Deben Estuary SSSI

saltmarsh vegetation fixed transects –

Identification/Establishment/Benchmark survey (Project Reference No: RP03044)

Carried out by Abrehart Ecology Ltd for Natural England, Environment Agency and Deben Estuary Partnership

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1. Background and introduction

1.1 Background information

The Deben Estuary Site of Special Scientific Interest (SSSI) is located on the east coast of England (centroid: TM294425), and includes the major estuary of the River Deben. The whole area is of exceptional biological interest, and the estuary contains approximately 40% of the saltmarsh habitat in Suffolk, and the most complete range of saltmarsh communities in the county (Natural England 1991).

The Deben Estuary was first notified as a SSSI in 1991 due to internationally important populations of over-wintering redshank (*Tringa totanus*), and nationally important populations of birds including, shelduck (*Tadorna tadorna*), black-tailed godwit (*Limosa limosa*), widgeon (*Anas penelope*), pintail (*Anas acuta*), and grey plover (*Pluvialis squatarola*). The area is also covered by other international designations - important over-wintering populations of dark-bellied brent geese (*Branta bernicla bernicla*) qualify the area for Special Protected Area (SPA) status (applied to the site in 1996), and large numbers of breeding avocets (*Recurvirostra avosetta*) and the presence of the threatened narrow-mouthed whorl snail (*Vertigo angustior*) have resulted in the designation of the area as a Ramsar site (also applied in 1996).

The coastal habitats of the Deben Estuary are largely undeveloped. However, they are under threat from "coastal squeeze" where man-made coastal defences form a hard limit to the landward migration of the saltmarsh and intertidal habitats in response to rising sea levels and storm surges (Natural England 1996; JNCC 2011).

Natural England has a duty to monitor and assess the condition of the saltmarsh and to report the conservation status of the SSSI features. a study of the saltmarsh features using the National Vegetation Classification was commissioned in 2013 (Abrehart Ecology 2013), which began to establish a baseline dataset. The results presented here, build on this original data to begin the process of long-term monitoring, and to establishing patterns/trends in saltmarsh quality and extent within the Deben Estuary SSSI. In this case, quality is defined as:

- Vegetation composition (characteristic species, plant communities, negative indicator species, and nationally rare species); and
- Range of NVC saltmarsh communities.

1.2 Aims and objectives

The overall aim of the project was to inform Natural England's reporting of the condition of the saltmarsh features of the Deben Estuary SSSI. This was achieved by:

- Establishing a set of permanent transects for future monitoring;
- Obtaining detailed, georeferenced vegetation survey data for each of the transects as a baseline data set; and
- Collecting high resolution data on specific key species.

2. Methods

2.1 Personnel, timing, and access

All surveys were conducted over a two week period from 27th September 2016 to 11th October 2016. The survey was carried out early/mid-Autumn due to funding constraints at Natural England. The timing was not considered optimal, but the weather during this period in 2016 was very mild and did not impact the quality of the information recorded.

All surveys were undertaken at low tide to ensure the entire marsh extent and low-lying vegetation of creeks could be surveyed.

Health and safety was an important factor considered during the planning of timing and access for each transect survey. A thorough risk assessment was conducted prior to the start of fieldwork and the lead surveyor made any necessary revision for each transect. Due to the hazards of lone working on and/or near intertidal areas and on unstable substrates, all surveys were conducted by a team of two people and led by an experienced saltmarsh NVC surveyor.

Tide times, tide heights, and weather conditions were checked each day before commencing field work. Where possible, each transect was started close to high tide to enable surveyors to work in a seaward direction following an ebbing tide. At several sites, surveying was commenced on an incoming tide due to time constraints on the project and surveying was suspended whilst the surveyors left the marsh during high tide and returned to finish the transect on an ebbing tide.

2.2 Transects recording method

2.2.1 Locations

Ten transects (Figure 1) were completed during the fieldwork period. Six of these were divided into two parts (either east-west or north south), giving a total of **16 transects and sub-transects**. The 16 transects were distributed to provide a representative sample of the geographical and vegetative variation present in the saltmarsh habitats of the SSSI.

The route of each of transect was initially indicated by Natural England using aerial photography and 1:10,000 Ordnance Survey maps, and subsequently refined by the surveyors on site. Wherever possible transect routes were in a straight line across the saltmarsh and perpendicular to the sea wall., with deviations due to large creeks kept to a minimum.

All transects started at the landward extent of the saltmarsh habitat. At sites with a sea wall, this was taken to be the seaward crest of the wall, as *Elytrigia atherica* was often dominant up the entire seaward face. At sites without an obvious sea wall (e.g. Bromeswell), identifying the landward extent of the saltmarsh was more of a challenge. For the purposes of this survey, "saltmarsh" was defined to include a range of swamp, marsh, and inundation grassland communities – the starting points of transects were therefore positioned to include these communities, at a point that would be easy to relocate in the future.

2.2.2 Survey method

Transects and sections

Working seaward from the start point, in a straight line perpendicular to the seawall, the surveyors recorded vegetation five meters either side of the transect line, as well as up to the seaward extent of each distinct vegetation community. Where saltmarsh vegetation extended seaward beyond the end of the saltmarsh cliff edge surveyors continued until the vegetation cover was ≤5%.

In addition to applying NVC notation to each quadrat and section, broad saltmarsh zones (Pioneer, Low marsh, Upper marsh, and Transitional marsh) were applied to each transect. This complies with standard Environment Agency methods for estuary surveying.

The position of each distinctive change in vegetation was recorded, and therefore split the transect into a series of sections. Each consecutive section was designated a letter in alphabetical order in a seaward direction. The landward extent of section A always formed the starting point of the transects. The start and end point of each section was marked out using 1m long bamboo canes with reflective adhesive tape attached to the top. This was particularly helpful for demarking the sections and for surveying along straight lines.

The following information was recorded per section:

- Longitude and latitude of the start and end points; accurate to 2-4m (see Section 2.3 for details of dGPS recording);
- NVC community of the section.
- Habitat attributes. These include the following:
    a. Descriptions of habitat extent;
    b. Physical structure of the saltmarsh (creeks and pans);
    c. Vegetation structure (height, zonation, sward structure, pattern of species distribution);
    d. Vegetation composition (characteristic species, indicators of negative trends e.g. *Spartina anglica*); and
    e. Management – As determined by surveyor's observation or by conversation with landowners, include mowing, grazing (Table 1), trampling, poaching, dunging, seawall re-engineering/re-alignment, trampling, burning, storms/tidal surges, amenity use, and any other anthropogenic influences.
- The abundance of species of interest, assessed using a shortened DAFOR scale (termed 'three-point scale' for the purposes of this report; see Table 2).

Particular attention was paid to recording the abundance of common cord-grass (*Spartina anglica*) which is an invasive species of saltmarshes in the UK. The abundance of *S. anglica* in was recorded in each section by the three-point scale (Table 2), and where possible as a percentage.

Table 1. Definitions of grazing (Dijkema and Wolff, 1983).

Level of grazing	Description
Light grazing	Most of the standing crop is not removed
Moderate grazing	Standing crop almost completely removed
Heavy grazing	Height <10cm, all standing crop removed
Abandoned grazing	Matted vegetation, no standing crop removed

Table 2. Three-point scale (modified from standard DAFOR scale) for recording botanical species abundance per section.

Abbreviation	Abundance category	Category description
D	Dominant	Formed over 50% of the vegetation cover
F	Frequent	Formed 5-50% of the vegetation cover
R	Rare	Formed less than 5% of the vegetation cover

Quadrats

Within each section 1-6 quadrats of 2m x 2m were surveyed to provide a detailed record of the vegetation composition. Where a section was less than 10m in length, typically one quadrat was assessed. In all sections over 10m in length, a minimum of two quadrats were assessed. Where a section comprised a vegetation community mosaic, quadrats were surveyed in each of the mosaic components. In total, 200 quadrats were surveyed along 10 transects.

Quadrats were located within homogenous stands of vegetation - care was taken to avoid boundaries or transition zones between visually distinct saltmarsh habitats. Where possible quadrats were located on the line of the transect or within 5m of the transect line, and further than 5m from the start and end of each section (to avoid transitional zones between sections).

The following information was recorded per quadrat on standard NVC recording sheets:

- Vegetation species with percentage cover;
- Percentage cover of bare ground (unvegetated substrate), open water and algal mat;
- General vegetation description;
- Aspect;
- Slope (degrees);
- Mean height of vegetation layers;
- Percentage cover of each vegetation layer;
- Substrate;
- Photograph – orientated seaward/along the transect; and
- Differential GPS – taken at the bottom left corner of the quadrat (see Section 2.3)

A preliminary appraisal of the NVC community within each quadrat was made in the field. Following the completion of fieldwork, NVC communities were reviewed with reference to Rodwell (2000).

2.3 Sub-meter GPS

An Archer 2 Handheld Portable Computer was used to record locations of section start and end points, quadrats, and additional plant species records. The unit was equipped with EZTag software to enable on-site differential GNSS data collection suitable for post-processing.

Sections, quadrats, and additional plant species records were assigned auto numbered record IDs on the EZtag software to allow cross referencing of the GNSS information with the survey data. Up to this point in the recording process, all location data was recorded to an accuracy of 2-4m depending on the availability of satellites due to cloud cover. The open nature of the saltmarsh habitats allowed connection with 10 or more positioning satellites at all times.

Following the completion of field work all GNSS data was downloaded from the Archer 2 into EZSurv, a desktop GNSS data post-processing software. The software used time and date of data collection for each transect alongside the location of the *hers* base station[1] provided by the International GNSS Service (IGS/CDDIS) to post-process the data, giving sub-meter accuracy positions for quadrats, section start and end points and additional plant species records.

[1] *hers* base station (International GNSS Service; IGS/CDDIS) Latitude: N 50° 52'02.27921" Longitude: 0° 20'10.31999".

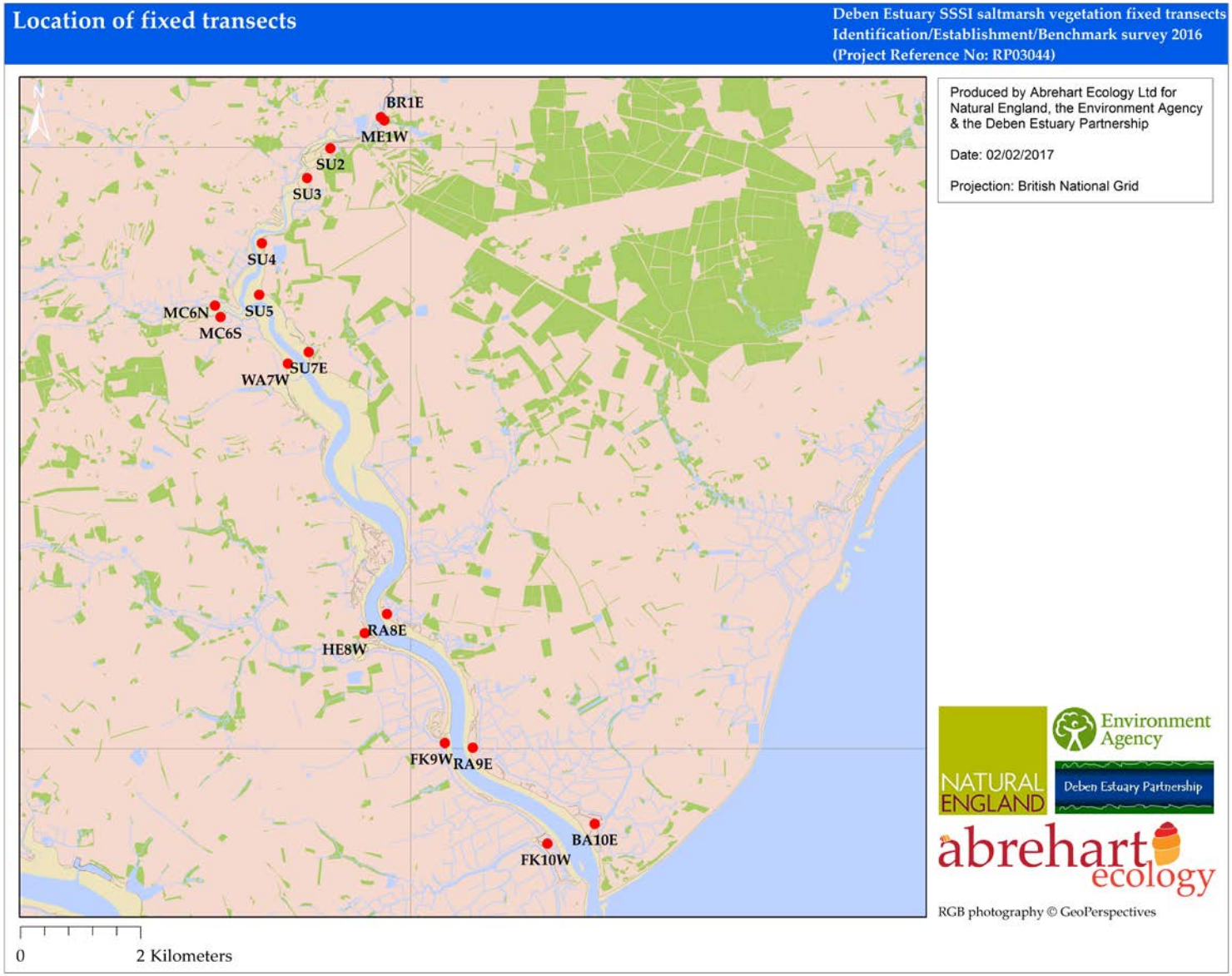

Figure 1. Locations of fixed transects.

2.4 Nomenclature and handling of floristic data

Botanical nomenclature followed Stace (2010), with vegetation communities and subcommunities corresponding to the NVC types described by Rodwell (2000).

Annual *Salicornia* (glasswort) saltmarsh communities have several distinct taxa. However, identification is challenging in the field, and studies to determine the true taxa in the group are ongoing. Due to the difficulty of identification, time constraints, and the time of year, *Salicornia* was generally recorded as an aggregate (although the nationally rare *Sarcocornia perennis* was always distinguished).

2.5 Survey limitations

Despite the rigorous documentation of saltmarsh vegetation communities by Rodwell (2000), an element of subjectivity is an intrinsic limitation on this kind of survey. In this case, deciding on the location of changes in vegetation (denoted by section boundaries), was challenging due to the complex nature of vegetation community transitions in saltmarsh. To maintain consistency in judging these boundaries, the same surveyors assessed all quadrats, sections, and transects. An experienced saltmarsh surveyor led the survey team to ensure that assistant surveyors were familiar with the vegetation communities on the saltmarsh and in the adjacent driftline and transitional habitats. Vegetation boundaries were also documented as fully as possible in the using descriptions, photography, and highly accurate GPS to allow a later review of information.

The survey was undertaken towards the end of the preferable survey season for saltmarsh vegetation (March-September). Many saltmarsh species, particularly annuals such as *Salicornia* spp., vary in abundance throughout the year. There is therefore a possibility that some species which decline towards the end of the season may be under-represented overall. However, such limitations apply whenever a survey is conducted if multiple visits are not possible. As this survey was completed rapidly (within 16 days), any effects of seasonal changes in vegetation should be minimal between transects.

Seasonal change also affected whether certain species of plant were flowering during the survey. The anatomy of the flower is an important feature for the accurate identification of vegetation, but is dependent of the timing of the survey. Where species were not flowing, it is possible that the plant was identified to genus level only. *Salicornia* species, which become harder to identify to species throughout their growth season, were also recorded as an aggregate (although the nationally rare *Sarcocornia perennis* was always distinguished).

3. Results

3.1 Details of presentation

Survey results are presented by transect. A table of location details is given for each transect overall, along with a description of the communities within each distinct vegetation section, a summary table of communities within each section, and a list of species of interest found along the transect.

Summary maps for each transect are presented in the Appendix, together with more detailed section and quadrat descriptions and photographs. The abundance (percentage cover) of each vegetation community within each section are indicated on the NVC maps. It should be assumed that the distribution of the community was consistent throughout the section, unless otherwise specified in the full section description.

3.2 Bromeswell east - BR1E

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Bromeswell	BR1E	Deben Estuary	90.54m	8	14	27/09/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	51.77306496	1.043942571	TM1010312649
			End	1.042399915	51.7697339	TM1001212274

Description

The transect at Bromeswell east was orientated approximately east – west, 307° beginning at the transitional grasslands to the west of the bramble and shrubs adjacent to the road and ending at the edge of the River Deben. The driftline saltmarsh was at the start of the transect

Arrhenatherium elatius dominated grassland (MG1b) was recorded from the start of the transitional zone, Section A. *Elytrigia atherica* gradually became the dominant species over for the next three sections. Section B was dominated by *Elytrigia atherica* with a low density of *Sonchus arvensis* in the sward, indicating the upper extent of tidal effects in this transect. In Section C *Sonchus arvensis* increased in density through the *Elytrigia atherica. Elytrigia atherica* formed a pure stand (SM24) on an area of slightly higher elevation, Section D. Section E comprised a low density of *Phragmites australis* and *Sonchus arvensis* in a dense sward of *Elytrigia atherica* (SM24). Section F contained the last dense sward of *Elytrigia atherica* in the transect.

Phragmites australis swamp formed a distinctive stand in Section G, with an understorey of *Atriplex patula* and some *Bolboscheonus maritima*. At the end of the transect, Section H, the *Phragmites australis* gave way to some typical saltmarsh plants including a small area of *Puccinellia maritima* and tall *Aster tripolium*. On the outer edge of the section *Spartina anglica* was present as a small stand, though larger areas were noted up and downstream of the end of the transect. The face of the saltmarsh was slumping into the channel where it still held small areas of *Puccinellia maritima*.

Section	No. of quadrats	Length (m)	NVC Code
A	2	18.00	MG1b *Arrhenatherium elatius* grassland, *Urtica dioica* sub-community
B	2	11.93	SM24 *Elymus pycnanthus* salt-marsh community
C	2	14.35	SM24 *Elymus pycnanthus* salt-marsh community
D	2	11.00	SM24 *Elymus pycnanthus* salt-marsh community
E	1	5.70	SM24 *Elymus pycnanthus* salt-marsh community
F	2	11.97	SM24 *Elymus pycnanthus* salt-marsh community
G	2	14.16	S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community + SM24 *Elymus pycnanthus* salt-marsh community
H	1	3.44	SM6 *Spartina anglica* salt-marsh community

Species of interest in BR1E

Festuca rubra *Elytrigia atherica* *Limonium vulgare* *Spartina anglica*

3.3 Melton west - ME1W

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Melton west	ME1W	Deben Estuary	18m	4	5	27/09/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	51.80911855	1.041268865	TM0975116650
			End	51.80632729	1.042311201	TM0983616343

Description

The transect at Melton, to the north of the bridge, started at the edge of the footpath and headed across the saltmarsh to the main river channel. The transect was orientated on a bearing of 130°. The river channel formed the end of this short transect.

The start of the transect was on the top sea wall, Section A, where *Elytrigia atherica* (SM24) dominated the vegetation. *Elytrigia atherica* formed a dense sward along a frass line 30cm from the base of the sea wall, which transitioned into a stand of *Phragmites australis* supporting *Atriplex patula* (S4d). There were areas of exposed muds here that were covered in *Enteromorpha intestinalis,* Section B.

As the *Phragmites australis* became shorter and less dense, *Puccinellia maritima* formed the main species in the community. A single stand of *Spartina X townsendii* was present on the northern side of the transect here in Section C. On the southern side of the transect was a dense stand purely of *Bolboscheonus maritima*, (S21). The front edge of the saltmarsh, Section D, was fragmented and slumping with soft, loose muds on the edges.

Section	No. of quadrats	Length (m)	NVC Code
A	1	2.03	SM24 *Elymus pycnanthus* salt-marsh community
B	1	8.13	S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community
C	2	2.77	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	1	5.06	S21 *Scirpus maritimus* swamp (40%), SM13a *Puccinellia maritima* salt-marsh community and SM6 *Spartina anglica* salt-marsh community (30%), *Puccinellia maritima* sub-community (5%) and Bare mud (25%)

Species of interest in ME1W

Elytrigia atherica *Spartina anglica*

3.4 Sutton Hoo north - SU2

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Sutton Hoo north	SU2	Deben Estuary	241.05m	13	19	27/09/2016

	Latitude	Longitude	Grid Ref
Start	51.830069162	0.985866647	TM0583718822
End	51.830170252	0.982918285	TM0564018824

Description

The transect at Sutton Hoo intersected a small section of driftline, with the remainder being saltmarsh. The transect began on a gentle slope was within the *Phragmites australis* line, and ended on the front face of the old eroding sea wall. The transect was orientated approximately east – west - 313°.

Phragmites australis formed the initial community in Section A, where it covered the upper slope. *Elytrigia atherica* dominated grassland (SM24) was recorded as a narrow band of vegetation, Section B, between bands of *Phragmites australis* in Section C.

After a narrow channel perpendicular to the transect, the saltmarsh sloped gently upwards along the length of the transect. *Puccinellia maritima* dominated in Section D with low density stands of *Juncus maritimus*. From here the *Puccinellia maritima* decreased in height and density from SM13a to the a very short sward SM13c. This was dicotyledon-rich with increasing *Limonium vulgare*, Section E. Within the transect *Juncus gerardii* formed dense almost pure stands, Section F.

Towards the outer edge of the saltmarsh, Section G, *Aster tripolium* (SM11) increased in density and height where there were many narrow creeks leading into the mudflats beyond. *Spartina anglica* increased in density with limited *Salicornia dolichostachya* through Section H. The next area of the saltmarsh, Section I, was bare muds extending across the mudflats to the west. To the west there was a raised area of muds, Section J, with a limited flora of mainly *Salicornia* sp. SM8. Following this was a shallow old borrow dyke Section K with no associated flora.

The last sections of the transect covered the eroding seawall. The rear face, Section L, was dominated with *Atriplex portulacoides*, while the top and the front face, Section M, were dominated by *Elytrigia atherica*. The main river channel was located beyond this wall.

Section	No. of quadrats	Length (m)	NVC Code
A	1	6.22	S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community
B	2	26.49	SM24 *Elymus pycnanthus* salt-marsh community/S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community
C	2	9.07	S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community
D	2	16.99	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
E	2	30.54	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
F	1	7.49	SM16b *Festuca rubra* salt-marsh community, *Juncus gerardii* sub-community
G	2	25.20	SM11 *Aster tripolium var. discoideus* salt-marsh community
H	2	11.46	SM6 *Spartina anglica* salt-marsh community
I	1	81.77	Exposed muds
J	1	10.75	SM8 Annual *Salicornia* salt-marsh community
K	1	10.27	Exposed muds
L	1	2.88	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
M	1	1.93	SM24 *Elymus pycnanthus* salt-marsh community

Species of interest in SU2

Cochlearia anglica	*Elytrigia atherica*	*Oenanthe lachenalii*	*Limonium vulgare*	*Triglochin maritima*
Juncus gerardii	*Sarcocornia perennis*	*Spartina anglica*	*Juncus maritimus*	*Glaux maritima*

3.5 Sutton Hoo south - SU3

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Sutton Hoo south	SU3	Deben Estuary	61.54m	7	13	27/09/2015
				Latitude	**Longitude**	**Grid Ref**
			Start	52.096733	1.331761	TM2830649503
			End	52.09663	1.3308918	TM2824749489

Description

The transect at Sutton Hoo south transitioned from driftline through saltmarsh vegetation to the main channel edge. Starting point on the front face slope of the seawall to an end point on the foreshore on a bearing of 252°.

Arrhenatherum elatius dominated grassland (MG1) was recorded on the upper face of the seawall, Section A. On the lower section of the transitional habitat, Section B, the *Elytrigia atherica* dominated and formed a pure community (SM24) in between two old oyster pools. The transition zone led seamlessly into Section C, a *Puccinellia maritima* sward (SM13c) with a high density of *Limonium vulgare, Triglochin maritima* and *Juncus gerardii*. This led to a complex mosaic area, Section D, supporting a high density of *Juncus gerardii* as a prostrate/flattened sward (SM16b) with occasional *Limonium vulgare* and *Juncus maritimus*. Within a narrow channel there was an area of dense *Juncus maritimus*, with *Festuca rubra* to the north (SM16c) and *Elytrigia atherica* to the south (SM24). *Spartina anglica* was found in this section for the first time.

Within Section E *Juncus gerardii* formed dense stands with scattered *Limonium vulgare* and very occasional *Triglochin maritima*. There were many pans throughout the section with *Spartina anglica* and *Atriplex portulacoides* on the edges. Section F comprised an *Atriplex portulacoides* and *Puccinellia maritima* dominated community. A number of narrow creeks and pans dissected the section and gave rise to an increase in *Spartina anglica* density.

The final section, Section G, was dominated by *Spartina anglica* along an uneven and fragmented saltmarsh edge – a number of blocks were falling from the front edge of the saltmarsh into the channel. On the outer edge of the transect was a small area supporting *Puccinellia maritima*.

Section	No. of quadrats	Length (m)	NVC Code
A	2	5.55	MG1 *Arrhenatherum elatius* grassland
B	2	10.37	SM24 *Elymus pycnanthus* salt-marsh community
C	1	3.54	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
D	3	16.39	SM16b *Festuca rubra* salt-marsh community and SM18 *Juncus maritimus* salt-marsh community, *Juncus gerardii* sub-community
E	2	18.53	SM16b *Festuca rubra* salt-marsh community, *Juncus gerardii* sub-community
F	1	2.62	SM16b *Festuca rubra* salt-marsh community, *Juncus gerardii* sub-community and SM14C *Halimione portulacoides* salt-marsh community, *Puccinellia maritima* sub-community
G	2	4.54	SM6 *Spartina anglica* salt-marsh community

Species of interest in SU3

Cochlearia anglica *Elytrigia atherica* *Festuca rubra* *Juncus gerardii* *Juncus maritimus*

Limonium vulgare *Spartina anglica*

3.6 Sutton north - SU4

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Sutton north	SU4	Deben Estuary	339.30m	5	5	28/09/2015
				Latitude	**Longitude**	**Grid Ref**
			Start	52.087	1.3200266	TM2755248384
			End	52.087244	1.3196506	TM2752548410

Description

The transect at Sutton began on the western face of the natural transitional slope and ended at the edge of the main river channel to the on a bearing of 312°.

Elytrigia atherica dominated grassland (SM24) was recorded from the face of the slope, Section A, with *Spartina anglica* and *Puccinellia maritima* at the base. The saltmarsh proper, Section B, started at the base of the slope with a band of herb-rich *Puccinellia maritima* (SM13c), with *Armeria maritima* and *Limonium vulgare* comprising 40% of the vegetation cover. *Spartina anglica* was present at a low density, and there were a number of man-made pans and pools filled with *Enteromorpha intestinalis*. *Aster tripolium* formed a continuous presence in the sward with *Festuca rubra* and *Elytrigia atherica* as isolated 1m x 1m stands on the higher elevation land, especially around the pools where the spoils from digging of the pools was placed.

Section C started at the edge of a pool that was surrounded by *Juncus maritimus* with *Atriplex portulacoides* in the understorey. *Aster tripolium* was scattered throughout the section. Tall *Puccinellia maritima* (SM13a) formed the majority of the vegetation in Section D, with limited *Limonium vulgare* and *Spartina anglica*.

There was a shallow creek (10cm deep) running through Section D. The final section, Section E. started beyond this creek as it joined several others that flowed north and into the main east-west channel. *Salicornia dolichostachya* was found on the lower edges of the creek with *Atriplex portulacoides* on the upper edges. *Spartina anglica* formed a dense community where there was rapid accretion and very soft deep mud. In the last metre of the transect *Atriplex portulacoides* formed the dominant vegetation. There was a stepped cliff with the upper level covered in algae and the lower mudflats covered in *Ulva lactuca*.

Section	No. of quadrats	Length (m)	NVC Code
A	1	4.21	SM24 *Elymus pycnanthus* salt-marsh community
B	2	14.33	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community and SM6 *Spartina anglica* salt-marsh community
C	3	19.56	SM14B *Halimione portulacoides* salt-marsh community, *Juncus maritimus* sub-community
D	2	6.78	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
E	2	14.59	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community and SM6 *Spartina anglica* salt-marsh community

Species of interest in SU4

Elytrigia atherica *Festuca rubra* *Armeria maritima* *Juncus gerardii* *Juncus maritimus*

Limonium vulgare *Spartina anglica* *Triglochin maritima*

3.7 Sutton south – SU5

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Sutton south	SU5	Deben Estuary	339.30m	12	16	28/09/2016

		Latitude	Longitude	Grid Ref
	Start	52.080137	1.3200279	TM2758747621
	End	52.079395	1.3154036	TM2727447524

Description

The transect at Sutton started on the upper transitional saltmarsh, crossed two wide creeks to an island in the river channel, and ended at the edge of the saltmarsh. Much of the transect was inaccessible by foot due to it being too fragile to walk on - the last three sections of the transect were therefore inspected from a boat at high tide.

Elytrigia atherica dominated grassland (SM24) was recorded at the start of the transect, Section A, where it formed a pure community. The saltmarsh started in Section B, where there was a narrow band of dicotyledon-rich saltmarsh (SM13c) with *Spartina anglica* (SM6) present at a low density at the edges of some small shallow pools. In one of the pools was a thick bacterial mat. There was a narrow band of *Atriplex portulacoides* at the start of the section.

Section C was a narrow creek/channel leading to the north, which supported *Spartina anglica* in the centre and *Atriplex portulacoides* on the edges. Section D was a mosaic of stands of *Juncus maritimus* with smaller areas of SM13c in the pans. On the north of the transect a pool extended into a channel, connecting to the main river. Section E was dominated by *Juncus maritimus*, with *Atriplex portulacoides* around the sides of the stands. *Festuca rubra* formed scattered tussocks on the higher uneven ground, and there were numerous pools. This gave way to a small area of SM13c with abundant *Triglochin maritima*. Section F held a higher density of *Atriplex portulacoides* with smaller areas of *Juncus maritimus,* and *Spartina anglica* dominated areas to the north.

Section G was dominated with *Atriplex portulacoides* and *Juncus maritimus* surrounding a number of pools. Dense tussocks made the ground uneven, and *Festuca rubra* was present on the higher ground. Section H was through an area of dense tussocks, filled with burrows and dominated with *Atriplex portulacoides*. The saltmarsh became increasingly fragmented closer to the main channel.

The last four sections of this transect were accessed by boat at high tide. Section I was the eastern channel with *Aster tripolium* on the upper slopes and *Salicornia dolichostachya* on the sides of the channel. Section J was across the first channel, and was dominated with *Aster tripolium* and exposed muds on a fragmented saltmarsh. A wider channel followed this, which formed Section K. The final part of the transect was the island at the edge of the main river. This was Section L, where the saltmarsh was very fragile and disintegrating, and the vegetation was limited to *Aster tripolium* and *Salicornia dolichostachya*.

Section	No. of quadrats	Length (m)	NVC Code
A	1	5.24	SM24 *Elymus pycnanthus* salt-marsh community
B	1	3.84	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
C	1	2.91	SM6 *Spartina anglica* salt-marsh community and SM16a *Festuca rubra* saltmarsh community, *Puccinellia maritima* sub-community
D	2	9.38	SM18 *Juncus maritimus* salt-marsh community and SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
E	1	5.54	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
F	2	12.75	SM14b *Halimione portulacoides* salt-marsh community, *Juncus maritimus* sub-community and SM14c *Halimione portulacoides* salt-marsh community, *Puccinellia maritima* sub-community and Pool
G	2	14.47	SM14b *Halimione portulacoides* salt-marsh community, *Juncus maritimus* sub-community
H	1	6.46	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
I	1	5.75	SM8 *Annual Salicornia* salt-marsh community
J	1	121.22	SM11 *Aster tripolium var. discoideus* salt-marsh community
K	0	45.22	Channel - Exposed muds
L	3	106.52	SM6 *Spartina anglica* salt-marsh community, SM11 *Aster tripolium var. discoideus* salt-marsh community and SM8 *Annual Salicornia* salt-marsh community

Species of interest in SU5

Armeria maritima	*Cochlearia anglica*	*Elytrigia atherica*	*Festuca rubra*	*Juncus maritimus*
Limonium vulgare	*Juncus gerardii*	*Spartina anglica*	*Suaeda maritima*	*Triglochin maritima*

3.8 Martlesham Creek north – MC6N

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Martlesham Creek north	MC6N	Deben Estuary	65.40m	8	11	10/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.078457	1.3074806	TM2673647395
			End	52.077916	1.3078638	TM2676547336

Description

The transect at Martlesham Creek north starts at the top of the sea wall and heads south to the creek edge on a bearing of 158°.

Elytrigia atherica dominated grassland (SM24) was recorded at the start of the transect, Section A, at the base of the sea wall A*triplex portulacoides* (SM14a) and *Puccinellia maritima* (SM13a) formed a mosaic only one metre wide, where *Aster tripolium* was present through the sward, Section B.

The main saltmarsh started on land that was 40cm lower than in section A. Section C was dominated with *Spartina anglica*, with very soft accreting muds present. The wide main channel was located South from this point, and had small stands of *Spartina anglica* (SM6) scattered through the muds with a dense covering of *Fucus vesiculosus*. On the far bank, Section D, there was a dense sward of *Spartina anglica* on a raised mound surrounded by deep, soft muds. As the land rose from the channel the *Spartina anglica* formed a constant sward, Section E. As the land dropped to the south it formed a lower pan, Section F, which was covered in *Spartina anglica* stands with smaller stands of *Salicornia dolichostachya* (SM8).

Section G started at the interface between the creek and the higher saltmarsh and where *Spartina anglica* dominated. The vegetation was dominated by *Atriplex portulacoides* in the first 30cm, with *Puccinellia maritima* subsequently becoming dominant and *Spartina anglica* a constant presence throughout. *Aster tripolium* was found at low densities across the section and the outer edge was largely formed of *Spartina anglica*. The saltmarsh had slumped but maintained a firm base until the last metre of the section where the muds were very soft, Section H.

Section	No. of quadrats	Length (m)	NVC Code
A	1	1.69	SM24 *Elymus pycnanthus* salt-marsh community and SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
B	2	2.08	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community and SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
C	1	3.99	SM6 *Spartina anglica* salt-marsh community
D	1	9.19	SM6 *Spartina anglica* salt-marsh community
E	1	3.87	SM6 *Spartina anglica* salt-marsh community
F	1	5.18	SM6 *Spartina anglica* salt-marsh community
G	2	21.13	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
H	2	18.23	SM6 *Spartina anglica* salt-marsh community

Species of interest in MC6N

Elytrigia atherica *Spartina anglica*

3.1 Martlesham Creek south – MC6S

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Martlesham Creek south	MC6S	Deben Estuary	117.81m	5	6	10/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.068869	1.3238031	TM2790346380
			End	52.069458	1.3252334	TM2799846450

Description

This short transect on the southern side of Martlesham creek extends north to the edge of creek on a bearing of 329°.

Elytrigia atherica dominated grassland (SM24) was recorded from the upper transitional saltmarsh, Section A, with *Phragmites australis* on the lower, wetter edges of the section. Section B was a short section, supporting low densities of *Puccinellia maritima* in sparse tussocks on low mud mounds.

Aster tripolium was dominant in Section C, with low densities of *Puccinellia maritima* and *Spartina anglica* common throughout. The muds in Section D were very soft, so the section was accessed by boat. To the north of the transect was a high density of *Spartina anglica*. In the middle of this there was a higher area of land supporting a species-poor *Puccinellia maritima* community, leading into *Spartina anglica* dominated areas around the edges of the section.

The final section, Section E, was dominated with *Spartina anglica*, and there were several channels dissecting the saltmarsh and open areas of muds. The *Spartina anglica* was aiding accretion in this section.

Section	No. of quadrats	Length (m)	NVC Code
A	1		SM24 *Elymus pycnanthus* salt-marsh community
B	1		SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
C	1		SM11 *Aster tripolium var. discoideus* salt-marsh community
D	2		SM6 *Spartina anglica* salt-marsh community and SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community and SM6 *Spartina anglica* saltmarsh community
E	1		SM6 *Spartina anglica* salt-marsh community

Species of interest in MC6S

Elytrigia atherica *Spartina anglica*

3.2 Waldringfield north – WA7W

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Waldringfield	WA7W	Deben Estuary	126.55m	5	6	10/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.068869	1.3238031	TM2790346380
			End	52.069509	1.3253393	TM2800546456

Description

The transect at Waldringfield North began at the top of the sea wall adjacent to a dead silver birch, and continued east to the edge of the estuary on a bearing of 51°.

The sea wall was steep and was undercut along the lower face. The vegetation down to the base of the wall, Section A, was dominated by *Elytrigia atherica.*

A band of dense, shrubby *Atriplex portulacoides* extended for one meter from the base of the sea wall, Section B. This section started as a narrow (<50cm) pan running parallel to the sea wall with no vegetation, and it ends as the ground slopes towards the first creek. *Puccinellia maritima* was scattered with *Atriplex portulacoides* throughout the first two metres of the section with occasional small stands of *Spartina anglica. Aster tripolium* was scattered throughout, increasing in density towards the end of the section. *Bostrychia scorpioides* was present under the other vegetation in the bare mud. The latter half of the section supported a higher density of *Puccinellia maritima.* At the end of Section B, the land stopped at a fragmenting creek system, Section C.

Section D formed the majority of the transect, and consisted of highly fragmented, fragile saltmarshes accessible only by boat to the outer edges. *Aster tripolium* was dominant on the raised fragments of saltmarsh, with small stands of *Salicornia dolichostachya* on the lower, more exposed muds. Section E formed an area of lower muds which held a low density of *Salicornia dolichostachya.* The outer edge of the saltmarsh supported a dense sward of *Spartina anglica* creating a pure sward at the estuary edge.

Section	No. of quadrats	Length (m)	NVC Code
A	1	3	SM24 *Elymus pycnanthus* salt-marsh community
B	1	3	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
C	1	11	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	1	7	SM11 *Aster tripolium* var. *discoideus* salt-marsh community and SM8 Annual *Salicornia* salt-marsh community
E	4	117	SM11 *Aster tripolium* var. *discoideus* salt-marsh community, SM8 Annual *Salicornia* salt-marsh community, SM6 *Spartina anglica* salt-marsh community and Creek
F	1	2	SM6 *Spartina anglica* salt-marsh community

Species of interest in WA7W

Elytrigia atherica *Spartina anglica*

3.3 Methersgate – SU7E

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Methersgate	SU7E	Deben Estuary	156.81m	8	12	10/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.070972	1.3308338	TM2837446636
			End	52.070466	1.3286944	TM2823046573

Description

The transect at Methersgate started close to a large dead oak tree, and continued west across transitional saltmarsh to an old borrow dyke. From here the transect crossed over a low sea wall, and continued out across an area of fragmented saltmarsh.

The grassland on the transitional slope, Section A, consisted mainly of *Elytrigia atherica* and *Arrhenatherum elatius*. Below this slope was a narrow mammal path which supported a dense sward of *Triglochin maritima* and *Plantago maritima*, Section B. At the margins of Section B were areas of longer *Elytrigia atherica* and a complex mosaic of *Festuca rubra* and low densities of *Lepidium latifolium*.

The main portion of the saltmarsh, Section C, was dominated with *Puccinellia maritima. Suaeda maritima* and *Limonium vulgare* were rare in this section, and two *Limonium humile* plants were present. *Spartina anglica* appeared at low density in this section for the first time in the transect. As the transect progressed to the west *Puccinellia maritima* increased in height and reduced in density, while *Aster tripolium* and *Spartina anglica* became more frequent. *Suaeda maritima* reduced in density in Section D. A creek, originally a borrow dyke forming part of the sea wall, formed Section E – this wall was intentionally breached in the 1970s. The vegetation was dominated by *Spartina anglica* on the upper slopes, and by *Salicornia dolichostachya* on the lower slopes.

Following the creek there was a small eroding sea wall, Section F, covered in *Elytrigia atherica* (SM24). Rubble had been placed along the front face of the wall in an attempt to reduce erosion. For three metres there was a band of *Puccinellia maritima* (SM13a) through an area of eroding saltmarsh, beyond which was a creek too dangerous to cross, Section G.

The final section, Section H, was impossible to access from land so was accessed by boat on the outer edge of the saltmarsh. The section was dominated by a dense sward of *Spartina anglica* through a highly fragmented and fragile eroding saltmarsh.

Section	No. of quadrats	Length (m)	NVC Code
A	1	2	SM24 *Elymus pycnanthus* salt-marsh community
B	1	1	SM16C *Festuca rubra* salt-marsh community, *Festuca rubra-Glaux maritima* sub-community/SM14A. *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community.
C	1	3	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	1	2	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
E	1	2	SM6 *Spartina anglica* salt-marsh community
F	3	76	SM24 *Elymus pycnanthus* salt-marsh community and SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
G	1	6	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
H	1	30	SM11 *Aster tripolium* var. *discoideus* saltmarsh community and SM6 *Spartina anglica* salt-marsh community

Species of interest in SU7E

Elytrigia atherica *Spartina anglica* *Lepidium latifolium* *Limonium vulgare* *Plantago maritima*

Limonium humile *Triglochin maritima*

3.4 Hemley – HE8W

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Hemley	HE8W	Deben Estuary	152.20m	10	17	10/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.031292	1.3462698	TM2963542273
			End	52.030765	1.3452097	TM2956542211

Description

The transect at Hemley started on the seaward side of a creek running parallel to the estuary (which created a physical boundary between the saltmarsh and the adjacent field margin) and continued east to the edge of the saltmarsh on a bearing of 59°.

Section A was dominated with *Elytrigia atherica* (SM24) with a low density of *Atriplex patula* in the sward. Section B started on a raised bank with a footpath. *Elytrigia atherica* dominated on the north side of the bank with *Atriplex portulacoides* (SM14a) dominant on the southern side. The section ended on the landward side of the footpath bank. In Section C, *Atriplex portulacoides* was present adjacent to the creek edge and ran parallel to the transect towards the footbridge, *Spartina anglica* was present in the sward.

Section D was a narrow area of SM13c with frequent *Armeria maritima* and *Limonium vulgare*. Following this section the saltmarsh became dominated by *Atriplex portulacoides,* Section E, with an increase in *Puccinellia maritima* to the east. Section F passed over a two-meter-wide creek, where *Puccinellia maritima* became more dominant. There was a single pan present, and *Aster tripolium* was widespread in lower elevation areas within the section.

Atriplex portulacoides became more dominant in Section G, and there were two small pans supporting a short turf *Puccinellia maritima* community. A creek ran along the southern edge of the section, with narrow areas of *Seriphidium maritima* along its length and patches of *Elytrigia atherica* on higher ground.

Section H covered an area of a creek where the banks were slumped into the channel. *Salicornia dolichostachya* was found on these banks, and *Puccinellia maritima* dominated the first ten metres back from the channel. A small pool was located to the south of the creek, and short turf *Puccinellia maritima* saltmarsh (SM13c) covered the centre and the area north of the transect line, joining additional pools to the north and south. This community extended to the end of this Section I before a low bund/old sea wall perpendicular to the transect line.

The final section, Section J, started at the landward side of the narrow bund/old sea wall and continued to the end of the saltmarsh at the estuary edge. The vegetation was dominated by *Atriplex portulacoides* either side of the bank, with *Elytrigia atherica* and *Seriphidium maritima* on the bank itself. The remainder of the vegetation consisted largely of *Puccinellia maritima* with a small stand of *Spartina anglica* at the edge of the transect. The face of the saltmarsh cliff had toppled in places along its length – the cliffed edge was 1.5m in height. Algae covered the higher mounds on the face, and some small stands of *Salicornia dolichostachya* were present.

Section	No. of quadrats	Length (m)	NVC Code
A	2	8.74	SM24 *Elymus pycnanthus* salt-marsh community
B	1	3.26	SM24 *Elymus pycnanthus* salt-marsh community
C	1	2.17	SM14b *Halimione portulacoides* salt-marsh community, *Juncus maritimus* sub-community
D	1	2.01	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
E	2	18.61	SM14c *Halimione portulacoides* salt-marsh community, SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community, *Puccinellia maritima sub-community* and Creek
F	2	44.04	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
G	2	24.29	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community, and SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
H	1	3.45	SM8 Annual *Salicornia* salt-marsh community and SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
I	3	35.56	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community, and SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
J	2	10.07	SM24 *Elymus pycnanthus* salt-marsh community, SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community, SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community

Species of interest in ME8W

Elytrigia atherica *Spartina anglica* *Limonium vulgare* *Armeria maritima* *Cochlearia anglica*

Limonium humile *Triglochin maritima*

3.5 Ramsholt north – RA8E

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Ramsholt	RA8E	Deben Estuary	93.17m	5	10	12/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.031292	1.3462698	TM2963542273
			End	52.030765	1.3452097	TM2956542211

Description

The transect at Ramsholt started on the top of the seawall and continued west to the edge of the saltmarsh on a bearing of 232°.

Section A began at the crest of the sea wall and ended at the toe. The vegetation across the face was dominated with tall, upright *Elytrigia atherica*, and along the base of the front face, there were small stands of *Atriplex portulacoides* and *Beta vulgaris* ssp. *maritima* and a deep layer of tidal frass and debris.

Section B extended from the sea wall to a parallel creek, and continued for 2m on the western side of the creek. The vegetation was dominated with *Atriplex portulacoides* as large bushy plants, with occasional *Suaeda maritima* and *Spartina anglica* along the centre of the transect line before the creek. Occasional *Atriplex portulacoides* plants were present along the creek where the edges had begun to slump into the channel.

Puccinellia maritima appeared in Section C as SM13a, and ended when *Spartina anglica* became more dominant. There was a creek meandering and parallel to the transect in Section C, with dense *Atriplex portulacoides* present along its edges. The sides of the creek were undercut in many places, and many stands of *Atriplex portulacoides were* slumped over the creek edge. *Spartina anglica* was scattered from the start of the section to the pan, with a single 2m x 2m stand located west beyond the pan. Away from the creek edges and pans the community was a constant *Puccinellia maritima* SM13a sward.

Spartina anglica swards became visibly more dense in the *Puccinellia maritima* saltmarsh in Section D. The ground in this section was very wet and uneven, with *Spartina ang*lica in the lower-lying areas. There were stands of SM13c scattered from 10m into the section up to the saltmarsh edge, where the section ended. This indicated a transition either to or from this community.

The final 10m of mudflats beyond the edge of the saltmarsh formed Section E. Here there were remains of creeks and banks, with vegetation limited to *Salicornia dolichostachya* and abundant *Enteromorpha intestinalis* on the lower muds. *Fucus vesiculosus* was present but rare and scattered. The mud mound further out in to the estuary was orientated as a peninsula running from north to south into the estuary.

Section	No. of quadrats	Length (m)	NVC Code
A	1	2.75	SM24 *Elymus pycnanthus* salt-marsh community/sub-community
B	2	11.04	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
C	2	17.90	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community, SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
D	4	54.64	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community/SM6 *Spartina anglica* salt-marsh community
E	1	6.84	SM8 Annual *Salicornia* salt-marsh community and Mud

Species of interest in RA8E

Elytrigia atherica *Spartina anglica* *Limonium vulgare* *Triglochin maritima* *Cochlearia anglica*

3.6 Falkenham Creek – FK9W

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Falkenham Creek	FK9W	Deben Estuary	76.80m	5	11	11/10/2016
				Latitude	**Longitude**	**Grid Ref**
			Start	52.011418	1.3578455	TM3053140100
			End	52.011386	1.3589509	TM3060740100

Description

The transect at Falkenham Creek started on the seawall and headed east on a bearing of 91°.

Section A began at the top of the sea wall and ended at the toe facing east. The upper half of the wall was purely *Elytrigia atherica*, mown to 10cm. Over the rest of the face *Elytrigia atherica* was dominant with some scattered *Phragmites australis*. Section B extended from the base of the sea wall up to 3.5m into the marsh. The ground was uneven with some *Spartina anglica* and *Atriplex portulacoides* cover and bare. *Salicornia dolichostachya* was present but rare.

The upper half of the salt marsh, Section C, consisted of a large expanse of *Puccinellia maritima* dominated saltmarsh SM13a on the slightly higher ground, with *Limonium vulgare* occurring frequently and *Spartina anglica* occurring only rarely. The transect crossed three creeks in this section. There was a pan that was filled with dark though clear water. *Puccinellia maritima* formed most of the vegetation with *Atriplex portulacoides* and *Suaeda maritima* also present throughout. Small stands of *Spartina anglica* were observed, mainly near the creek and pan edges.

Section D was at the interface between the SM13a and SM13c on the seaward edge of some *Spartina anglica* stands. *Puccinellia maritima* was localised to the south of the transect in the first seven metres. The short sward of SM13c covered the majority of the section, with *Salicornia europea* forming a large portion of the community giving it an overall reddish colour. *Limonium vulgare* was also frequent and continuous in the community. There were multiple pools and pans across the section with *Spartina maritima* around the edges. Ten large stands of *Spartina anglica* were located to the south of the transect line in this section.

Over the last eight metres of the saltmarsh, Section E, the land rose slightly relative to the previous section. Tall *Puccinellia maritima* and *Spartina maritima* plants were frequent, and *Aster tripolium* and *Salicornia europea* were present but rare throughout. *Atriplex portulacoides* was frequent, especially along the margins of creeks and on a small peninsula of saltmarsh which divided them. The tip of the peninsula had no vegetation and was eroded and showed root scalping (washing by the tide). From the tip of the peninsula to the end of the creeks there was a gradual increase in elevation with a one metre drop at the mouth of the creek and a 30cm drop at the start of the creek. There was an undulating basin to the creek with raised areas covered in algae . The face of the saltmarsh was undercut, and toppled mounds along the face were covered with algae. There was root scalping between 1cm - 30cm of the top edge of the saltmarsh.

Section	No. of quadrats	Length (m)	NVC Code
A	2	4.98	SM24 *Elymus pycnanthus* salt-marsh community
B	1	3.15	SM6 *Spartina anglica* salt-marsh community
C	3	32.33	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	4	28.69	SM13c *Puccinellia maritima* saltmarsh community, *Limonium vulgare-Armeria maritima* sub-community
E	1	7.66	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community

Species of interest in FK9W

Elytrigia atherica *Spartina anglica* *Limonium vulgare* *Triglochin maritima* *Cochlearia anglica*

Spartina maritima

3.7 Ramsholt south – RA9E

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Hemley	HE8W	Deben Estuary	142.67m	7	11	10/10/2015
				Latitude	**Longitude**	**Grid Ref**
			Start	52.01054	1.3662045	TM3110940029
			End	52.010555	1.3641358	TM3096740024

Description

The transect at Ramsholt north of the Ramsholt Arms and headed west on a bearing of 265°.

Section A started at the seaward crest of the sea wall and ended at the folding. On the face of the wall there was tall *Elytrigia atherica* and a dense thatch with deep debris from the 2013 storm surge. The crest and rear of the sea wall were covered with stunted *Phragmites australis*.

Section B extended for 3m out from the toe of the sea wall. This section was covered with a dense swathe of *Atriplex portulacoides* interspersed with *Spartina anglica*, with some *Suaeda maritima* and *Aster tripolium* also present.

After Section B the elevation lowered by 10cm, at which point the vegetation changed to a *Puccinellia maritima* dominated mosaic, Section C. In the centre of the transect line SM13c formed a narrow strip of vegetation 2m wide, while the rest of the vegetation in the section was a *Puccinellia maritima* dominated, species-poor community. The section ended 1.5 metres from the edge of a creek.

Section D began and ended 2m either side of a creek that running perpendicular to the transect line. The creek had a slumping edge with a steep gradient of 80 degrees. The edges of the saltmarsh around the creek were unstable and easily fragmented, making it difficult to cross. The vegetation community throughout the section was dominated by *Atriplex portulacoides,* with *Puccinellia maritima* and *Spartina maritima* less frequent.

Beginning 2m from the creek in Section D, and ending at the interface with the SM13c in Section F, Section E was dominated by *Puccinellia maritima, Suaeda maritima, Atriplex portulacoides,* and *Aster tripolium*. It crossed a narrow creek (30cm wide x 30cm deep) which had an orange pigment and an oily film.

The largest expanse of the transect , Section F, was a *Puccinellia maritima* dominated species poor community, with *Spartina anglica* increasing in density throughout. The saltmarsh was very unstable and wet underfoot, and easily sank to over 20cm. There was a group of seven irregularly-shaped pans in this section, with *Spartina anglica* around the perimeters and in areas between them.

One pan from Section F final pan extended into Section G, and was dominated with tall *Puccinellia maritima* and *Spartina anglica*. The sediment here was slightly firmer than in Section F, though it was still unstable and moved under foot pressure. *Limonium vulgare* was frequent throughout the section. *Puccinellia maritima* became taller as elevation increased towards the end of the transect, but remnants of SM13c vegetation

were still present. Vegetation in the last 10m of the section, largely Suaeda maritima, was uniform in height.

There was root scalping along the edge of the saltmarsh, and large mounds of toppled muds on the shore of the mudflats1.6m below the saltmarsh. The transect ended 4m out into the mudflats as some *Salicornia dolichostachya* was present. Many of the mud mounds at this point were covered with algae. There was a large pan draining into a creek to the north - if this creek continues to expand more it could increase the drainage of the marsh and the rate of destablisation.

Section	No. of quadrats	Length (m)	NVC Code
A	1	3.42	SM24 *Elymus pycnanthus* salt-marsh community
B	1	4.73	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
C	2	13.97	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	1	8.57	SM14c *Halimione portulacoides* salt-marsh community, *Puccinellia maritima* sub-community
E	1	5.63	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
F	3	52.91	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
G	2	53.45	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community

Species of interest in RA9E

Elytrigia atherica *Spartina anglica* *Limonium vulgare* *Triglochin maritima* *Cochlearia anglica*

Spartina maritima

3.8 Falkenham – FK10W

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Falkenham	FK10W	Deben Estuary	218.08m	5	11	11/10/2015
				Latitude	**Longitude**	**Grid Ref**
			Start	51.995187	1.3806277	TM3217838368
			End	51.996239	1.382849	TM3232538492

Description

The transect at Falkenham started on the front face of the sea wall, which was 3m high and sloped at 35 degrees on either side. The transect headed from the sea wall to the edge of the saltmarsh on a bearing of 53°.

Section A started on the seaward face of the sea wall one metre below the crest. This side of the wall was covered by a mesotrophic grassland community, dominated by *Arrhenatherium elatius* and *Dactylis glomeratus,* which had been mown to a height of 10cm. The section ended at the base of the sea wall, which was dominated by *Elytrigia atherica.*

Section B, started at the toe of the sea wall and extended for 3m across the folding to the fence line. *Phragmites australis* was dominant throughout with an *Atriplex portulacoides* understorey, with taller, denser vegetation along the base of the sea wall. *Spartina anglica* was present to the south of the central transect line. A low-density area of *Puccinellia maritima* and *Aster tripolium* covered the substrate over the last metre of the section.

The largest portion of the saltmarsh was Section C. *Puccinellia maritima* was dominant, with *Atriplex portulacoides*, *Suaeda maritima,* and *Aster tripolium* scattered throughout. *Limonium vulgare* was present in the first 20cm. There was a large creek running perpendicular to the transect line, which was filled with soft sediment over ankle deep. On the far (eastern) side of the creek the vegetation was taller by 10cm, here were the first plants of *Cochlearia anglica* as a rare plant throughout. *Spartina maritima* was present at 45% cover in a 6m x 6m stand. A second creek was narrow and 50cm deep with soft sediment. The section ended at the interface between SM13a and the SM13c vegetation communities.

Typical SM13c *Puccinellia maritima* herb rich saltmarsh, *Salicornia europea,* and *Limonium vulgare* were frequent and continuous across Section D. *Spartina maritima* was scattered throughout the section, including some large stands of 10m x 10m. There was one large pool in the centre of the section and four small stands of *Spartina anglica* on the pool margin. *Spartina anglica* formed swathes throughout the saltmarsh in a seawards direction from this pool. After the pool the vegetation was covered in sediment and was brown in coloration, indicating frequent inundation and sedimentation.

Section E, ended at the edge of the estuary. It consisted of tall *Puccinellia maritima*, *Aster tripolium*, and *Atriplex portulacoides*, with *Spartina anglica* present but rare throughout. Three metres from the start there was a creek running parallel to the transect. This creek featured an area of *Salicornia dolichostachya* on the lower sections of slumped muds that extended from the outer edge of the creek. *Spartina anglica* was localised to the latter

half of the section. *Limonium vulgare* was present but rare in the last eight metres of the section. The final metre was root scalped, and colonised by algae. The edge of the saltmarsh was toppled with weathered mud mound topography and a one metre drop onto the mudflats below, where *Fucus vesiculosus* was occasionally present.

Section	No. of quadrats	Length (m)	NVC Code
A	1	7.12	SM24 *Elymus pycnanthus* salt-marsh community
B	1	2.98	S4d *Phragmites australis* swamp and reed-beds, *Atriplex prostrata* sub-community, SM14a *Atriplex portulacoides* saltmarsh community, *Atriplex portulacoides* sub-community, SM6 *Spartina anglica* saltmarsh community
C	3	56.99	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
D	4	114.05	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
E	2	36.94	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community

Species of interest in FK10W

Elytrigia atherica *Spartina anglica* *Limonium vulgare* *Triglochin maritima* *Cochlearia anglica*

Spartina maritima

3.9 Bawdsey – BA10E

Details

Transect name	Transect code	Estuary	Total length	No. of sections	No. of quadrats	Date surveyed
Bawdsey	BA10E	Deben Estuary	366.12m	25	36	10/10/2015

		Latitude	Longitude	Grid Ref
	Start	51.999341	1.3953673	TM3316838877
	End	51.997368	1.3911087	TM3288638644

Description

The transect at Bawdsey started on the front face of the sea wall and headed to the edge of the saltmarsh on a bearing of 246.08°.

The sea wall, Section A, was dominated by a dense, uniform sward of *Elytrigia atherica*. At the base of the sea wall, Section B, *Atriplex portulacoides* formed dense shrubby areas before a narrow creek running perpendicular to the transect line. The creek formed Section C, with *Salicornia dolichostachya* on the western side.

Section D began at the far side of the first creek with an area of *Puccinellia maritima* (SM13a). There was an area of saltmarsh almost completely separated from the main marsh by creeks/channels, with narrow connections to the rest of the marsh to the north. The plant community, *Atriplex portulacoides* and occasional *Suaeda maritima,* was uniform throughout.

Section E started at the edge of the creek surrounding Section D – this was a 1.2m channel approximately 1m deep at this point and containing soft sediments. There were meanders and many channels intersecting the marsh network. The plant community here was the same as section D (SM13a). The section ended at the interface between SM13a and SM6/SM13c transitional communities in a pan.

Section F consisted of an 8m x 8m pan in a depression in the saltmarsh. The plant community was SM13a, with *Spartina anglica* and *Limonium vulgare* found throughout. There were numerous runnels and gullies outside the pan to the south, with a SM13a plant community. At the interface with section G was a vegetated pan, with a with variable topography colonised by *Elytrigia atherica* (SM24) on the higher ground. There was an additional pan of stable cracked substrate with soft wet mud at the margins, dominated by *Puccinellia maritima* and some *Limonium vulgare*. On higher ground to the north of the second pan the plant community was SM16d. There were many deep, narrow gullies here which meandered through the section connecting various smaller pans. Section H started at the edge of a short *Puccinellia maritima* SM13c community, and contained a shallow pool of water which didn't drain. *Spartina anglica* was present in the final metre of the section.

Festuca rubra dominated to the south of the transect line in Section I and along higher ground on the edge of the main creek which dissected the saltmarsh, running perpendicular to the transect line at this point. *Puccinellia maritima* was dominant to the north along slightly lower ground, and there was an increase in the density of *Atriplex portulacoides* in SM13a. The creek was approximately 8m wide and featured mud shelves approximately 1m wide on western side, Section J. The mud shelves were vegetated with *Salicornia*

dolichostachya. The higher elevation of the ground around the creek edges, Section K, permitted the growth of *Festuca rubra* rather than *Puccinellia maritima,* and *Festuca rubra* therefore dominated the plant community. Other vegetation included *Atriplex portulacoides, Suaeda maritima, Limonium vulgare* and *Aster tripolium*. SM24 driftline communities were found at the northern edge along the main creek on higher ground.

Across the creek, *Puccinellia maritima* was dominant in Section L with a covering of *Limonium vulgare* and *Suaeda maritima* throughout. *Sarcocornia perennis* was found in shallow runnels interspersing the section and bare mud. Section M, was dominated by *Puccinellia maritima*, which was taller during the first and last metres of the section.

Section N, started and ended at the edges of a sparse *Spartina anglica* sward within a SM13a plant community. A mosaic of communities formed the adjacent Section O, comprising SM13c, SM6, SM13a and SM8 saltmarsh communities. The ground level was uniform throughout Section O, but contained frequent pans connected by shallow runnels - these were mostly vegetated with SM6 *Spartina anglica.*

Section P started with dominant *Atriplex portulacoides* interspersed with *Puccinellia maritima* on areas of higher ground. A sward of *Spartina anglica* started on the southern edge of the transect line in the middle of the section and expanded towards the south. There was a gully intersecting the transect in the centre, where it increased in width as it joined the main creek at the end of the section. Section Q began 1m from the edge of the creek in Section P, and contained a mosaic of SM16d, SM13a, and creek, ending at an interface between SM13a and SM13c. The creek here was 2m wide with undercuts in the banks. Mud mounds had toppled into the creek and there was soft sediment. SM16a plant communities were on the southern side and SM13a to the north adjacent to the creek. Section R was a short swathe of SM13c with an average height of 10cm. There was short *Puccinellia maritima* and taller *Limonium vulgare* throughout with *Salicornia europaea* agg. present.

The start and end of Section S was at the interface of SM13c plant communities either side of a creek approximately 3m wide, 1m deep, with soft sediment. The creek was undercut and small pieces of dislodged saltmarsh were seen in the meandering channel. On the eastern side of the creek the plant communities consisted of *Atriplex portulacoides*, *Suaeda maritima, Aster tripolium* and *Limonium vulgare*. Section T consisted mainly of SM13c with some SM13a plant communities. There was an expanse of SM13c, bordered by SM13a adjacent to some small creeks and with *Spartina anglica* in depressions. The last 10m of this section covered by SM13a *Puccinellia maritima* plant communities to the southern side of the transect line as the elevation increased.

In Section U *Festuca rubra* replaced *Puccinellia maritima* from the previous section and the ground elevation slightly increased. *Limonium vulgare* was found at the start of the section, and appeared to have spread from the previous section. Section U ended at the edge of a creek at the centre of a horse-shoe shaped bend. Other vegetation present included *Atriplex portulacoides, Aster tripolium,* and *Suaeda maritima*. Section V started at the western side of the creek approximately, which was 2m wide and 1m deep at this point. The vegetation was dominated by *Atriplex portulacoides* (SM14c) and a small area of SM13c. There was some undercutting of the bank of the creek, and evidence of mud mounds which had toppled into the water. There was a second small channel about halfway through the section. There was one small pool (approximately 1m x 1m). The last 10m of the section was a mosaic of SM13c and SM14c plant communities. Section W was an area of SM13c extending north and south of the transect line with *Spartina anglica* on the western margin.

Section X was dominated with *Puccinellia maritima* and the community was around the wide margin of a creek running perpendicular to the transect line. *Atriplex portulacoides* covered 30% of the community. There was a pan three metres from the creek (50cm x 2m). *Salicornia europea* was present on the bare ground. The section ended on the western side of the creek. The creek was two metres wide and 70cm deep.

This final Section Y, started on the western side of the creek and ended at the edge of the cliffed saltmarsh.

It was formed of a mosaic of communities, tall tussocks of *Puccinellia maritima, Atriplex portulacoides* with *Aster tripolium* and *Suaeda maritima* which constituted to the SM13a community. The shorter stands of SM13c held very little *Atriplex portulacoides* and abundant *Limonium vulgare* and *Salicornia europea*. There were three small pools in the centre of the section to the north of the transect line (2m x 2m average for all three). There were a maximum of 10 plants of *Spartina anglica* in the centre of the section. In the last 10m *Atriplex portulacoides* formed 15% of the community. *Spartina anglica* was on the southern edge as a thinly distributed sward. The front edge of the saltmarsh was root scalped for 1 metre with an undercut edge and mounds toppling into the mudflats. *Spartina anglica* was a sparse sward on the southern side of the final portion of the transect.

Section	No. of quadrats	Length (m)	NVC Code
A	1	2.45	SM24 *Elymus pycnanthus* salt-marsh community
B	1	2.99	SM14a *Halimione portulacoides* salt-marsh community, *Halimione portulacoides* sub-community
C	1	2.91	SM8 Annual *Salicornia* salt-marsh community
D	2	18.35	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
E	1	5.73	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
F	1	7.02	SM6 *Spartina anglica* salt-marsh community, SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
G	3	35.69	SM24 *Elymus pycnanthus* salt-marsh community + SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community + SM16d *Festuca rubra* salt-marsh community, *Festuca rubra* sub-community
H	1	6.68	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
I	2	10.75	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community + SM16d *Festuca rubra* salt-marsh community, *Festuca rubra* sub-community
J	1	4.11	SM8 Annual *Salicornia* salt-marsh community
K	1	10.06	SM16d *Festuca rubra* salt-marsh community, *Festuca rubra* sub-community + SM24 *Elymus pycnanthus* salt-marsh community
L	1	5.37	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
M	1	8.33	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community

Section	No. of quadrats	Length (m)	NVC Code
N	1	11.09	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
O	3	35.09	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community + SM6 *Spartina anglica* salt-marsh community + SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community + SM8 Annual *Salicornia* salt-marsh community.
P	2	15.86	SM14c *Halimione portulacoides* salt-marsh community, *Puccinellia maritima* sub-community
Q	2	14.81	SM16d *Festuca rubra* salt-marsh community, *Festuca rubra* sub-community + SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
R	1	16.02	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
S	1	20.93	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
T	2	32.36	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community + SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
U	1	9.81	SM16d *Festuca rubra* salt-marsh community, *Festuca rubra* sub-community
V	2	33.81	SM14c *Halimione portulacoides* salt-marsh community, *Puccinellia maritima* sub-community + SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
W	1	7.99	SM13c *Puccinellia maritima* salt-marsh community, *Limonium vulgare-Armeria maritima* sub-community
X	1	16.30	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community
Y	2	31.60	SM13a *Puccinellia maritima* salt-marsh community, *Puccinellia maritima* sub-community

Species of interest in BA10E

Armeria maritima *Cochlearia anglica* *Elytrigia atherica* *Limonium vulgare* *Spartina anglica*
Spartina maritima *Triglochin maritimum*

3.10 Locally and Nationally Scarce Plants

***Bupleurum tenuissimum* – Slender Hare's-ear**

Status: Nationally Scarce

This slender, often diminutive, annual is primarily a colonist of thinly vegetated or disturbed coastal sites including coastal banks, sea walls, drained estuarine marshes, and the margins of brackish ditches.

This species was found only on one occasion during this survey – it is a cryptic species in the summer and very difficult to locate in the late autumn.

***Lepidium latifolium* – Dittander**

Status: Nationally Scarce

A rhizomatous perennial herb native on creek-sides, ditches, sea-walls, open brackish grassland, and the upper fringes of estuarine saltmarshes. It is also naturalised in disturbed areas such as waste ground, docklands, railways, and roadsides.

This is now a common species along roadsides, and was seen more frequently on the way to the estuaries than on the upper saltmarshes where it is becoming scarce. This species was only found twice during the survey, at Sutton Hoo south and Methersgate.

***Limonium humile* – Lax sea-lavender**

Status: Nationally Scarce

A perennial herb of ungrazed or lightly grazed muddy estuarine saltmarshes. It often grows in close proximity to its commoner relative, *Limonium vulgare*, and replaces it in some areas.

This species was only found at Sutton Hoo north and Methersgate.

***Sarcocornia perennis* – Perennial Glasswort**

Status: Nationally Scarce

A woody perennial subshrub of saltmarshes, especially in bare or sparsely vegetated areas of firm, muddy sand and gravel. *S. perennis* occurs on eroding lower parts of saltmarshes, at higher elevations on saltmarsh drift-lines, on shell and shingle banks, and sometimes also on bare ground behind sea-walls.

This distinctive species was never found in large stands but was well distributed throughout the SSSI, being found in all the estuaries under study and on nearly all transects.

***Spartina maritima* – Small cord-grass**

Status: Nationally Scarce

A rhizomatous perennial herb of tidal mud-flats and saltmarshes, frequently planted as a mud-binder and forming extensive stands in many estuaries. It originated in Southampton Water (S. Hants.) in c.1890 as an amphidiploid derivative of *S.* x *townsendii*. Lowland.

The species was found in varying quantities around the SSSI, especially in the southern portion of the estuary.

4. Conclusions

4.1 Main points

This survey has fulfilled the criteria mentioned in the specification. Ten transects were recorded along the Deben Estuary SSSI. 200 quadrats were recorded along these transects with information on 133 sections along these.

5. Survey improvements and amendments

5.1 Field work

5.1.1 Identification of flora

Accurate identification of some plant species requires observing the morphology of the flowing plant. However, as described in Section 2.5, different species of plant have different flowering seasons, and therefore cannot all be surveyed in this way at the same time. It is therefore recommended that future surveys in the Deben Estuary are conducted at varying times of year, to give opportunity for all species to be observed during their flowering period. If possible, multiple surveys in the same year are recommended, to give a more accurate assessment of the relative abundances of each species.

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Appendix