

Distribution and Extent of *Zostera* Beds: Snab Sands



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2021

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1. Introduction

1.1. Background

Seagrass (*Zostera*) beds have seen huge declines in the last century and are now nationally rare. Seagrass beds within the South Walney Channel represent the only seagrass beds in North West England (Tittley et al 1998).

Seagrasses are ecosystem engineers and their beds are highly productive and provide key ecosystem processes and services including: supporting biodiversity; providing spawning, nursery and refuge grounds for fish; a food source for overwintering wildfowl; sediment stabilisation; erosion control; carbon sequestration; and contributing to primary productivity (NERC088).

Snab Sands is located within the South Walney Channel on the East side of Walney Island. The bay lies within Morecambe Bay European Marine Sites (EMS /Natura 2000 sites) which include the Morecambe Bay Special Area of Conservation (SAC), Morecambe Bay and Duddon Estuary Special Protection Area (SPA) and Morecambe Bay Ramsar Site. It is also within South Walney and Piel Channel Flats Site of Special Scientific Interest (SSSI). Morecambe Bay SAC and South Walney and Piel Channel Flats SSSI support the key feature 'Mudflats and sandflats not covered by water at low tide' (Habitats Directive Annex 1) of which 'Intertidal seagrass beds' are a sub feature.

Historical survey data of the South Walney Channel (Tittley et al, 1998) shows *Zostera* beds to be present in a large area of Snab Sands. The presence of a seagrass bed at Snab Sands was last recorded in the Gateway/AMEC 2012 survey, finding a 5.5ha bed but there have been no further surveys.

1.2. Survey Location

The survey took place at Snab Sands, which lies between Long Rein Point and Snab Point on Walney Island. The location is accessible from Snab Point car park.

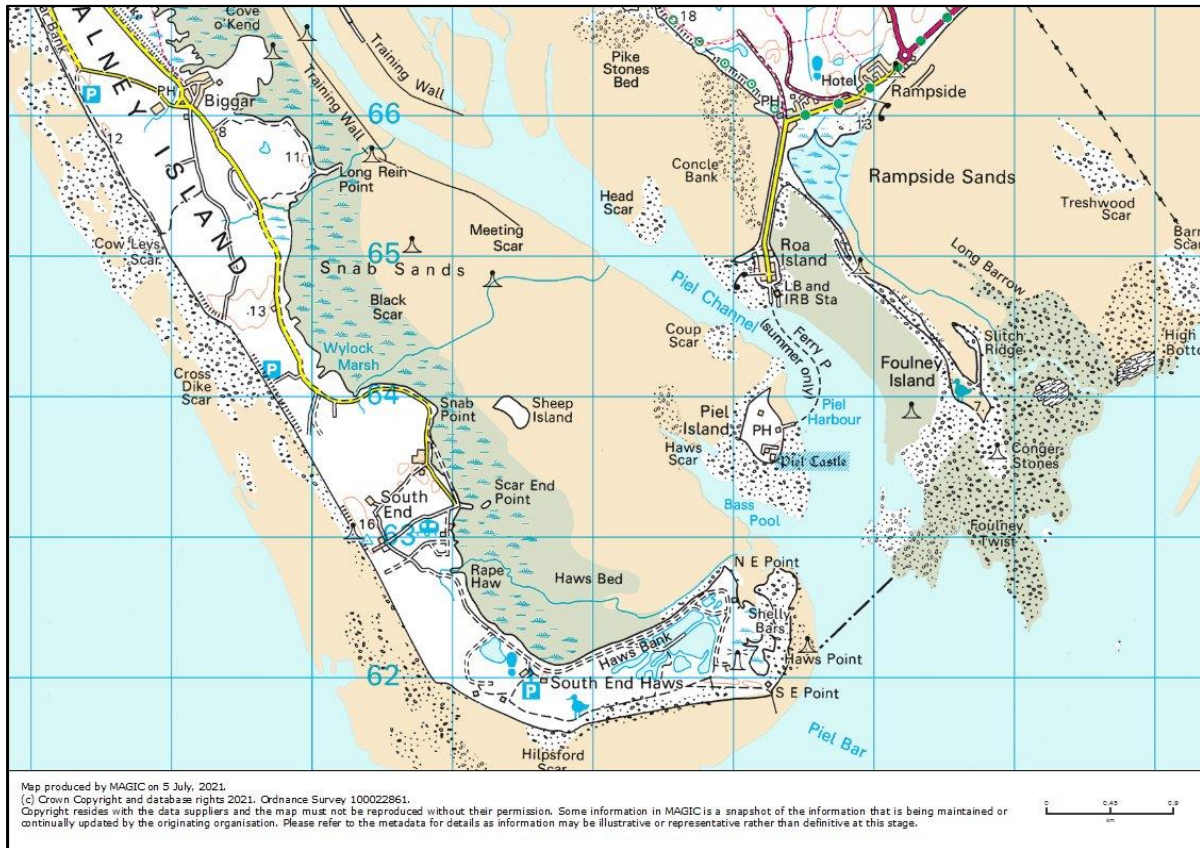


Figure 1 Overview of Snab Sands. Access to survey site is from a car park at Snab Point.

2. Survey Methodology

2.1. Comparison of Survey Methodologies

Due to the only known seagrass meadows in the Morecambe Bay area being clustered around Walney, Roa and Foulney Islands, there have been a number of surveys to document the extent of the beds. However, recent surveys have focused mainly on the northern seagrass beds and there is a lack of information on the extent of the beds on the South Western banks of the Piel Channel.

2.1.1. Environment Agency WFD Monitoring Standard

The Environment Agencies “Intertidal Seagrass Monitoring for Water Framework Directive (WFD) Purposed” document encloses operational instructions for carrying out intertidal seagrass surveys for WFD purposes. The document also outlines the preparation required before fieldwork can take place, and what must be recorded during the survey.

Table 1 outlines the three main monitoring metrics provided by the Environment Agency. The metric includes determining the species of seagrass present (*Zostera noltii*, *Zostera*

marina var. angustifolia), shoot density and bed extent. The EA also state that records should be taken of negative impacts affecting the *Zostera* bed, such as wasting disease, opportunistic microalgal cover, obvious 'blow outs' (bare areas caused by physical disturbance) and evidence of anthropogenic influence (bait digging holes, anchor-chain scour, litter, physical removal or vehicle tracks). When measuring the shoot density as a percentage cover, the EA require the recording of seagrass leaf cover, bare sediment and of other plant/algal species to be recorded.

Table 1 Monitoring metrics for seagrass surveys (Environment Agency, 2014)

| Monitoring metrics | Method of survey |
|-----------------------|--|
| Taxonomic composition | Seagrass species present. |
| Shoot density | Measured as the percentage cover of seagrass in an appropriate sized quadrat. |
| Bed extent | Measured as the area cover in hectares of: <ul style="list-style-type: none"> • the continuous bed, deemed to have >5% shoot density, this is mandatory; and • where possible, the <5% shoot density area. |

The EA's methodology states that at least three randomly placed 1m² quadrats should be placed within each segment, and the random placement of quadrats must be representative of the percentage cover of the bed. For areas of >5% seagrass shoot density, the percentage of seagrass leaf cover, other plant species and bare ground should be recorded. Quadrats should be placed randomly throughout areas with <5%, continuous cover (patches <10m apart). 10% of quadrats should be photographed and saved as a reference for future surveys.

2.1.2. Natural History Museum Survey (1998)

The Natural History Museum 1998 survey was undertaken to map *Zostera* distribution within the Walney Channel. The information was used to create management recommendations for the *Zostera* beds.

The survey consisted of a 100m by 100m grid, overlaid on the survey area. Individual 100m² sectors were visited and the presence or absence of *Zostera* was recorded. Occurrences of narrow (*Zostera noltii*) and wide-leaved (*Zostera marina var. angustifolia*) forms were documented, along with the presence of *Spartina anglica*.

The survey found that *Spartina* and *Zostera* were present at Snab Sands. *Spartina* was also recorded in the two segments south of Snab Sands, shown in Figure 2.

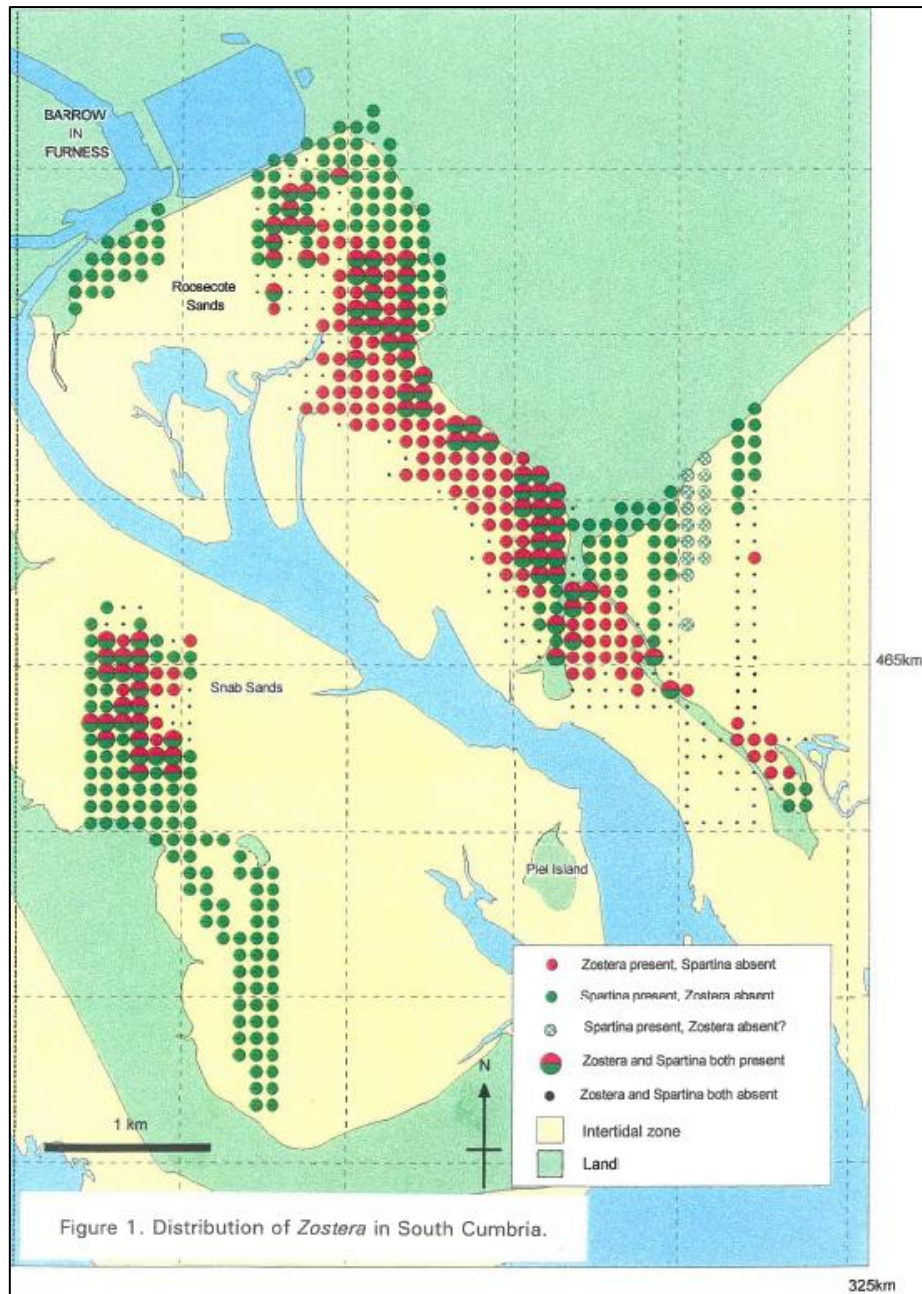


Figure 2 Map of intertidal seagrass beds in the Piel Channel (Tittley et al., 1998)

2.1.3. AMEC Gateway Survey (2012)

A survey of the intertidal *Zostera* beds within the Walney Channel was undertaken by AMEC on behalf of Gateway Storage Company Ltd (Gateway) (AMEC, 2012). The survey was commissioned as part of an Environmental Impact Assessment (EIA) for a proposed development in close proximity to Walney Channel.

The survey aimed to outline the distribution of *Zostera* within and around the proposed construction area. The survey area was overlaid with a 100m by 100m grid, with sampling points located at intersections. At each sample point a 1m² quadrat was placed on the intertidal and *Zostera* coverage was recorded as a percentage. Other data recorded included opportunistic algal species, muscle crumble and presence of associated epifaunal species.

The presence of *Zostera* was recorded at Snab Sands within this survey, however data is very limited.

2.1.4. Natural England Surveys (2013, 2016 & 2017)

The Natural England surveys in 2013, 2016 and 2017 focused on areas to the north east of Piel Channel. Snab Sands was not included in any of the surveys.

The methodology was the same for each survey and consisted of overlaying a 75m by 75m grid on the survey area. The grid intersects were identified using Geographical Information Software (GIS) and exported as an Excel file, allowing the coordinates to be uploaded onto GPS units for use in the field. At each intersect a 1m² quadrat with internal divisions was placed on the intertidal. The following information was recorded (Latham, 2013):

1. Percentage cover of *Zostera* species, where this was less than 5% the number of *Zostera* plants was recorded;
2. Presence of *Zostera* within 10m of the quadrat;
3. Percentage cover of bare sediment;
4. Percentage cover of any creeks, channels or standing water;
5. Percentage cover of macroalgae;
6. Percentage cover of *Spartina*, where this was less than 5%, the number of *Spartina* plants was recorded;
7. Condition of the *Zostera* present in the quadrat;
8. Presence of blow outs or anthropogenic influences within the quadrat;
9. Presence of signs of life within the sediment (e.g. mounds, casts, siphons), and;
10. Presence of any notable additional/ associated species

2.1.5. Pre-survey Visit and Extent Mapping

An initial walkover of Snab Sands was completed on the 19th July 2021. The walkover survey enabled the presence a *Zostera* at the site to be confirmed and the extent of the beds to be established. This identified the areas to be included in the sampling grid in the following surveys.

2.2. Consents, Licenses and Permissions

2.2.1. Access Permissions

No access permissions were required as this is a non-intrusive survey with no samples being taken.

2.2.2. Licences

No licence was required as the survey did not involve the collection of samples or specimens, as per the Wildlife and Countryside Act 1981.

2.2.3. SSSI Consent

No damaging activities were carried out within South Walney and Piel Channel SSSI during the survey, therefore, no SSSI consent was required.

2.2.4. Habitats Regulations Assessment (HRA)

No HRA was required as the survey was non-intrusive with no samples being taken.

2.3. Survey Dates

The survey was conducted during low tides on 25th and 26th August, 6th and 15th September 2021. Survey dates were within the peak bloom of *Zostera*, August and early-mid September (Foden and Brazier, 2001). A further survey of the salt marsh channels was carried out on 15th October 2021.

2.4. Survey Techniques

2.4.1. Intertidal mudflats survey

A 75m by 75m grid was arranged over the survey area using QGIS. The survey area was determined based on the walkover bed extent polygon. This resulted in a grid with 140 intersecting points (Figure 4), these were the survey points. The GPS coordinates of each intersect were identified in QGIS and exported to Excel. The coordinates were then uploaded to a GPS unit which was used to locate quadrat placements in the field.

At each survey point a 1m² quadrat was placed. The following information was then recorded:

- 1) percentage cover of *Zostera* species, where this was less than 5% the number of *Zostera* plants was recorded;
- 2) presence of *Zostera* within 10m of the quadrat;
- 3) percentage cover of bare sediment;
- 4) percentage cover of any creeks, channels or standing water;
- 5) percentage cover of macroalgae;
- 6) percentage cover of *Spartina*, where this was less than 5%, the number of *Spartina* plants was recorded;
- 7) condition of the *Zostera* present in the quadrat;
- 8) presence of blow outs or anthropogenic influences within the quadrat;
- 9) presence of signs of life within the sediment (e.g. mounds, casts, siphons), and;
- 10) presence of any notable additional/ associated species

All percentage cover estimates were agreed by both surveyors. Photographs were taken of all quadrats (4 quarter quadrat photos to maintain detail), with the photo references recorded in situ. Copies of the survey recording sheet and an example of the quadrat photographs are included in (Annex G and H).

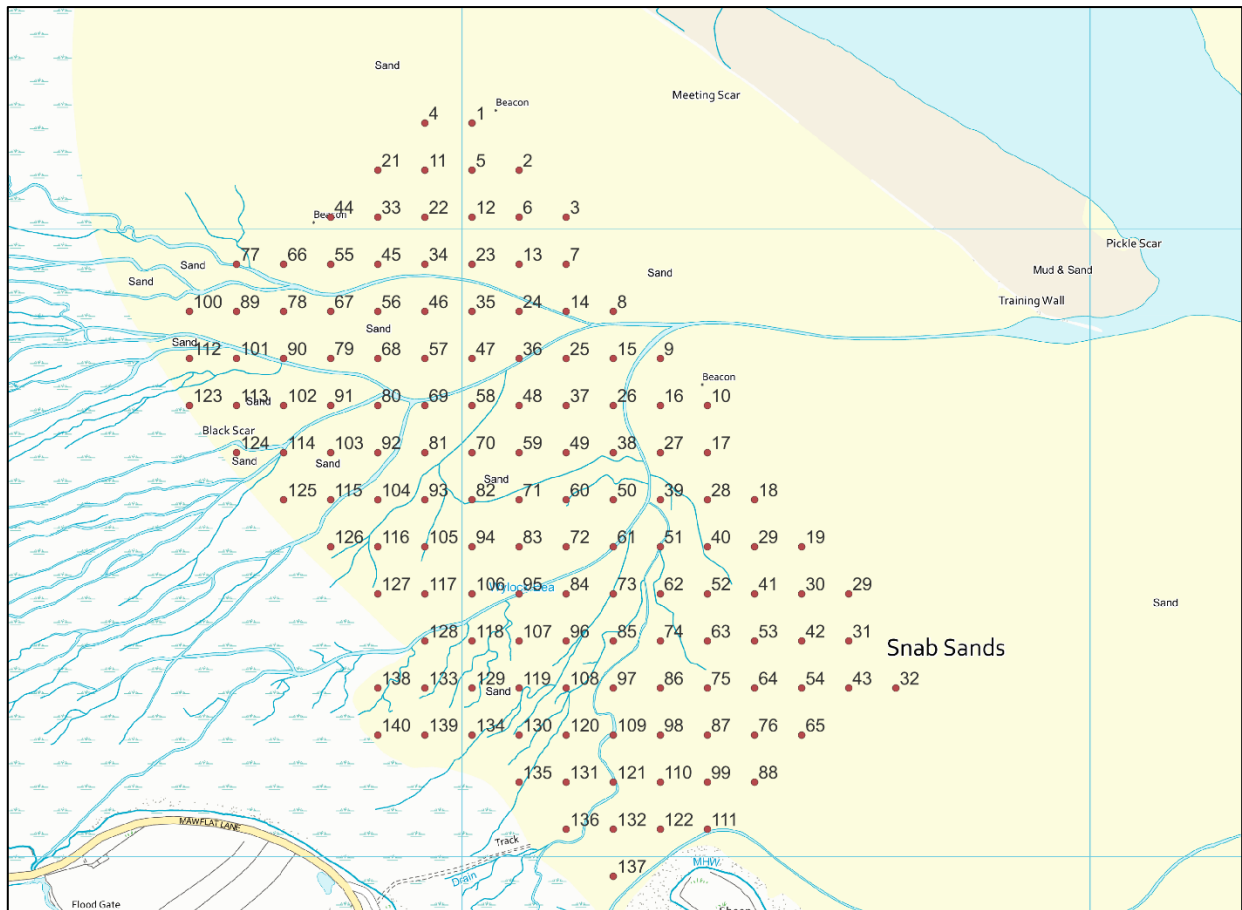


Figure 3 Grid intercept points (75 x 75m grid) over the seagrass bed on Snab Sands. A total of 140 intersect points were created; these are shown overlaid on an Ordnance Survey map of the area.

2.4.2. Channel survey

During the walkover survey *Zostera marina var. angustifolia* was observed in creeks, channels and shallow pools of standing water. It did not form distinct beds like *Zostera noltii*. *Zostera marina var. angustifolia* was observed beyond the survey area, within channels that flowed through the salt marsh to the north west of the mudflats. A separate survey, using a different methodology was conducted to record the presence and extent of *Zostera marina var. angustifolia* in the salt marsh channels landward of Snab Sands.

Surveyors walked the lengths of the channels through the salt marsh between Sheep Island and Long Rein Point. The start and end coordinates of sections of channels containing *Zostera marina var. angustifolia* were recorded using GPS units and the GPS app (GPS & Maps) on mobile phones (this gave $\pm 8m$ accuracy). This could then be uploaded to QGIS and mapped as line data to show approximate locations of *Zostera marina var. angustifolia* within the channels on Snab Sands.

2.5. Non-Native Species

Non-native species are known to be present within the Walney Channel area. Due to this, all survey equipment was thoroughly dried before and after fieldwork took place to ensure there

was no transfer of non-native species from one site to another. No non-native species were recorded on this survey.

3. Results

3.1. *Zostera* Extent and Distribution

During the walkover survey, surveyors recorded points around the perimeter of the main area covered by *Zostera noltii*. These points were mapped in QGIS and a polygon was drawn to show where the main area of *Zostera noltii* was located, this area included a large, dense bed but also nearby disconnected patches of *Zostera* (Figure 4). Patches of *Zostera* outside of this main area were also recorded and mapped as points. A large, dense area of *Zostera* was present in the middle of The survey area with smaller, patchy beds extending out from this.

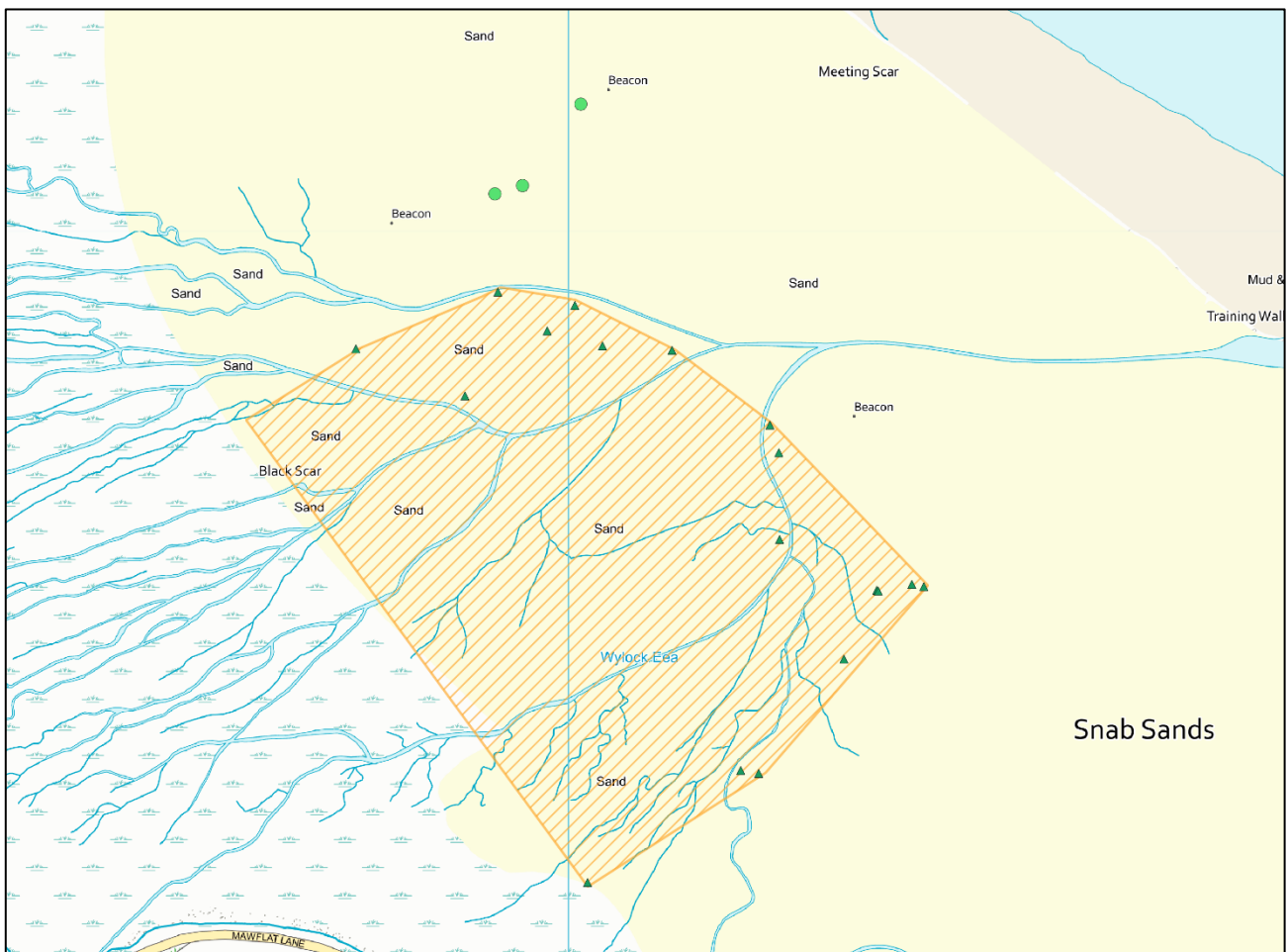


Figure 4 Presence of *Zostera* (triangles) recorded during the walkover survey around the perimeter of the beds. The orange polygon was drawn around these points to indicate the location of the majority of *Zostera* at Snab Sands. Green circles show presence of *Zostera* found outside of the main area.

In the survey area, *Zostera noltii* was more abundant than *Zostera marina* var. *angustifolia*. Out of 140 quadrats, 27 contained *Zostera noltii* and six contained *Zostera marina* var.

angustifolia (Figure 5). 63 quadrats were within 10m of *Zostera* (Figure 6). The presence of *Zostera* within 10m of 45% of the survey points shows that the extent of the seagrass beds is considerably greater than indicated by mapping only the presence and absence of *Zostera* within quadrats. The distribution of *Zostera* within 10m of quadrat points largely matches the initial extent polygon (figure 4), but it also highlights some outliers around the main bed, supporting initial observations of several smaller patches of *Zostera* bed outside of the main area.

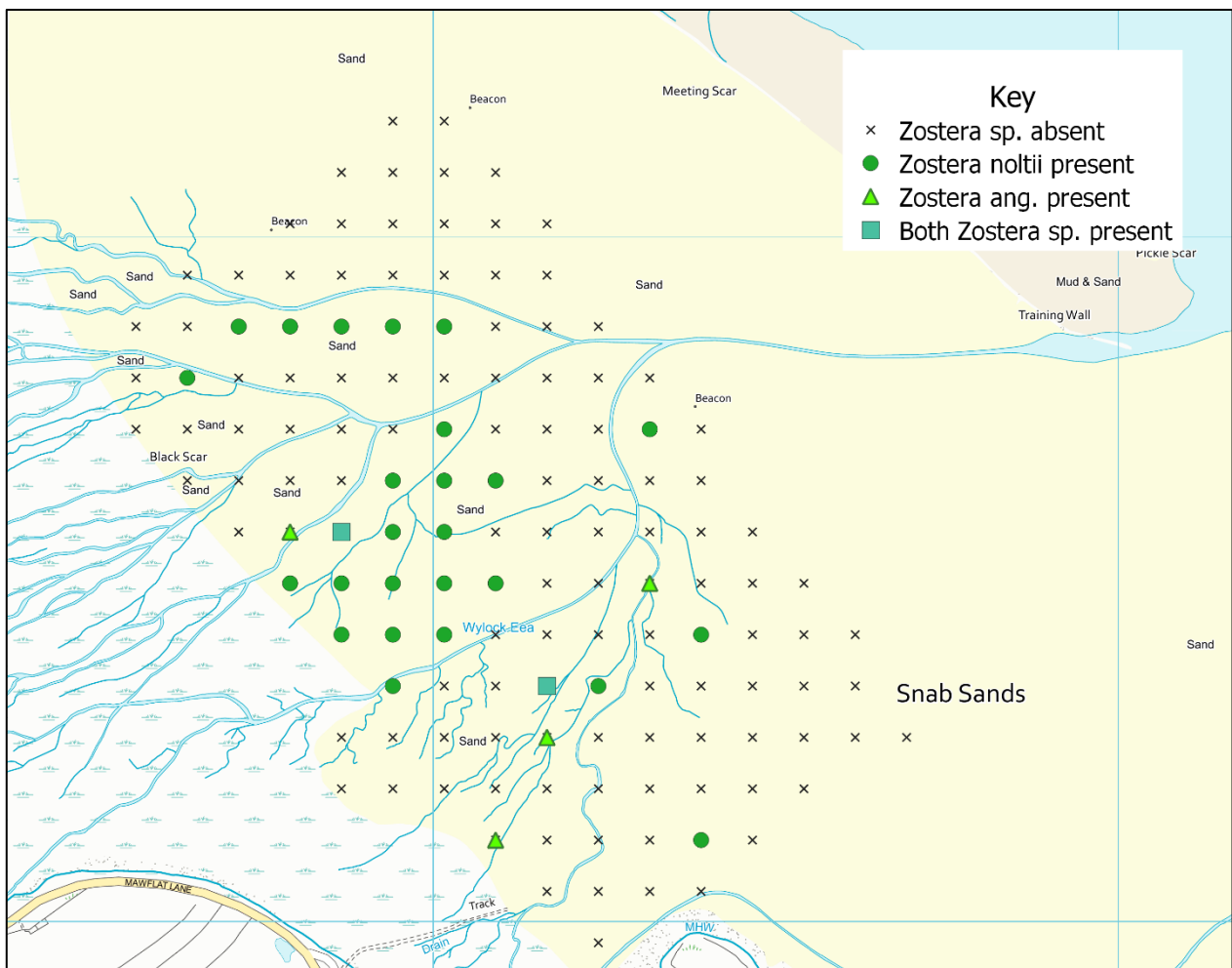


Figure 5 Presence of *Zostera noltii* (dark green circles), *Zostera marina* var. *angustifolia* (light green triangles) and both species (blue squares). Absence of either *Zostera* species within the quadrat (x).

Zostera marina var. *angustifolia* was found to grow within pools of standing water, whereas *Zostera noltii* was observed to grow in distinct beds on raised areas of sediment. *Zostera marina* var. *angustifolia* was also observed growing in the channels and creeks that extend into the salt marsh beyond the intertidal mudflat (Figure 9).

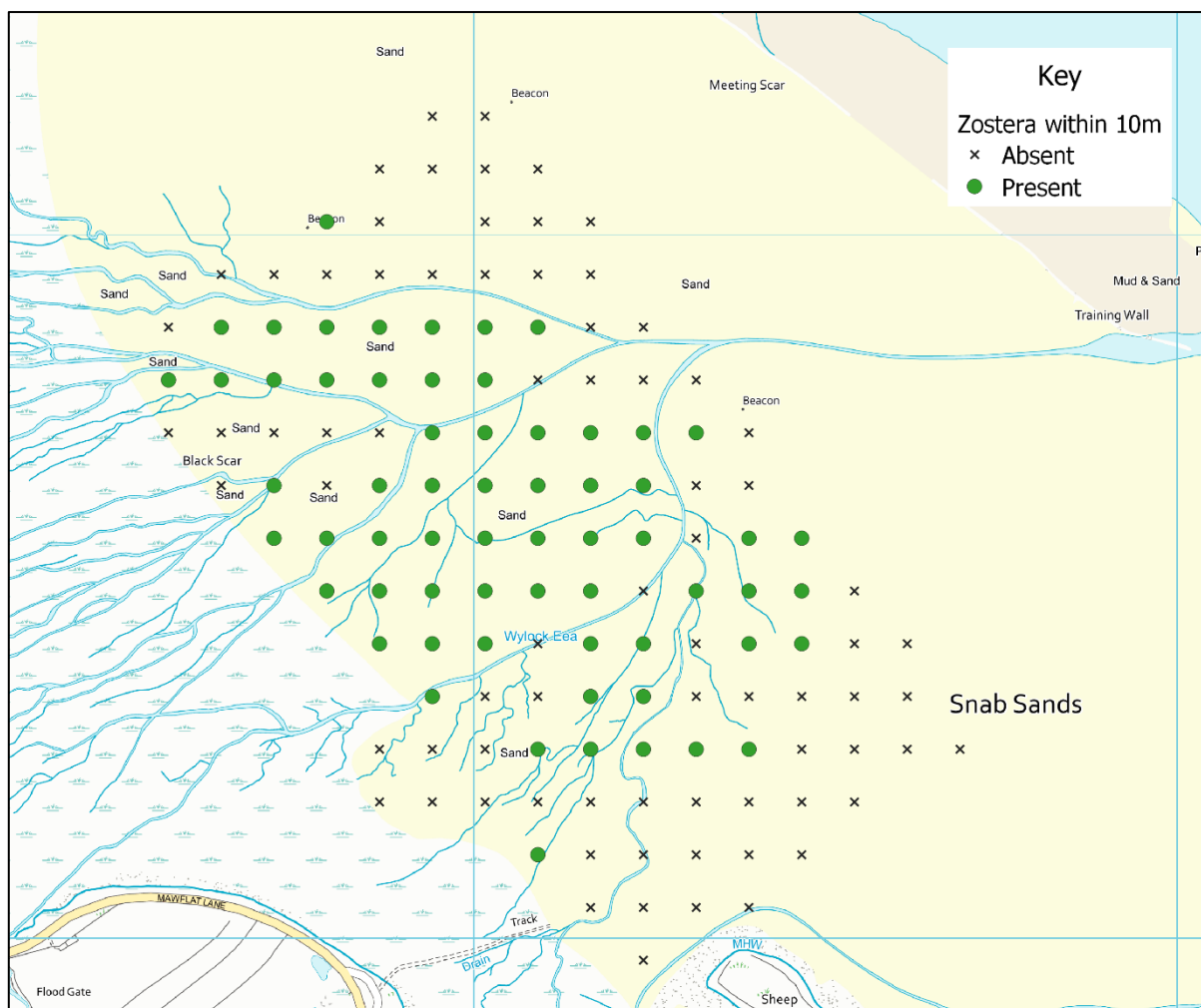


Figure 6 Presence (green circles) and absence (black crosses) of *Zostera* within 10m of the survey point across the survey area.

3.2. *Zostera* Cover and Condition

Percentage cover of *Zostera* was measured at each survey point (Figure 7). In quadrats where *Zostera* was present, the percentage cover of *Zostera noltii* was generally high, with a mean of 51.50% (s.d.=35.54). The mean percentage cover of *Zostera marina* var. *angustifolia* was lower, with a mean of 20.80% (s.d.=17.15). This coverage qualifies the area as containing a *Zostera* bed, as plant densities provide at least 5% coverage (OSPAR, 2009).

The condition of the *Zostera* beds was generally 'good' for both species meaning there was no evidence of blackening, an indicator of poor health. However, blackening was present and recorded within 13 quadrats, this equates 42% of survey points containing *Zostera*. It is worth noting that not all the seagrass within the quadrat was blackened. Blackening was recorded in quadrats generally closer to the shore but overall quadrats with blackened *Zostera* were not restricted to one area, it occurred both in the main bed, and to the north and south of the main area. Blackening across a large area of the bed was observed to have occurred between survey days where it was previously in good condition, the reason for this was not clear.

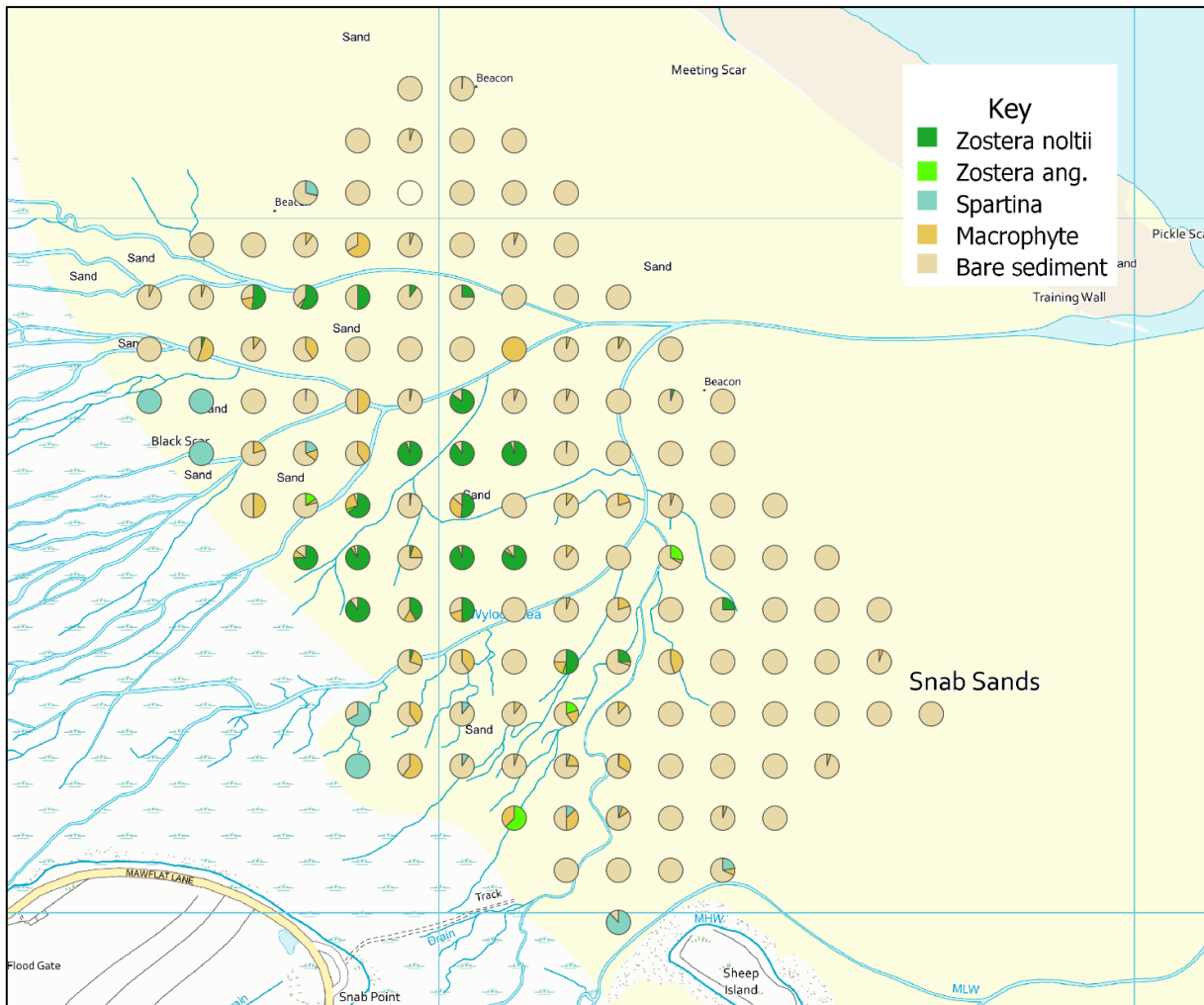


Figure 7 Percentage cover of *Zostera noltii* (dark green), *Zostera marina var. angustifolia* (bright green), *Spartina* (blue), macrophyte (dark beige) and bare sediment (light beige) at survey points.

4. Discussion

Both *Zostera noltii* and *Zostera marina var. angustifolia* were present at Snab Sands. The main *Zostera noltii* bed is located approximately 1.4km from the Walney Channel on a raised area of intertidal, surrounded by recessed streams that flow into the channel. There have been two previous recorded surveys investigating the extent of *Zostera* cover on Snab Sands. One study was carried out by the Natural History Museum in 1998, and although it does give a good representation of the location and density of *Zostera* coverage, it does not quantify the area of the beds. There is a second, more recent survey undertaken by Gateway/AMEC in 2012 which quantifies the coverage of *Zostera* beds in hectares, however there are no accessible maps for this study. The Gateway/AMEC 2012 survey recorded a 5.5ha area of *Zostera* beds on Snab Sands. Without more details on this study, we cannot directly compare the area covered by *Zostera* between now and 2012, however it is evident that there has not be any significant decline in the extent of the *Zostera* beds at Snab Sands. The polygon showing the area of Snab Sands where *Zostera* is present covers 40ha. This does not show the perimeter of the main *Zostera* bed and includes a patchwork

of smaller *Zostera* beds and bare sediment so cannot be directly compared to previous bed extents made by AMEC (2012). It does however, show that *Zostera* is still present at Snab Sands over a large area of the intertidal mud flats.

In addition to the main bed of *Zostera noltii*, the species was also found to be present at other locations on Snab Sands. The most abundant areas were found to the North of the main bed, where *Zostera noltii* density decreased as it became closer to the channel. Further occurrences of *Zostera noltii* were recorded to the South East and East, however, these were found on more randomised patches of raised ground.

The distribution of *Zostera* species was mapped, showing the presence/absence, percentage cover and the presence/absence within 10m at each survey point. A visual comparison of the current *Zostera* distribution (presence within 10m) and the 1998 NHM survey, which mapped the presence of *Zostera* within 100m by 100m grid squares, is presented in Figure 8. The comparison shows a similar distribution of *Zostera* in the areas covered by both surveys, with the exception of the northernmost area of the survey where some *Zostera* coverage has been lost in the period from 1998 - 2021. When comparing the two maps, it can be seen that the current survey found *Zostera* coverage extending to the south east of Snab Sands. The NHM survey did not include this location in their survey area, as it was assumed this went beyond the seaward extent of the *Zostera* bed. This implies *Zostera* distribution has changed but because the area was not surveyed to confirm absence in this area, historic comparisons cannot be drawn.

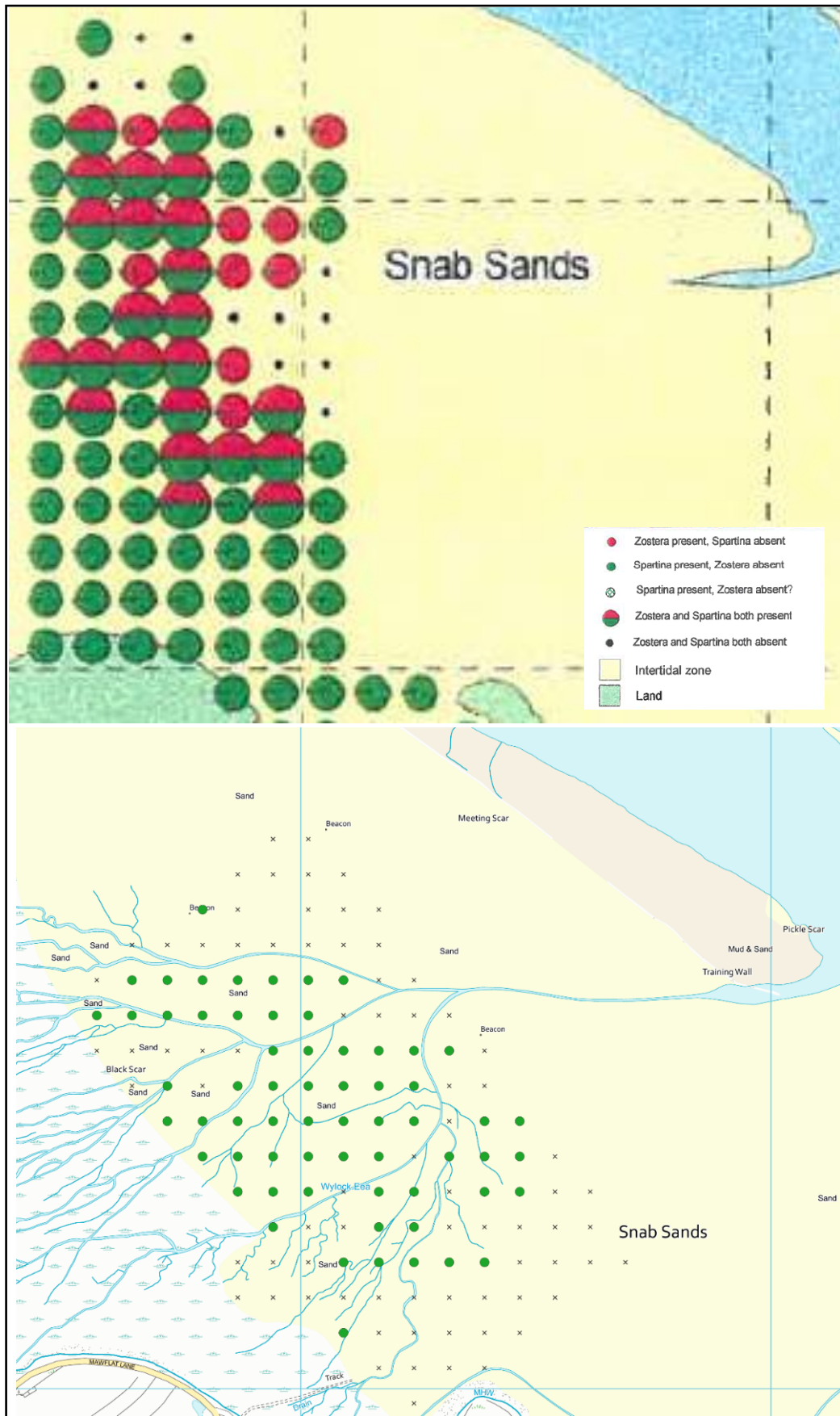


Figure 8 Comparison of Snab Sands showing NHM 1998 presence/absence of *Zostera* within 100m x 100m squares and the presence/absence of *Zostera* within 10m of grid intercepts within a 75m x 75m grid in the current survey.

During the main survey, the growth of *Zostera marina* var. *angustifolia* within channels landward of the survey area was noted. A further day of surveying was then undertaken to map the extent of *Zostera* coverage within the channels, shown in Figure 9. On the mudflats only six points within the survey area contained *Zostera marina* var. *angustifolia*. In contrast to this, areas closer to land within channels submerged in a few inches of water contained vast amounts of *Zostera marina* var. *angustifolia* and almost no *Zostera noltii*.

No obvious anthropogenic pressures were recorded within the survey quadrats. However, during the channel surveys, polluted water was observed, possibly with oil. The areas in which this was observed are near to the track that leads from the road at Snab Point and is used by cars which drive over the mudflats during low tide to reach Piel Island. There are no boat moorings on this side of the channel, therefore, no blow outs from anchoring were observed.

The salt marsh cord-grass species, *Spartina*, is present on Snab Sands, covering dense areas on the upper intertidal zone. The *Spartina* species results in sediment stabilization and the formation of salt marsh, allowing other salt marsh species to colonise, these species may outcompete *Zostera* and reduce the available area suitable for *Zostera* beds. *Spartina* was recorded in 16 out of 140 quadrats. In quadrats where *Spartina* was present *Zostera* species were absent. Common glasswort (*Salicornia europaea*), also known as marsh samphire was also observed in 24 out of 140 quadrats, generally closer to the upper intertidal zone. In just four out of the 24 survey points both *S. europaea* and *Zostera* species were present.

Macrophyte species were present in 63 quadrats. In 19 of these *Zostera* species were also present. The percentage cover of macrophytes is shown in Figure 7.

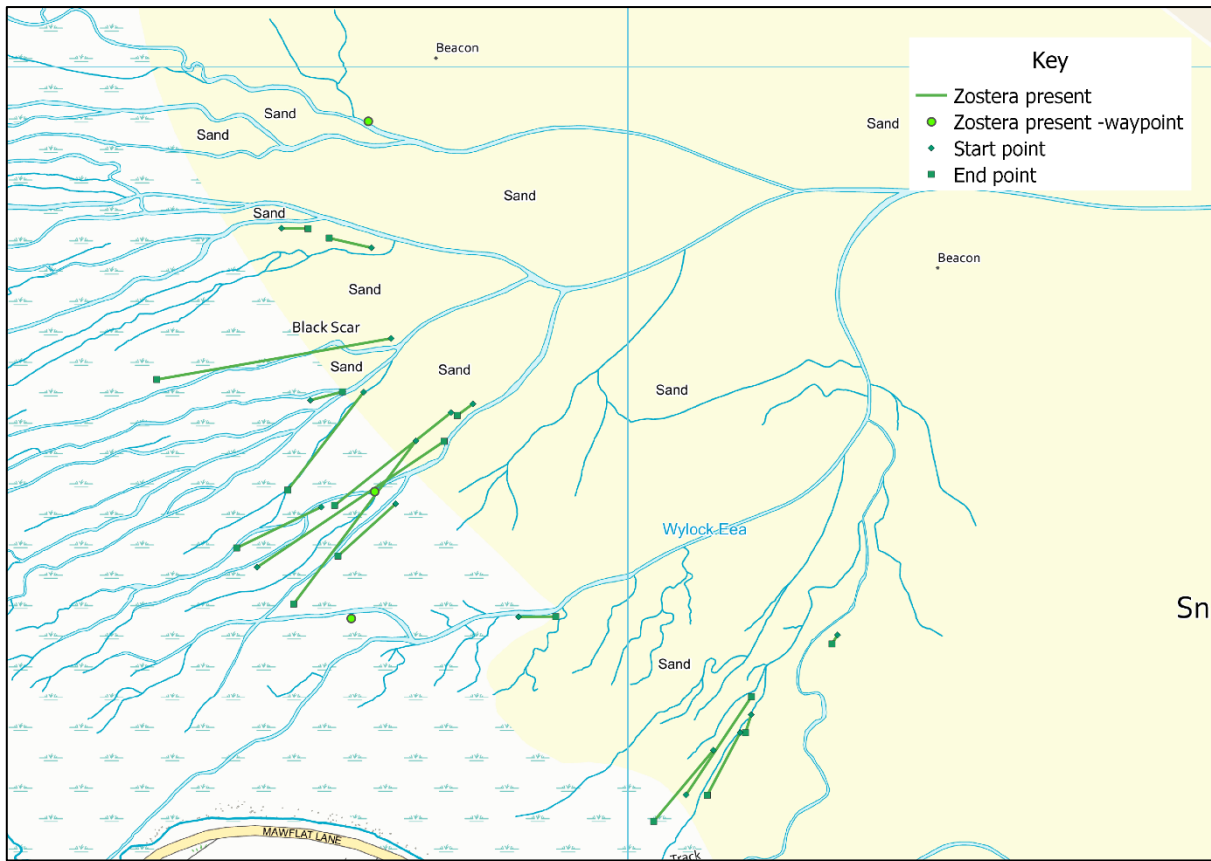


Figure 9 Presence of *Zostera marina* var. *angustifolia* within channels landward of the original survey area (accurate to 6m). The lines indicate continuous coverage, and the points indicate isolated patches.



Figure 10 *Zostera marina* var. *angustifolia* coverage within a channel surrounded by *Spartina* coverage.

5. Conclusion

Due to the lack of previous data on the extent of *Zostera* at Snab Sands, it is difficult to make direct comparisons to previous year's surveys. Time constraints meant it was not possible to get an accurate record of the extent of the main *Zostera* bed. However, the area of Snab Sands covered by *Zostera noltii* was significantly larger than expected, based on the 5.5ha of *Zostera* beds estimated by AMEC (2012). No comparison of *Zostera* area can be made with the 1998 NHM survey as no area quantification was given in the report.

The distribution of *Zostera* recorded within the survey area is similar to the distribution shown in the 1998 NHM survey. However, the differences between the two distributions are as follows:

- *Zostera* was absent in the northern area of this survey whereas the 1998 NHM survey recorded a presence in this location. This implies that presence of *Zostera* in the northern area of on Snab Sands has been lost in the period from 1998 – 2021.
- The 1998 NHM survey did not extend to the south eastern areas that were identified to have a *Zostera* presence in this survey. Therefore, comparisons cannot be made for this area with historical records.

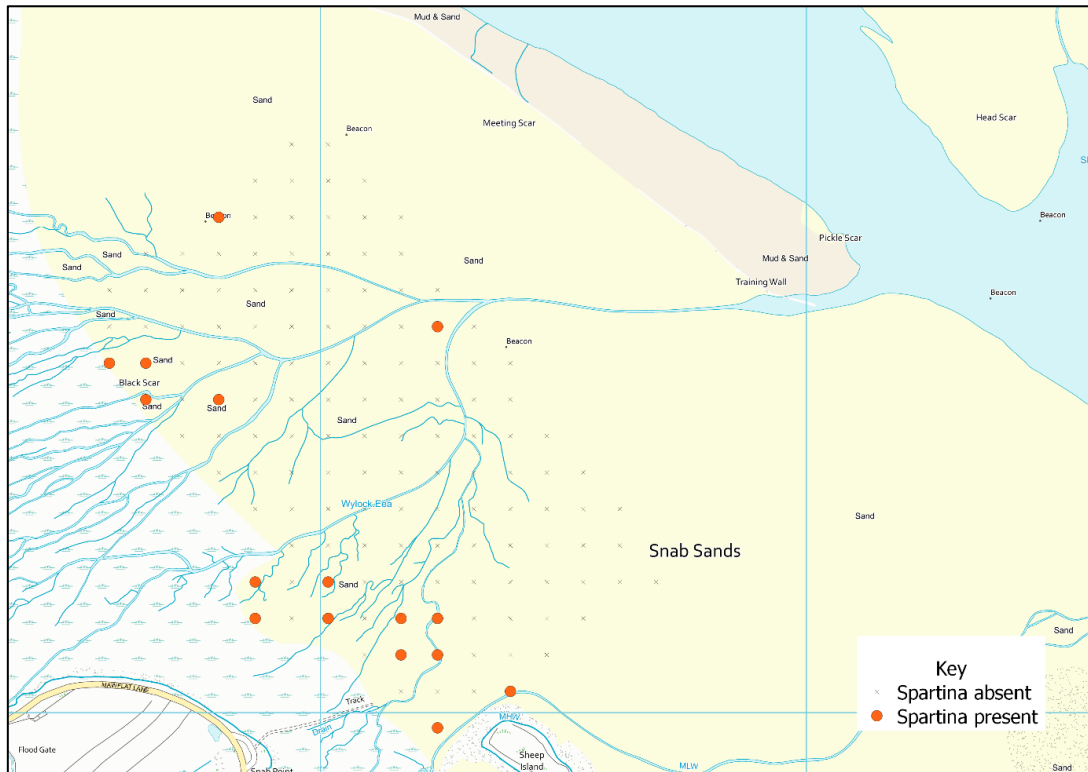
The *Zostera* found within the survey area was mostly in good condition. Approximately 30% of *Zostera* within survey points was blackened. Due to Snab Sands being a fairly inaccessible location with no moorings or areas of public interest, almost no anthropogenic influences were observed during the survey.

6. References

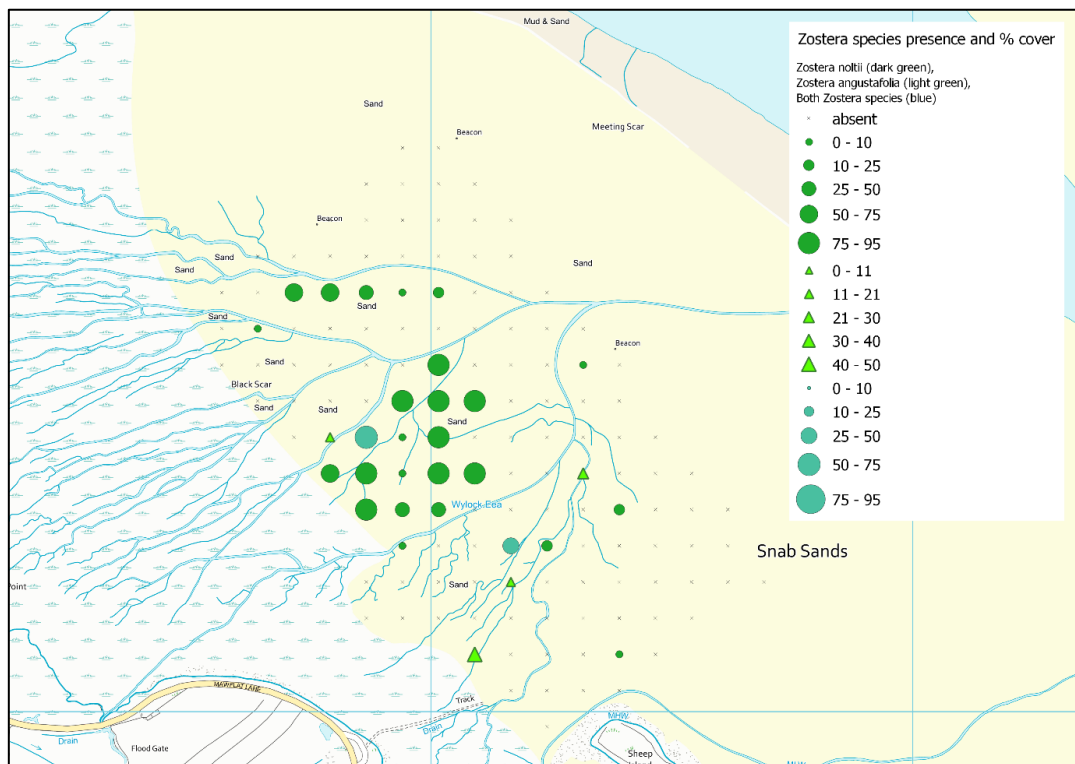
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7. Appendix

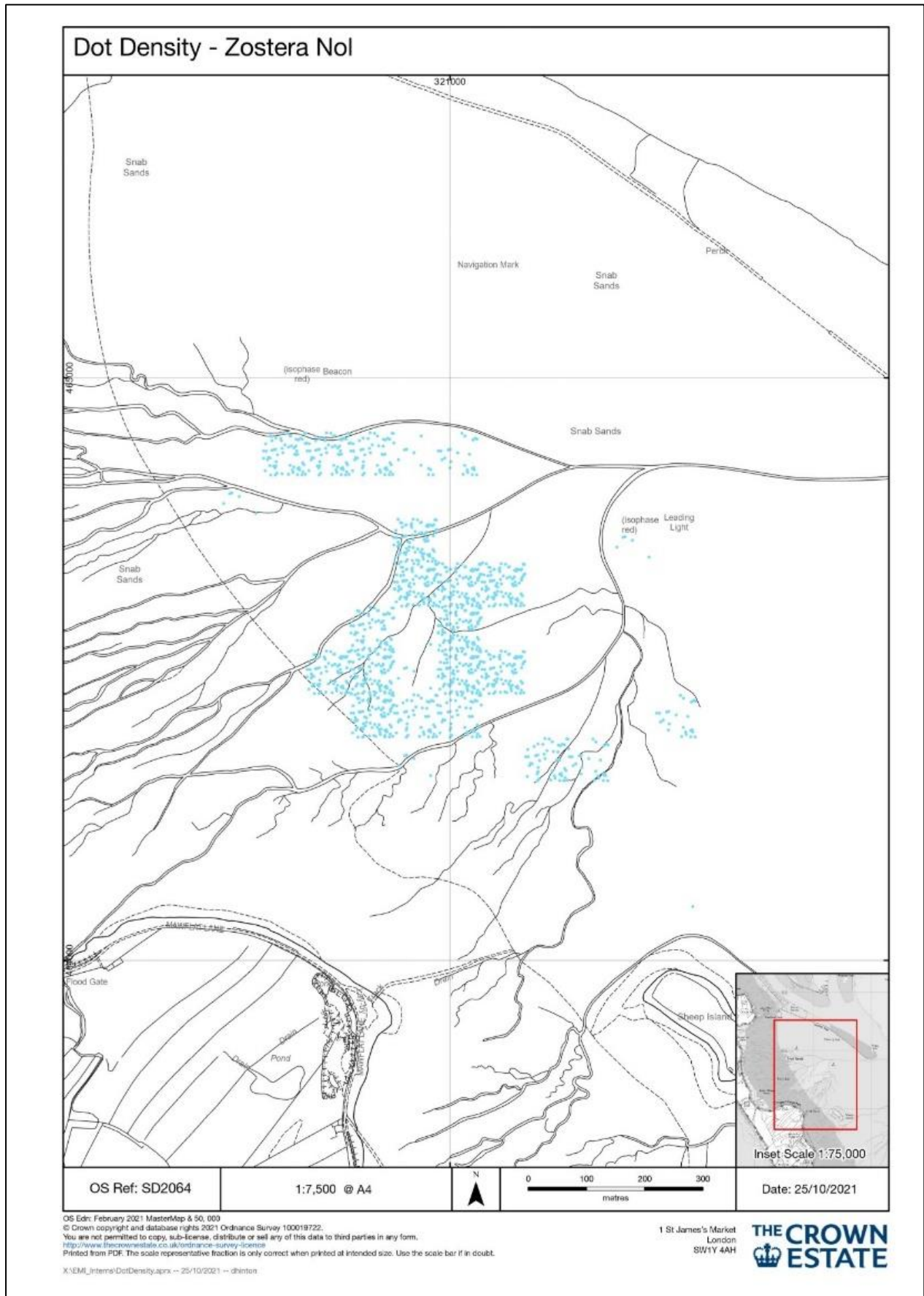
Annex A – Presence/absence of *Spartina*



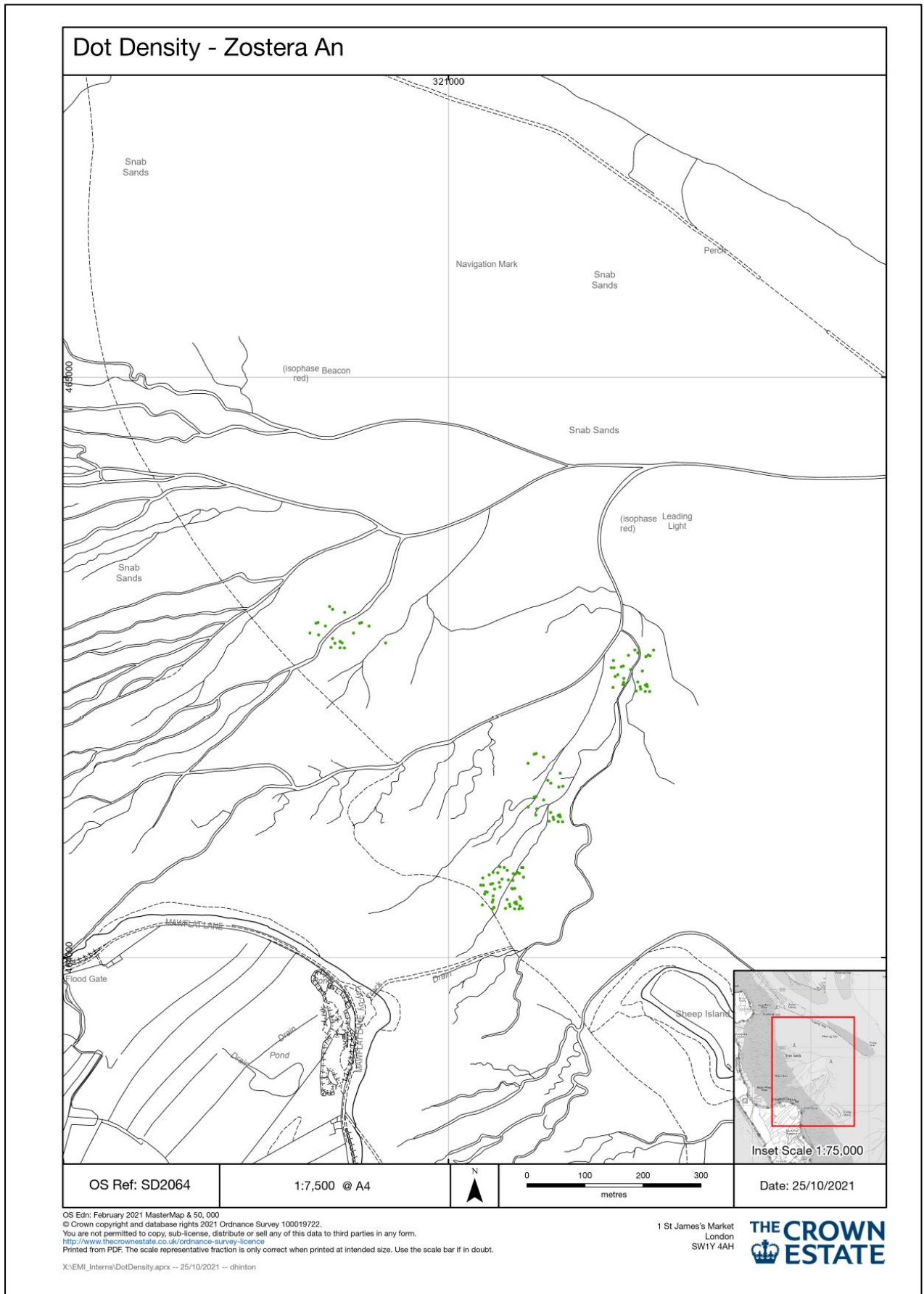
Annex B – Percentage cover of *Zostera* species



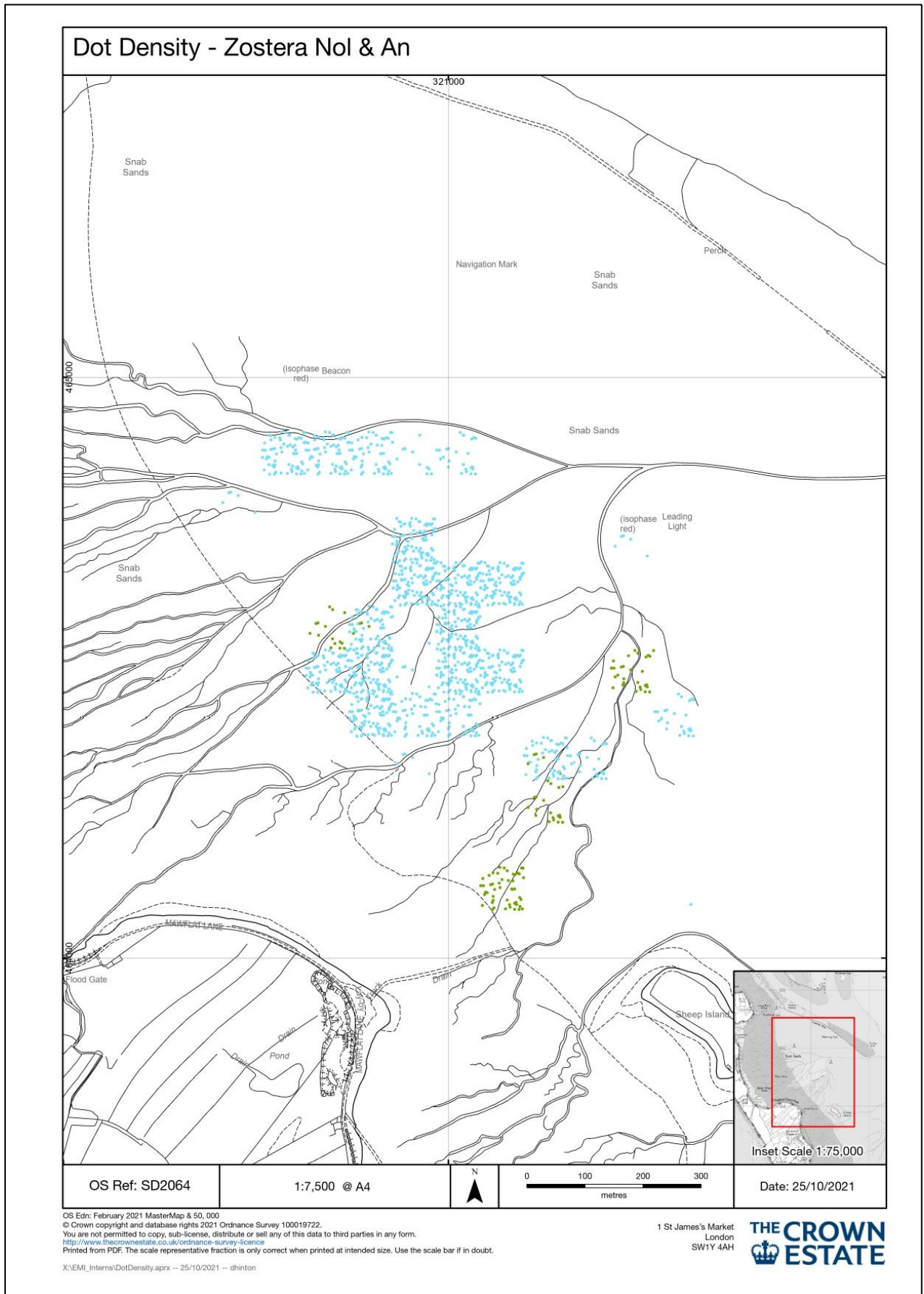
Annex C – Dot density representation of *Zostera Noltii*



Annex D – Dot density representation of *Zostera marina* var. *angustifolia*



Annex E – Dot density representation of *Zostera* species



Annex F – *Zostera marina* var. *angustifolia* distribution (Tittley et al., 1998)

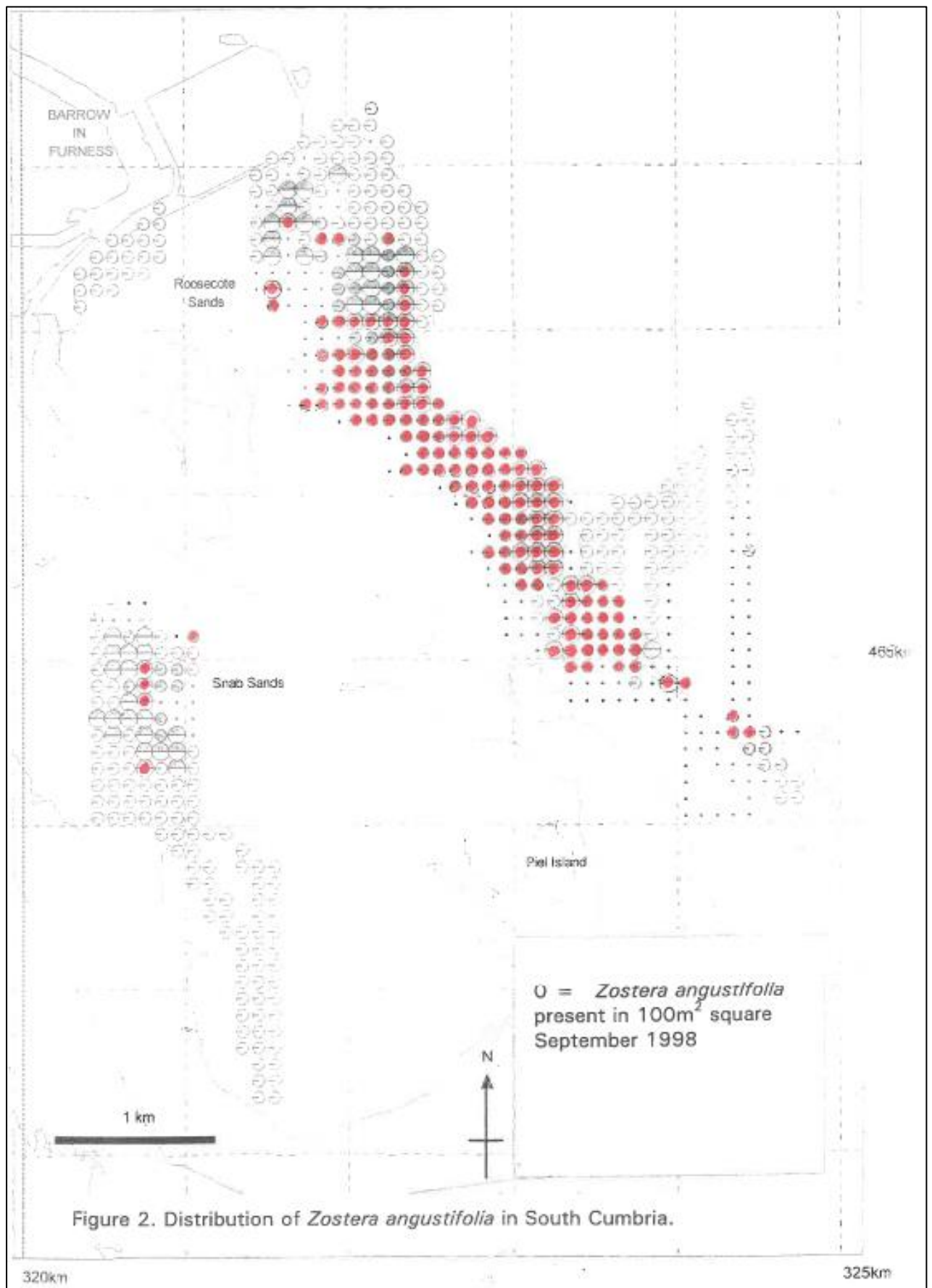


Figure 2. Distribution of *Zostera angustifolia* in South Cumbria.

Annex G – *Zostera noltii* distribution (Tittley et al., 1998)

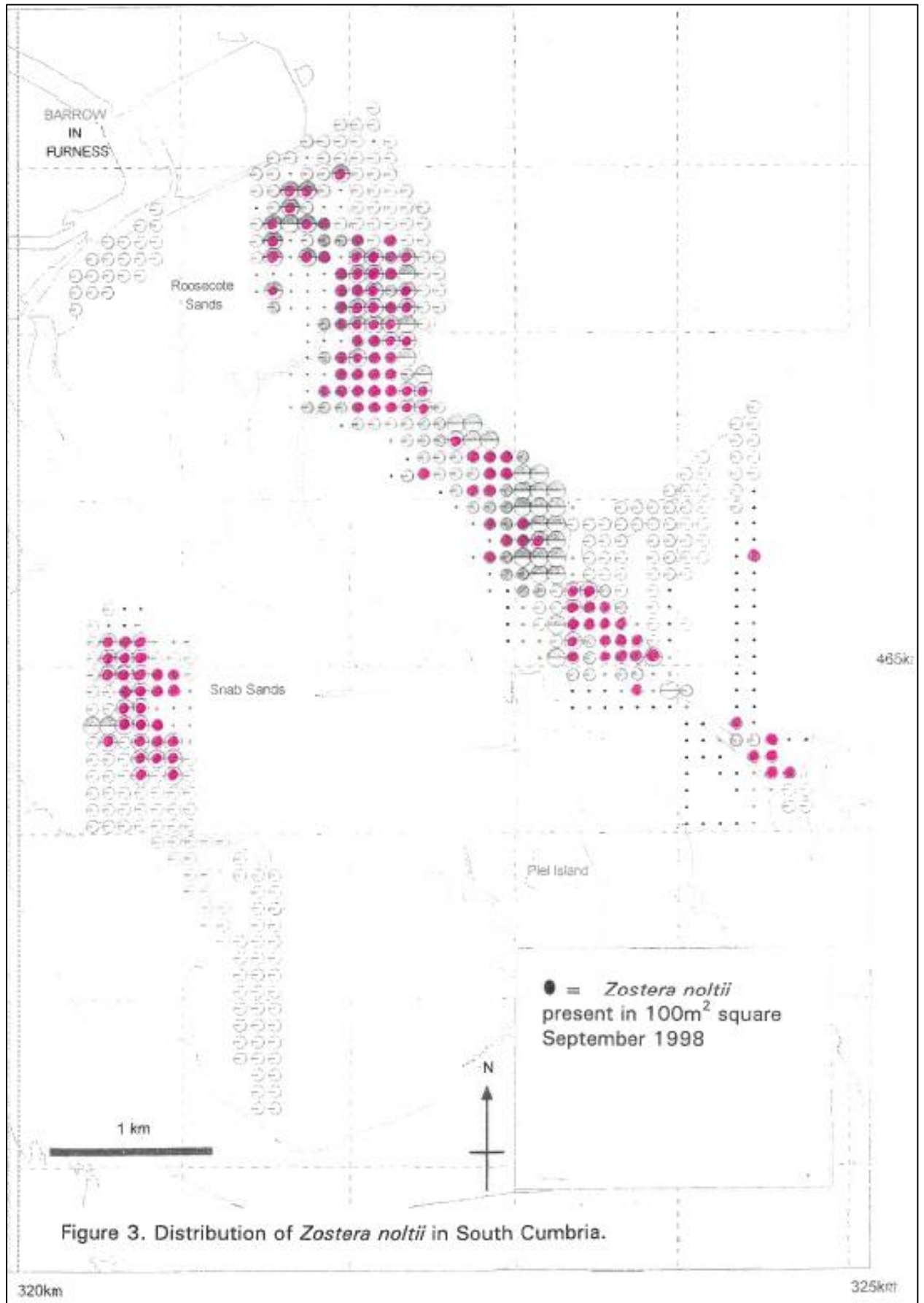


Figure 3. Distribution of *Zostera noltii* in South Cumbria.

Annex H – Survey Sheets

| Snab Sands Seagrass Survey | | | | | | | | | | | | | | |
|---|---------|--------------------------|--------------------------------|------------------------------------|-----------------|-------------------------|----------------------|--------------------------|--------------------|-------------------|--|------------------------------|--------------------------|--------------------|
| Recorders: | | | | | | | | | | | | | | |
| Dates: Wednesday 25th August 2021 and Thursday 26th August 2021 | | | | | | | | | | | | | | |
| Tide times: Wednesday 08:31 (LW), 14:10 (HW); Thursday 09:04 (LW), 14:47 (HW) | | | | | | | | | | | | | | |
| Quadrant No. | WPT No. | Zostera noltii (% (No.)) | Zostera angustifolia (% (No.)) | Zostera Condition (Good/Blackened) | Blow outs (P/A) | Anthropogenic Influence | Macrophyte Cover (%) | Spartina Cover (% (No.)) | Additional species | Bare sediment (%) | Channels/ Creeks (C) or Standing Water (S) (%) | Mounds/ Casts/ Siphons (P/A) | Zostera within 10m (P/A) | Photo Reference(s) |
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Annex G – Quadrat photograph examples

