ENGLISH NATURE

# Survey of selected saline lagoons, Suffolk Coast, September 1998

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# Survey of selected saline lagoons, Suffolk Coast, September 1998

by

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The photographic transparencies mentioned on page 4 are held by English Nature, the Environment Agency and The National Trust.

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## SUMMARY AND CONCLUSIONS

Four suites of lagoons on the Suffolk coast were surveyed on behalf of English Nature by staff at the Natural History Museum in September 1998.

1. While 10 lagoons on King's Marshes, Orfordness, were surveyed in 1996, a further 18 have been identified to the northeast of these, a series of old gravel extraction pits known as "the disturbed shingle lagoons"; these 18 were surveyed in 1998.
2. In Autumn 1996 a suite of new lagoons was created at Benacre Broad to counteract anticipated loss of lagoon area to coastal erosion and reed encroachment. The new lagoons and the relic of the main broad were surveyed in 1998.
3. The area known as Reedland Marsh, north of Dunwich, contains a number of small percolation lagoons, some of which were studied in 1989, but these were not included during the cSAC assessment. All lagoons seaward of the Dunwich River were surveyed in 1998.
4. The Environment Agency created a small lagoon at Buss Creek, Southwold, in 1997. This site had not been assessed for habitat quality, and so was surveyed in 1998.

Surveys were conducted using the survey methodology being defined by English Nature, to determine the biota of the lagoons, their salinity, their integrity, their water sources, and other aspects of the habitat, including those pertinent to their conservation management. All faunistic sampling was undertaken using 0.5 mm meshes. Species were identified *in situ* wherever possible. Salinities were measured to the nearest part per thousand. Substrata, size and depth were assessed *in situ*. A series of photographs was taken to represent the various sites as best as possible.

**1.** The "disturbed shingle lagoons" on King's Marsh, Orfordness, lagoons form an extensive suite of 18 pools, protected from anthropogenic impacts, and supporting a more diverse community than that previously recorded for King's Marsh lagoons 1 to 10, including good populations of the scheduled starlet sea anemone, *Nematostella vectensis*, and with four animal (*Cerastoderma glaucum, Hydrobia ventrosa, H. neglecta, Idotea chelipes*) and two plant (*Ruppia* sp., *Chaetomorpha linum*) lagoonal specialist species. These lagoons make a valuable addition to the cSAC.

Further monitoring of these sites is recommended in order to understand more fully their salinity regimes and the stability of their community.

**2.** The main lagoon at Benacre Broad has reduced in area by some 40% since 1996, and has lost areas previously recorded as harbouring scheduled species. At the same time, owing to the exigencies of coastal erosion, the exit pipe system has been lost, and this reduction in water exchange is likely to have lead to the lower salinity regime, to the detriment of lagoonal specialist species. Management geared to reversing the decline in the main lagoon habitat should be concerned with maintaining as large a submerged area as possible, and enhancing the water exchange through the shingle bank, although with the present rate of erosion and mobility of the bank this last may not be feasible.

The new lagoons inland at Benacre are all small and of lower salinity. As might be expected from their short history, the sedimentary infauna is sparse, although the apparently more mature lagoon 5 did harbour *Ruppia* and associated specialists. At this stage it appears likely that these lagoons are of such a small size and generally

low salinity that the community which they develop would be insect dominated. Some of these pools should be isolated from terrestrial freshwater input, but connected with the percolation supply from seaward, to maintain a higher salinity regime (above 20‰). In addition, it would be beneficial to enlarge these to maximise the permanently flooded area.

**3.** Twenty-one lagoons (or systems) were surveyed on Reedland Marsh in October 1998. Their communities included an essentially estuarine sedimentary infauna, with high densities of *Nematostella vectensis* in some pools (16 sites, common to super-abundant in 8 of these), and a diverse assemblage of specialist species associated with submerged macrophytes or algae where these occurred. The densities of *Hydrobia neglecta* were particularly notable, and the scheduled *Gammarus insensibilis* was recorded from 13 sites. These lagoons would make a worthy addition to the sequence of lagoonal SACs proposed for the Suffolk coast. A survey of the surrounding plant communities may be of further value for an integrated conservation appraisal.

As the principal threat to their integrity appears to be the operation of earth-moving machinery to maintain the shingle bank (maintenance of which is essential to the lagoons longer term existence), the principal management requirement is that the EA is aware of this sensitive habitat, and conducts such operations in a manner which avoids impact to the lagoons themselves.

**4.** An area of the *Phragmites*-filled Bus Creek, on the north side of Southwold, has been cleared of reeds as part of the development of a "Wildlife Site". The resulting 0.25 ha of open water, overlying refractory reed debris on mud in some 1 m of freshwater, is not a saline lagoon. The adjacent boating pond has slightly more merit as a lagoon, supporting a sparse community typical of low salinity brackish pools, and of no conservation merit.

The Suffolk coast incorporates some of the most important saline lagoon systems in Great Britain, including extensive examples of shingle percolation lagoons. These sites house a number of scheduled species, notably including the starlet sea anemone, *Nematostella vectensis*, and the "lagoonal sand shrimp", *Gammarus insensibilis*. Other notable species are the rare lagoonal mysid *Paramysis nouveli*, and good populations of the less common lagoonal hydrobiid, *Hydrobia neglecta*. Three of these species were recorded in the present survey.

The present results indicate that the specialist lagoonal interest of Suffolk is greater than previously indicated (although some sites have declined).

## INTRODUCTION

Coastal saline lagoons are a key habitat under the UK Biodiversity Action Plan and are a priority habitat under the EC Directive 93/43/EEC ("The Habitats and Species Directive"). Within Suffolk there are two candidate Special Areas of Conservation (cSACs) based around saline lagoons, viz. Benacre to Easton Bavents Lagoons and Orfordness to Shingle Street Lagoons. These lagoons were surveyed on behalf of English Nature in Autumn 1996 (Bamber, 1997).

Recent developments, such as reconstruction of the site at Benacre Broad and the identification of further lagoons within the Orfordness-Shingle Street cSAC, resulted in a requirement for further surveying of these lagoons. In addition, known and potential saline lagoons have been identified outside these cSACs which also required surveying in the context of Bamber (1997), in order to make more comprehensive the information on the quality and extent of the saline lagoon resource in Suffolk.

Four suites of lagoons were surveyed on behalf of English Nature by staff at the Natural History Museum in September 1998 (see Map 1).

1. While 10 lagoons on King's Marshes, Orfordness, were surveyed in 1996, a further 18 have been identified to the northeast of these, a series of old gravel extraction pits known as "the disturbed shingle lagoons". These 18 were surveyed in 1998. Impacts from the management of the site prompted the need for up-to-date data and an assessment of lagoonal interest. Management proposals include the use of machines to reinstate shingle banks, or the acceptance of breaches to allow shoreline realignment. Initial fieldwork in 1997 indicated a diverse system supporting a varied biota, including abundant *Nematostella vectensis* (Gilliland and Cottle, pers. comm.).
2. In Autumn 1996 a suite of new lagoons was created at Benacre Broad to counteract anticipated loss of lagoon area to coastal erosion and reed encroachment. Although these were studied in 1996, further surveying is required to determine the effects of the development. The new lagoons and the relic of the main broad were surveyed in 1998.
3. The area known as Reedland Marsh, north of Dunwich, contains a number of small percolation lagoons, some of which were studied in 1989, but these were not included during the cSAC assessment. A survey of the entire Reedland resource was therefore required: all lagoons seaward of the Dunwich River were surveyed in 1998.
4. The Environment Agency created a small lagoon at Buss Creek, Southwold, in 1997. This site had not been assessed for habitat quality, and so was surveyed in 1998.

This report describes the results of those surveys.

## METHODS

Surveys were conducted in the manner of the survey methodology being defined by English Nature (as described below), to determine the biota of the lagoons, their salinity, their integrity, their water sources, and other aspects of the habitat, including those pertinent to their conservation management.

Depth of water was measured to the nearest cm, and area estimated *in situ*. Site sketches were taken to supplement aerial photography for compilation of maps.

Sampling was undertaken under licences 19981541 and 19981542 granted under Section 16 (3) (a) of the Wildlife and Countryside Act. All faunistic sampling was undertaken using 0.5 mm meshes. Species were identified *in situ* wherever possible, although infaunal sedimentary samples were retained for subsequent microscopic examination. Some material of *Nematostella vectensis, Gammarus insensibilis* and *Idotea chelipes* was collected and fixed in methanol for an ongoing DNA study of lagoonal species at Southampton Oceanography Centre, as requested by EN Suffolk. Estimates of the abundance of species within each lagoon are based on the "SACFOR" scale (see Appendix 1).

Salinities were measured to the nearest part per thousand using a Reichert salinity refractometer, at as many points in a lagoon as were deemed necessary to define the range at the time of survey; deeper lagoons were also investigated for salinity stratification. (The previous weeks had been dry, with little rainfall). All saline inputs to the lagoons were from the North Sea (34-35‰); adjacent sources of lower salinity water were also measured as appropriate.

Substrata were assessed *in situ*; in the event, the fine mud to muddy sand substrata were highly organic, such that assessment of even coarser grades of granulometry were impractical (and indeed the organic component may be important to the infauna). Furthermore, most lagoons supported a mosaic of sediment, particularly at Benacre where the recent reconfiguring and infill had produced as yet unstable substrata for most lagoons. While the predominant fine sediment was assessed as 50-60% silt/clay, 30-40% sand at Reedland and King's Marsh, and *ca* 30% silt/clay, 70% sand at Benacre, the substrata are referred to below simply as "mud", "muddy sand", etc. as appropriate.

A series of photographs was taken to represent the various sites as best as possible, although in low lying marshland with reeds, specific pool photographs are almost impossible and of little value. Photographic transparencies are supplied with this report.

## RESULTS

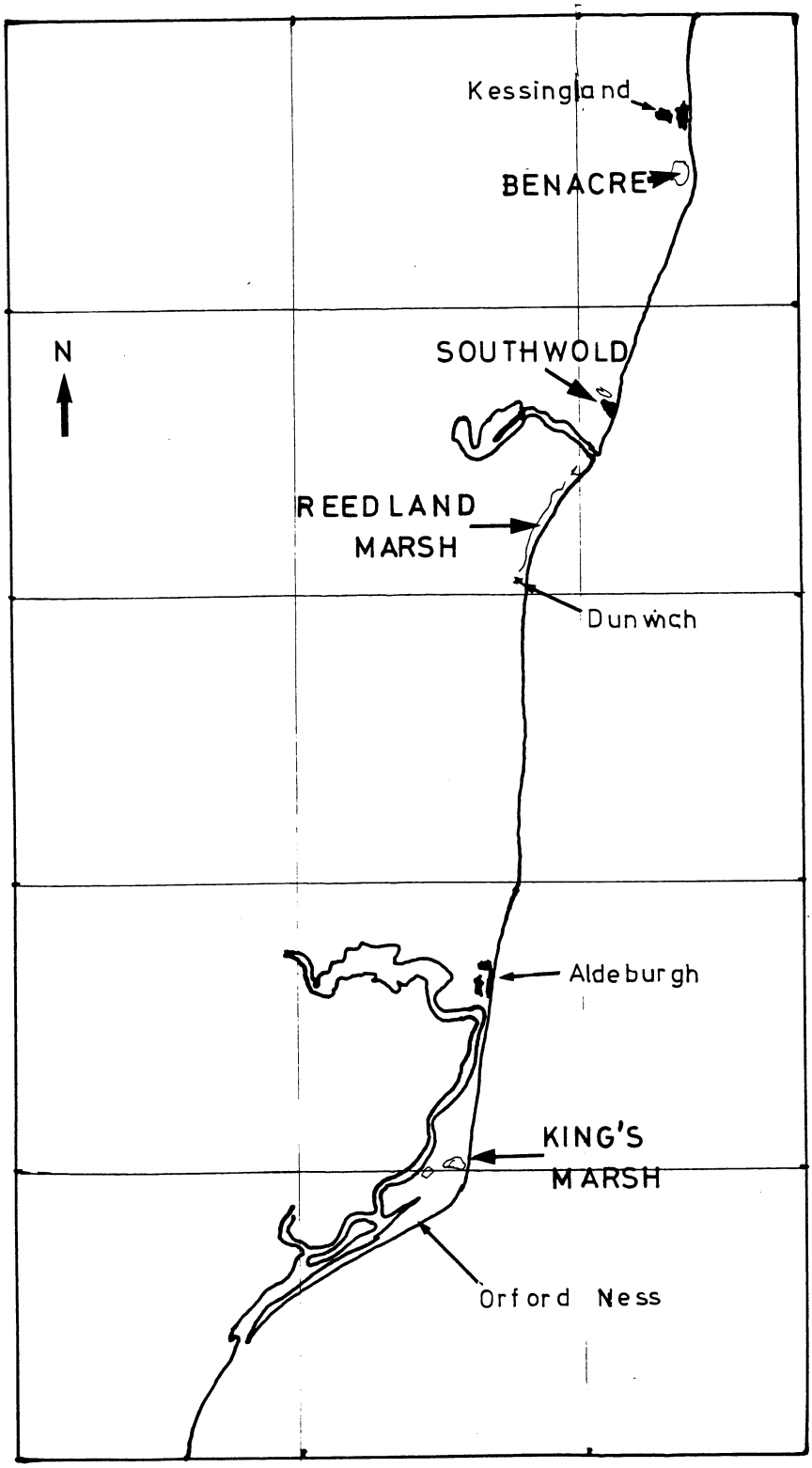
The surveys are reported in the format of the Saline Lagoon Directory (Downie, 1996). Species are listed for individual lagoons as in Bamber *et al.* (1998), with animals preceding plants, and each Kingdom in order of dominance.

Owing to the small size of each individual pool, (most <0.1 ha) and the potentially ephemeral nature of many, individual pool maps were not prepared, rather the entire resource at each site is presented as a single map. Uniformity of habitat at each pool suggest that a location map is of most value.

Results for the lagoons are set out in the four geographical areas as listed in the Introduction. For each area, the introductory page (Overview) collates the information from the individual lagoons, and presents interpretation of the habitat and recommendations for management.

**MAP 1. The Suffolk coastline showing the four saline lagoon sites surveyed**

Grid divisions at 10 National Grid units, thus 10 km.



# KING'S MARSHES

## KING'S MARSHES

### Overview

The Orford Ness "disturbed shingle lagoons" on the eastern side of the Ness within King's Marsh have not been surveyed previously, although *Nematostella vectensis* had been observed there. Many of the lagoons are subject to overtopping on extreme tides, and some to regular drying out; percolation into many of the lagoons is sufficient to cause tidal fluctuation. The Marsh as a whole is subject to periodic inundation by the sea (approximately every two to five years). The lagoons lie within the Orfordness to Shingle Street cSAC and the Alde-Ore Estuary SPA, Ramsar and SSSI.

Eighteen lagoons were studied in all (Map 2), numbered generally from south to north in sequence after the original 10 surveyed in 1996, thus as lagoons 11 to 28. The lagoons form an extensive suite, protected from anthropogenic impacts by their isolation on the Ness and by the site being managed by the National Trust. The principal longer-term threat to their integrity would be coastal erosion, i.e. the loss of the shingle bank protecting them from the North Sea.

The lagoons ranged in salinity from 30 to 40‰, probably towards their upper range owing to low rainfall (their only freshwater source) over the previous few weeks; there was evidence of dehydration of some lagoons.

### Fauna and Flora

The community of these lagoons, while similar to that described for King's Marsh lagoons 1 to 10 (see Bamber, 1997), is more diverse, including good populations of the scheduled starlet sea anemone, *Nematostella vectensis*, and with four animal (*Cerastoderma glaucum, Hydrobia ventrosa, H. neglecta, Idotea chelipes*) and two plant (*Ruppia* sp., *Chaetomorpha linum*) lagoonal specialist species.

Lagoons 11 (essentially with a purely estuarine rather than lagoonal community) and 15 (a shallow scrape) had comparatively impoverished faunae, attributed in part to their lacking submerged plants. Similarity analysis separated the remaining lagoons into two clusters, with lagoons 12, 14, 22, 24 and 28 being distinguished as a cluster owing to their lack of lagoon cockles, although there was no clear distinction of their substrata.

### Threats

Management proposals include the use of machines to reinstate shingle banks, or the acceptance of breaches to allow shoreline realignment. Such activity along the eastern side of the Marsh would have its impact on the less diverse lagoons 28 and 23.

### Recommendations

With respect to the saline lagoons, no habitat management other than protection from anthropogenic interference appears to be necessary or warranted. These lagoons are a valuable addition to the cSAC. Further monitoring of these sites is recommended in order to understand more fully their salinity regimes and the stability of their community.

Individual lagoon descriptions follow. The detail of the lagoonal biota is presented in Table 1.

**MAP 2. King's Marsh "disturbed shingle lagoons" 11 to 28**

Divisions on the border are 0.1 of a National Grid division, thus 100 m.

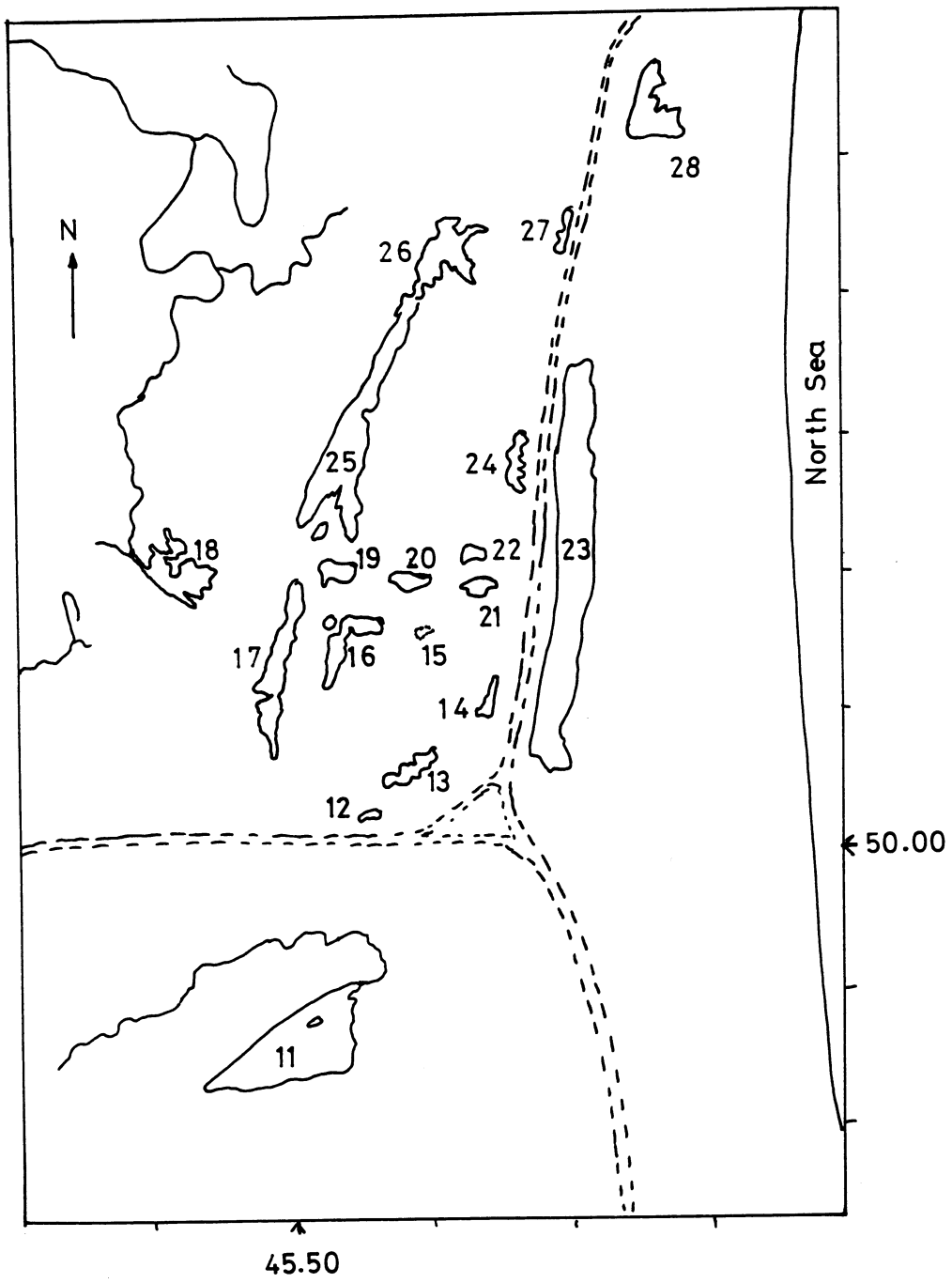


**TABLE 1. The biota of King's Marsh lagoons 11 to 28**

| KINGS MARSHES | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lagoon #** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** |
| Species Salinity | 34-35 | 34 | 34 | 34 | 34 | 32 | 31 | 30-32 | 32 | 30 | 35 | 40 | 35-37 | 31 | 30-36 | 36-40 | 38 | 34-36 |
| *Nematostella vectensis* | | | 4 | 1 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | | 1 | 1 | 3 | 3 | 3 | 3 |
| *Sagartia troglodytes* | | | | | | | 1 | | | | | | | | | | 1 | |
| *Lineus "viridis"* | | | | | | | 1 | | | | | | | | | | | |
| Nemertean | | | 1 | | | | | | | | | | 1 | | | | | |
| *Tubificoides pseudogaster* | 2 | | | 3 | | 2 | 3 | 3 | | 1 | | | 4 | 4 | 3 | 3 | 2 | |
| *Tubificoides benedii* | | | | | | | | 3 | | | | | | | | | | |
| Oligochaete indet | | 2 | 3 | 1 | | 2 | 4 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | | 2 |
| *Nereis diversicolor* | 1 | | | 2 | | | | 2 | | | | 1 | 2 | 2 | | | 1 | 2 |
| *Streblospio benedicti* | | | | | | | | 2 | | | | | 1 | | | | | |
| *Spio martinensis* | | | | | | | | | | | | | 3 | | | | | |
| *Arenicola marina* | | 2 | | 4 | 5 | 4 | 2 | | 1 | 4 | 4 | 4 | 3 | 1 | 2 | 4 | | 3 |
| *Capitella capitata* | | 2 | 4 | 1 | | | 4 | 3 | | | | | 2 | 2 | 1 | 1 | 2 | 2 |
| *Aphelochaeta marioni* | 2 | | | | | | | | | | | | | | | | | |
| *Abra tenuis* | | | | | | | | 3 | | | | 1 | | 1 | 5 | 5 | | 3 |
| *Cerastoderma glaucum* | | | 3 | | | 3 | 3 | 3 | 2 | 2 | | 1 | 3 | | 5 | 5 | 2 | |
| *Retusa obtusa* | | | | 2 | | | | | | | | | 1 | 2 | | | | |
| *Hydrobia ventrosa* | | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 3 | 5 | 5 | 2 | 3 |
| *Hydrobia neglecta* | | | | | | | | 1 | | | | | 1 | | | | | 2 |
| *Littorina saxatilis* | | 2 | 2 | | | 2 | 4 | | 3 | 1 | 1 | | 3 | 2 | 5 | 5 | | |
| Chironomid indet | | | 4 | 1 | | 5 | 3 | 4 | 2 | 2 | 2 | 1 | 4 | 2 | 3 | 1 | 1 | 2 |
| Dipteran larvae/pupae | | | 1 | | | | 1 | | | | | | | | | | | |
| *Idotea chelipes* | 1 | | | | | 4 | 5 | 3 | 3 | 1 | 1 | | | 2 | 6 | 5 | 2 | 3 |
| *Corophium volutator* | | | | | | | | | | | | | 1 | | 2 | 3 | | 4 |
| *Crangon crangon* | 4 | | | | | | | | | | | | | | | | | |
| *Palaemonetes varians* | 1 | | 3 | | | 4 | | | 3 | 1 | | | 2 | | | | 2 | |
| *Carcinus maenas* | 2 | | | | | | | | | | | | | | | | | |
| *Pomatoschistus microps* | 2 | | 1 | | 1 | | | 1 | 2 | 3 | 2 | | | | 2 | 1 | 1 | |
| *Gasterosteus aculeatus* | | | 3 | | 1 | 4 | 5 | 4 | 3 | 3 | 3 | 1 | 4 | 1 | 5 | 4 | 3 | |
| | | | | | | | | | | | | | | | | | | |
| *Cladophora* sp. | | 3 | 2 | 2 | | 4 | | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | |
| *Ulva lactuca* | 1 | | | | | | | | | | | | | | | | | 2 |
| *Chaetomorpha linum* | | | | | | | 2 | 3 | 3 | | | | | | 5 | 4 | | 4 |
| *Ruppia* sp. | | | 4 | | | 5 | 4 | | 4 | 3 | 1 | | | | 1 | | | |
| | | | | | | | | | | | | | | | | | | |

1 = rare; 2 = occasional; 3 = frequent; 4 = common; 5 = abundant; 6 = superabundant

## SITE DESCRIPTIONS

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 11 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45504985 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.9 ha |
| **MAX DEPTH (m):** | 1.0 |
| **SALINITY (‰):** | 34 to 35 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

### Lagoon Description

This is the southernmost of the disturbed shingle lagoons, isolated to the south of the track south of lagoons 12 to 28, and some 400 m from the seashore. An inlet stream drains off the surrounding marsh-grassland, entering the lagoon at the northeast corner, presumed to obtain supply from the River Alde via a drainage ditch. The lagoon is triangular, with no outlet.

Saline input is attributed to intermittent flow from the river, groundwater from the marsh and percolation from seaward. Salinity ranged from 34‰ on the eastern side and within the inlet stream to 35‰ in the western corner, with no stratification. The substratum was of soft mud (ca 80% silt:20% sand) overlying firm shingle. The lagoon shelves gradually from 5 cm depth near the shore (more extensively to the west) to over 80 cm in the centre.

The lagoon supported no submerged plants, although the inlet stream contained *Ulva*. The sparse fauna was dominated by *Crangon crangon* (a species normally avoiding lagoons), with gobies, shore crab and occasional annelids: it was the only site where *Crangon, Carcinus* or *Aphelochaeta marioni* were recorded. The only lagoonal specialist recorded was *Idotea chelipes* (rare).

This community is essentially estuarine rather than lagoonal (see Bamber *et al.*, 1992).

### Species present

*Crangon crangon*
*Pomatoschistus microps*
*Carcinus maenas*
*Tubificoides pseudogaster*
*Aphelochaeta marioni*
*Nereis diversicolor*
*Idotea chelipes*
*Palaemonetes varians*
*Ulva lactuca*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 12 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45565003 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.004 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 34 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 12 (12 x 3 m) is one of three small pools north of the cross-track to the north of lagoon 11; at the time of the survey they all showed signs of dehydration, with the immediate bank covered with bleached *Cladophora*. Saline water ingress is entirely by percolation. The thin mud substratum over shingle supported a sparse fauna of lugworm, oligochaetes and *Capitella*, while the submerged *Cladophora* was exploited by *Hydrobia ventrosa* and *Littorina saxatilis*.

**Species present**
*Hydrobia ventrosa*
*Arenicola marina*
*Capitella capitata*
Oligochaete indet.
*Littorina saxatilis*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 13 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45595006 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.08 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 34 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 13, an amorphous elongate pond approximately 80 m long lies to the northeast of lagoon 12. Physiography, substratum and salinity were similar, but the lagoon was approximately 20 cm deep, with stands of *Ruppia* and a more dense and diverse fauna, additional species being the lagoon cockle, insect larvae, gobies and stickleback and *Palaemonetes varians*. The starlet sea anemone *Nematostella vectensis* was common in the marginal mud.

**Species present**

*Nematostella vectensis*
*Capitella capitata*
*Hydrobia ventrosa*
Chironomidae indet
*Cerastoderma glaucum*
*Gasterosteus aculeatus*
Oligochaete indet
*Littorina saxatilis*
Nemertean indet.
Dipteran larvae/pupae
*Pomatoschistus microps*
*Cladophora*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 14 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45645010 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.07 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 34 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 14 is an elongate, shallow, isolated lagoon northeast of lagoon 13, of uniform salinity, with a substratum of soft mud overlying firm shingle. The mud supported the annelids typical of this suite of lagoons (lugworm, oligochaetes, ragworm and *Capitella*), while the sparse *Cladophora* supported a dense population of *Hydrobia ventrosa*, itself being preyed upon by *Retusa obtusa* (this last rarely recorded in lagoons, but see also Reedland/Dunwich lagoons). *Nematostella vectensis* was rare in shallow marginal mud.

**Species present**

*Arenicola marina*
*Hydrobia ventrosa*
*Tubificoides pseudogaster*
*Nereis diversicolor*
*Retusa obtusa*
*Nematostella vectensis*
*Capitella capitata*
Oligochaete indet
Chironomidae indet
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 15 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45605016 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.01 ha |
| **MAX DEPTH (m):** | 0.03 |
| **SALINITY (‰):** | 34 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

The site of "lagoon" 15 was a shallow mud "scrape", with a water area some 10 by 8 m and approximately 3 cm depth; similar scrapes occurred to the south. Within the soft mud overlying the shingle, lugworm (predominantly juvenile) were abundant, *Hydrobia ventrosa* and *Nematostella vectensis* were occasional; there was no aquatic vegetation.

At the time of survey, this site could not be described as a lagoon.

**Species present**

*Arenicola marina*
*Nematostella vectensis*
*Hydrobia ventrosa*
*Pomatoschistus microps*
*Gasterosteus aculeatus*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 16 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45545017 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 32 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 16 was a shallow, L-shaped system with an adjacent round scrape, grading gently to 30 cm depth (25 cm in the scrape) over soft mud on shingle. No inlet or outflow were present. *Ruppia* was common, dominant over *Cladophora* in the southern arm and scrape but the alga was commoner in the northern arm.

The plants supported *Hydrobia ventrosa* and *Littorina saxatilis*. The soft mud was colonized by lugworm, ragworm, chironomids, oligochaetes and lagoon cockles; *Nematostella vectensis* was rare but throughout the lagoon. Stickleback, *Palaemonetes varians* and *Idotea chelipes* were common in the water.

The lagoon was typical of the western lagoons of this set, with the diverse biotopes associated with substratum, submerged plants and water column.

**Species present**

Chironomidae indet
*Arenicola marina*
*Hydrobia ventrosa*
*Idotea chelipes*
*Palaemonetes varians*
*Gasterosteus aculeatus*
*Cerastoderma glaucum*
*Tubificoides pseudogaster*
Oligochaetes indet
*Littorina saxatilis*
*Nematostella vectensis*
*Cladophora*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 17 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45485010 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.2 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 31 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 17, an elongate system with a detached northern pool, was another typical western lagoon of the system, of similar depth, physiography and substratum, uniform (although slightly lower) salinity, with a denser and more diverse complement of the biota found in lagoon 16. The fauna and flora were comparatively uniform, although *Nematostella vectensis* only occurred in the northern detached pool.

The lagoon thus represents a good example of those Kings Marsh lagoons with a diverse specialist community, and demonstrates the conservation merit of the lagoons in this area.

**Species present**

*Idotea chelipes*
*Gasterosteus aculeatus*
*Capitella capitata*
Oligochaetes indet.
*Hydrobia ventrosa*
*Littorina saxatilis*
*Nematostella vectensis*
*Tubificoides pseudogaster*
Chironomid indet
*Cerastoderma glaucum*
*Arenicola marina*
*Sagartia troglodytes*
*Lineus "viridis"*
Dipteran larvae/pupae
*Ruppia*
*Chaetomorpha linum*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 18 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45425019 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.2 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 30 to 32 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 18 lies isolated to the west of this system, as a convoluted lagoon connecting (perhaps intermittently) to a marsh creek which leads westwards to a drain connecting with the River Alde. Salinity ranged from 30‰ at the western side, adjacent to the creek, to 32‰ at the eastern side. The surrounding *Spartina*-dominated grass-banks intruded into the lagoon, and the substratum of soft mud was deep in places (up to 20 cm overlying the gravel).

Both *Cladophora* and *Chaetomorpha* were present, and the fauna was a diverse mixture of lagoonal specialists and estuarine species (this was the only lagoon on Kings Marsh to harbour *Tubificoides benedii*); lugworm was surprisingly not recorded. *Nematostella vectensis* was again restricted to marginal shallow mud, predominantly to the eastern side of the lagoon.

**Species present**

*Gasterosteus aculeatus*
*Hydrobia ventrosa*
Chironomidae indet
*Tubificoides pseudogaster*
*Tubificoides benedii*
*Capitella capitata*
*Abra tenuis*
*Cerastoderma glaucum*
*Idotea chelipes*
*Nereis diversicolor*
*Streblospio shrubsolii*
*Nematostella vectensis*
*Hydrobia neglecta*
*Pomatoschistus microps*
Oligochaete indet
*Cladophora*
*Chaetomorpha linum*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 19 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45545020 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.06 ha |
| **MAX DEPTH (m):** | 1.0 |
| **SALINITY (‰):** | 32 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

The westernmost of a row of three lagoons (numbers 19 to 21) of similar physiography (without inlet or outlet), shape (rectangular), size (some 35 x 15 m), substratum (soft mud, ca 80% silt:20% sand, overlying firm shingle, deeper in mid lagoon) and fauna, lagoon 19 is the deepest of the three, grading from a few cm at its western edge to 1 m in the middle.

Of these three, *Ruppia* was denser in this lagoon, and *Chaetomorpha* present. The plants supported *Hydrobia ventrosa*, *Littorina saxatilis* and *Idotea chelipes*; the substratum harboured oligochaetes, lugworm (sparsest of the three lagoons), chironomids, lagoon cockle and, peripherally and rarely, starlet sea anemone; lagoonal prawns and both fish species of this system were frequent.

**Species present**

*Hydrobia ventrosa*
*Littorina saxatilis*
Oligochaete indet
*Idotea chelipes*
*Palaemonetes varians*
*Gasterosteus aculeatus*
*Cerastoderma glaucum*
Chironomidae indet
*Pomatoschistus microps*
*Nematostella vectensis*
*Arenicola marina*
*Cladophora*
*Chaetomorpha linum*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 20 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM25585019 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.06 ha |
| **MAX DEPTH (m):** | 0.8 |
| **SALINITY (‰):** | 30 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

The central of this group of three lagoons (see Lagoon 19), lagoon 20 had the lowest salinity. The habitat and biota were generally as for Lagoon 19, but with lugworm commoner, *Chaetomorpha* absent, and thus fewer periwinkles.

**Species present**
*Hydrobia ventrosa*
*Arenicola marina*
*Gasterosteus aculeatus*
*Pomatoschistus microps*
Oligochaete indet
*Cerastoderma glaucum*
Chironomidae indet
*Idotea chelipes*
*Palaemonetes varians*
*Littorina saxatilis*
*Nematostella vectensis*
*Tubificoides pseudogaster*
*Cladophora*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 21 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45635018 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.06 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 35 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 21 is very similar to lagoon 20, although of higher salinity, with slightly sparser communities; no cockles or prawns were found. Otherwise the description for Lagoon 20 applies.

**Species present**

*Arenicola marina*
*Hydrobia ventrosa*
*Gasterosteus aculeatus*
*Pomatoschistus microps*
Chironomidae indet
Oligochaete indet
*Littorina saxatilis*
*Idotea chelipes*
*Nematostella vectensis*
*Cladophora*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 22 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45635022 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.05 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 40 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

A small, square lagoon in grassier marshland, with deep soft mud overlying shingle, isolated from the surrounding lagoons, and with a high salinity. The substratum was dominated by lugworm, with oligochaetes and rare *Abra*, while *Hydrobia ventrosa* was common there and on the (sparse) *Cladophora*. Other species were few and rare.

**Species present**
*Arenicola marina*
*Hydrobia ventrosa*
Oligochaete indet
*Nereis diversicolor*
*Cerastoderma glaucum*
*Abra tenuis*
*Gasterosteus aculeatus*
Chironomidae indet
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 23 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45715023 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 1.8 ha |
| **MAX DEPTH (m):** | 0.25 |
| **SALINITY (‰):** | 35 to 37 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

The eastern side of this lagoon system is bounded by the extensive lagoon 23, some 400 m long during the present survey but, from the evidence of earlier aerial photographs, its area fluctuates below this. The lagoon is apparently maintained by percolation from the sea; there are no connecting ditches or streams. Salinity ranged from 35‰ at the southern end to 37‰ at the northern end.

The lagoon was shallow, and comparatively uniform, the substratum a mosaic of bare shingle and thin mud overlying firm shingle. Annelids dominated the benthos (*Spio martinensis* was only recorded in this lagoon), although *Hydrobia ventrosa* occurred on the sediment (with its predator *Retusa obstusa*) as well as in the patchy *Cladophora* with *Littorina saxatilis*.

**Species present**

*Hydrobia ventrosa*
*Tubificoides pseudogaster*
Chironomidae indet
*Gasterosteus aculeatus*
Oligochaete indet
*Arenicola marina*
*Spio martinensis*
*Cerastoderma glaucum*
*Littorina saxatilis*
*Palaemonetes varians*
*Nereis diversicolor*
*Capitella capitata*
*Nematostella vectensis*
Nemertean indet
*Streblospio shrubsolii*
*Retusa obstusa*
*Hydrobia neglecta*
*Corophium volutator*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 24 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45675027 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.2 ha |
| **MAX DEPTH (m):** | 0.15 |
| **SALINITY (‰):** | 31 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 24 is to the northeast of lagoon 22, a shallow, elongate lagoon (ca 90 x 25 m) with complex margins, probably derived from a number of smaller excavations. The thin mud substratum overlying the firm shingle predominantly supported oligochaetes and estuarine polychaetes; the only submerged plant was *Cladophora*, which supported *Hydrobia ventrosa* and *Littorina saxatilis*. *Nematostella vectensis* was rare in shallow mud to the southwestern corner.

**Species present**

*Tubificoides pseudogaster*
*Hydrobia ventrosa*
Oligochaete indet
*Nereis diversicolor*
*Capitella capitata*
*Retusa obstusa*
*Littorina saxatilis*
Chironomidae indet
*Idotea chelipes*
*Gasterosteus aculeatus*
*Nematostella vectensis*
*Arenicola marina*
*Abra tenuis*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 25 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45555030 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.5 ha |
| **MAX DEPTH (m):** | 0.15 |
| **SALINITY (‰):** | 30 to 36 |
| **ADJACENT HABITATS:** | *Salicornia-Halimione* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

The largest of the central group of lagoons, lagoon 25 is wider at the southern end (with a detached circular scrape) narrowing to the north but effectively contiguous with lagoon 26. Salinity ranged from 30‰ in the south, 32‰ in the centre to 36‰ where it joins lagoon 26. The lagoon was shallow throughout, and generally similar to lagoon 17 (adjacent to the south), although the flora was dominated by *Chaetomorpha* rather than *Ruppia*. The fauna was also much as that of lagoon 17, although most species were denser here, and *Abra tenuis* was present (abundant). There had been much recent mortality of both clams and cockles.

**Species present**

*Idotea chelipes*
*Littorina saxatilis*
*Cerastoderma glaucum*
*Hydrobia ventrosa*
*Abra tenuis*
*Gasterosteus aculeatus*
*Nematostella vectensis*
*Tubificoides pseudogaster*
Chironomid indet
*Arenicola marina*
*Corophium volutator*
*Pomatoschistus microps*
*Capitella capitata*
Oligochaetes indet.
*Chaetomorpha linum*
*Cladophora*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 26 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45615043 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.3 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 36 to 40 |
| **ADJACENT HABITATS:** | *Salicornia-Halimione* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

This lagoon is a higher salinity offshoot to the north of lagoon 25 (40‰ at its southern confluence with lagoon 25, declining steadily eastwards to 36‰), very shallow and static, with no *Ruppia* but dense *Chaetomorpha*, in places decaying and supporting *Beggiatoa*. The fauna was effectively identical to that of lagoon 25, although lugworm were notably more numerous. *Nematostella vectensis* was frequent but patchy.

**Species present**

*Idotea chelipes*
*Littorina saxatilis*
*Cerastoderma glaucum*
*Hydrobia ventrosa*
*Abra tenuis*
*Arenicola marina*
*Gasterosteus aculeatus*
*Nematostella vectensis*
*Tubificoides pseudogaster*
*Corophium volutator*
Oligochaetes indet
*Pomatoschistus microps*
Chironomid indet
*Capitella capitata*
*Chaetomorpha linum*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 27 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45715046 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.02 ha |
| **MAX DEPTH (m):** | 0.15 |
| **SALINITY (‰):** | 38 |
| **ADJACENT HABITATS:** | *Salicornia-Halimione* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

A small shallow lagoon, some 35 m long by 3 to 8 m wide to the north of this system, between lagoons 26 and 28. The fauna was sparse, although *Nematostella vectensis* was frequent along the western edge; the community was a reduced version of that in Lagoon 17, without the *Ruppia* or *Chaetomorpha* and thus also the associated herbivores.

**Species present**

*Nematostella vectensis*
*Gasterosteus aculeatus*
*Tubificoides pseudogaster*
*Capitella capitata*
*Cerastoderma glaucum*
*Hydrobia ventrosa*
*Idotea chelipes*
*Palaemonetes varians*
*Pomatoschistus microps*
Chironomidae indet
*Nereis diversicolor*
*Sagartia troglodytes*

| | |
|---|---|
| **SITE NAME:** | Kings Marsh Lagoon No. 28 |
| **LOCATION:** | Orfordness, Suffolk |
| **GRID REFERENCE:** | TM45775055 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, NT Reserve |
| **AREA:** | 0.7 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 34 to 36 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle |
| **SURVEY DATE:** | 24 September 1998 |

**Lagoon Description**

Lagoon 28 is the northernmost of this system, and the closest to the sea, whence it derives saline input via percolation. The lagoon was large but shallow, with soft mud overlying firm shingle, deep in patches particularly towards the northeastern edge. Salinity ranged from 34‰ at the eastern edge to 36‰ at the western. *Chaetomorpha* was present throughout and *Ulva* patchy. The fauna was similar to that of lagoons 25 and 26 although less dense and without the natant species (the fish or prawn); *Nematostella vectensis* was frequent throughout the lagoon; *Corophium volutator* was at its most abundant here.

**Species present**
*Corophium volutator*
*Idotea chelipes*
*Hydrobia ventrosa*
*Nematostella vectensis*
*Nereis diversicolor*
Oligochaete indet.
*Capitella capitata*
*Hydrobia neglecta*
Chironomidae indet
*Chaetomorpha linum*
*Ulva lactuca*

# BENACRE BROAD

## BENACRE BROAD

### Overview

In the Autumn of 1996, a suite of small new lagoons was created at Benacre Broad, inland of the original lagoon, in order to try to preserve the interest of the site by substituting for areas which will be lost to coastal erosion. These lagoons had not been surveyed, and the 1998 survey was to determine what colonization had taken place and hence the quality of the habitat.

The main lagoon of Benacre Broad was surveyed in the Autumn of 1996 (Bamber, 1997). At this time the area was estimated at 8 ha. Reconstruction of the seaward shingle bank had included an exit pipe with flap valves at the south-east corner. A salinity range from 28 to 32‰ indicated improved percolation through the shingle bank, together with efficient release of freshwater by the exit pipe system (salinities measured in July 1985 were 6 to 7‰).

Although the substrata were relatively barren, the area adjacent to *Phragmites* marsh on the northern shore supported occasional *Nematostella vectensis* and had clumps of *Chaetomorpha* in which was *Gammarus insensibilis*. The lagoonal mysid *Paramysis nouveli* was also present. The only cockles found were older dead shells.

The modifications undertaken since that survey have resulted in the dieback of much of the landward *Phragmites*, leaving open areas of muddy sand, increased by deposition of sediment into the western half and edges of the main lagoon, reducing its area by some 40% (see Map 3). This is considered disadvantageous to the saline lagoonal community. In particular, the area where the scheduled species occurred in 1996 is no longer under water (a requisite of lagoonal specialists is complete submergence). At the same time, owing to the exigencies of coastal erosion, the exit pipe system has been lost, and this reduction in water exchange is likely to have lead to the lower salinity regime (notwithstanding the wetter year of 1998; with the weeks immediately preceding the present survey having had low rainfall, the measured salinity levels are likely to be high for the present regime), to the detriment of the lagoonal specialists (notably the probable cause of mortality of the 1997 recruitment of *Cerastoderma glaucum*).

The new lagoons inland are all small and of lower salinity. As might be expected from their short history, the sedimentary infauna is sparse and insect dominated. The apparently more mature lagoon 5 did harbour *Ruppia* and associated specialists. A single *Nematostella vectensis* was recorded from lagoon 4. It is thus too early to assess the colonization of these new lagoons, although if there were a significant saline input then regular (perhaps 6-monthly) monitoring of their progress would be worthwhile. At this stage it appears likely that these lagoons are of such a small size and generally low salinity that the community which they develop would be insect dominated. This may be considered of value in diversifying the reserve, and indeed the more extensive areas of open sediment may increase utilization by birds (the priority at the site).

The original saline lagoon has declined since 1996. Management geared to improving this feature should be concerned with maintaining as large a submerged area as possible, and enhancing the water exchange through the shingle bank, although with the present rate of erosion and mobility of the bank this last may not be feasible. If, as indications are, the main broad is not sustainable in the medium to long term, management should concentrate on the newer, landward pools. Some of these pools should be isolated from terrestrial freshwater input, but connected with the percolation

supply from seaward, to maintain a higher salinity regime (above 20‰). In addition, it would be beneficial to enlarge these to maximise the permanently flooded area. For example, if pools 2 and 3 could be extended by approximately 200 m to seaward, and isolated from the freshwater input from the north and west, a habitat favourable to specialist lagoonal species should evolve.

Individual lagoon descriptions follow. The detail of the lagoonal biota is presented in Table 2.

**MAP 3. Benacre Broad, with new pools 1 to 8**

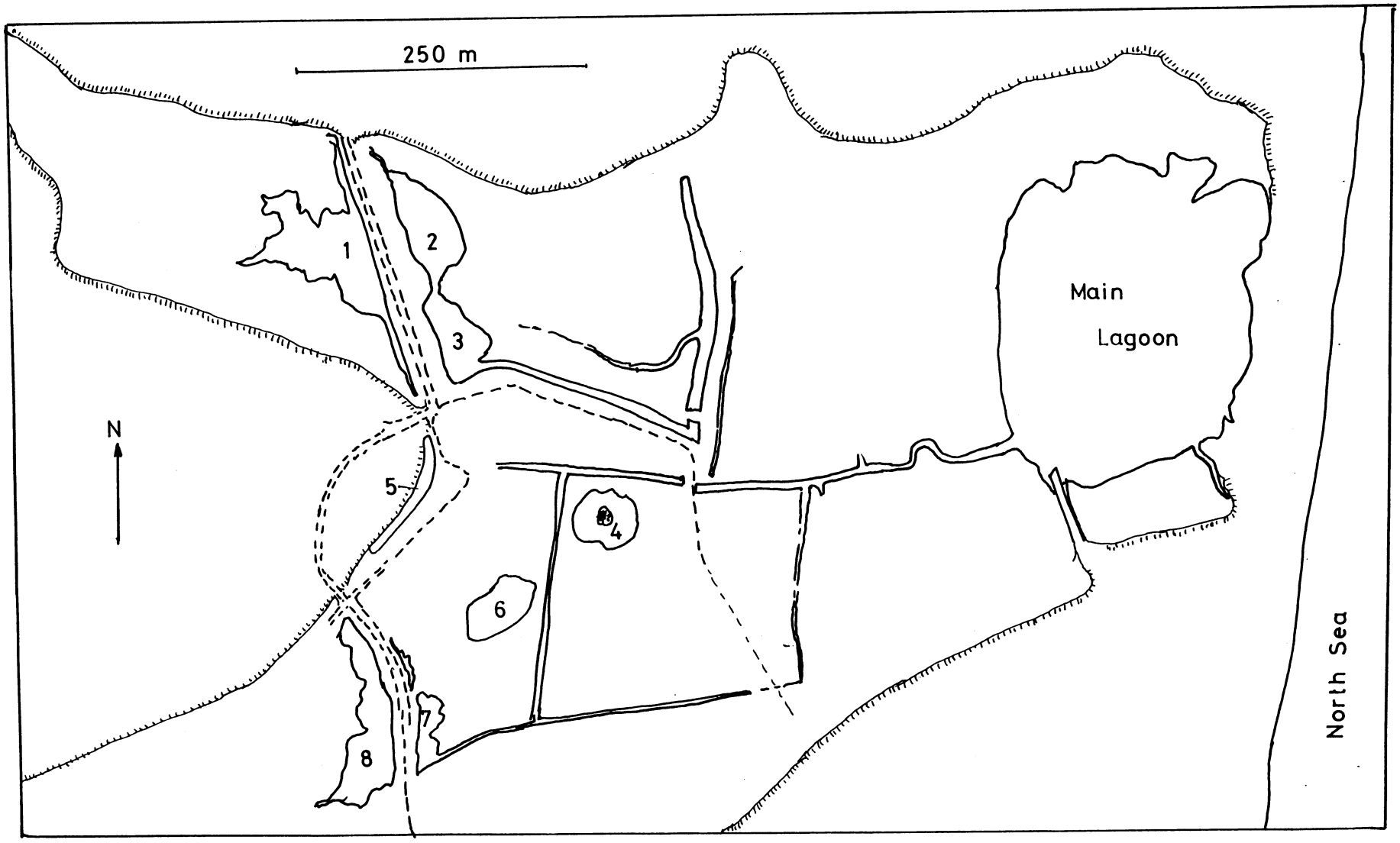


**TABLE 2. The biota of Benacre Broad lagoons**

| **BENACRE** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Lagoon #** | "Biscay" | 2 | 3 | 4 | 5 | 6 | 7 | *Inland* | Main Broad |
| Species Salinity | 2 | 16 | 16 | 10 | 16 | 18 | 11-16 | *0* | 16-20 |
| *Nematostella vectensis* | | | | 1 | | | | | |
| *Tubificoides pseudogaster* | | | | | | 1 | | | 1 |
| Oligochaete indet. | 2 | | | 1 | | | | | |
| *Nereis diversicolor* | | | 2 | 1 | 1 | | 2 | | 1 |
| *Polydora ciliata* | | | | | | | | | 1 |
| *Arenicola marina* | | | | | | | | | 4 |
| *Cerastoderma glaucum* | | | d | | | | | | d |
| *Hydrobia ventrosa* | | | | | 3 | | | | 3 |
| Chironomid indet | 4 | 4 | 1 | 4 | 4 | 4 | 4 | | 3 |
| Dipteran larvae/pupae | 2 | | | | | | | | |
| Sigarid/Corixidae | 3 | | | | | | | | |
| *Neomysis integer* | 4 | 2 | | 2 | | 1 | | | 2 |
| *Praunus flexuosus* | | | | | | | | | 4 |
| *Sphaeroma rugicauda* | | | 3 | 2 | 5 | | 3 | | 1 |
| *Idotea chelipes* | | | | | 4 | | | | 3 |
| *Gammarus duebeni* | 4 | 3 | 2 | | | 1 | | | 1 |
| *Gammarus zaddachi* | 3 | 1 | | | | | | | |
| *Corophium insidiosum* | | | | | | | | | 2 |
| *Corophium multisetosum* | 1 | 3 | | | | | | | |
| *Corophium volutator* | | | 2 | 3 | | 1 | | | 1 |
| *Palaemonetes varians* | | 1 | | 3 | 2 | 3 | | | |
| *Pomatoschistus microps* | | 2 | 2 | 2 | | | 3 | | 4 |
| | | | | | | | | | |
| *Cladophora* sp. | | | 3 | 1 | | | | | 3 |
| *Enteromorpha* | | | 2 | | | | | | 4 |
| *Ruppia* sp. | | | | | 4 | | | | |
| | | | | | | | | | |
| d = dead shells only | | | | | | | | | |
| | | | | | | | | | |
| 1 = rare; 2 = occasional; 3 = frequent; 4 = common; 5 = abundant; 6 = superabundant | | | | | | | | | |

## SITE DESCRIPTIONS

| | |
|---|---|
| **SITE NAME:** | Benacre Main Broad |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM532828 |
| **TYPE/CLASSIFICATION:** | Natural, Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | 5 ha |
| **MAX DEPTH (m):** | 0.5 |
| **SALINITY (‰):** | 16 to 20 |
| **ADJACENT HABITATS:** | Woodland, shingle shore, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

### Lagoon Description

Benacre Broad is a large, natural lagoon formed by the entrapment of the Benacre Marsh drainage by a shingle bar. It was surveyed in the Autumn of 1996 (Bamber, 1997). The main broad at Benacre has been the subject of reconfiguration, as well as suffering die back of reeds and encroachment of the shingle bank as the shoreline recedes through natural processes. In particular, infilling had occurred to landward and along the northern edge (notwithstanding the water level being lower in 1998 than was observed in 1996); the area of the lagoon body had reduced from some 8 ha to 5 ha in 1998.

The sea-wall exit pipe, which had been recently installed at the time of the 1996 survey for the purpose of draining the Broad, was no longer functional in 1998, although the "outlet creek" leading to it was still present. All water exchange between the lagoon and the sea is via percolation and overtopping across the shingle bank. Salinities in 1996 ranged from 28‰ at the outlet channel to 32‰ at the northeastern corner; in 1998 salinities had reduced to 20‰ throughout the seaward end of the lagoon and to 16‰ at the landward edge. As the weather locally had been dry prior to the survey, this may be assumed to be a high salinity in recent terms. Bamber (1997) described improved percolation through the shingle bank, together with more efficient release of freshwater via the outlet; this has proven to be a temporary condition, and the salinity regime, as well as the lagoonal area, have subsequently declined.

The substratum remains firm to muddy sand (ca 30% silt) and relatively barren, dominated by lugworm (not recorded in 1996). Recently dead shells of lagoon cockle (predominantly early 1997 recruitment) were found extensively, a few with tissue remaining within; previous low salinity is the most likely cause of this mortality.

*Enteromorpha* and *Cladophora* were both patchily present, with associated *Hydrobia ventrosa* and *Idotea chelipes*. The soft mud with associated *Chaetomorpha* adjacent to the northern bank reed-marsh in 1996, which had harboured *Nematostella vectensis* and *Gammarus insensibilis*, was well above water and away from the lagoon edge in 1998: none of these three species was found. The rare lagoonal specialist mysid *Paramysis nouveli* had also been lost since 1996, although both the commoner species *Praunus flexuosus* and *Neomysis integer* were present.

Thus, the community had generally degraded to a lower salinity/estuarine assemblage of species, with the loss of the rarer lagoonal specialists recorded in 1996.

This is attributed to the decline in water exchange at the seaward edge (with high freshwater input compared with sea-water input and freshwater loss), and to the resulting reduction in salinity, compounded by a reduction in the lagoonal area.

**Species present**

| | 1998 | 1996[1] |
|---|---|---|
| *Arenicola marina* | 4 | |
| *Praunus flexuosus* | 4 | |
| *Pomatoschistus microps* | 4 | 4 |
| *Idotea chelipes* | 3 | 2 |
| *Hydrobia ventrosa* | 3 | |
| Chironomidae indet. | 3 | 1 |
| *Neomysis integer* | 2 | 2 |
| *Corophium insidiosum* | 2 | |
| *Tubificoides pseudogaster* | 1 | |
| *Nereis diversicolor* | 1 | 2 |
| *Sphaeroma rugicauda* | 1 | 1[2] |
| *Gammarus duebeni* | 1 | |
| *Corophium volutator* | 1 | 2 |
| *Polydora ciliata* | 1 | 1 |
| *Enteromorpha* | 4 | *[3] |
| *Cladophora* | 3 | |
| *Palaemonetes varians* | | 3 |
| *Nematostella vectensis* | | 2 |
| *Gammarus insensibilis* | | 1 |
| *Paramysis nouveli* | | 1 |
| *Chaetomorpha* | | *[3] |

[1] data from Bamber (1997)
[2] *S. hookeri*
[3] algae were not ranked in 1996, merely recorded as present (*) or common (**)
Occurrences are on the SACFOR scale (see Appendix 1)

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 1 ("Bay of Biscay") |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM523832 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | 0.1 ha |
| **MAX DEPTH (m):** | >1.0 |
| **SALINITY (‰):** | 2 |
| **ADJACENT HABITATS:** | Woodland, freshwater and *Phragmites* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

This pool lies to the northwestern corner of the Benacre system, part of the old freshwater marsh system, now impounded to seaward by a raised trackway. It comprises an area of open, essentially freshwater amongst extensive stands of *Phragmites*, with a soft mud substratum overlying firmer soil. Freshwater input is from the west; what saline input occurs is likely to be from residual salt in the soil and potential winddrift from the seaward system.
The fauna is dominated by insect larvae, corixids, low-salinity amphipods and *Neomysis integer*. While of some merit as a freshwater marsh-pool system, it was not a saline lagoon in 1998.

**Species present**
Chironomidae indet
*Neomysis integer*
*Gammarus duebeni*
*Gammarus zaddachi*
Sigarid/Corixid spp.
Dipteran larvae/pupae
Oligochaete indet
*Corophium multisetosum*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 2 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM524833 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 16 |
| **ADJACENT HABITATS:** | Woodland, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 2 lies immediately seaward of pool 1, on the seaward side of the trackway. The substratum is a complex of loose soft mud (much presumably recently imported) and extensive refractory plant (reed) debris. Depth is generally shallow (<10 cm) but approaching 30 cm in the middle. The pool is approximately circular, with a saline stream at its northern edge (possibly an intermittent inlet) and connecting to pool 3 at its southern side. Salinity was uniform throughout, and likely to be high for the average for this pool.
No submerged plants were present; the fauna was sparse, similar to that of pool 1, but also with prawns and gobies.

**Species present**
Chironomidae indet
*Gammarus duebeni*
*Corophium multisetosum*
*Neomysis integer*
*Pomatoschistus microps*
*Gammarus zaddachi*
*Palaemonetes varians*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 3 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM524830 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.4 |
| **SALINITY (‰):** | 16 to 18 |
| **ADJACENT HABITATS:** | Open mud, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 3 lies "downstream" of pool 2, with a similar substratum. The pool is circular at its western end, narrowing to a shallow ditch running eastwards. Salinity was 16‰ at the northern pool rising to 18‰ at the southern end of the ditch.
The fauna and flora, still generally sparse, gave indication of a higher salinity regime, with *Enteromorpha* and *Cladophora* present, the decline of *Gammarus zaddachi* and *Corophium volutator* replacing the *C. multisetosum* of pool 2. A few recently dead shells of *Cerastoderma glaucum* were present.
Generally the community was of unremarkable low-salinity or estuarine species.

**Species present**
*Sphaeroma rugicauda*
*Nereis diversicolor*
*Gammarus duebeni*
*Corophium volutator*
*Pomatoschistus microps*
Chironomidae indet.
*Cladophora*
*Enteromorpha*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 4 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM526828 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.45 |
| **SALINITY (‰):** | 10 |
| **ADJACENT HABITATS:** | Grassland, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 4 lies to the south of the ditch section of pool 3, as a circular, isolated pond with a central island. The substratum is of rich organic mud with much plant debris, largely of *Phragmites*. The banks slope steeply to approaching a depth of half a metre. Salinity, at 10‰, was the lowest of the seaward pools in this system.
The community was a more diverse example of that found in pool 3, sparse, with a few specimens of *Nematostella vectensis* in the mud to the eastern side, the only site at which this species was found during the 1998 Benacre survey. The isolation of this pool, and absence of any freshwater inlet channel, may afford it more stability.

**Species present**
Chironomidae indet
*Corophium volutator*
*Palaemonetes varians*
*Neomysis integer*
*Sphaeroma rugicauda*
*Pomatoschistus microps*
*Nereis diversicolor*
*Nematostella vectensis*
Oligochaete indet
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 5 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM523829 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 1.0 |
| **SALINITY (‰):** | 16 |
| **ADJACENT HABITATS:** | Woodland, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 5 is a narrow pool, more a wide ditch, at the midwestern margin of the lagoon system, just south of a bird hide. It is the site of experimental introduction of *Chara*, and thus those areas were not sampled to avoid interference. Salinity was a uniform 16‰. The substratum is of rich organic mud with much refractory debris.

This was the only lagoon within the system in which *Ruppia* was found, here growing extensively, and both *Idotea chelipes* and *Hydrobia ventrosa* were associated with this plant.

Species present
*Sphaeroma rugicauda*
Chironomidae indet
*Idotea chelipes*
*Hydrobia ventrosa*
*Palaemonetes varians*
*Nereis diversicolor*
*Ruppia*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 6 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM524827 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 18 |
| **ADJACENT HABITATS:** | Grassland, freshwater and *Salicornia* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 6 was an open, shallow pool, with no inlet or outlet; salinity was a uniform 18‰. The pool appears to have a history of drying out.
The substratum was of rich organic mud with much refractory debris. There were no submerged plants, and the fauna was sparse, of an estuarine assemblage.

**Species present**
Chironomidae indet.
*Palaemonetes varians*
*Tubificoides pseudogaster*
*Neomysis integer*
*Gammarus duebeni*
*Corophium volutator*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 7 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM523826 |
| **TYPE/CLASSIFICATION:** | Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.35 |
| **SALINITY (‰):** | 11 to 16 |
| **ADJACENT HABITATS:** | Woodland, track, freshwater and *Phragmites* marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

Pool 7 lies within reedmarsh at the head of a ditch draining down to the main lagoon, with freshwater input from pool 8 by percolation through the trackway to its western edge. A connecting pipe here has a seaward flap valve, but was dry at the time of survey. Salinity varied from 16‰ in the northern corner to 11‰ at the head of the ditch, presumably where the freshwater percolates through. The substratum was soft mud overlying firm clay.
The northern region was populated only by chironomids, while gobies, young ragworm and *Sphaeroma* were frequent in the southwestern corner.

**Species present**
Chironomidae indet
*Sphaeroma rugicauda*
*Pomatoschistus microps*
*Nereis diversicolor*

| | |
|---|---|
| **SITE NAME:** | Benacre Broad, pool 8 |
| **LOCATION:** | Benacre, Suffolk |
| **GRID REFERENCE:** | TM522826 |
| **TYPE/CLASSIFICATION:** | Natural, Isolated |
| **DESIGNATION:** | SSSI, NNR, SPA, cSAC |
| **AREA:** | 0.1 ha |
| **MAX DEPTH (m):** | ?>0.8 |
| **SALINITY (‰):** | 0 |
| **ADJACENT HABITATS:** | Woodland, freshwater marsh |
| **SURVEY DATE:** | 22nd September 1998 |

**Lagoon Description**

To the west of the trackway at pool 7 lies a freshwater system within reedmarsh, with *Typha* and *Potamogeton pectinatus*. Salinity was zero, and no sampling of fauna was undertaken.

# REEDLAND MARSHES

## REEDLAND MARSHES LAGOONS

### Overview

North of Dunwich village, between the Dunwich River and the shingle bank sea-defence, lies an area of shingle grassland with *Spartina-Salicornia* marsh, containing a number of saline ponds of varying permanence. There is apparently continual bulldozer movement of shingle onto the bank to maintain the defence, either leaving residual water-filled scrapes or disrupting more established shallow ponds.

Water supply to these ponds is by percolation through the shingle bank and egress by groundwater drainage to the River, except for those ponds intimately connected with the River where there is some input from the river on high tide.

Twenty-one lagoons (or systems) were surveyed in October 1998, numbered for convenience from the north to the south (Map 4). All lagoons were shallow. A number of smaller ponds and scrapes were observed but not studied in detail. Linear drainage ditches cross the marshland at intervals, harbouring macroalgae, prawns and small fish; the ditches are regularly flushed by the River.

In addition water-filled linear scrapes exist at the landward base of the shingle bank, particularly adjacent to pools 1 to 2 and to pools 10 to 16. These are shallow, predominantly *Ulva* dominated systems with some dense populations of animals, but largely ephemeral: the scrape at pools 10 to 16 was studied and is described below.

Pools 6, 7, 8 and 9 are those lagoons surveyed previously (A, B, C and D respectively of Bamber, 1989).

Salinities ranged predominantly between 26 and 40‰, although the northernpost pool (lagoon 1a) was at 20‰.

The lagoonal communities included an essentially estuarine sedimentary infauna, with high densities of *Nematostella vectensis* in some pools (present in 16 sites, common to super-abundant in 8 of these), and a diverse assemblage of specialist species associated with submerged macrophytes or algae where these occurred. The densities of *Hydrobia neglecta* were particularly notable, and the scheduled *Gammarus insensibilis* was recorded from 13 sites.

Bray-Curtis similarity analyses divided these lagoons into three principal clusters:

1. lagoons 2, 3, 8 and 18 (Cluster 1), those with a thin veneer of mud over shingle, had a reduced infauna, notably lacking in *Corophium volutator* (and *Nematostella vectensis*).
2. the northern lagoons (lagoons1 and 5 but also 15) with a diverse infauna, with *Nematostella vectensis* represented in low numbers, other lagoonal specialists common, but negligible *Hydrobia neglecta* populations.
3. the southern lagoons (lagoons 10 to 14, 19 to 21) with a diverse infauna, with good *Nematostella vectensis* and *Hydrobia neglecta* populations, and other lagoonal specialists common. These southern lagoons were assessed subjectively as having a more organic substratum.

These lagoons are considered to be of high nature conservation interest and consideration should be given as to how best to reflect this importance. A survey of the surrounding plant communities may be of further value for an integrated conservation appraisal.

As the principal threat to their integrity appears to be the operation of earth-moving machinery to maintain the shingle bank (maintenance of which is essential to the lagoons longer term existence), the principal management requirement is that the EA is aware of this sensitive habitat, and conducts such operations in a manner which avoids impact to the lagoons themselves.

Individual lagoon descriptions follow. The detail of the lagoonal biota is presented in Table 3.

**MAP 4. Reedland Marshes**

**Lagoons 1 to 21**

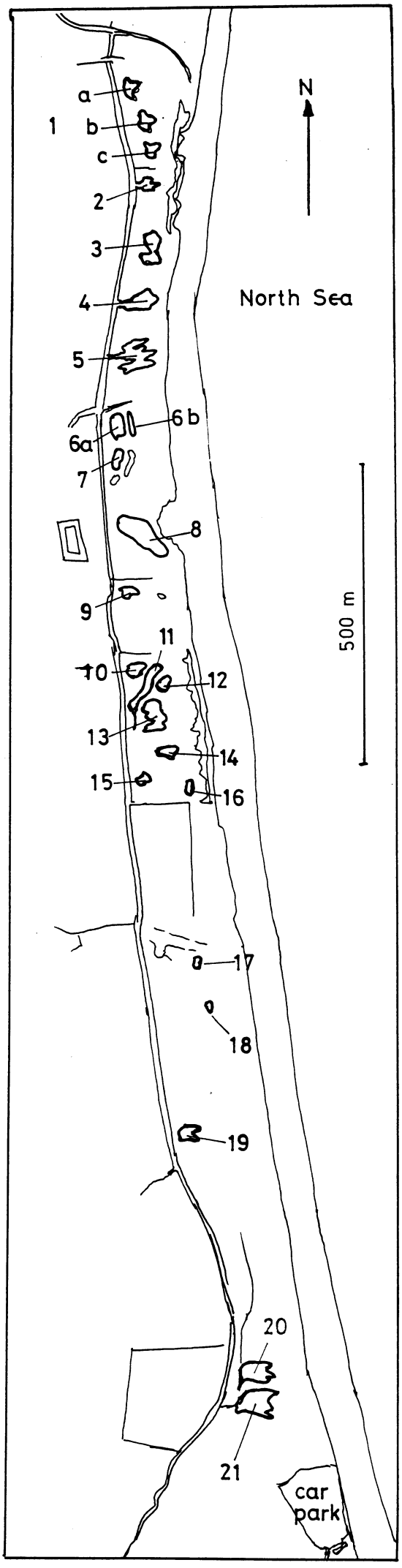


**TABLE 3. The biota of Reedland Marshes lagoons**

| **DUNWICH-REEDLAND** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field Name | P1 | P2 | P3 | Q | R | A | TU | B | B2 | B3 | C | D |
| **Lagoon #** | **1a** | **1b** | **1c** | **2** | **3** | **4** | **5** | **6a** | **6b** | **7** | **8** | **9** |
| Species Salinity | 20 | 26 | 28 | 30 | 36 | 28 | 34 | 30 | 40 | 36-40 | 35 | 26 |
| *Nematostella vectensis* | | 1 | 1 | | | | | 4 | | 3 | | 2 |
| *Sagartia troglodytes* | | | | | | | | | | | | |
| *Lineus "viridis"* | | | | | | | | 1 | | 1 | | |
| *Nemertean indet* | | | | | | | | | | | 1 | |
| *Tubificoides diazi* | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 4 | 1 | 4 | 3 | 4 |
| *Tubificoides benedii* | | | | | | 2 | 1 | 4 | 1 | 3 | 3 | 4 |
| *Cauleriella zetlandica* | | | | | | | | 1 | | 1 | | |
| *Nereis diversicolor* | 5 | 2 | 2 | | | | 2 | | | | | |
| *Polydora ciliata* | | | | 2 | | | | | | | | |
| *Pygospio elegans* | | | | | | | | 4 | | 2 | | |
| *Manayunkia aestuarina* | | | | | | | | 2 | 1 | 2 | | |
| *Arenicola marina* | 1 | 1 | 2 | 4 | 2 | 1 | 3 | 4 | 4 | 3 | 5 | 5 |
| *Capitella capitata* | | | | | | | | | | | | |
| *Abra tenuis* | 1 | 2 | 2 | 3 | 5 | | 3 | 5 | | d | 2 | 4 |
| *Cerastoderma glaucum* | | | | | 2 | | | | | | | |
| *Retusa obtusa* | | | | | | | | | | | | 3 |
| *Hydrobia ventrosa* | 2 | d | | | | | | | | | | |
| *Hydrobia neglecta* | 4 | | | | | 3 | 1 | | | | 4 | 1 |
| *Hydrobia ulvae* | | | | | | | | 1 | | | | |
| *Rissoa membranacea* | 1 | | | | | | | | | | | |
| *Littorina saxatilis* | 3 | | | | | | | | | | | 1 |
| Chironomid indet | 5 | 5 | 5 | 4 | 3 | | | | | 3 | 3 | 4 |
| Sigarid/Corixidae | | | | | | | | | | | | |
| *(Cyprideis torosa)* | | | | | | | | 1 | | | | |
| *Neomysis integer* | | | | | 1 | | | 3 | | 2 | 1 | |
| *Praunus flexuosus* | | | | | | 4 | 1 | | | | | |
| *Idotea chelipes* | 4 | 2 | 2 | | | 2 | 1 | | | 1 | 1 | 1 |
| *Gammarus duebeni* | | | | | | | | | | | | |
| *Gammarus* cf *chevreuxi* | | | | | | | | | | 1 | | |
| *Gammarus insensibilis* | | | | | | 1 | | | | 3 | | |
| *Corophium insidiosum* | | | | | | | | | | 2 | | 2 |
| *Corophium volutator* | 5 | 6 | 5 | | | | 3 | 4 | 1 | 5 | | |
| *Palaemonetes varians* | 4 | | | | 3 | | | 4 | | 3 | | 3 |
| *Amphipholis squamata* | | | | | | | | | | | | |
| *Gasterosteus aculeatus* | | | 1 | | 2 | | 1 | 3 | | 1 | 1 | 1 |
| *Pomatoschistus microps* | 1 | | | 2 | | | | 1 | | | | |
| *Enteromorpha* | | | | 2 | 4 | 4 | | | | | | |
| *Ulva lactuca* | | | | 3 | 4 | 5 | 1 | 1 | 2 | 1 | 4 | |
| *Cladophora* sp. | | | | | 2 | 1 | 3 | 4 | 1 | 5 | 2 | |
| *Chaetomorpha linum* | 1 | 2 | 2 | | | | 1 | | | | | 1 |
| *Ruppia* sp. | 5 | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1 = rare; 2 = occasional; 3 = frequent; 4 = common; 5 = abundant; 6 = superabundant | | | | | | | | | | | | |

**TABLE 3. The biota of Reedland Marshes lagoons**

| **DUNWICH-REEDLAND** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Shore | 8 | 9 | 10 | 11 | 12 |
| **Lagoon #** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | | **17** | **18** | **19** | **20** | **21** |
| Species Salinity | 38 | 36 | 36 | 36 | 37 | 40 | 33 | 36-38 | 30 | 30 | 30 | 30 | 30 |
| *Nematostella vectensis* | 6 | 2 | 6 | 5 | 2 | 1 | 3 | 4 | | | 5 | 5 | 5 |
| *Sagartia troglodytes* | | | | | | | 1 | | | | 1 | | 1 |
| *Lineus "viridis"* | | | | 1 | 1 | | | 2 | | | | | |
| *Nemertean indet* | | | | | | | | | | | | | |
| *Tubificoides pseudogaster* | 1 | 4 | 5 | 2 | 2 | 4 | 2 | | 2 | 2 | 1 | 2 | 3 |
| *Tubificoides benedii* | | | | | | | | | | | | | 1 |
| *Cauleriella zetlandica* | | | | | | | | | | | | | |
| *Nereis diversicolor* | | | | | | 2 | | | 2 | | | | 1 |
| *Polydora ciliata* | | | | | | 1 | | 2 | | 1 | | | |
| *Pygospio elegans* | | | | | | | | | | | | | |
| *Manayunkia aestuarina* | | | | | | | | | | | | | |
| *Arenicola marina* | 4 | 4 | 2 | 4 | 4 | | | 3 | | 3 | | | |
| *Capitella capitata* | 2 | 5 | 3 | 5 | 1 | 2 | 1 | | | | | | 1 |
| *Abra tenuis* | 6 | 2 | 3 | 4 | 4 | 1 | | | | | | | |
| *Cerastoderma glaucum* | | | | | 1 | | 4 | | | | | | |
| *Retusa obtusa* | 2 | 2 | 3 | 3 | | | | 4 | | | | | |
| *Hydrobia ventrosa* | | | | | | | | | | | | | |
| *Hydrobia neglecta* | 3 | 3 | 4 | 4 | 2 | | | 6 | 5 | 4 | 3 | 3 | 4 |
| *Hydrobia ulvae* | | | | | | | | | | | | | |
| *Rissoa membranacea* | | | | | | | | | | | | | |
| *Littorina saxatilis* | | | | 2 | | | | | | | | | |
| Chironomid indet | 5 | 3 | 3 | 2 | 4 | 4 | 2 | | 1 | 3 | 3 | 3 | 4 |
| Sigarid/Corixidae | | | | | | | | | | 2 | | 1 | |
| *(Cyprideis torosa)* | 2 | | | | 1 | | | | 2 | | | | |
| *Neomysis integer* | | 1 | | 1 | | | | | | 1 | | | |
| *Praunus flexuosus* | | | | | | | | | | | | | |
| *Idotea chelipes* | 3 | 2 | 3 | 4 | | | 5 | 4 | | | 4 | 4 | 4 |
| *Gammarus duebeni* | | | | | | | 1 | | | | 1 | | |
| *Gammarus* cf *chevreuxi* | | | | | | | | | | | | | |
| *Gammarus insensibilis* | 2 | 3 | 3 | 3 | 2 | 3 | 4 | 2 | | | 4 | 3 | 2 |
| *Corophium insidiosum* | | | | | | | | | | | | 2 | |
| *Corophium volutator* | 5 | 3 | 2 | 3 | 4 | 4 | | 4 | | | 4 | 3 | 3 |
| *Palaemonetes varians* | | 3 | | 3 | 4 | 3 | | | | | | | |
| *Amphipholis squamata* | | | | | | | | 1 | | | | | |
| *Gasterosteus aculeatus* | | | | 4 | | | | 4 | | | 3 | 3 | 3 |
| *Pomatoschistus microps* | | | | | | | | | | | | | |
| *Enteromorpha* | 4 | 4 | 1 | 2 | | 1 | 1 | 4 | 2 | 1 | 3 | 3 | 2 |
| *Ulva lactuca* | | 2 | 3 | 3 | 1 | 2 | | 4 | 2 | 2 | | 1 | 1 |
| *Cladophora* sp. | | | | | | | | | | | | | |
| *Chaetomorpha linum* | 2 | 2 | 4 | 4 | 2 | 2 | | 1 | 1 | 3 | 3 | | |
| *Ruppia* sp. | | | | | | | 4 | | | | 4 | 2 | 2 |
| | | | | | | | | | | | | | |
| 1 = rare; 2 = occasional; 3 = frequent; 4 = common; 5 = abundant; 6 = superabundant | | | | | | | | | | | | | |

## SITE DESCRIPTIONS

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 1a, b and c |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4880 7300 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | 0.2 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 20 to 28‰ |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

### Lagoon Description

A group of three similar lagoons, each of <0.1 ha, with a soft mud substratum. The northernmost (1a) supported a dense stand of *Ruppia*, associated with which were four gastropod species (the only Reedland site at which *Hydrobia ventrosa* and *Rissoa membranacea* were recorded) and a denser population of predominantly juvenile *Idotea chelipes* (biotope ENLag,Veg of Bamber, 1997). Otherwise their fauna was similar, with dense *Corophium volutator* together with annelids and *Abra tenuis*, typical of the biotope ENLag.IMS.Ann.Soft but without the lagoon cockle. The starlet anemone, *Nematostella vectensis* was rare in pools b and c. The only alga present was *Chaetomorpha*.
None of these pools was connected to the River (which was at 30‰ at this point), and their salinities were surprisingly distinct, at 20‰ in 1a, 26‰ in 1b and 28‰ in 1c.

### Species present

| | 1a | 1b | 1c |
|---|---|---|---|
| *Corophium volutator* | 5 | 6 | 5 |
| Chironomidae indet | 5 | 5 | 5 |
| *Nereis diversicolor* | 5 | 2 | 2 |
| *Idotea chelipes* | 4 | 2 | 2 |
| *Abra tenuis* | 1 | 2 | 2 |
| *Tubificoides pseudogaster* | 2 | 1 | 2 |
| *Arenicola marina* | 1 | 1 | 2 |
| *Nematostella vectensis* | | 1 | 1 |
| *Palaemonetes varians* | 4 | | |
| *Hydrobia neglecta* | 4 | | |
| *Littorina saxatilis* | 3 | | |
| *Hydrobia ventrosa* | 2 | | |
| *Rissoa membranacea* | 1 | | |
| *Pomatoschistus microps* | 1 | | |
| *Gasterosteus aculeatus* | | | 1 |
| *Chaetomorpha linum* | 1 | 2 | 2 |
| *Ruppia* sp. | 5 | | |

1 = rare; 2 = occasional; 3 = frequent; 4 = common; 5 = abundant; 6 = superabundant

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 2 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4871 7286 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 30 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

A small pool south of the Pool 1 system, connected by a narrow outlet to the Dunwich River, with a thin layer of mud overlying shingle substratum. Both *Enteromorpha* and *Ulva* were present, together with a relatively estuarine infauna, including *Arenicola* exploiting the mud interstitial within the shingle (biotope ENLag.IMS.Ann.Soft without the lagoon cockle or *Corophium*). No lagoonal specialist species were present.

**Species present**
Chironomidae indet.
*Arenicola marina*
*Abra tenuis*
*Tubificoides pseudogaster*
*Polydora ciliata*
*Pomatoschistus microps*
*Ulva lactuca*
*Enteromorpha* sp.

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 3 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4863 7280 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | 0.1 ha |
| **MAX DEPTH (m):** | 0.25 |
| **SALINITY (‰):** | 36 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

Lagoon 3 is an open, shallow double system, similar to lagoon 2 in its northern half, with thin mud over shingle, but with thicker mud in its southern half; the community was similar to that of lagoon 2, but with a denser *Abra* population and including occasional lagoon cockle (biotope ENLag.IMS.Ann.Soft without *Corophium*). The numerous *Abra tenuis* present included a substantial proportion of spat. Macroalgae were commoner, and stands of benthic *Cladophora* also present.
The lagoon was isolated from the River, and slightly hyperhaline.

**Species present**
*Abra tenuis*
Chironomidae indet
*Palaemonetes varians*
*Arenicola marina*
*Cerastoderma glaucum*
*Gasterosteus aculeatus*
*Tubificoides pseudogaster*
*Neomysis integer*
*Enteromorpha*
*Ulva lactuca*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 4 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4863 7280 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | 0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 28 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

This lagoon, connecting to the Dunwich River by a narrow outlet, had a mud substratum overlying shingle, with a dense stand of *Ulva* and *Enteromorpha*, decomposing in many areas and overlying anoxic mud; *Beggiatoa* was frequent. The sediment infauna was sparse (patchy) and comprised oligochaetes and rare lugworm.
Within the fresher algae were lagoonal specialist species including *Idotea chelipes*, *Hydrobia neglecta* and the scheduled amphipod *Gammarus insensibilis* (biotope ENLag.Veg). Salinity was uniform at 28‰.

**Species present**
*Praunus flexuosus*
*Hydrobia neglecta*
*Idotea chelipes*
*Tubificoides pseudogaster*
*Tubificoides benedii*
*Arenicola marina*
*Gammarus insensibilis*
*Ulva lactuca*
*Enteromorpha*
*Cladophora*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 5 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4855 7271 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.15 |
| **SALINITY (‰):** | 34 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

To the south of lagoon 4 is an area with extensive evidence of bulldozer excavation, leaving an area of amorphous interconnected shingle scrapes connecting via a narrow outlet with the Dunwich River. This appears to be a relic of a more discrete lagoon, with a community similar to that observed in the shingle-bank-side scrape adjacent to lagoon 1. Salinity was consistent at 34‰.
The predominant alga was *Cladophora*, although both *Ulva* and sparse *Chaetomorpha* were present, with juvenile *Idotea chelipes* associated (only) with the latter. The fauna was similar to those of lagoons 3 and 4, predominantly infaunal with *Corophium volutator* (biotope ENLag.IMS.Ann).

**Species present**
*Arenicola marina*
*Abra tenuis*
*Corophium volutator*
*Tubificoides pseudogaster*
*Nereis diversicolor*
*Tubificoides benedii*
*Hydrobia neglecta*
*Praunus flexuosus*
*Idotea chelipes*
*Gasterosteus aculeatus*
*Cladophora*
*Ulva lactuca*
*Chaetomorpha*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 6 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4848 7260 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 30-40 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

A pair of lagoons, the westernmost (6a) being lagoon A of Bamber (1989), with a soft mud substratum with *Cladophora* and a community including dense populations of both *Abra tenuis* and *Nematostella vectensis*. The annelid-dominated infauna was both dense and diverse. A single *Hydrobia ulvae* was recorded here (and nowhere else along the Reedham marsh). Salinity was 30‰ (35‰ in January and August 1989). A similarly diverse infauna was recorded in 1989, but without *Nematostella*. To seaward was a separate narrow pond (6b) at 40‰, with denser *Ulva* but a reduced fauna, dominated by lugworm.

| **Species present** | 6a | | 6b |
|---|---|---|---|
| | 1998 | 1989 | 1998 |
| *Abra tenuis* | 5 | 5 | |
| *Arenicola marina* | 4 | 1 | 4 |
| *Pygospio elegans* | 4 | 1 | |
| *Nematostella vectensis* | 4 | | |
| *Tubificoides pseudogaster* | 4 | 2 | 1 |
| *Tubificoides benedii* | 4 | 2 | 1 |
| *Corophium volutator* | 4 | 4 | 1 |
| *Palaemonetes varians* | 4 | 4 | |
| *Neomysis integer* | 3 | 4 | |
| *Gasterosteus aculeatus* | 3 | | |
| *Manayunkia aestuarina* | 4 | 2 | 1 |
| *Lineus viridis* | 1 | 2 | |
| *Cauleriella zetlandica* | 1 | | |
| *Hydrobia ulvae* | 1 | | |
| *(Cyprideis torosa)* | 1 | | |
| *Pomatoschistus microps* | 1 | 4 | |
| *Cladophora* | | | |
| *Ulva lactuca* | | | |

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 7 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4848 7255 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 Ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 36 to 40 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

This pond, lagoon B of Bamber (1989) lies just south of lagoon 6 and is similar to it. The main body was at 40‰ (31‰ in January 1989), while a smaller offshoot connected by a ditch was at 36‰.
The soft mud substratum was dominated by stands of *Cladophora*, with which a number of lagoonal specialist arthropods were associated, including the scheduled *Gammarus insensibilis*. The single *G.* cf *chevreuxi* specimen cannot be confirmed, but this (lagoonal) species has only previously been recorded from the south-west. The sedimentary fauna was similar to that of lagoon 6, with the notable exception that *Abra tenuis* was only present as dead shells (common in 1989); otherwise the fauna was notably denser and more diverse than that found during the 1989 survey.

**Species present**

| | 1998 | 1989 |
|---|---|---|
| *Corophium volutator* | 5 | 2 |
| *Tubificoides pseudogaster* | 4 | 4 |
| *Nematostella vectensis* | 3 | |
| *Tubificoides benedii* | 3 | |
| Chironomidae indet | 3 | 5 |
| *Gammarus insensibilis* | 3 | |
| *Arenicola marina* | 3 | 1 |
| *Palaemonetes varians* | 3 | |
| *Pygospio elegans* | 2 | 1 |
| *Corophium insidiosum* | 2 | |
| *Neomysis integer* | 2 | 4 |
| *Manayunkia aestuarina* | 2 | |
| *Gasterosteus aculeatus* | 1 | |
| *Idotea chelipes* | 1 | |
| *Gammarus* cf *chevreuxi* | 1 | |
| *Lineus viridis* | 1 | 2 |
| *Cauleriella zetlandica* | 1 | |
| *Abra tenuis* | | 4 |
| *Cladophora* | | |
| *Ulva lactuca* | | |

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 8 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4846 7242 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | 0.25 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 35 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

Lagoon 8, lagoon C of Bamber (1989) was the largest in this sequence, despite encroachment of shingle from the seaward bank. The substratum was a thin veneer of mud over shingle, with *Ulva* common, including decomposing beds with *Beggiatoa*. Salinity was a uniform 35‰ (34‰ in January 1989, 36‰ in August 1989). The community was generally similar to that of lagoons 2 to 4, with an *Arenicola* and oligochaete dominated infauna; *Hydrobia neglecta* was present on the *Ulva*.

**Species present**

| | 1998 | 1989 |
|---|---|---|
| *Arenicola marina* | 5 | |
| *Hydrobia neglecta* | 4 | 1* |
| Chironomidae indet | 3 | |
| *Tubificoides pseudogaster* | 3 | 1 |
| *Tubificoides benedii* | 3 | 1 |
| *Abra tenuis* | 2 | 4 |
| *Idotea chelipes* | 1 | |
| *Neomysis integer* | 1 | |
| Nemertean indet | 1 | 3 |
| *Gasterosteus aculeatus* | 1 | |
| *Cladophora* | | |
| *Chaetomorpha* | | |

**Hydrobia ventrosa*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 9 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4838 7237 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 26 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 25 September 1998 |

**Lagoon Description**

Lagoon 9, lagoon D of Bamber (1989), was a triangular depression with a soft mud substratum, isolated from adjacent ditches, with a uniform salinity of 26‰ (34 to 38‰ in 1989). The benthic infauna comprised the lugworm-*Abra*-chironomid-oligochaete community typical of this sequence, with occasional *Nematostella vectensis*, while the rare clumps of *Chaetomorpha* had an associated lagoonal specialist *Idotea-Corophium insidiosum-Hydrobia neglecta-Littorina saxatilis* community (biotope ENLag.Veg). This was significantly more diverse than the fauna recorded in 1989, of only dense *Hydrobia* with rare chironomids and *Capitella*; *Ulva* was recorded as dense at that time (absent in 1998).

**Species present**

*Arenicola marina*
Chironomidae indet.
*Tubificoides pseudogaster*
*Tubificoides benedii*
*Abra tenuis*
*Retusa obtusa*
*Palaemonetes varians*
*Corophium insidiosum*
*Nematostella vectensis*
*Hydrobia neglecta*
*Littorina saxatilis*
*Idotea chelipes*
*Gasterosteus aculeatus*
*Chaetomorpha linum*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoons 10 to 14 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4830 7212-7226 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | Each <0.1 ha |
| **MAX DEPTH (m):** | 0.1 to 0.25 |
| **SALINITY (‰):** | 36 to 38 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

A group of 5 intimately associated pools and two outliers (lagoons 15 and 16) occurs between two east-west drainage ditches, with an adjacent flooded scrape area along the landward foot of the shingle sea-wall.
The five pools contain a soft organic mud substratum supporting a similar community of lugworm-oligochaetes-chironomids-*Capitella-Corophium volutator* (biotope ENLag.IMS.Ann.Soft, but with lagoonal cockle only in lagoon 14). *Nematostella vectensis* was particularly common in these lagoons, as well as in the very shallow runnels between them. *Chaetomorpha*, *Ulva* and *Enteromorpha* were all present, with an associated ENLag.Veg biotope community of *Hydrobia neglecta-Idotea chelipes-Gammarus insensibilis*. From their community, these lagoons are of particular conservation merit.

**Species present***
*Nematostella vectensis*
*Arenicola marina*
*Capitella capitata* agg
*Abra tenuis*
Chironomidae indet
*Tubificoides pseudogaster*
*Corophium volutator*
*Hydrobia neglecta*
*Gammarus insensibilis*
*Retusa obtusa*
*Idotea chelipes*
*Palaemonetes varians*
*Cyprideis torosa*
*Neomysis integer*
*Lineus viridis*
*Gasterosteus aculeatus*
*Cerastoderma glaucum*
*Littorina saxatilis*

*See Table 3 for frequencies in each lagoon.

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 15 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4825 7210 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 40 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

A higher salinity isolated lagoon with thick mud overlying shingle; the adjacent river salinity was 9‰. The infauna was sparse and annelid-chironomid and *Corophium volutator* dominated, while occasional clumps of *Chaetomorpha* supported *Gammarus insensibilis*. *Nematostella vectensis* was rare in shallow mud to the western edge.

**Species present**

Chironomidae indet
*Tubificoides pseudogaster*
*Corophium volutator*
*Palaemonetes varians*
*Gammarus insensibilis*
*Nereis diversicolor*
*Capitella capitata*
*Polydora ciliata*
*Nematostella vectensis*
*Abra tenuis*
*Chaetomorpha*
*Ulva lactuca*
*Enteromorpha*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 16 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4830 7205 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.3 |
| **SALINITY (‰):** | 33 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

An isolated, deeper linear pool to the south of lagoon 14, the only one of this group to support *Ruppia*, other plants being rare. *Idotea chelipes* and *Gammarus insensibilis* were common amongst the *Ruppia*, while this was the only lagoon on the marsh to support a reasonable population of *Cerastoderma glaucum*. The benthic fauna was sparse, although *Nematostella vectensis* was frequent along the northern edge.

**Species present**
*Idotea chelipes*
*Gammarus insensibilis*
*Cerastoderma glaucum*
*Nematostella vectensis*
*Tubificoides pseudogaster*
Chironomidae indet.
*Gammarus duebeni*
*Capitella capitata*
*Sagartia troglodytes*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Shingle Bank Lagoon |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4836 7215 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | 0.25 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 36 to 38 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

The flooded scrape at the foot of the shingle bank had a shingle substratum with patchy mud, flooding a "*Salicornetum*". The area had patches of dense *Enteromorpha*, often decomposing, which supported a dense population of *Hydrobia neglecta*; elsewhere was a mosaic of ENLag.IMS.Ann and the "Soft" variant with lugworm and *Polydora ciliata*, but no *Abra*; *Nematostella vectensis* was common on open mud patches.

**Species present**

*Hydrobia neglecta*
*Retusa obtusa*
*Nematostella vectensis*
*Idotea chelipes*
*Corophium volutator*
*Gasterosteus aculeatus*
*Arenicola marina*
*Polydora ciliata*
*Lineus viridis*
*Gammarus insensibilis*
*Amphipholis squamata*
*Enteromorpha*
*Ulva lactuca*
*Chaetomorpha*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoons 17 and 18 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4815 7170, TM4812 7160 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | Each <0.1 ha |
| **MAX DEPTH (m):** | 0.1 |
| **SALINITY (‰):** | 30 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

Two small lagoons lie some 150 (lagoon 17) and 200 m (lagoon 18) south of lagoon 16. Both had a salinity of 30‰, and a substratum of mud overlying shingle, with a sparse infauna, dominated by lugworm in lagoon 18 but not 17. Three algal species were present, exploited by *Hydrobia neglecta*.

**Species present**

| Lagoon | 17 | 18 |
|---|---|---|
| *Hydrobia neglecta* | 5 | 4 |
| *Tubificoides pseudogaster* | 2 | 2 |
| Chironomidae indet. | 1 | 3 |
| *Nereis diversicolor* | 2 | |
| *Arenicola marina* | | 3 |
| *Sigara* sp. juveniles | | 2 |
| *Cyprideis torosa* | 2 | |
| *Polydora ciliata* | | 1 |
| *Neomysis integer* | | 1 |
| *Enteromorpha* | 2 | 1 |
| *Ulva lactuca* | 2 | 2 |
| *Chaetomorpha linum* | 1 | 3 |

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoon 19 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4800 7140 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | <0.1 ha |
| **MAX DEPTH (m):** | 0.2 |
| **SALINITY (‰):** | 30 |
| **ADJACENT HABITATS:** | *Salicornia* saltmarsh and *Phragmites* reedmarsh; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

Lagoon 19 lies some 500 m north of Dunwich, connected via a narrow outlet with the Dunwich River which was at 25‰ at this point. The substratum was of soft mud overlying shingle.
While decaying *Enteromorpha* was resulting in patches of *Beggiatoa*, the lagoon supported a good stand of *Ruppia* with associated ENLag.Veg biotope specialists; the infauna was of low diversity, dominated by chironomids and *Corophium volutator*, with *Nematostella vectensis* common throughout.

**Species present**
*Nematostella vectensis*
*Idotea chelipes*
*Gammarus insensibilis*
*Corophium volutator*
*Hydrobia neglecta*
Chironomid indet
*Gasterosteus aculeatus*
*Sagartia troglodytes*
*Tubificoides pseudogaster*
*Gammarus duebeni*
*Ruppia*
*Enteromorpha*
*Chaetomorpha*

| | |
|---|---|
| **SITE NAME:** | Reedland Marshes Lagoons 20 and 21 |
| **LOCATION:** | Dunwich, Suffolk |
| **GRID REFERENCE:** | TM4790 7092-7100 |
| **TYPE/CLASSIFICATION:** | Percolation |
| **DESIGNATION:** | SSSI, NNR, cSAC, Ramsar, SPA |
| **AREA:** | Each 0.2 ha |
| **MAX DEPTH (m):** | 0.15 to 0.25 |
| **SALINITY (‰):** | 30 |
| **ADJACENT HABITATS:** | *Salicornia-Spartina* saltmarsh on shingle; Dunwich River |
| **SURVEY DATE:** | 23 September 1998 |

**Lagoon Description**

The southernmost pair of lagoons on Reedland Marsh lie some 200 m north of Dunwich, a pair of similar, rectangular lagoons connected by narrow outlets to the Dunwich River, both at 30‰ (adjacent river 24‰, at some 3 hrs after high tide). The substratum was of often deep soft mud, with a low diversity infauna but *Nematostella vectensis* abundant; *Enteromorpha* was commoner than *Ulva*, and there were patchy stands of *Ruppia* throughout, with an associated ENLag.Veg biotope community.

**Species present**
*Nematostella vectensis*
*Idotea chelipes*
*Hydrobia neglecta*
Chironomidae indet.
*Corophium volutator*
*Gasterosteus aculeatus*
*Gammarus insensibilis*
*Tubificoides pseudogaster*
*Corophium insidiosum*
*Sagartia troglodytes*
Corixidae indet.
*Capitella capitata*
*Nereis diversicolor*
*Tubificoides benedii*
*Enteromorpha*
*Ruppia*
*Ulva lactuca*

# BUSS CREEK

## BUSS CREEK

An area of the *Phragmites*-filled Bus Creek, on the north side of Southwold (Map 5), has been cleared of reeds as part of the development of a "Wildlife Site". The site was assessed in October 1998 for its potential merits as a saline lagoon.

| | |
|---|---|
| **SITE NAME:** | Buss Creek |
| **LOCATION:** | Southwold, Suffolk |
| **GRID REFERENCE:** | TM509769 |
| **TYPE/CLASSIFICATION:** | *Not a lagoon* |
| **DESIGNATION:** | Buss Creek County Wildlife Site |
| **AREA:** | *ca* 0.2 ha of open water |
| **MAX DEPTH (m):** | 1.0 |
| **SALINITY (‰):** | 2 |
| **ADJACENT HABITATS:** | Grazed grassland; *Phragmites* reedswamp. |
| **SURVEY DATE:** | 22nd and 23rd September 1998 |

### Lagoon Description

Buss Creek is a tributary of the Blyth River, rising near the coast north of the pier at Southwold whence it flows landwards, north of Southwold, before turning south to meet the Blyth River west of the Harbour. Its connection to the river is inhibited by a sluice gate, and thus the Creek is only tidal at its downstream-most 50 m or so. The rest of the creek is a *Phragmites*-filled ditch.

An area at its upper end was cleared of reeds in 1997 with the intention of enhancing its environmental quality. The resulting 0.25 ha ditch of open water, overlying reed debris on mud in some 1 m of freshwater, is not a saline lagoon. What slight salinity was measured presumably derives from groundwater, as no saline input occurs either from the shore or upstream from the Blyth River. The only fauna detected was a stickleback, freshwater insect larvae and oligochaetes.

The adjacent boating pond has slightly more merit as a lagoon (see below) but itself was of no conservation merit.

| | |
|---|---|
| **SITE NAME:** | Buss Creek Boating Pond |
| **LOCATION:** | Southwold, Suffolk |
| **GRID REFERENCE:** | TM510768 |
| **TYPE/CLASSIFICATION:** | Isolated pond |
| **DESIGNATION:** | ? |
| **AREA:** | 2.25 ha |
| **MAX DEPTH (m):** | >1.0 |
| **SALINITY (‰):** | 8 |
| **ADJACENT HABITATS:** | Marsh grazing; *Phragmites* reedswamp; residential. |
| **SURVEY DATE:** | 23rd September 1998 |

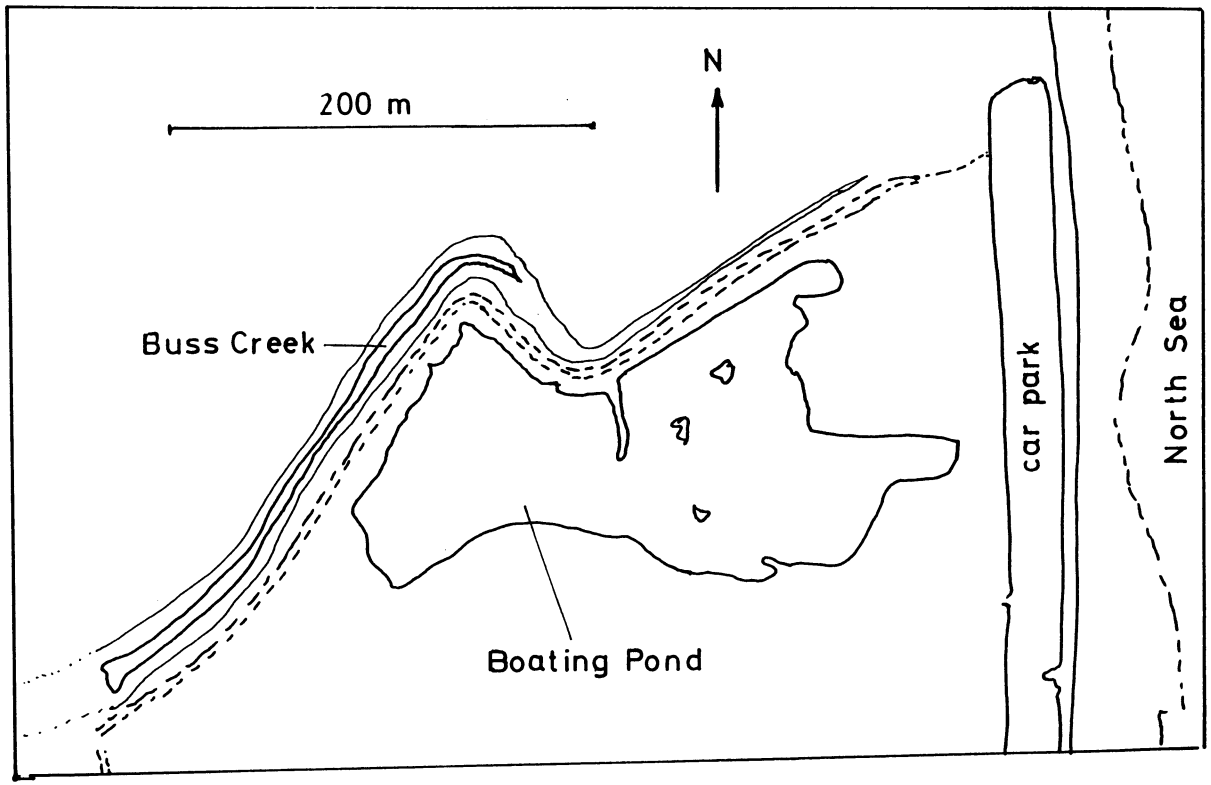
**Lagoon Description**

The recreational boating pond lies south of the "headwaters" of Buss Creek, Southwold, and was only studied for context of Buss Creek itself. There is no evident input of saline water from the sea, but salinity was uniformly at 8‰, suggesting some percolation through the sea-wall.

The pool supported a sparse community typical of low salinity brackish pools, and of no conservation merit. Ducks were present, and it is likely to be used by a variety of birdlife.

**Species present**

*Gasterosteus aculeatus*
*Palaemonetes varians*
Oligochaete indet.
Chironomidae
Dipteran larvae/pupae
*Neomysis integer*
*Pomatoschistus microps*
*Ruppia* sp.




**MAP 5. Buss Creek and boating pond, Southwold**

# CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSIONS AND RECOMMENDATIONS

1. The "disturbed shingle lagoons" on King's Marsh, Orfordness, lagoons form an extensive suite of 18 pools, protected from anthropogenic impacts, and supporting a more diverse community than that previously recorded for King's Marsh lagoons 1 to 10, including good populations of the scheduled starlet sea anemone, *Nematostella vectensis*, and with four animal (*Cerastoderma glaucum, Hydrobia ventrosa, H. neglecta, Idotea chelipes*) and two plant (*Ruppia* sp., *Chaetomorpha linum*) lagoonal specialist species. These lagoons are considered to be of high nature conservation interest.

Further monitoring of these sites is recommended in order to understand more fully their salinity regimes and the stability of their community.

2. The main lagoon at Benacre Broad has reduced in area by some 40% since 1996, and has lost areas previously recorded as harbouring scheduled species. At the same time, owing to the exigencies of coastal erosion, the exit pipe system has become defunct, and this reduction in water exchange is likely to have lead to the lower salinity regime, to the detriment of lagoonal specialist species. If considered worthwhile, management geared to reversing the decline in the main lagoon habitat should be concerned with maintaining as large a submerged area as possible, and enhancing the water exchange through the shingle bank. However, with the present rate of erosion and mobility of the bank this lagoon may not be sustainable.

The new lagoons inland at Benacre are all small and of lower salinity. As might be expected from their short history, the sedimentary infauna is sparse, although the apparently more mature lagoon 5 did harbour *Ruppia* and associated specialists. At this stage it appears likely that these lagoons are of such a small size and generally low salinity that the community which they develop would be insect dominated.

Some of these pools should be isolated from terrestrial freshwater input, but connected with the percolation supply from seaward, to maintain a higher salinity regime (above 20‰). In addition, it would be beneficial to enlarge these to maximise the permanently flooded area.

3. Twenty-one lagoons (or systems) were surveyed on Reedland Marsh in October 1998. Their communities included an essentially estuarine sedimentary infauna, with high densities of *Nematostella vectensis* in some pools (16 sites, common to super-abundant in 8 of these), and a diverse assemblage of specialist species associated with submerged macrophytes or algae where these occurred. The densities of *Hydrobia neglecta* were particularly notable, and the scheduled *Gammarus insensibilis* was recorded from 13 sites. These lagoons are considered to be of high nature conservation interest. A survey of the surrounding plant communities may be of further value for an integrated conservation appraisal.

As the principal threat to their integrity appears to be the operation of earth-moving machinery to maintain the shingle bank (maintenance of which is essential to the lagoons longer term existence), the principal management requirement is that the EA is aware of this sensitive habitat, and conducts such operations in a manner which avoids impact to the lagoons themselves.

4. An area of the *Phragmites*-filled Bus Creek, on the north side of Southwold, has been cleared of reeds as part of the development of a "Wildlife Site". The resulting 0.25 ha of open water, overlying refractory reed debris on mud in some 1 m of freshwater, is not a saline lagoon. The adjacent boating pond has slightly more merit

as a lagoon, supporting a sparse community typical of low salinity brackish pools, and of no conservation merit.

The Suffolk coast incorporates some of the most important saline lagoon systems in Great Britain, including extensive examples of shingle percolation lagoons. These sites house a number of scheduled species, notably including the starlet sea anemone, *Nematostella vectensis*, and the "lagoonal sand shrimp", *Gammarus insensibilis*. Other notable species are the rare lagoonal mysid *Paramysis nouveli*, and good populations of the less common lagoonal hydrobiid, *Hydrobia neglecta*. Three of these species were recorded in the present survey.

The present results indicate that the specialist lagoonal interest of Suffolk is greater than previously indicated, although some sites have declined.

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# APPENDIX 1

# APPENDIX 1. APPLICATION OF THE SEMI-QUANTITATIVE "SACFOR" SCALE TO SALINE LAGOONS

**Application Of The Semi-Quantitative "SACFOR" Scale To Saline Lagoons**

The ranking of species along the scale of Superabundant, Abundant, Common, Frequent, Ocasional or Rare relates to the frequency and abundance of occurrence of species within their biotope and the frequency of that biotope.

The lagoons have essentially two biotopes:

- ENLag.Veg: the community associated with submerged macrophytes and algae. Species associated with this biotope, such as *Idotea chelipes, Corophium insidiosum* and *Hydrobia neglecta*, are not likely to be more common than the biotope, but may be less common. Samples taken within this biotope involve hand-net sweepings, so are impractical to quantify in terms of area (it being a 3-dimensional habitat) or volume.
- ENLag. IMS.Ann: the community associated with the sedimentary substratum of the lagoon, including the polychaetes and oligochaetes, *Nematostella vectensis* and *Corophium insidiosum*.

In addition the mysids, prawns and fish are associated with the water body, although some of these appear to be secondarily associated with the ENLag.Veg biotope.

The score of each species is thus derived as a factor of the number of samples of the relevant biotope in which the species occurs, and the density/dominance of that species within those samples. Owing to differences in size and ambit of the species, numerical frequencies warrant different scores for different species. Bryozoans and hydrozoans are treated by occurrence of colonies.

The whole is qualified from extensive experience of the potential abundance of such species within lagoonal habitats.

Thus, generally:

species found only once or twice in the lagoon rank as **rare**;

species found rarely but in a number of samples rank as **occasional**;

species found in relatively low numbers but in most samples, or reasonable numbers in a few samples, rank as **frequent**;

species occurring in reasonable numbers in every sample of their biotope would rank as **common**;

species occurring in large numbers in every sample are **abundant**;

species occurring in very large numbers in every sample of an at least common biotope are **superabundant**.

As an indicator of the interspecific variation in the context of these terms, "large numbers" for *Nematostella vectensis* would be >1000 $m^{-2}$, for *Nereis diversicolor* >100 $m^{-2}$,for *Sphaeroma rugicauda* >25 $m^{-2}$, for *Arenicola marina* >10 $m^{-2}$.

For example:

*Ruppia* would be rare as a single plant or clump of a few plants, occasional as a few sporadic plants or clumps, frequent as plants occurring in more than 25% of the available habitat, common as plants occurring in more than 50% of the available habitat, and abundant when occurring in more than 75% of the available habitat.

*Nematostella* would rank as rare as less than 5 individuals found, occasional as rare occurrence in a number of samples, frequent when occurring as tens of individuals per sample for most samples, common when occurring as hundreds per $m^2$ or as tens in all samples, abundant as >1000 per $m^2$, and superabundant when occurring in thousands per square metre and across all the available biotope.

*Idotea* would rank as abundant when occurring in tens in every sample of an at least common biotope (e.g. *Ruppia*), rare when occurring in as less than 5 individuals either at all or owing to a rare occurrence of the biotope.

Gobies would rank as rare if only 1 or 2 recorded, common if occurring in every sample, abundant if numerous in every sample. Mysids would rank as common if a number of shoals were observed, abundant if numerous in every net-sweeping of the open water.