NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Appendix 23.6 Terrestrial and Aquatic Invertebrate Survey Report

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Hopkins Ecology

Site: Holland Haven Marshes Site of Special Scientific Interest

Item: Surveys and Assessment of Aquatic and Terrestrial Invertebrates

Client: Royal HaskoningDHV on behalf of North Falls Offshore Wind Limited

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CONTENTS

SUMMARY

The North Falls Offshore Wind Farm (herein 'the project') is a proposed extension to the operational Greater Gabbard Offshore Wind Farm, which is located off the east coast of England in the Southern North Sea. The project is currently awaiting a grid connection offer from National Grid. In the interim, an area immediately landward of the coast between the settlements of Clacton-on-Sea and Frinton is being targeted for ecological surveys in relation to the Holland Haven Marshes Site of Special Scientific Interest (SSSI) in order to inform the project's Environmental impact Assessment (EIA). The surveys and assessment presented here are intended to establish its baseline value for invertebrates, and to inform the assessment of impacts and suggest potential mitigation and enhancement measures.

The SSSI forms a tract of grazing marsh and associated habitat either side of the Holland Brook and includes a frontage to the sea with associated maritime grassland. Invertebrates are listed as a feature on the citation, although none of these are currently considered to be of conservation concern.

Terrestrial Species

Terrestrial surveys were undertaken at six sampling stations in each of June, July and August. These comprised stations with tall maritime grassland with varying extents of open short sward and disturbed ground conditions, and one with an improved agricultural grass sward with association to wet marginal vegetation including terrestrial bankside habitat.

A total of 121 species were recorded within the terrestrial samples, of which the specialist species are associated with: open short sward, bare sand and chalk, scrub edge, rich flower resource, and reed-fen and pools.

Of the terrestrial species in the SSSI citation, Roesel's bush cricket was recorded at two stations, but is likely to be more widespread in the maritime grassland. It was not recorded from improved agricultural grass swards.

Six species of conservation concern were identified, of which three are very likely to have their status 'downgraded' based on the descriptions of their current distributions within authoritative information sources. The three species of conservation concern are:

- one Nationally Scarce rove beetle,
- one butterfly (small heath) with Priority Species status while remaining widespread (albeit declining nationally), and
- one moth (cinnabar) with Priority Species status while remaining widespread (albeit declining nationally).

The standard classification scheme for determining the value of invertebrate assemblages, is based on the numbers of rare and scarce species.

- The dry maritime grassland and associated habitats are considered to be of District importance on the basis of the species recorded and also the likely presence of other species. It is probably unlikely, however, that the assemblages are of County value when compared to other coastal grassland sites in Essex.
- The wet or humid grassland including improved agricultural grass swards in association with other habitats, are likewise probably of District importance. It is unlikely that these would justify a higher rating.

The Fisher's estuarine moth is a protected species associated with maritime grassland in Essex and north Kent. Within the data search are a series of records from 2005-2019, associated with the maritime grassland. This is a species listed on Annex II of the Habitats Directive (and thereby protected in England under the Conservation of Habitats and Species Regulations 2017 (as amended)), and Hamford Water Special Area of Conservation (SAC) is designated for the moth. The SAC is located north along the coast ~5.7km from the survey area. The presence of the Fisher's estuarine moth is of at least National value, and if the population is important or otherwise of value in the context of the population at Hamford Water SAC then it would be of international importance.

Aquatic Species

Sixteen stations were surveyed for aquatic invertebrates in June and August, using the 'Buglife Ditch Manual method' (Palmer et al., 2013).

Most of the ditches are at a late seral stage, with substantial growth of emergent common reed, while more extensive areas of open water are present only in a small number of ditches that are at any earlier seral stage or are otherwise to wide and deep for emergent vegetation to develop.

A total of 48 species or 'morpho' species were collected across the 16 ditch stations and the two sampling periods. The beetles were the richest group, with 21 species collected.

Using standard metrics, the majority of species have low salinity tolerance, marsh fidelity and species quality scores, and are therefore considered to be freshwater species without particular habitat associations. Overall:

- Species that are tolerant of brackish conditions were recorded from two stations, and species dependent on mildly brackish conditions were recorded in the main channel of the Holland Brook. One water beetle is listed as being a species of brackish pools and ditches and saltmarsh.
- Species which are widespread or typical of grazing marsh assemblages were found in five stations (five species).
- Species scoring more than the minimum in terms of quality / status scores were found in 11 stations, with 12 species scoring either 2 or 3 on a scale from '1' to '5'.

The microhabitats to which the specialist species are associated are 'open water on disturbed mineral sediments', 'moss and tussock fen', and 'slow-flowing rivers'.

Of the two aquatic species listed on the SSSI citation, neither was recorded.

Three species of water beetle are of conservation concern and are listed as Nationally Scarce within the most recent review. All three are believed to be widespread on the Essex coastal marshes, and are associated with open water on disturbed mineral sediments, and moss and tussock fen, and slow-flowing rivers.

With reference to historic survey work, the Holland Haven Marshes were ranked in terms of species quality as the lowest scoring of the 29 Essex sites that are listed within a published national review of invertebrates in grazing marsh ditches. However, the presence of three Nationally Scarce species it is nevertheless of note as is the presence of water beetles from a range of conditions, and with reference to the standard classification scheme it is concluded that the aquatic assemblage is of District value.

1. INTRODUCTION

BACKGROUND

1.1 The North Falls Offshore Wind Farm (herein 'the project') is a proposed extension to the operational Greater Gabbard Offshore Wind Farm, which is located off the east coast of England in the Southern North Sea. The project is being developed by North Falls Offshore Wind Farm Ltd. (NFOW), a joint venture between SSE Renewables and RWE.

1.2 The project is proposed in response to The Crown Estate's (TCE) extension leasing round, launched in 2017, with TCE recognising that extensions to operational wind farms are proven to be a successful way of efficiently developing more offshore generating capacity. NFOW was awarded an Agreement for Lease (AfL) from TCE in September 2020. NFOW have begun the process of baseline data collection to inform an EIA for the project in support of a Development Consent Order (DCO) application proposed to be submitted to the Planning Inspectorate in 2023.

1.3 NFOW is currently awaiting a grid connection offer from National Grid, which will then inform the detailed site selection of the offshore cable corridor, landfall location, onshore cable route and onshore substation location. Whilst this process is ongoing, in order to ensure that adequate baseline data is collected to inform the project's EIA, NFOW have undertaken a suite of ecological surveys in 2021 so that baseline data for the project can be gathered.

1.4 In the first instance, NFOW is targeting an area immediately landward of the coast between the settlements of Clacton-on-Sea and Frinton (herein the 'cable landfall search area'). Due to the presence of the Holland Haven Marshes Site of Special Scientific Interest (SSSI) within the cable landfall search area, NFOW intends to undertake targeted Phase 2 ecology surveys of the SSSI during 2021 in order to inform earlier consultation with stakeholders regarding potential impacts of the project upon the SSSI.

1.5 The surveys and assessment presented here are intended to establish its baseline value for invertebrates present within the SSSI and its surrounding habitat, and to inform the assessment of impacts and suggest potential mitigation and enhancement measures.

SITE CONTEXT

1.6 The Holland Haven Marshes SSSI lies between Frinton and Clacton on the Essex coast, and forms a tract of grazing marsh and associated habitat either side of the Holland Brook. The SSSI includes a frontage to the sea with associated maritime grassland. The species listed on the citation comprise both aquatic species within ditches, and terrestrial species in the wider grazing marsh habitat. The total area of the SSSI is 208.8ha.

LEGISLATION AND PLANNING POLICY

1.7 The following key pieces of overlapping nature conservation legislation are relevant to invertebrates in a planning context (Hopkins and Thacker, 2016[1]):

- The Conservation of Habitats and Species Regulations 2017 (as amended)
- Natural Environment and Rural Communities Act 2006 (NERC 2006); and
- The Wildlife and Countryside Act 1981 (as amended) (WCA 1981).

[1] Hopkins, G. W., and Thacker, J. I. (2016). Protected species and development control: the merits of widespread invertebrate species in the European Habitats Directive and UK legislation. *Insect Conservation and Diversity*, *9*(4), 259-267.

1.8 The Conservation of Habitats and Species Regulations 2017 is of potential relevance here in relation to the Fisher's estuarine moth *Gortyna borelii lunata* (Lepidoptera: Noctuidae). This is listed on Annex II of the Habitats Directive and associated Regulations, with the requirement for Special Areas of Conservation (SACs) to be established for the species. SACs are afforded substantial protection, as do areas integral to their function. Hamford Water SAC is designated for the Fisher's estuarine moth and is located ~5.7km to the north.

1.9 Various invertebrates receive full or some form of partial protection under the WCA 1981, including the Fisher's estuarine moth. NERC 2006 identified a substantial number of invertebrates as Priority Species (or Species of Principal Importance within Section 41), and required local authorities to have regard for their conservation. The National Planning Policy Framework (NPPF) (DHCLG, 2021[2]) re-iterates the importance of these priority species and local planning authorities are required to promote the "*protection and recovery"* via planning and development control.

1.10 Although the NPPF has an overarching aim of minimising impacts to biodiversity, the majority of rare or scarce species are not specifically recognised by legislation or planning policy. The level of protection afforded to these is undefined and should be considered within the overall aim of minimising impacts on biodiversity.

1.11 Within this report 'species of conservation concern' is used as an umbrella term for any legally protected species, those identified as 'priority species', and other species that are considered to be rare or scarce. In broad terms these fall into the following categories:

- Annex II and IV species of the Habitats Directive and those covered by the Wildlife and Countryside Act, i.e. Fisher's estuarine moth.
- Priority Species that are rare or scarce.
- Priority Species that are widespread but declining, such as many moths.
- Other rare or scarce species that are not listed by name within legislation or policy, but which are part of the wider invertebrate biodiversity. A number of species listed on SSSI citations in general, and also relevant here, are no longer of conservation concern following revisions to their statuses since the citations were prepared. The level of protection afforded to these species is unclear and possibly open to interpretation, but they nevertheless form part of the special interest of the relevant SSSI, and it should be assumed that operations that damage their habitats would normally constitute an offence.

[2] DHCLG (2021). *National Planning Policy Framework for England*. Department for Communities and Local Government, London.

2. METHODS

PERSONNEL AND CONSENTS

2.1 All fieldwork and identifications were undertaken by Dr Graham Hopkins CEnv MCIEEM FRES and Dr Jonathan Thacker MCIEEM, both of whom hold PhDs in entomology and have extensive experience of undertaking surveys of macroinvertebrates in ditch and grazing marsh habitats.

2.2 The required consent for the sampling described below was granted by Natural England under Section 28E(3)(a) of the Wildlife and Countryside Act 1981 (as amended), dated 06 July 2021 (2605211648BL).

DATA SEARCH

2.3 A data search for a 2km radius from the SSSI boundary was commissioned from the Essex Field Club and provided by the client. Other sources of information in the published and grey literature were searched for using Google Scholar and Google Search, using various of relevant terms.

TERRESTRIAL SAMPLING

2.4 A visual appraisal was undertaken to appraise the quality of microhabitats and resources potentially relevant to invertebrates (based on the criteria and descriptions provided by Fry and Lonsdale, 1991[3]; Falk, 2007[4]; and Kirby 2011[5]) located within the survey area. This was undertaken on 17 and 18 May 2021, and used to inform the selection of sampling stations.

2.5 To standardise terminology for habitat descriptions and associations, reference is made to the classification of habitats, microhabitats and specialist species (Specific Assemblage Types) as contained within the Pantheon database (Webb et al., 2018[6]). The broad protocol for sampling follows those developed for the Invertebrate Species-habitat Information System (ISIS) (Webb and Lott, 2006[7]; Drake et al., 2007[8]).

2.6 Field sampling was undertaken at six sampling stations, comprising tall maritime grassland with varying extents of open short and disturbed ground conditions (stations 1, 2, 3, 5 and 6), and one with an improved agricultural grass sward in association to wet marginal vegetation including ditch-edge (station 4). These sampling stations covered the range of terrestrial habitats and also included the areas of habitat judged to be of the highest quality and most likely to support significant species and assemblages. Each station was sampled for 50-minutes, using a combination of hand searching and netting. The species-groups covered are

[3] Fry, R. and Lonsdale, D. (1991). *Habitat Conservation for Insects: A Neglected Green Issue.* Amateur Entomologists Society, Middlesex.

[4] Falk, S. J. (2007). Bees and wasps in the diversified coniferous woodland settings of British Centerparcs. *British Journal of Entomology and Natural History*, 20: 21-45.

[5] Kirby, P. (2001). *Habitat Management for Invertebrates: A Practical Handbook.* RSPB, Bedfordshire.

[6] Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. (2018). *Pantheon - database version 3.7.6.* Available from: [redacted]

[7] Webb, J. R. and Lott, D. A. (2006). The development of ISIS: a habitat-based invertebrate assemblage classification system for assessing conservation interest in England. *Journal of Insect Conservation*, 10(2), 179-188.

[8] Drake C.M., Lott, D.A., Alexander, K.N.A. and Webb, J. (2007). *Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation*. Natural England, Sheffield.

those relevant for ISIS in each habitat, and include the major insect orders and families as appropriate. The surveys were undertaken on 30 June, 20 and 21 July and 12 August 2021.

AQUATIC FIELD SURVEY

2.7 Survey methods follow the recommendations of Buglife (Palmer et al., 2013[9]). A brief summary follows; detailed information is to be found in Palmer et al.

2.8 Sixteen sampling stations were selected to provide a spatial spread of stations and to cover the range of ditch types present as far as possible, to include those from early- to late-successional stages, physical shape and also conductivity. The scoping of ditches was on 17 and 18 May 2021. Each sampling stations was based on a 50m length of ditch, where the plant and ditch characteristics were reasonably constant. Sampling used a standard benthic net to take samples each of for 1-3 minutes, followed by 7.5 minutes of sorting. Four such samples were taken from each length of ditch, and the resulting collection of invertebrates was pooled. Unambiguously-identifiable species are recorded and released; others are collected and stored in preservative, although time is not wasted collecting excessive numbers of abundant taxa. The surveys were undertaken on 28 and 29 June, and 10 and 11 August 2021.

2.9 Ditch characteristics (profile, depth, and vegetation cover) were recorded. Conductivity was measured using a handheld meter (Hanna HI-98311) on 17 and 18 May 2021.

2.10 Palmer et al. (loc. cit.) list the following important taxa: “adult water beetles, adult water bugs, the larvae of caddisflies, mayflies, stoneflies and dragonflies (with caveats on identification limitations), molluscs (Pisidium only if expertise is available), larger crustaceans, soldierflies, mosquitoes, dixids and water and raft spiders.” The assessment method does not take into account the abundance of taxa, only their presence.

2.11 Metrics of species attributes were taken from Palmer et al. as follows:

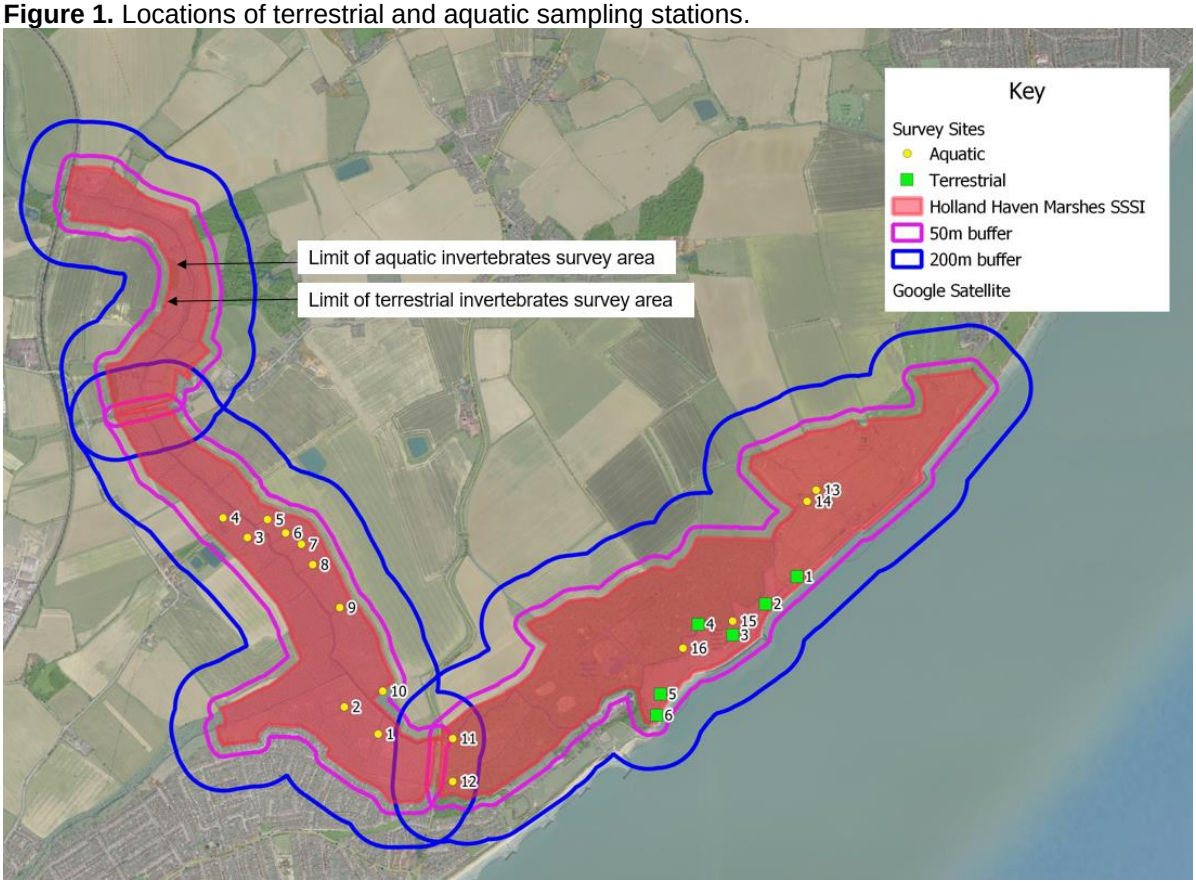
- Salinity scores for invertebrates range from 0 (not at all tolerant of salinity) to 2 (tolerant of high levels of salinity). The salinity index for invertebrates in Palmer et al. consists of the sum of salinity scores for all taxa present. Brackish ditches typically have lower invertebrate diversity than ditches with no saline influence, however, grazing marsh complexes with a range of salinity conditions may have species that are not present in sites with no saline influence.
- Marsh fidelity provides a measure for the extent to which species are restricted to grazing marsh. Thus, a score of 3 denotes species restricted to grazing marsh, 2 for species widespread in grazing marsh but with good populations in other wetland types, and 1 for species with no preference for grazing marsh.
- Habitat quality scores for invertebrates are not considered useful by Palmer et al. The scores on this metric (which measures the grazing marsh fidelity of invertebrates) were not found to provide additional discriminatory features over and above the species quality index (SQI), based on rarity (because invertebrates with high fidelity to grazing marshes also score highly on SQI.

SAMPLING STATIONS

2.12 The sampling stations are shown below (Figure 1) with grid references in Appendix 2.

[9] Palmer, M., Drake, N. and Steward, N. (2013). *A Manual for the Survey and Evaluation of the Aquatic Plant and Invertebrate Assemblages of Grazing Marsh Ditch Systems.* Buglife, Peterborough.

Figure 1. Locations of terrestrial and aquatic sampling stations.



EVALUATION

2.13 Both terrestrial and aquatic species were classified into broad biotope, habitat and Specific Assemblage Type associations within the Natural England's Pantheon package (Webb loc. cit.). This standardises the descriptions of species habitat and resource requirements and allows for the rapid identification of generalist and specialist species.

2.14 The formal evaluation of the survey area is based on the numbers of species of conservation concern as defined below. Thus, species of conservation concern are broadly defined as Red Data Book species (recorded in <30 tetrads on the national grid reference and in danger of extinction), Nationally Scarce species (recorded in between 30 and 100 tetrads), and priority species defined as those listed in Section 41 of the NERC Act 2006 (Table 1); and Local' species, are considered to be of restricted occurrence but do not justify listing in a category of greater rarity. Species that do not fall into these categories are 'common' or of 'least concern'.

2.15 Most of the conservation statuses listed below are not specifically identified or recognised within legislation or planning polices, the exceptions being Priority Species, protected species, and Habitats Directive: Annex II species. The other categories of conservation status are used to identify species of wider 'biodiversity value'.

Table 1. Definitions and criteria to classify the conservation statuses of invertebrates.

Conservation status	Definition
Red Data Book (RDB) (combined description for all categories)	Taxa in danger of extinction or with small populations in Great Britain.

Conservation status	Definition
Nationally Scarce / Notable	Species which are estimated to occur in 16 to 100 10 km squares in Great Britain. The subdividing of this category into Nationally Scarce A and Nationally Scarce B has not been attempted for some species because of either the degree of recording that has been carried out in the group to which the species belongs, or because there is some other reason why it is not sensible to be so exact.
Nationally Scarce / Notable A	Taxa which do not fall within RDB categories but which are none-the-less uncommon in Great Britain occur in 30 or fewer 10 km squares of the National Grid.
Nationally Scarce / Notable B	Taxa which do not fall within RDB categories but which are none-the-less uncommon in Great Britain and thought to occur in between 31 and 100 10 km squares of the National Grid.
Local	Not rigidly defined, loosely referring to species confined to a particular habitat type or species that are too widespread to warrant Nationally Scarce status but are nevertheless infrequently encountered.
Priority Species	Species listed as Species of Principal; Importance via their inclusion on Schedule 41 of the NERC Act. Many Priority Species also have RDB or Nationally Scarce status, but a substantial number are widespread but declining moths and do not otherwise have a conservation status. These moths are typically habitat generalists and at least a few species would be expected at most sites.
Protected species	Defined here as species with legal protection via • The Conservation of Habitats and Species Regulations 2017 (as amended), or • The Wildlife and Countryside Act 1981 (as amended).
Habitats Directive: Annex II species	These species for which Special rea of Conservation (SAC) are designated, although in most cases only a sub-set of sites with these species are designated as SACs.

2.16 Evaluation of the terrestrial fauna follows the criteria presented by Colin Plant Associates (2006)[10] to define the significance of invertebrate habitats with modifications to allow for the inclusion of Priority Species) (Table 2). A level of professional judgement is used in applying the criteria, taking into account the overall assemblages of species present and in particular whether individual habitats or resources support substantial numbers of species, as informed by the Pantheon output.

Table 2. The criteria used to define significance of invertebrate habitats.

Significance	Description	Minimum qualifying criteria
International / European (Habitats Directive)	European important site	Internationally important invertebrate populations present, defined as: Designated as an SAC for invertebrates or supporting part of a population for which an SAC is designated, or containing habitats that are threatened or rare at the European level (including, but not exclusively so, habitats listed on the EU Habitats & Species Directive)

[10] Colin Plant Associates (2006). *EcIA Guideline Comments*. Unpublished Report to the Institute of Ecology and Environmental Management. Available from: [redacted]

Significance	Description	Minimum qualifying criteria
National	UK important site.	Achieving SSSI invertebrate criteria (Curzon et al., 2019[11]) or supporting sustainable populations of species that are listed as being RDB critically endangered, or supporting sustainable populations of species listed in Annex II of the Habitats Directive but not functionally linked to a population for which an SAC is designated, or supporting sustainable populations of species listed in and generally held to have RDB (endangered) status, or supporting sustainable populations of any species protected under the UK Wildlife and Countryside Act, as amended or containing important invertebrate habitats that are actively threatened nationally (Great Britain).
Regional	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in south-east England.	Habitat that is scarce or threatened in the region, or which is well-represented in the region but is rare or absent outside the region, and which has, or is reasonably expected to have, an assemblage of invertebrates that includes a combination of RDB and Nationally Scarce species amounting to at least ten such species in total or supporting sustainable populations of at least six Priority Species (excluding the widespread but declining moths).
County	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the county in question.	Habitat that is scarce or threatened in the county and contains or is reasonably expected to contain an assemblage of invertebrates including a combination of RDB or Nationally Scarce species, amounting at least five such species in total.
District	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the administrative District.	A rather vague definition of habitats falling below county significance level, but which may be of greater significance than merely Local. They include sites for which Nationally Scarce species in the range from 1 to 4 examples are reasonably expected, but not yet necessarily recorded, sites that have 1 to 4 Priority Species that also have RDB or Nationally Scarce status, and sites that have an outstanding assemblage of widespread but declining Priority Species moths.

[11] Curson J., Howe, M., Webb, J., Heaver D. and Tonhasca, A.(2019). *Guidelines for the Selection of Biological SSSIs Part 2: Detailed Guidelines for Habitats and Species Groups Chapter 20 Terrestrial and Freshwater Invertebrates.* Available from: https://data.jncc.gov.uk/data/747968a5-a8a7-4bd6-b12c-3329c3b5b6ca/SSSI-Guidelines-20-Invertebrates-2019.pdf

Significance	Description	Minimum qualifying criteria
Local	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the affected and neighbouring Parishes.	Habitats or species unique or of some other significance within the local area.
Low Significance	_	Although almost no area is completely without significance these are the areas with nothing more than expected “background” populations of common species and the occasional Nationally Scarce species.

LIMITATIONS

2.17 The principal limitations to the surveys were:

- Terrestrial invertebrates. The survey period for terrestrial invertebrates started in late-June, due to access and survey restriction; the weather was also overcast for the June and July surveys, which would have limited the numbers of active and flying insects.
- Aquatic surveys. Within Palmer et al., the survey period for ditches is described as follows: “Invertebrate fieldwork should start in the last week in April and ideally be completed by early June, although useful results can be obtained up to mid-October”. The Aquatic survey therefore started after the ‘ideal’ period, but include a mid-summer survey to record species that would appear later in the season, principally beetles.

2.18 Although the survey limitations have inevitably reduced the species recorded, the overall assessment of the value of habitats and assemblages is thought to be robust.

3. TERRESTRIAL INVERTEBRATES

DESK STUDY INFORMATION

Assemblages

3.1 In the review of the terrestrial habitats that are important for invertebrates along the Essex coast, Drake et al. (1996[12]) list grazing marsh as supporting nationally important assemblages, while the coastal grassland habitat is considered to be of local value for its assemblages (Table 3). The species highlighted for each habitat cover a range of species groups and with a range of ecological requirements.

Table 3. Relevant terrestrial habitats and their value within the Essex Marshes (taken from Drake et al., loc. cit.).

Habitat	Specific habitat features of value within the habitat	Value
Grazing marsh	Light grazing and trampling, some winter flooding, no summer flooding; associated pools; structurally diverse sward.	Nationally significant
Sea walls and other dry grassland associated with grazing marsh, including hedges	Herb-rich grassland with structural diversity; patches of dry ground on sunny side.	Local

3.2 The SSSI citation lists the Roesel's bush cricket *Metrioptera roeselii* (Orthoptera: Tettigoniidae), but this is no longer of conservation concern, having undergone a substantial climate-driven range expansion since the 1990s (Sutton, 2015[13]). Also listed is bee *Bombus muscorum* which is known from the survey area as reported below; this is a Priority Species and although not otherwise listed as being of conservation concern it is likely that it has undergone declines and would justify at least Nationally Scarce status[14].

3.3 The data search records returned records for only 28 species of conservation concern, which is a very low number of records and almost certainly reflects under-recording. Other than for the Fisher's estuarine moth (see below), the records are from the north of the search area, from the Great Holland Pits. These are associated with open grassland, tall sward and short sward, and also trees (Table 4). The two specialist species are the wall *Lasiommata megera* and small heath *Coenonympha pamphilus* butterflies (Lepidoptera: Nymphalidae).

3.4 A wider search of records with the published and grey literature has not revealed a substantial number of other records, and the only record of particular note is the presence of the moss carder bee *Bombus muscorum* (Hymenoptera: Apidae), which is an uncommon Priority Species associated with the flat grassy area between the landward toe of the raised embankment and the borrow dyke (also referred to as 'the folding') (Gardiner & Benton, 2011)[15].

[12] Drake, M., Clements, D., Eyre, M. Gibbs, D. and Kirby, P. (1998). *Invertebrates and their Habitats in Natural Areas. Volume 2 – Southern Areas.* English Nature, Peterborough.

[13] Sutton, P.G. (2015). *A Review of the Orthoptera (Grasshoppers and Crickets) and Allied Species of Great Britain. Natural England Commissioned Report NECR187.* Natural England, Sheffield.

[redacted]

[15] Gardiner, T., & Benton, T. (2011). The *Importance of Sea Walls for the Moss Carder Bee Bom*bus muscorum *in Essex*. Hymettus Ltd., Midhurst.

Table 4. Habitat and association of the species reported by the data search (classified using Pantheon).

Biotope	No. of species	Habitat	No. of species	Specific Assemblage Type	No. of species
Open habitats	12	Tall sward & scrub	10	-	-
		Short sward & bare ground	2	Open short sward	2
Tree-associated	7	Arboreal	6	-	-
		Decaying wood	1	Heartwood decay	1

Fisher's Estuarine Moth

3.5 The Fisher's estuarine moth is a protected species associated with maritime grassland in Essex and north Kent, with legal protection under The Conservation of Habitats and Species Regulations 2017 (as amended) and the Wildlife and Countryside Act (as amended).Within the data search are a series of records from 2005-2019 described as being from 'Natural England monitoring', associated with the maritime grassland within the SSSI (see Section 5 for additional detail on its protected status).

FIELD SURVEYS

3.6 The field survey undertook sampling at six discrete stations and incidental recording elsewhere during field surveys. These stations were located along the coastal belt and comprise the highest quality habitat within the survey area and also stations that are considered representative of the wider habitats within the survey area (Table 5).

Table 5. Descriptions of terrestrial sampling stations.

Station	Description	Key features for invertebrates	
		Positive	Negative
1	Maritime grassland located in the 'folding' or the flat grassy area between the landward toe of the raised embankment and the borrow dyke. The vegetation was a moderately closed grass sward with a low abundance of flowering herbs.	Part of a relatively large block of similar habitat (as identified in Gardiner and Benton, loc. cit.), and with extensive areas of potential foraging habitat for bees in vicinity. High local habitat diversity in terms of sward height.	Little variation in topography. Little bare earth and exposed substrate. The nearby sea wall was concrete, thus without vegetation.
2	This area was a disturbed maritime grassland associated with an area of hardstanding and compacted gravel. The sward was varied in structure and included patches of open substrate and vegetation dominated by low-growing herbs such as bird's foot trefoil *Lotus corniculatus*.	Bare substrate present, although mostly compacted. Range of vegetation types within a restricted area, including low, opens swards. Extensive area of other habitat nearby.	Little variation in topography. The nearby sea wall was concrete, thus without vegetation.
3	This was an area of tall maritime grassland with some limited areas of open vegetation associated with a track and with tall reed *Phragmites australis* to the northern edge.	Bare substrate present, although mostly compacted. Range of vegetation types within a restricted area, including some open swards. Extensive areas of other habitat locally.	The nearby sea wall was concrete, thus without vegetation.

Station	Description	Key features for invertebrates	
		Positive	Negative
4	This area was part of a field of improved grass sward dominated by rye grass *Lolium* species and agricultural grasses. The herb component was low, and this habitat represented the vegetation of a large part of the SSSI, and was presumably under agricultural management.	Part of an extensive block of habitat and with other areas nearby.	Low habitat and botanical diversity.
5	This was a relatively open sward of bents and fescue grasses and presumably under agricultural management.	Extensive area of habitat, and other habitats nearby.	Relatively uniform sward conditions, without bare substrates or small-scale variations in topography. North-facing slope.
6	This was an area of disturbed grassland located adjacent to a busy track and with areas of heavy tramping by pedestrians grading into a longer grass sward.	High diversity of habitat and vegetation conditions within a restricted area. Extensive bare substrate with gradients in conditions from compacted substrate through to taller swards. Extensive areas of other habitats nearby.	Area of this habitat type was relatively small.

3.7 A total of 121 species were recorded within the terrestrial samples, and their ecological and habitat characteristics are shown below (Table 6). The key points are:

- The species of open habitats comprise the majority of species, associated with tall and open grasslands and with a number of specialist assemblages present (see below).
- Many of the wetland species recorded were hoverflies that are potential vagrants from further afield, but there were also a few species that are likely to be present as local populations, such as the soldierfly *Oplodontha viridula* (Diptera: Stratiomyidae).
- A small number of tree-associated species were recorded, presumably associated with the few areas of woody vegetation in the survey area but associated with blossom within sampling stations, or otherwise present as vagrants.
- The specialist species are associated with grassland, from open disturbed ground conditions through to scrub edge, with the rich flower resource also identified as being important for specialists (mainly bees).

Table 6. Habitat and assemblage associations of the species recorded during field surveys (classified using Pantheon).

Biotope	No of species	Habitat	No of species	Specific Assemblage Type	No of species
Open habitats	85	Tall sward & scrub	61	-	-
		Short sward & bare ground	23	Open short sward	3
		-	-	Bare sand and chalk	4
		-	-	Scrub edge	3
		-		Rich flower resource	12

Biotope	No of species	Habitat	No of species	Specific Assemblage Type	No of species
Wetland	14	Acid and sedge peats	9	Reed-fen & pools	1
		Running water	1	-	-
		Wet woodland	1	-	-
Tree-associated	11	Arboreal	5	-	-
		Decaying wood	4	Bark and sapwood decay	4
		Shaded woodland floor	2	-	-

3.8 Of the terrestrial species in the SSSI citation, Roesel's bush cricket was recorded at stations 1 and 3 but is likely to be more widespread. The other species listed on the citation, namely the moss carder bee *Bombus muscorum*, was not recorded but its presence was reported by Gardiner & Benton (loc. cit.) and the maritime grassland habitat remains in a suitable condition, thus the population is likely to be extant

SPECIES OF CONSERVATION CONCERN

3.9 Six species that are currently listed as being of conservation concern were recorded (of which once has RDB status and two are Nationally Scarce) which are classed as), but three of these are bees / wasps that would probably be classed as common or 'least concern' based on the current descriptions of their distribution and occurrences in authoritative reviews, namely *Megachile leachella*[16] and *Heriades truncorum*[17] (Hymenoptea: Magachilidae) and *Philanthus triangulum*[18] (Hymenoptera: Crabronidae).

3.10 The three species of conservation concern are therefore one Nationally Scarce rove beetle, and one butterfly and one moth with Priority Species status while remaining widespread albeit declining nationally (Table 7), namely the small heath butterfly and cinnabar moth.

Table 7. Species of conservation concern.

Species	Higher taxon	Status	Sampling station	Ecology	Reference
Tachyporus formosus	Coleoptera: Staphylinidae	Nationally Scarce	4	A predator found in wet meadows and similar habitats.	Zahn, et al. (2007)[19]; Lane, 2019[20]
Small heath *Coenonympha pamphilus*	Lepidoptera: Nymphalidae	Priority Species (a widespread but declining species.)	1 and 2	Associated with dry, open sward grassland, where the caterpillars feed on fine-leaved grasses.	Fox et al. (2010)[21]

[16] [redacted]

[17] [redacted]

[18] [redacted]

[19] Zahn, A., Juen, A., Traugott, M., & Lang, A. (2007). Low density cattle grazing enhances arthropod diversity of abandoned wetland. *Applied Ecology and Environmental Research*, *5*, 73-86.

[20] Lane, S.A. (2019). *A Review of the Status of the Beetles of Great Britain – The Staphylinidae: Tachyporinae beetles. Natural England Commissioned Reports No. 265*. Natural England, Sheffield.

[21] Fox, R., Warren, M.S., and Brereton, T.M. (2010). *A New Red List of British Butterflies, Species Status 12.* Joint Nature Conservation Committee, Peterborough.

Species	Higher taxon	Status	Sampling station	Ecology	Reference
Cinnabar *Tyria jacobaeae*	Lepidoptera: Arctiidae	Priority Species (a widespread but declining species.)	3	Frequently found wherever the caterpillar foodplant of ragwort *Jacobaea vulgaris* is present, which is typically dry or moderately dry grassland and pasture with some disturbance.	Butterfly Conservation (2007)[22]

[22] Butterfly Conservation (2007). *Biodiversity Action Plan – Moths*. Available from: [redacted]

4. AQUATIC INVERTEBRATES

DESK STUDY INFORMATION

4.1 The grazing marshes in Essex are considered to be of national value for invertebrates, with the majority of the species provided as examples being flies and water beetles (Table 8).

Table 8. Relevant aquatic habitats and their value (taken from Drake et al., loc. cit.).

Habitat	Specific habitat features of value within the habitat	Value
Grazing marsh, ditches and pools	Light grazing and trampling; some winter flooding, no summer flooding; associated pools; structurally diverse sward; mainly old reed with dense litter layer; reed growing on gradient from dry ground to standing in shallow water.	Nationally important

4.2 Comparative data are provided for a large number of grazing marsh sites within Drake (2004)[23], with summary data for Holland Haven Marshes. The key points are:

- Overall value is considered to be of less than County value for freshwater invertebrates. Brackish and wetland groups are not rated, presumably due to the scarcity or absence.
- In terms of fidelity to grazing marsh, Drake had three categories of fidelity, of which none of the species were reported as having high fidelity (i.e. almost restricted) to grazing marsh; and five species were in the next category of '*form*(ing) *part of the characteristic fauna of grazing marsh',* while also being associated with other wetland types.
- The species quality index score for water beetles is the lowest for the 29 Essex sites that are listed.

4.3 Two dragonflies are listed within desk study sources, namely the ruddy darter *Sympetrum sanguineum* within the SSSI citation and the common darter *Sympetrum striolatum* (Odonata: Libellulidae (within the data search, but neither is considered to be of conservation concern (Daguet et al., 2008[24]). The soliderfly *Stratiomys singularior* is also listed on the SSSI citation, but is no longer of conservation concern, partly due to range expansion and greater survey effort revising its known distribution (Drake, 2017[25]).

FIELD SURVEYS

4.4 The field survey undertook sampling at 16 discrete stations. These stations were located through much of the survey area, to provide a good spatial spread and to provide as sample covering the main ditch types (Table 9). The majority of ditches across the survey area and within the SSSI are at a late seral stage with extensive growth of common reed, little open water and shallow depth. More extensive areas of open water are largely restricted to ditches with cattle poaching, greater width and depth or recent cleaning.

[23] Drake, C.M. (2004). *English Nature Research Reports Number 579 Grazing Marsh Assemblages and Site Classification Using Invertebrates*. English Nature, Peterborough.

[24] Daguet, C., French, G. and Taylor, P. (2008). *The Odonata Red Data List for Great Britain Species Status. 11.* JNCC, Peterborough.

[25] Drake, C.M. (2017). *A Review of the Status of the Larger Brachyceran Flies of Great Britain. Natural England Commissioned Report NECR192.* Natural England, Sheffield.

Table 9. Description of ditch sampling stations (brackish ditches have a conductivity of >2000µScm^{-1}).

Ditch	Width	Depth	Conductivity (µScm^{-1})	Description
1	4m	1m	290	Late seral phase ditch choked by common reed *Phragmites australis*. Heavily poached to the east by cattle; grazed on both sides. Emergents were restricted to reed 95% only. The small amount of open water was covered by floating macrophytes; common water starwort *Callitriche stagnalis* and *Lemna* spp. Smooth newts were present.
2	4m	1m	320	Late seral phase ditch, choked by common reed. Grazed on both eastern and western sides. Bankside vegetation with no wetland characteristics. Emergents comprised common reed 80%, brooklime *Veronica beccabunga* 10%, water forget-me-not *Myosotis scorpioides* 5% and water plantain Alisma plantago-aquatica 5%. Floating macrophytes comprised small quantities of *Lemna* species only.
3	3m	0.3m	335	Late seral phase ditch, mostly choked by common reed. Bankside vegetation included hard rush *Juncus inflexus*. The sole emergent was common reed, and aquatic macrophytes were absent except for *Lemna* species, which included fat duckweed *Lemna gibba*.
4	4m	0.3m	375	Late seral phase ditch, mostly choked by common reed. Bankside vegetation included hard rush *Juncus inflexus*. The sole emergent was common reed and macrophytes were absent except for *Lemna* spp, which included fat duckweed *Lemna gibba*.
5	4m	0.3m	320	Late seral phase ditch, mostly choked by common reed and greater pond sedge. Small amount of poaching by cattle; grazed on both sides, with little wetland component to wider vegetation. Emergents comprised common reed 50% and greater pond sedge *Carex riparia* 50%. Aquatic macrophytes were absent except for *Lemna* species, which included fat duckweed *Lemna gibba*.
6	3m	0.3m	345	Late seral phase ditch choked by common reed. Poaching by livestock and grazed to both sides. Bankside vegetation included hard rush *Juncus inflexus*. The sole emergent was common reed. Aquatic macrophytes were absent.
7	4m	0.3m (no water in places)	325	Late seral phase ditch choked by common reed. Poaching by livestock giving gentle slope to water. Sole emergent 100% common reed. The small amount of open water at the ditch's end included common water starwort and fool's water cress *Apium nodiflorum* as floating macrophytes at a low cover.
8	4m	0.3m	410	Late seral phase ditch, although without as much common reed as surrounding ditches (5-7; 9). Grazed on both sides. Emergents comprised common reed 40%, greater pond sedge 40%, reedmace 10%, bulrush *Scirpus* sp. 10%, water mint *Mentha aquatica* 20%, branched bur-reed *Sparganium erectum* 1% and water plantain 2%. The sole floating macrophyte was fool's water cress 20%.
9	4m	0.5m	460	Late seral phase ditch choked by common reed (10% open water). Grazed on both sides. Emergents comprised common reed 95% and greater pond sedge 5%. Submerged macrophytes comprised soft hornwort

Ditch	Width	Depth	Conductivity (μScm^{-1})	Description
				Ceratophyllum submersum at low abundance. *Lemna* spp. was the sole floating macrophyte (10%).
10	3m	0.5m	385	Mid-late seral phase ditch with 20% open water, dominated by common reed. Grazed on both sides. Surrounding vegetation comprised terrestrial with brambles and occasional shrubs. The sole emergent was common reed only (80% cover) and the sole floating macrophyte *Lemna* species.
11	10m	>1m	655	This was the main river channel of the Holland Brook, and consequently very wide with a very slow flow. Turbidity moderate. Grazed to the south, but with high levees on either side so not grazed to the water's edge. Emergents were restricted to a bankside fringe, of common reed, soft rush *Juncus effusus* 1% and gipsywort *Lycopus europaeus*. The sole aquatic macrophyte *Lemna* species at 5% cover.
12	2m	0.3m	575	Shallow late seral phase ditch choked by common reed, heavily poached to the north by cattle giving very gentle slope to water. Not grazed to the south. Very little open water. The sole emergent was common reed 100% and the sole submerged macrophyte was spiked water milfoil *Myriophyllum spicatum* at very low abundance (1%).
13	1.5m	0.4m	425	A shallow V-shaped ditch recently cut/scraped, so that the common reed was c. 1m tall. It was set within improved grassland surrounding a golf course. The sole emergent was common reed covering 50% of the water surface with *Lemna* spp. covering the remainder (50%).
14	4m	0.5m	450	A shallow U-shaped ditch dominated by common reed, but the reed appears to have been cut/scraped in the previous few years. The water depth was variable and apparently fluctuated with rainfall, as judged by stranded duckweed on the bank sides. Set within improved grassland (golf course). The sole emergent was common reed (80% cover) and water plantain 1%. The sole floating macrophyte was *Lemna* spp. with 20% cover.
15	2m	0.4m	520	Shallow and narrow ditch with no open water. Not grazed. The bankside vegetation comprised common reed with 50%, but the bankside reed had overtopped and flattened to cover the water's surface so that there was no open water. The sole floating macrophyte was *Lemna* spp. with 5% cover.
16	6m	>1m	485	Meandering, rather open ditch with 50% open water. The emergents were common reed and common reedmace *Typha latifolia*. The sole floating macrophyte was invasive New Zealand pigmyweed *Crassula helmsii* with ~10% cover with filamentous algae at 5% cover.

4.5 A total of 48 species or 'morpho' species were collected across the 16 ditch stations and the two sampling periods. The beetles were the richest group, with 21 species collected.

4.6 To assess these assemblages, reference is made to the various metrics provided within the Buglife Manual (Palmer et al., loc. cit.) for salinity tolerance, marsh fidelity and species quality. Pantheon is also used to describe the habitat associations of species.

4.7 Using the Buglife metrics, the majority of species have low salinity tolerance, marsh fidelity and species quality scores, and are therefore considered to be freshwater species without particular habitat associations (Table 10). Thus:

- Species that are tolerant of brackish conditions were recorded from two stations (3 and 4) and species dependent on mildly brackish conditions were recorded in one station (11, the main channel of the Holland Brook).
- Species which are widespread or typical of grazing marsh assemblages were found in five stations (five species).
- Species scoring more than the minimum in terms of quality / status scores were found in 11 stations, with 12 species scoring either 2 or 3 on a scale from '1' to '5'. (Species scoring 2 are equivalent to species considered to be of local occurrence and species scoring 3 were Nationally Scarce at the time the scoring developed [but see below]).

Table 10. Summary of ditch invertebrates, with species not in the lowest categories for salinity tolerance, marsh fidelity and quality scoring. The salinity scores >0 are as follows: 1: tolerant of mildly brackish; and 2: dependent on mildly or moderately brackish. The marsh fidelity scores are for: 2: widespread in grazing marsh and also other wetlands; and 3: confined to grazing marsh. Species quality scores from 2 to 5 are for species that are of local occurrence or rare.

Ref	No. of spp	Salinity scores >0		Marsh fidelity scores greater >1	Species status / quality scores of >1	
		1	2	2	2	3
1	16	-	-	*Rhantus grapii*	*Cymbiodyta marginellus* *Enochrus testaceus* *Aeshna mixta* *Hippeutis complanatus*	-
2	14	-	-			-
3	10	*Hygrotus parallellogrammus*	--	*Hygrotus parallellogrammus* *Berosus affinis*	*Berosus affinis*	*Hygrotus parallellogrammus*
4	12	*Sigara stagnalis,*	-	-	*Sigara stagnalis*	
5	13	-	-	-	-	-
6	16	-	-	*Ilybius ater*	*Enochrus testaceus*	-
7	9	-	-	-		-
8	13	-	-	-	*Liopterus haemorrhoidalis*	-
9	17	-	-	-	*Liopterus haemorrhoidalis*	-
10	14	-	-	-	-	*Hydaticus seminiger*
11	10	-	*Jaera* sp *Leptmoysis* sp	-	*Bithynia leachii* *Sigara stagnalis*	
12	18	-		*Peltodytes caesus*	*Sigara stagnalis*	*Peltodytes caesus*
13	2	-	-	-	-	-
14	8	-	-	-	*Enochrus testaceus*	-
15	6	-	-	-	-	-

Ref	No. of spp	Salinity scores >0		Marsh fidelity scores greater >1	Species status / quality scores of >1	
		1	2	2	2	3
16	19	-	-	*Peltodytes caesus*	*Sigara stagnalis*	*Peltodytes caesus*

4.8 Using the Pantheon classification (Table 11) the species mainly fall into the wetland habitats, with and three associated with wet woodland or shaded woodland flora, and two with coastal habitat. Of the species classified the specialists are associated with three Species Assemblage Types (Table 12).

Table 11. Habitat and assemblage associations of the species recorded during field surveys (as classified using Pantheon).

Biotope	No of species	Habitat	No of species	Specific Assemblage Type	No of species
Wetland	41	Marshland	33	Open water on disturbed mineral sediments	2
		Acid and sedge peats	6	Moss & tussock fen	2
		Wet woodland	3	-	-
		Lake	2	-	-
		Running water	2	Slow-flowing rivers	1
Tree-associated	3	Wet woodland	3		-
		Shaded woodland floor	3	-	-
Coastal	2	Brackish pools and ditches	2	-	-
		Saltmarsh	2	-	-

Table 12. Specialist species (as classified by Pantheon).

Specific Assemblage Type	No of species	Taxon	Status
Open water on disturbed mineral sediments	*Peltodytes caesus*	Coleoptera: Haliplidae	Nationally Scarce
	Plea minutissima	Heteroptera: Pleidae	-
Moss and tussock fen	*Hydaticus seminiger*	Coleoptera: Dytiscidae	Nationally Scarce
	Rhantus grapii	Coleoptera: Dytiscidae	-
Slow-flowing rivers	*Bithynia leachii*	Mollsuca: Bithyniidae	-

4.9 Of the aquatic species listed on the SSSI citation, the ruddy darter was not recorded but the habitat of the wider and more open ditches is considered suitable. The other aquatic species on the citation is the *Stratiomys singularior*, but it is unlikely that this was collected (a single soliderfly larva was collected from station 2, but it is unlikely that this was *S. singularior.*

SPECIES OF CONSERVATION CONCERN

4.10 Three species of water beetle are of conservation concern and are listed as Nationally Scarce within the most recent review, Foster 2010[26], and these are listed below (Table 13). All three are believed to be widespread on the Essex coastal marshes.

Table 13. Species of conservation concern.

Species	Status	Habitats within Pantheon		Habitat (from Friday, 1988[27])	Stations
		Habitat	Specific Assemblage Type		
Peltodytes caesus Coleoptera: Haliplidae	Nationally Scarce	Marshland	Open water on disturbed mineral sediments	Fenland drains and quarry ponds	12 and 16
Hydaticus seminiger Coleoptera: Dytiscidae	Nationally Scarce	Marshland	Moss & tussock fen	Pools, often shaded	10
Hygrotus parallelogrammus Coleoptera: Dytiscidae	Nationally Scarce	Brackish pools & ditches and saltmarsh	-	Brackish water	3

[26] Foster, G.N. (2010). *A Review of the Scarce and Threatened Coleoptera of Great Britain Part 3: Water Beetles of Great Britain. Species Status No. 1.* JNCC, Peterborough.

[27] Friday, L.E. (1988). A Key to the Adults of British Water Beetles. *Field Studies,* 7 (1988), 1-151

5. DISCUSSION

EVALUATION

Fisher's Estuarine Moth

5.1 The Fisher's estuarine moth is listed on Annex II and IV of the Habitats Directive and as such receives substantial legal protection via The Conservation of Habitats and Species Regulations 2017 (as amened) and also the Wildlife and Countryside Act 1981 (as amended) (Table 14).

Table 14. Summary of the protection afforded to the Fisher's estuarine moth.

Legislation	Schedule /annex	Protection
The Conservation of Habitats and Species Regulations 2017 (as amended)	Annex IIa	Designation of protected areas required within the natural range of the animal species listed. This is the basis for designating SACs for named species, although it is not required for all populations to be designated and the presence of the species outside the SAC is only relevant if there is a functional link to the SAC population.
	Annex IVa	Special protection required for the native animal species listed.
Wildlife and Countryside Act 1981 (as amended)	S. 9(4)(b)	Intentional disturbance of animal occupying such a structure or place.
	S. 9(4)(c)	Obstruction of access to any structure or place used for shelter or protection.
	S. 9(5)	Selling, offering for sale, possessing or transporting for the purpose of sale (live or dead animal, part or derivative); advertising for buying or selling live or dead animal, part or derivative.

5.2 As reported in Section 3, the Fisher's estuarine moth is known within the SSSI following monitoring by Natural England (Annex 3). A systematic search for the characteristic evidence of its presence was not attempted during the current surveys, but the sole foodplant, hog's fennel *Peucedanum officinale,* was recorded within the maritime grassland and it should be assumed that the moth continues to be present.

5.3 Its sole foodplant is hog's fennel*,* and the caterpillars feed in the stems, later boring into the roots, and it is likely that a single plant only supports a single larva to adult emergence. Hog's fennel is associated with maritime grassland and can be abundant along the edge of scrub*,* where it may benefit from reduced grazing, trampling and mowing. Studies on the ecology of the caterpillars showed that although hog's fennel was found to occur at a lower density in areas that supported a high abundance of tall, coarse grass species, plants in these situations were more likely to be used by the caterpillars (Ringwood et al., 2004[28]).

5.4 Within the United Kingdom there are two Special Areas of Conservation (SAC) designated for the Fisher's estuarine moth, one in north Kent and the second at Hamford Water SAC located north along the coast ~5.7km from the survey area. It is unlikely that there is suitable habitat between the survey area and the SAC, with the intervening habitat being farmland and Frinton itself lying on the coast between the two. There are apparently no data on the dispersal ecology of the Fisher's estuarine moth from the UK or elsewhere in Europe, and it does not

[28] Ringwood, Z., Hill, J., & Gibson, C. (2004). Conservation management of *Gortyna borelii lunata* (Lepidoptera: Noctuidae) in the United Kingdom. *Journal of Insect Conservation*, 8(2), 173-183.

appear to be reported from moth traps as a vagrant. It is likely therefore that the population within the survey area is effectively isolated from the SAC.

5.5 The likely presence of the Fisher's estuarine moth is of at least National value, and if the population is important or otherwise of value in the context of the population at Hamford Water SAC then it would be of International importance.

Terrestrial Assemblages

5.6 The terrestrial surveys covered the grassland and transition habitats from grassland, including maritime grasslands close to the sea wall and also improved swards under what is assumed to be more typical agricultural management.

5.7 Across the surveys three species of conservation concern were recorded, namely:

- The Nationally Scarce beetle *Tachyporus formosus* associated with damp or humid grassland. This was found in a station comprising improved grass sward under agricultural management.
- The small heath butterfly, which is a widespread but declining Priority Species. This was found in open sward grassland near the sea wall.
- The cinnabar moth, which is which is a widespread but declining Priority Species and is associated with ragwort in grassland of various types.

5.8 Within the literature the dry grassland associated with the sea wall at the survey area is known to support species such as the moss carder bee (Gardiner and Benton, loc. cit.), although none were recorded within the current surveys and the overall assemblage of dry grassland species was low. Nevertheless, it is likely that these grasslands support a larger assemblage of rare and scarce species than were recorded.

5.9 The agricultural grasslands generally lack many of the features with which high quality assemblages are associated. However, one Nationally Scarce species was recorded but it is likely that the agricultural grassland is of value where it is in association with other habitats or vegetation, such as ditches or scrub.

5.10 Using the Colin Plant Associates scheme (see Section 2), the presence of one to five scarce species would justify a site as being of District value. The following evaluations are therefore assigned to the invertebrate assemblages:

- Dry maritime grassland and associated habitats are considered to be of District importance on the basis of the species recorded and also the likely presence of other species. It is probably unlikely, however, that the assemblages are of County value when compared to other coastal grassland sites in Essex.
- Wet or humid grassland including agricultural swards in association with other habitats are likewise probably of District importance. It is unlikely that these would justify a higher rating.

Aquatic Assemblages

5.11 Three species of conservation concern were recorded by the aquatic surveys, namely three species of beetle that are Nationally Scarce. These are associated with a range of conditions, from relatively open water situations (*Peltodytes caesus*), to ditches that are at a later successional stage or certainly more vegetated (*Hydaticus seminiger*); one species is also associated with brackish conditions (*Hygrotus parallelogrammus*).

5.12 The direct conductivity measurements suggest the ditches are freshwater, and substantially below the threshold of >2000µScm^{-1} to be classed as brackish. However, there is clearly a level of brackish influence as judged by the presence of species that are either tolerant or dependent on mildly brackish conditions.

5.13 With reference to the survey work reported by Drake (loc. cit.), the Holland Haven Marshes were ranked in terms of species quality as the lowest scoring of the 29 Essex sites that are listed. However, with the presence of three Nationally Scarce species it is nevertheless of note as is the presence of water beetles from a range of conditions, and with reference to the Colin Plant Associates criteria it is concluded that the aquatic assemblage is of District value.

6. CONCLUSIONS

Terrestrial Species

6.1 A total of 121 species were recorded within the terrestrial samples, of which the specialist species are associated with open short sward, bare sand and chalk, scrub edge, rich flower resource, and reed-fen and pools.

6.2 The three species of conservation concern were recorded: one Nationally Scarce rove beetle, and one butterfly and one moth with Priority Species status while remaining widespread albeit declining nationally, namely the small heath butterfly and cinnabar moth.

6.3 The standard classification scheme for determining the value of invertebrate assemblages (based on the numbers of rare and scarce species) returned the following classifications:

- The dry maritime grassland and associated habitats are considered to be of District importance on the basis of the species recorded and also the likely presence of other species. It is probably unlikely, however, that the assemblages are of County value when compared to other coastal grassland sites in Essex.
- The wet or humid grassland including agricultural swards in association with other habitats are likewise probably of District importance. It is unlikely that these would justify a higher rating.

6.4 The Fisher's estuarine moth is known from the maritime grassland, and this is a species listed on Annex II of the Habitats Directive, with partial legal protection. The presence of the Fisher's estuarine moth is of at least National value, and if the population is important or otherwise of value in the context of the population at Hamford Water SAC then it would be of International importance.

Aquatic Species

6.5 Most of the ditches are at a late seral stage, with substantial growth of emergent common reed, while more open conditions (extensive open water) are in the recently cleaned ditches or wider ditches.

6.6 A total of 48 species or 'morpho' species were collected across the 16 ditch stations and the two sampling periods. The beetles were the richest group, with 21 species collected.

6.7 Using standard metrics, the majority of species have low salinity tolerance, marsh fidelity and species quality scores, and are therefore considered to be freshwater species without particular habitat associations. Thus:

- Species that are tolerant of brackish conditions were recorded from two stations, and species dependent on mildly brackish conditions were recorded in the main channel of the Holland Brook. One water beetle is listed as being a species of brackish pools and ditches and saltmarsh.
- Species which are widespread or typical of grazing marsh assemblages were found in five stations (five species).
- Species scoring more than the minimum in terms of quality / status scores were found in 11 stations, with 12 species scoring either 2 or 3 on a scale from '1' to '5'.

6.8 The specialist species are associated with open water on disturbed mineral sediments, moss and tussock fen, and slow-flowing rivers.

6.9 Three species of water beetle are of conservation concern and all three are believed to be widespread on the Essex coastal marshes, associated with open water on disturbed mineral sediments, and moss & tussock fen, and slow-flowing rivers.

6.10 With the presence of three Nationally Scarce species it is nevertheless of note, as is the presence of water beetles from a range of conditions, and with reference to the standard classification scheme it is concluded that the aquatic assemblage is of District value.

7. APPENDIX 1: PHOTOGRAPHS

Figure 2. Terrestrial station 1.

Figure 3. Terrestrial station 2.

Figure 4. Terrestrial station 3.

Figure 5. Terrestrial station 4.

Figure 6. Terrestrial station 5.

Figure 7. Terrestrial station 6.

Figure 8. Late seral stage ditches.

Figure 9. An example of the limited extent of open water within late seral stage ditches.

Figure 10. Holland Brook, station 11.

8. APPENDIX 2: SURVEY DATA

Locations of sampling stations.

Station	X	Y
Aquatic		
1	TM 20740	17230
2	TM 20590	17350
3	TM 20161	18100
4	TM 20053	18187
5	TM 20250	18180
6	TM 20330	18120
7	TM 20400	18070
8	TM 20450	17980
9	TM 20570	17790
10	TM 20760	17420
11	TM 21070	17210
12	TM 21070	17020
13	TM 22680	18310
14	TM 22640	18260
15	TM 22310	17730
16	TM 22090	17610
Terrestrial		
1	TM 22595	17927
2	TM 22455	17806
3	TM 22310	17669
4	TM 22157	17716
5	TM 21990	17407
6	TM 21973	17314

Terrestrial survey data.

Higher taxon	Family	Species	Sampling station					
			1	2	3	4	5	6
Araneae	Araneidae	*Araniella cucurbitina*				X		
Araneae	Araneidae	*Larinioides cornutus*					X	
Araneae	Dictynidae	*Dictyna uncinata*					X	
Araneae	Linyphiidae	*Erigone atra*				X		
Araneae	Linyphiidae	*Lepthyphantes tenuis*				X	X	
Araneae	Linyphiidae	*Neriene peltata*			X			
Araneae	Philodromidae	*Philodromus aureolus*		X				
Araneae	Tetragnathidae	*Metellina mengei*			X			
Araneae	Tetragnathidae	*Tetragnatha extensa*		X				
Araneae	Theridiidae	*Enoplognatha ovata*					X	
Coleoptera	Anthicidae	*Notoxus monoceros*					X	X
Coleoptera	Apionidae	*Ischnopterapion loti*					X	
Coleoptera	Apionidae	*Oxystoma pomonae*			X			
Coleoptera	Cantharidae	*Cantharis nigra*				X	X	
Coleoptera	Cantharidae	*Cantharis rufa*				X		
Coleoptera	Cantharidae	*Rhagonycha fulva*	X	X	X	X	X	X
Coleoptera	Carabidae	*Nebria brevicollis*	X					
Coleoptera	Carabidae	*Notiophilus biguttatus*			X			

Higher taxon	Family	Species	Sampling station					
			1	2	3	4	5	6
Coleoptera	Carabidae	*Pterostichus nigrita*			X			
Coleoptera	Cerambycidae	*Pseudovadonia livida*						X
Coleoptera	Chrysomelidae	*Cryptocephalus pusillus*						X
Coleoptera	Chrysomelidae	*Psylliodes chrysocephala*					X	
Coleoptera	Coccinellidae	*Coccinella septempunctata*				X		
Coleoptera	Coccinellidae	*Harmonia axyridis*	X					
Coleoptera	Coccinellidae	*Rhyzobius litura*						X
Coleoptera	Coccinellidae	*Subcoccinella vigintiquatuorpunctata*				X		
Coleoptera	Coccinellidae	*Tytthaspis sedecimpunctata*			X	X		
Coleoptera	Curculionidae	*Anthonomus rubi*						X
Coleoptera	Curculionidae	*Mecinus pascuorum*					X	
Coleoptera	Curculionidae	*Trichosirocalus troglodytes*					X	
Coleoptera	Malachiidae	*Malachius bipustulatus*	X	X	X	X	X	X
Coleoptera	Oedemeridae	*Oedemera nobilis*	X					
Coleoptera	Phalacridae	*Phalacrus championi*						X
Coleoptera	Staphylinidae	*Tachyporus chrysomelinus*					X	
Coleoptera	Staphylinidae	*Tachyporus formosus*				X		
Dermaptera	Forficulidae	*Forficula auricularia*		X				
Diptera	Asilidae	*Leptogaster cylindrica*	X	X		X	X	X
Diptera	Conopidae	*Sicus ferrugineus*		X				
Diptera	Rhagionidae	*Chrysopilus cristatus*					X	
Diptera	Sciomyzidae	*Coremacera marginata*	X	X				
Diptera	Sciomyzidae	*Limnia unguicornis*	X					
Diptera	Stratiomyidae	*Chloromyia formosa*				X		
Diptera	Syrphdiae	*Helophilus pendulus*		X	X			
Diptera	Syrphidae	*Cheilosia albitarsis*					X	
Diptera	Syrphidae	*Episyrphus balteatus*		X		X	X	X
Diptera	Syrphidae	*Eristalis arbustorum*				X		
Diptera	Syrphidae	*Eristalis nemorum*					X	
Diptera	Syrphidae	*Eristalis pertinax*						X
Diptera	Syrphidae	*Eristalis tenax*						X
Diptera	Syrphidae	*Melanostoma mellinum*			X			
Diptera	Syrphidae	*Pipizella viduata*	X					
Diptera	Syrphidae	*Platycheirus albimanus*				X		
Diptera	Syrphidae	*Platycheirus clypeatus*			X			
Diptera	Syrphidae	*Sphaerophoria scripta*			X	X	X	
Diptera	Syrphidae	*Syritta pipiens*			X		X	
Diptera	Syrphidae	*Syrphus ribesii*			X			
Heteroptera	Coreidae	*Coreus marginatus*		X				
Heteroptera	Coreidae	*Coriomeris denticulatus*						X
Heteroptera	Lygaeidae	*Ischnodemus sabuleti*			X			
Heteroptera	Miridae	*Closterotomus norwegicus*						X
Heteroptera	Miridae	*Leptopterna dolabrata*		X			X	
Heteroptera	Miridae	*Leptopterna ferrugata*		X				

Higher taxon	Family	Species	Sampling station					
			1	2	3	4	5	6
Heteroptera	Miridae	*Liocoris tripustulatus*		X	X			
Heteroptera	Miridae	*Lopus decolor*					X	
Heteroptera	Miridae	*Lygus cf. pratensis*	X					
Heteroptera	Miridae	*Megaloceroea recticornis*				X		
Heteroptera	Miridae	*Miridius quadrivirgatus*					X	X
Heteroptera	Miridae	*Notostira elongata*	X		X	X	X	
Heteroptera	Miridae	*Phytocoris varipes*				X		
Heteroptera	Miridae	*Plagiognathus chrysanthemi*	X					X
Heteroptera	Miridae	*Stenodema calcarata*	X		X	X		
Heteroptera	Miridae	*Stenodema laevigata*	X					X
Heteroptera	Miridae	*Stenodema trispinosa*	X				X	
Heteroptera	Nabidae	*Himacerus mirmicoides*	X		X			
Heteroptera	Nabidae	*Nabis limbatus*	X					
Heteroptera	Pentatomidae	*Aelia acuminata*			X			X
Heteroptera	Rhopalidae	*Chorosoma schillingi*			X	X		
Homoptera	Aphrophoridae	*Philaenus spumarius*					X	X
Homoptera	Cicadellidae	*Eupelix cuspidata*		X				X
Hymenoptera	Apidae	*Andrena nígroaenea*						X
Hymenoptera	Apidae	*Anthophora bimaculata*			X			
Hymenoptera	Apidae	*Bombus lapidarius*	X	X		X		
Hymenoptera	Apidae	*Bombus pascuorum*				X		
Hymenoptera	Apidae	*Bombus terrestris*	X					
Hymenoptera	Apidae	*Nomada flava*		X				X
Hymenoptera	Colletidae	*Hylaeus communis*	X					
Hymenoptera	Colletidae	*Hylaeus confusus*	X					
Hymenoptera	Colletidae	*Hylaeus dilatatus*	X					
Hymenoptera	Crabronidae	*Cerceris rybyensis*						X
Hymenoptera	Crabronidae	*Philanthus triangulum*						X
Hymenoptera	Formicidae	*Formica cunicularia*				X		
Hymenoptera	Formicidae	*Lasius flavus*	X					
Hymenoptera	Formicidae	*Lasius niger*				X		
Hymenoptera	Formicidae	*Myrmica sabuleti*			X			
Hymenoptera	Halictidae	*Sphecodes monilicornis*	X					
Hymenoptera	Megachilidae	*Heriades truncorum*						X
Hymenoptera	Megachilidae	*Megachile centuncularis*		X				
Hymenoptera	Megachilidae	*Megachile leachella*						X
Lepidoptera	Arctiidae	*Tyria jacobaeae*			X			
Lepidoptera	Hesperiidae	*Ochlodes faunus*				X		
Lepidoptera	Hesperiidae	*Thymelicus lineola*					X	
Lepidoptera	Hesperiidae	*Thymelicus sylvestris*	X		X	X	X	
Lepidoptera	Lepidoptera	*Aphantopus hyperantus*				X		
Lepidoptera	Lycaednidae	*Polyommatus icarus*	X					
Lepidoptera	Noctuidae	*Autographa gamma*			X			X
Lepidoptera	Nymphalidae	*Aglais urticae*						X

Higher taxon	Family	Species	Sampling station					
			1	2	3	4	5	6
Lepidoptera	Nymphalidae	*Inachis io*				X		
Lepidoptera	Satyridae	*Coenonympha pamphilus*	X	X				
Lepidoptera	Sesiidae	*Bembecia ichneumoniformis*		X			X	
Lepidoptera	Yponomeutidae	*Yponomeuta evonymella*	X					
Opiliones	Phalangiidae	*Rilaena triangularis*		X				
Orthoptera	Acrididae	*Chorthippus albomarginatus*	X				X	
Orthoptera	Acrididae	*Chorthippus brunneus*	X					
Orthoptera	Acrididae	*Chorthippus parallelus*	X		X			
Orthoptera	Acrididae	*Omocestus viridulus*		X				
Orthoptera	Tettigoniidae	*Conocephalus discolor*	X	X				
Orthoptera	Tettigoniidae	*Metrioptera roeselii*	X		X			
Orthoptera	Tettigoniidae	*Tettigonia viridissima*			X			
Stylommatophora	Helicidae	*Cepaea nemoralis*		X				
Diptera	Stratiomyidae	*Oplodontha viridula*						

Aquatic survey data.

Taxon	Species	Salinity tolerance	Marsh fidelity	Quality score	Station															
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusca: Bithyniidae	*Bithynia leachii*	1	1	2											X					
Mollusca: Bithyniidae	*Bithynia tentaculata*	1	1	1	X	X	X		X	X	X		X							
Mollusca: Lymnaeidae	*Lymnaea palustris*	0	1	1	X	X	X	X	X	X	X	X	X	X	X		X	X		X
Mollusca: Lymnaeidae	*Lymnaea stagnalis*	0	1	1						X		X							X	X
Mollusca: Lymnaeidae	*Radix balthica*	0	1	1	X	X		X	X	X	X	X	X	X	X	X			X	X
Mollusca: Physidae	*Physa fontinalis*	0	1	1	X	X	X	X	X	X	X		X	X						
Mollusca: Planorbidae	*Anisus vortex*	0	1	1	X	X	X	X	X	X	X	X	X	X			X	X		
Mollusca: Planorbidae	*Hippeutis complanatus*	0	1	2	X															
Mollusca: Planorbidae	*Planorbis planorbis*	0	1	1	X	X	X	X	X	X	X	X	X	X				X		
Mollusca: Sphaeriidae	*Pisidium sp.*			1				X												
Hirudinea: Glossiphoniidae	*Helobdella stagnalis*	0	1	1		X				X										
Isopoda: Asellidae	*Asellus aquaticus*	0	1	1	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Isopoda: Janiridae	*Jaera species*	2	1	1											X					
Mysidacea: Mycidae	*Leptomysis species*	2	1	1											X					
Coleoptera: Dytiscidae	*Agabus bipustulatus*	0	1	1							X	X	X			X				
Coleoptera: Dytiscidae	*Hydaticus seminiger*	0	1	3										X						
Coleoptera: Dytiscidae	*Hydroporus palustris*	0	1	1	X					X		X	X	X		X			X	
Coleoptera: Dytiscidae	*Hydroporus planus*	0	1	1	X					X		X								

Taxon	Species	Salinity tolerance	Marsh fidelity	Quality score	Station															
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Coleoptera: Dytiscidae	*Hygrotus inaequalis*	0	1	1				X								X		X		X
Coleoptera: Dytiscidae	*Hygrotus parallellogrammus*	1	2	3			X													
Coleoptera: Dytiscidae	*Hyphydrus ovatus*	0	1	1									X					X		X
Coleoptera: Dytiscidae	*Ilybius ater*	0	2	1						X										X
Coleoptera: Dytiscidae	*Liopterus haemorrhoidalis*	0	1	2								X	X							
Coleoptera: Dytiscidae	*Rhantus grapii*	0	2	2	X															
Coleoptera: Haliplidae	*Haliplus lineatocollis*	0	1	1									X			X				X
Coleoptera: Haliplidae	*Haliplus ruficollis*	0	1	1	X	X			X				X	X		X				X
Coleoptera: Haliplidae	*Peltodytes caesus*	0	3	3												X				X
Coleoptera: Helophoridae	*Helophorus aequalis*	0	1	1										X						
Coleoptera: Helophoridae	*Helophorus minutus*	0	1	1					X	X		X	X			X				X
Coleoptera: Hydrophilidae	*Anacaena limbata*	0	1	1	X	X			X	X		X	X	X						X
Coleoptera: Hydrophilidae	*Berosus affinis*	0	3	2			X													
Coleoptera: Hydrophilidae	*Cymbiodyta marginellus*	0	1	2	X															
Coleoptera: Hydrophilidae	*Enochrus testaceus*	0	1	2	X					X								X		
Coleoptera: Hydrophilidae	*Hydrobius fuscipes*	0	1	1					X		X		X							
Coleoptera: Noteridae	*Noterus clavicornis*	0	1	1			X	X	X	X		X	X	X		X	X			
Diptera: Stratiomyidae	Species 1	0	1	1		X														

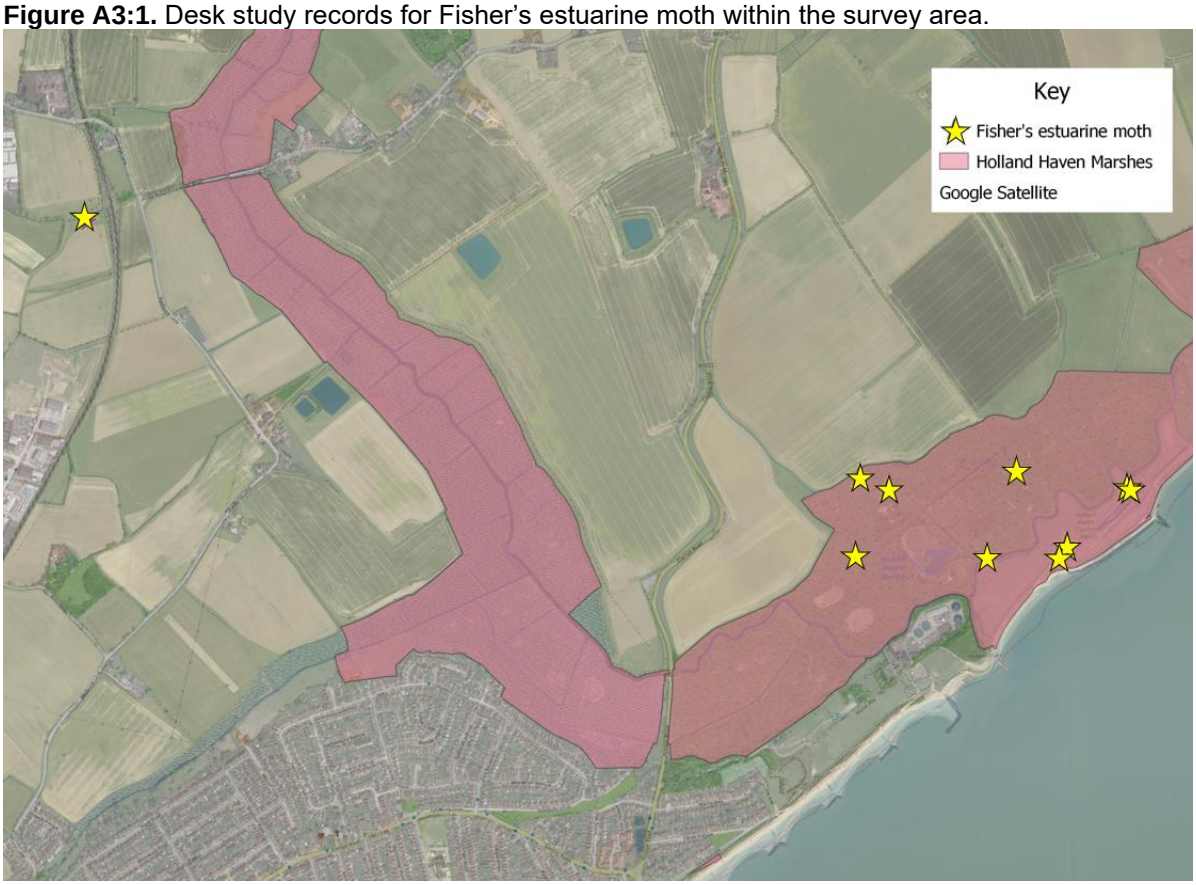
Taxon	Species	Salinity tolerance	Marsh fidelity	Quality score	Station															
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Heteroptera: Corixidae	*Hesperocorixa linnaei*	0	1	1			X	X								X				X
Heteroptera: Corixidae	*Hesperocorixa sahlbergi*	0	1	1														X		
Heteroptera: Corixidae	*Sigara nigrolineata*	0	1	1											X					
Heteroptera: Corixidae	*Sigara stagnalis*	1	1	2				X							X	X				X
Heteroptera: Gerridae	*Gerris lacustris*	0	1	1												X				X
Heteroptera: Naucoridae	*Ilyocoris cimicoides*	0	1	1		X									X	X			X	X
Heteroptera: Notonectidae	*Notonecta glauca*	0	1	1		X		X						X		X			X	X
Heteroptera: Pleidae	*Plea minutissima*	0	1	1												X				
Odonata: Aeshnidae	*Aeshna mixta*	0	1	2	X															
Odonata: Coenagrionidae	*Coenagrion puella*	0	1	1										X						
Odonata: Coenagrionidae	*Ischnura elegans*	0	1	1		X									X	X				X
Odonata: Libellulidae	*Sympetrum striolatum*	0	1	1											X	X				X

9. APPENDIX 3: FISHER'S ESTUARINE MOTH (CONFIDENTIAL)

The data search records include locations for the Fisher's estuarine moth with eight-figure grid references (equivalent to an accuracy of 10m by 10m). The records from within the survey area are shown in Figure A3:1.

These records are attributed to 'Natural England Fishers Estuarine moth monitoring' and include estimates of the percentage of plants at a locality with feeding signs. The records are dated 2005, and then 2011-19. It is not known if the records represent a systematic search for evidence of the moth or are based on visits to 'known' or 'pre-determined' locations.

Figure A3:1. Desk study records for Fisher's estuarine moth within the survey area.



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