seasons) – this requires a minimum of five counts for each species/season considered.

4.7 Site access for surveys

Arrangements should ideally be made for observers and drone operators to have access from Tees Road to the Seal Sands shoreline at the Bailey's Bridge end of the Venator site (Figure A2) and along the south bank of Seal Sands (Fig. 1).

APPENDIX A

Table A1. No. harbour seals at Seal Sands (hand-held photo counts June-July 2024)

Date	l.w.	time start	A/SA	MP	LP	Dead P
24-June	12:18	12:43	73	10	0	
26-June	13:53	13:55	83	16	0	
27-June	14:45	15:03	89	14	1	1*
08-July	12:24	13:36	99	15(+)	0	
10-July	13:41	13:43	127	19-20	3	1**
11-July	14:18	13:02	52	8+?2	1+?2	

27/06: *1 alone on site **E** 10/07; still visible during July surveys; **2nd dead P alone on mudflats near Baileys Bridge.

Table A2. No. of harbour seals at Greatham Creek (blue-shaded counts were on rising or high tide following Seal Sands count; yellow-shaded counts were on ebbing tide preceding a Seal Sands count).

			No. seals			% of those at SS	
Date	**Low w**	**Time start**	**A/SA**	**MP**	**LP**	**%A/SA**	**%P**
25 June	13:04	12:18	0	1	0	0	Nc
25 June	13:04	17:07	1	9	0	Nc	Nc
26 June	13:53	18:21	1	9	1	1%	63%
27 June	14:45	11:30	12	7	0	13%	47%
28 June	15:40	11:30	14	7	0	Nc	Nc
08 July	12:24	20:40	6	15	1	6%	100%
10 July	13:41	11:43	18	8	0	14%	36% (rain)
11 July	14:18	11:07	8	8	2	15%	~90%

Table A3. Counts from the drone survey over site F, with counts from manual camera compared.

Count	A/SA	MP	LP	? (w)
Drone-1 (13:38)	17	6	0	?2
Hand-held camera (13:40–41)	18	4 (+?2)	0	?1LP(w)

Drone-2	10	6	2
Drone-3 (overhead) (up to 13:55)	24	7	1

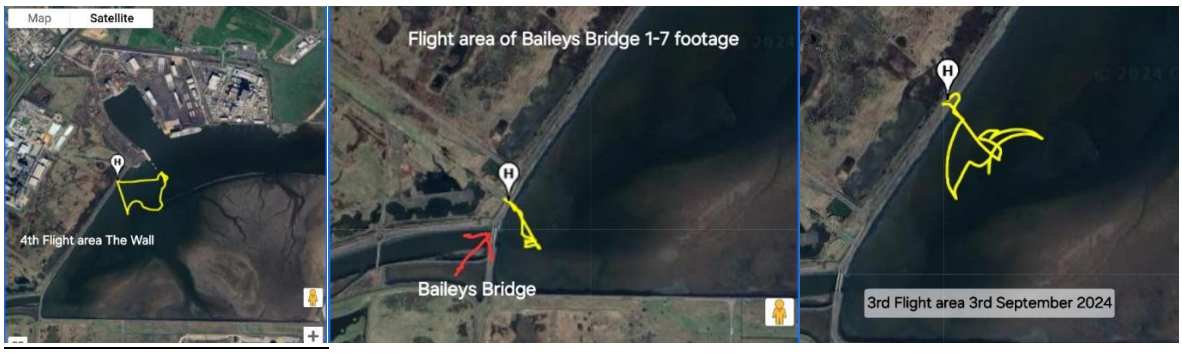

Fig. A1. Examples of drone flight areas on 19/08/24 and 03/09/24 (R. Wise).

Table A4. Summary of drone counts during harbour seal moulting season (Aug–Sep 2024)

Date	**Location**	**Harbour seals**		**Grey seals**	**Comment**
		Adults/SAs	*Pups.*	*All*	
04/08/24	**TOTAL**	**96**	**4**		**No SAs noted; 1P with "mouth rot"**
19/08/24	**C**-Spit	~65		?	Resolution of Spit photos insufficient for H/G distinction
	E –Wall	17	0	12	Includes 1 SA grey seal
	G – Bailey's Bridge	9	0	1	Includes ?1 SA harbour seal
19/08/24	**TOTAL**	**~91**	**0**	**?13+**	
03/09/24	**C**-Spit	34		31	
	D			63	
	Seaton Ch > **D**	77			
	E -Seaton Ch (1)	46	0	0	No SAs or Ps. 3 As in water approaching haul-out
	F	6	1		Pup app haul-out, mouth open
03/09/24	**TOTAL**	**163**	**1**	**94**	Includes 5 SA harbour seals

Fig. A2. Potential vehicle access road to Seal Sands from Tees Road

[i] Wilson, S.C. 2001. Population growth, reproductive rate and neonatal morbidity in a re-establishing harbour seal colony. *Mammalia 65*(3), 319–334.

[ii] https://inca-teesvalley.co.uk/reports/tees-seals-project/

[iii] www.pinnipeds.org

[iv] Tees Estuary Seal Study (TESS). II – Health and Welfare. TEES AND NORTH-EAST HARBOUR SEAL PUP MORBIDITY. Preliminary investigation 2024