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# TRANSACTIONS OF THE NORFOLK & NORWICH NATURALISTS' SOCIETY

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# TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY

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## WILDLIFE 2000

During its 125th anniversary celebrations, the Norfolk and Norwich Naturalists' Society announced its intention to document the wildlife of Norfolk for the start of the new millennium in a project called **Wildlife 2000**. In practical terms the project was launched in May 1995 when representatives of the Society, English Nature, Norfolk Wildlife Trust and the Castle Museum met and agreed to share this common vision.

Sir Thomas Browne has given us a fascinating glimpse of seventeenth century wildlife in the County of Norfolk. He writes of bustards, storks, ravens and kites; salmon and otters; and the mole cricket which he describes as common in "*fenny places.... and dunghills and churchyards in this citty*."

Nineteenth century records of the mole cricket from Castle Acre and Stoke Holy Cross suggest a lingering presence for this species in river flood plains across the county, but we are left tantalisingly ignorant of its historic distribution. How widespread was it, how abundant where it did exist, and until how recently did it survive?

**Wildlife 2000** is a project designed to ensure that twenty first century naturalists will have the answers to the equivalent questions they might ask about our flora and fauna, as they approach the end of their own century.

**Wildlife 2000** seeks to create a "time capsule" which will preserve our knowledge of the countryside, and what could be found in it at the start of the third millenium. The project is not just concerned with nature reserves and rare species, but seeks to give an accurate account of the wider countryside and the commoner species which abound within it.

Just as the mole cricket was common in Thomas Browne's day but is now lost, so any other creature or plant which we take for granted could become rare or extinct over the next century. By documenting the wildlife heritage which we pass into the care of the twenty first century, those who come after us may be in a better position to preserve and protect that legacy.

## WILDLIFE 2000 Publications

*Trans. Norfolk Norwich Nat. Soc.* 1997; **31**(1)

- MOORE, L. Chalk grassland in Norfolk. 1-30  
HAMOND, R. The Cirripedia, Branchiura & Cladocera of Norfolk 52-62  
WITHERS, P. The free-living bark-lice (Insecta; Psocoptera) of Norfolk 87-94

*Trans. Norfolk Norwich Nat. Soc.* 1998 **31**(3)

- HOWLET, D. & BAKER, R. The freshwater bivalve Mollusca of Norfolk. 306-335  
CLARKE, K. Norfolk Diatoms: Centric Diatoms. 344-380

*Trans. Norfolk Norwich Nat. Soc.* 1999 **32** (1)

- WHEELER, B.D. The fens of Norfolk: an ecological and historical perspective.  
1. The valleyhead fens. 3-26  
JACKSON, M. The aquatic macroinvertebrate fauna of the littoral zone  
of the Norfolk Broads 1977-1995. 27-56  
HARRIS, J. Vegetation and land-use survey of the ronds of the Broads rivers. 76-94  
CLARKE, K. Studies on the ronds of the River Waveney 95-104

*Trans. Norfolk Norwich Nat. Soc.* 2000 **33** (1)

- BANHAM, P. Seaweeds in Wells-next-the Sea. 25-27  
DURRANT, K.C. Norfolk Sawflies and Horntails.  
BAKER, R. & HOWLETT, D. Fresh and Brackish Water Snails in Norfolk 52-79

*Trans. Norfolk Norwich Nat. Soc.* Occasional Publication No. 5

- HANCY, R. *The Study of Plant Galls in Norfolk.* 1-108

*Trans. Norfolk Norwich Nat. Soc.* Occasional Publication No. 6

- GEORGE, M., *Birds in Norfolk and the law, past and present.*

*Trans. Norfolk Norwich Nat. Soc.* Occasional Publication No. 7

- RICHMOND, D., *Grasshoppers and allied insects of Norfolk.* 1-64

*Trans. Norfolk Norwich Nat. Soc.* 2001 **34** (1)

- RICHMOND, D., Bumblebees of Norfolk 1-18  
CLARKE, K.B., Plankton algae of the River Bure 28-54  
DURRANT, K.C., Norfolk Bugs 58-67

TED ELLIS TRUST. *The fauna of Wheatfen in the 20<sup>th</sup> C. Invertebrates*, Vols 1-2

*Trans. Norfolk Norwich Nats' Soc.* Occasional publications No 8.

- BRYAN SAGE, *Egyptian Geese at Holkham Park*

*Trans. Norfolk Norwich Nats' Soc.* 2002 **34** (1)

- HOWLETT, D. & BAKER, R. The Molluscan fauna of East Walton Common. 31-40  
DURRANT, K.C., Norfolk terrestrial Heteroptera 54-66



# THE NORFOLK MARINE FAUNA, PAST AND PRESENT

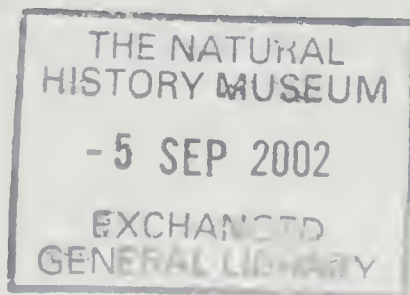
PRESIDENTIAL ADDRESS DELIVERED TO THE SOCIETY IN  
OCTOBER 2001

Dr Richard Hamond  
Scaldbeck House, Morston, Norfolk, NR25 7BJ

## Introduction

Every President of this Society regards the giving of this address as the culmination of his year in office; in my case this sense of honour is heightened because of following in the footsteps of my grandfather, Charles Annesley Hamond, whose year as President was from 1906 to 1907. His address, given on the 26th March 1907, was on the long-term geographical changes to the Blakeney Harbour area, as shown by maps from the preceding three centuries and more, all of which changes have been summarised in the admirable *History of the Glaven Ports* by Hooton (1996). Whether my grandfather, a keen yachtsman, ever noticed any but the most obvious kinds of marine animals, and what he would have thought of a grandson who has spent most of his life here trying to identify every species that he could find, I am quite unable to say!

I launch my dinghy at Morston in order to get to my crab-boat and load her with my fishing gear. A brown box aft of the engine is the world's smallest chart room. Setting off from Morston Quay, I go down to the west end of the Point round the corner, and northwards to, on this occasion, the Blakeney Overfalls Buoy, known to all our locals as the Bellman. In the exceptionally calm summer of 1989 I went just over 32km north-east to the Dudgeon Lightship, sadly now replaced by a buoy; but normally I go about 19km or less. At sea, one may meet one's fishermen friends. Getting to where I want to use the dredge I shoot it, haul it, tip the dredge-haul on to a large metal tray, and examine it. At the end of the day, I head for Morston where all the animals brought home (or discarded and remembered) have to be identified and recorded.



So much for what I do, and where and how I do it; what does all this recording seem to reveal? Well, to begin with, very few additions have been made since my return from Australia in 1985 to the middle-sized and larger Norfolk marine invertebrates, but a great many additions to the smaller forms such as bottom-living copepods; marine mites (my previous work requiring considerable re-assessment in view of the admirable Linnean Synopsis by Green and Macquitty, 1987); ostracods (many collected, which I hope to work through); and certain groups which await identification (though not by me), such as nematodes and protozoa. Hitherto, considering only the groups that I have studied, my Norfolk list includes 694 spp recorded by previous authors (of which I have not seen 106) and a further 664 that I have added, totalling 1358 spp. This compares with 1922 spp for Northumberland (Foster-Smith, 2000), 767 (probably very incomplete) for St Andrews (Laverack & Blackler, 1974), 1689 for the Isle of Man (Bruce, Colman & Jones, 1963), and 1933 for the Plymouth area (Marine Biological Association 1957). Comparable lists for all study groups are not available for Oban, Millport, Menai Bridge, or Robin Hood's Bay (although the two last-named have faunal card-indices); and some geographically incomplete lists exist for Northern Ireland and Eire, which is a pity because the Irish fauna may well turn out to be the richest of the lot (see below, on ocean currents). Two unpublished groups included in my Norfolk list, but not in the Northumbrian list, are nemertines and tunicates; including them, the Northumbrian fauna might well reach a total of 2000 species. This shows quite clearly that Norfolk's faunal inferiority to these other areas, while real, is by no means as great as formerly supposed.

As far as I know, the poorest intertidal and subtidal fauna of any county in the British Isles is possessed by Suffolk, whose loose shingle is the most unfavourable substrate possible for marine life. Norfolk is saved from being like this only by having (1) a rocky shore in the north-east, most fully developed at West Runton, and (2) an apparently greater variety of substrates offshore (though Suffolk is very much under-investigated in this and other respects). The estuarine salt-marsh facies, which is so famously developed in North Norfolk between Salhouse and Hunstanton, is shared by the Suffolk, Essex, and Lincolnshire coasts, and the offshore fauna of the

Wash (as far as investigated) is definitely more different from that off North Norfolk than might be expected from two adjacent areas. The Joint Nature Conservation Council have already surveyed the macrofauna of the Wash, and are continuing to do so.

I regard the poverty of our fauna as due largely to the main factors discussed below, but I want firstly to deal with a topic which, as it were, leads into these factors and makes them more intelligible; this is, why do certain animals not have their parasites or hangers-on living with them here, when they nearly always have them in the much richer areas mentioned above? For our first example, the lobster (*Homarus gammarus*) has four species of parasites around the British Isles, namely (1) the amphipod *Isaea elmhirsti* on the mouth parts; (2) the harpacticoid copepod *Tisbe elongata* and (3) the eunicid polychaete *Histriobdella homari*, both loose in the gill chambers; and (4) the siphonostomatous copepod *Nicothoe astaci* immovably anchored to the gills themselves. North Norfolk lobsters commonly bear the first three of these, but why has *Nicothoe* occurred only once, many years ago (record cited by Hamond. 1973a)? Lack of an intermediate host is probably not the answer, because the careful survey by Mason (1959) failed to discover any larval nicothoids on two spp of fishes (the viviparous blenny, *Zoarces viviparus*, found occasionally in the Blakeney Harbour area, and the bullhead *Taurulus bubalis* which has always been moderately frequent out to sea, although scarce inshore). Of 28 species of marine invertebrate, only *Munida* (a squat-lobster) and *Porania* (a starfish) have never been found in Norfolk waters, whilst scampi *Nephrops* and the starfish *Astropecten* are unrecorded off North Norfolk (Hamond. 1971,1991), all the others being well known here. On the other hand, the nature of the sea-bottom may be relevant. Mason's lobsters came from the Hebrides and the Orkneys, whose solid rocks have plenty of small caves and holes in which the lobsters can moult in calm waters, sheltered from predators, and in which the larvae of *Nicothoe* can lurk ready to infect the same (or another) lobster that has just cast its shell. If correct, this would explain both the lack of need for any other host and the absence of *Nicothoe* off North Norfolk, where the rocks are in the form of flints of all sizes resting on hard chalk, affording the newly moulted lobsters no more



than the minimum of shelter from predators, and leaving them exposed to strong tidal currents that presumably sweep the *Nicothoe* larvae away. This reconstruction also assumes that the other three associates are able to migrate from the old lobster-shell to the new, freshly moulted lobster (a) as adults, and (b) without requiring the new lobster to be physically soft, but merely unoccupied and thus ready for infection; they do not have to pierce the integument in the way that *Nicothoe* does. All this remains to be proved, but is indirectly supported by the fact that other nicothoid larvae (being to all appearances feeble swimmers) need to hide somewhere where a potential host might blunder into them; for instance:-

(1) I have found these larvae occasionally in offshore sands, ready to infect amphipods that burrow into the sand near them or alight upon them.

(2) Specimens of the well-known shore amphipod *Corophium volutator*, are not infected when living in exposed intertidal mud, but no less than 22% of them had the nicothoid *Sphaeronella leuckarti* when living in long-lasting burrows in thick durable clay at Holme (Hamond 1973a, p.354). These burrows provided excellent shelter for nicothoid larvae, so that any *Corophium* meeting a larva would be highly likely to be infected.

To these postulated mechanisms of infection I have found one probable exception; *Sphaeronella paradoxa* was found by me in the amphipod *Bathyporeia sarsi* in circumstances which suggest that it may infect new hosts when these swarm in the plankton (Hamond 1973a, pp.354-355). These observations need to be repeated and extended if ever *B. sarsi* regains its former abundance in the sands of Blakeney Harbour. Other species of *Sphaeronella* are rare here, and at present their larvae cannot be identified to species or even genus.

An interesting parallel to the nicothoid copepods is presented by the epicarid isopods (Hamond 1974; Naylor, 1972). Several species of epicarid are found here, each in its own host (with rare exceptions); their micropiscus larvae are also feeble swimmers, and may be found either riding pick-a-back on planktonic calanoids or loose in dredgings, but again



there is no known way of identifying these larvae to species. Many other examples of a host failing, in Norfolk waters, to have the associate recorded with it elsewhere, are known among other copepods and the entoprocts (Hamond 1973b; see below), as well as the epicarids.

We also have several examples of unusual missing or 'wrong' associations.

(1) The scaleworm *Harmothoe lunulata* has been found elsewhere associated with various other polychaetes, but never with *Thelepus cincinnatus* until I found a specimen; this association was new to science. (Garwood (2000, p 95) shows that the classical *H. lunulata* is a group of closely allied species, all of which should now be referred to *Malmgrenia*, but I have not yet been able to apply his taxonomy to the Norfolk specimens of *H. lunulata*.

(2) The common hermit-crab *Pagurus bernhardus*, when adult, lives in large shells of the common whelk (*Buccinum undatum*) all round the British Isles; these shells frequently have sea-anemones sitting on them. All the textbooks identify this anemone as *Calliactis parasitica*, of which there is a fine photograph on the front cover of Wood, 1988 (the only book of its kind to give a representative coverage of East Anglian waters), but of which there are no reliable North Sea records; conversely, *Urticina eques* is the usual anemone on hermit-houses in Norfolk waters, but has never been found at Plymouth (Stephenson, 1935, p.147). Sometimes, in Norfolk waters, the anemone may also be *Metridium* or *Sagartiogeton* (*laceratus* or *undatus*). The same applies to certain harpacticoid copepods living with the hermit in its house; off our west coasts (and once off Holland; Humes and Ho, 1969) the copepod is *Sunaristes paguri*, but off our east coasts (from the Thames to the Firth of Forth, as well as the Low Countries) it is *Dactylopodella rostrata*.

(3) The above associations are all more or less normal, but here is one that was wildly abnormal. The snakelocks anemone is common on the west coast, but its only east coast record (many years ago near Newcastle) was apparently a complete fluke; astonishingly, its usual copepod parasite,

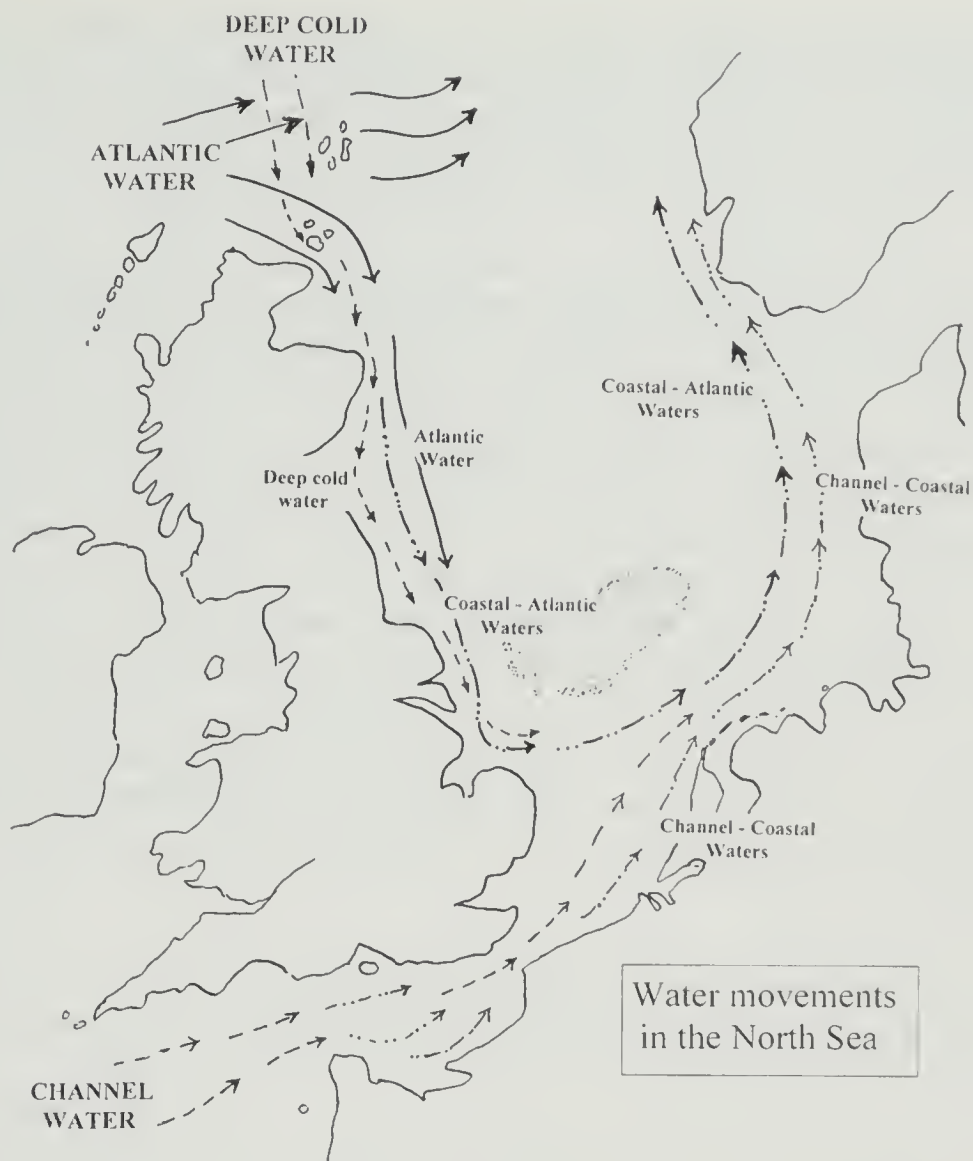
*Paranthessius anemoniae*, was found a few miles north of Wells among a horde of brittlestars, *Ophiothrix fragilis*!

Last in this section, several ectoparasitic copepods have been found loose, well away from their normal hosts; one example is *Anthessius arenicolus*, whose host, the bivalve *Dosinia exoleta*, is known from North Norfolk only well offshore, and then only as isolated dead valves. It is almost a relief to be able to state that both the other British species occur here on their normal host, the common whelk; *Anthessius leptostylis*, previously found only in Scandinavian waters, is perhaps slightly more common here than the southern *A. teissieri*.

Allowing for the unavoidably fragmentary nature of observations, I tend at present to attribute these anomalies to environmental stress, caused by various factors of which the best known is sea temperature; the others being offshore tides and currents, Norfolk's isolation, pollution, variety of substrates, and over-fishing.

**(a) Sea Temperature.** Our annual cycle is roughly a sinewave, and various organisms have their seasons in it but this ignores the incursion of water masses (mostly from the north) bringing in visiting species which seldom survive for more than a few days.

The general circulation pattern of shallow waters around north-west Europe shows a section through the Wyville Thomson Ridge, looking north-west; the cold southerly undercurrent, at its south-easterly end, slips round the east side of the Shetlands and flows south at depth along the east coast of Scotland, mingling bit by bit with warmer Atlantic surface water heading in the same direction. This mixing, while still incomplete off Northumberland, is pretty well complete in the shallower waters off Durham and Yorkshire, and is complete off Cromer, so that off North Norfolk the waters within about 80km of Blakeney Point are more or less of one temperature from top to bottom at any instant, carrying a rather sparse permanent plankton (all the year round), enriched by periodic but transient incursions of Northumbrian plankton when the Atlantic inflow is stronger than usual. These incursions



are denoted by the ctenophore *Beroe cucumis* (swimming just below the surface like little pink airships), the copepod *Anomalocera* (only in the height of summer), the pteropod mollusc *Clione limacina* (only in April 1954) and of course the celebrated arrow-worm *Sagitta elegans* (whereas *S. setosa*, indicating southern North Sea water, is far less frequent); most of the time the prevailing North Norfolk plankton is so poor in species that neither species of *Sagitta* can be said to indicate very much of anything. Care is needed here, because in summer *Anomalocera* is often accompanied by its close relative *Labidocera* and another more distantly related form

*Isias*, and all three might be regarded as indicating Atlantic water, were it not for the fact that *Labidocera* has never been found off Northumberland, and both it and *Isias*; have been shown to be basically central North Sea forms which spread out into Norfolk waters now and again.

From about November to January, Norfolk waters have cooled to about the same temperatures as those further north, so that incursive plankton animals from there have a much better chance of survival here, and in fact one can see how the copepods *Calanus* (the favourite food of the herring), and *Candacia* and *Metridia* (both only in certain years) spread down the east coast month by month, just as the herring does. *Calanus* was common in bottom plankton off Blakeney Point in late October to mid-November 1961, just when the Yarmouth herring fishery was starting. When Norfolk waters and Northumbrian waters are not at quite the same temperatures, northern plankton animals of course do not survive. This appears to be why Norfolk waters may at any one time yield a first Norfolk record of a species, or a new record of a species which is scarce here, but a dependable supply of only those few species (relative to our entire fauna) that can live here all the year round, and can endure high or low temperatures widely different from their breeding ranges.

Of winter breeders we thus have the following:-

(a) Although the small and inconspicuous hydroids of *Tiaropsis* and *Staurophora* have never been found here, they must live nearby, because their young medusae occur year after year in spring plankton in Blakeney Harbour, but I have never found older ones. Perhaps mature medusae came here in an unusually cold northern incursion years ago and succeeded in reproducing to give rise to their respective hydroids who, in every spring thereafter, have budded off young medusae which were killed by the water heating up too fast in late spring before they had had a chance to become adult.

(b) The purely Arctic polychaete *Proceratea prismatica* had previously been found in Europe only twice, both as sexual stages; that from the Clyde has been lost, and the damaged male from Denmark could, when I saw it, be



referred equally well to this or to its close relative *Proceraea cornuta*, which in the 1960s was much commoner in Blakeney Harbour than it is now (due, apparently, to the massive and unaccountable decline of its food, the hydroid *Hartlaubella gelatinosa*). However, on 10. 2.1967, near the Blakeney Overfalls Buoy, having just taken the lowest offshore temperature that I ever recorded (3.5°C), my plankton-net (set to fish with its mouth half in and half out, so as to catch whatever was floating or swimming at or very near the surface), caught several of the sexual stages of *P. prismatica* which, at home, I tried unsuccessfully to cross with *P. cornuta* and then drew (after preservation) for my Zooplankton sheet on autolytoids no. 113 (Hamond 1967) - a very welcome and wholly unexpected last minute addition to my Ph.D. thesis. I have also found, in certain summertime dredgings near that buoy, the asexual stages of a species of *Proceraea* which is very like *cornuta* but more slightly built, and which for the time being I regard as possible *prismatica*, although I never discovered its food.

A similar instance occurred in the summer of 1965, when the sexual stages of another autolytoid (provisionally identified as *Autolytus langerhansi*, which Garwood (2000, p.109) records from Northumberland) were moderately common in plankton off North Norfolk; structurally they were just like the sexual stages of our common *A. brachycephalus*, but were quite differently coloured and would not mate with them, nor did I ever find the asexual bottom-dwelling stage to find out who it was or what it fed on.

(c) Several specimens of a certain harpacticoid, dredged at various places off the North Norfolk coast, agree about equally well with *Thalestris frigida* and *Thalestris normani*, which I therefore regard as synonymous, especially since both of them have been found hitherto only in the Arctic. My failure to catch egg-bearing females may be because (i) they breed here, but only in winter, during which offshore work is not only unpleasant but dangerous; (ii) they breed here at other times, so that I have failed to catch breeding females of this rare species purely by chance; or (iii) they arrive here as planktonic larvae from further north and grow to adulthood without producing eggs, so that each generation has to be recruited afresh. At the moment I am quite unable to decide between these three alternatives.

The requirements of a marine animal can often be determined by mapping its distribution in relation to temperature, salinity, or some other factor. Thus Reid (1935) has shown that the big sea-urchin *Echinus* must have a small Atlantic component in its ambient water, and in fact I know of no East Anglian record of it south of about Cromer (although off North Norfolk it is common in wrecks but rare elsewhere); around the British Isles as a whole it is not a particularly northern or southern animal.

So far we have dealt mainly with cold water visitors; certain warm water fishes migrate here in summer such as mackerel, grey mullet, and bass, all common; ballan wrasse and John Dory, both rare; rosy seaperch (small *Helicolenus*), rarer still; and close in to sandy beaches in August, in the warmest shallows of all, the stingray *Dasyatis pectinaca*. That splendid faunal refuge, the wreck of the 'Hjordis' on the outside of the Point, used to be a good place for many invertebrates including the hydroids *Halecium lankesteri* and *Sertularella gaudichaudi*, but alas is now no more, although both these hydroids are found occasionally out to sea; two other warm water hydroids are *Plumularia diaphana* under rocks at West Runton, and *Obelia bidentata* just below low-water mark from Scolt Head to Hunstanton, and all four of these have occurred in many summers, so appear to be resident. The velvet swimming-crab *Necora puber* (so much hated by the whelkers and crabbers from the vicious way in which it pinches their fingers) used to be found as an occasional migrant before I left for Australia in 1968, but was certainly resident and breeding by the time I got home in 1985.

The above four hydroids, as well as the hydroid *Eudendrium arbusculum*, the comb-jelly *Beroe gracilis*, the compass jellyfish *Chrysaora*, and the hairy crab *Pilumnus*, are all unknown from Northumberland whose summer maximum of about 15°C is, I suspect, too low for them, this clearly brands *Pilumnus* as a Channel immigrant into the North Sea.

In general, a species will always try to breed at about its normal breeding temperature; thus the hydroid *Halecium undulatum* breeds in early May in the southern North Sea (including Norfolk), in late May at the Faeroes, and in late June off Iceland. However, I found an exception to this in the worm

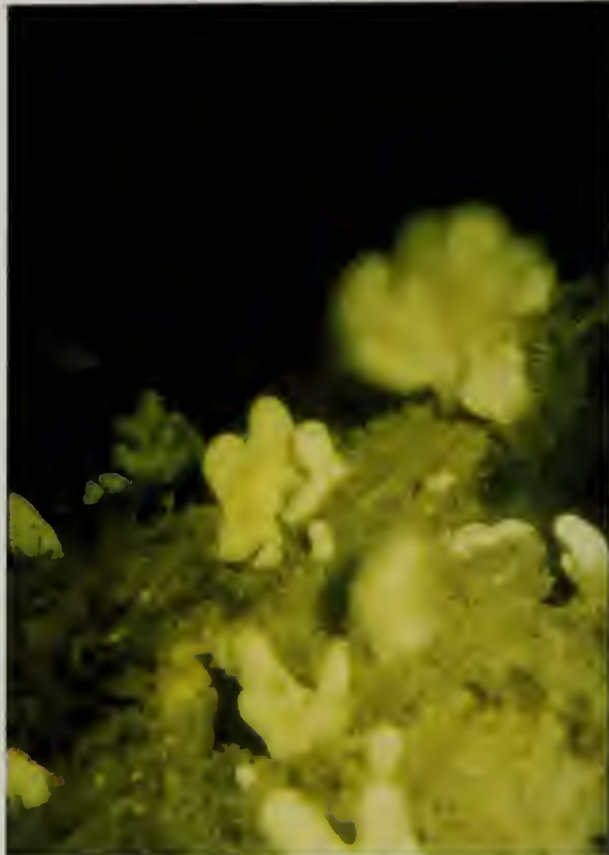


Orion next to the ferry boat in Morston Quay.



*Arcticia eques* (formerly *Tealia felina* var. *lofotensis*).





Above right: *Alcyonium* – dead mans fingers – 2km off Cromer Pier. (Percy Trett).

Above left: *Autolytus brachycephalus* - pre-ovulatory female stolons.

Below left: *Proceratea cornuta* from Morston Creek.

Below right: *Chlamys opercularis* in dredge near Bellman 1966.







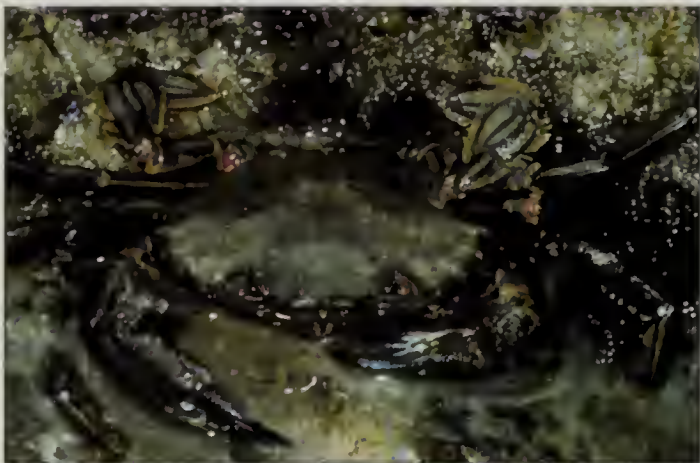
*Ophiothrix fragilis*.



*Echinus esculentus* 1km north of Cromer Pier. (Percy Trett).



*Bathyporeia sarsi* with *Sphaeronella paradoxa*. Tilby Head sandbank.



*Necora puber* velvet swimming crab.  
(J. Fenton).



Entire *Thelepus cincinnatus* with  
*Harmothoe lunulata* clinging to its abdomen



*Harmothoe lunulata* from *Thelepus* tube.



*Autolytus alexandri*, whose southern limit is the North coast of France; off Norfolk it breeds at the lowest offshore temperature that I have recorded ( $3.5^{\circ}\text{C}$ ), and from then on up to  $11.2^{\circ}\text{C}$ , only in spring; but a fertilised female (with her eggs under her in a bag) was taken off Plymouth in mid-September 1928 when the temperature was higher (about  $14^{\circ}\text{C}$ ) and falling, not rising! Her mate must have been nearby, but was not caught. This pair of *A. alexandri* may or may not have still been interfertile with normal members of their species, but would they have ever been able to meet and what caused them to breed at this unusual temperature?

When the annual range alters in a given place, this will probably show up in the disappearance of certain animals. The Norfolk offshore temperature ranged from  $3.5^{\circ}\text{C}$  to  $17^{\circ}\text{C}$  (or in some summers  $17.5^{\circ}\text{C}$ ) before I left for Australia in 1968, but by my return in 1985 it had shifted upwards by about  $2^{\circ}\text{C}$  overall, from  $4^{\circ}\text{C}$  or  $5^{\circ}\text{C}$  to  $19^{\circ}\text{C}$ . This almost certainly accounts for the increase in the velvet swimming-crab, and possibly for the disappearance of four hydroids, one harpacticoid, the spidercrab *Hyas coarctatus* (although its relative *H. araneus* is still the common spidercrab here, our largest pycnogonid, *Nymphon spinosum*, and the small whelk-like mollusc *Boreotrophon truncatus*, which resembles *Echinus* in that the furthest south record of living specimens along the east coast of England is off North Norfolk.

Finally, an instance when a species may have a breeding-range which does not accord with its known distribution. In Cley Marsh there are two species of the copepod genus *Schizopera* which are far more abundant during their breeding-season (December to March) than at any other time of the year. At first sight this would imply that they are northern species, and would breed all the year round in Arctic or sub-Arctic salt-marshes; but the trouble is, that there are not any! and therefore some other explanation must be found. The one I favour at the moment is that these animals have become progressively adapted, not only to the variable salinities and other constraints of a salt-marsh life, but to being most abundant and most fertile at a season when predators are at their minimum; in brief, winter breeding is for them a predator-dodging device.

## Offshore Tides and Currents

The fishing boats belonging to my fishermen friends work at various distances from the coast, depending on their size, which is in turn determined by their anchorage. East of Blakeney Point the boats have to be small enough to be launched and recovered by tractor, and therefore seldom exceed about 6 to 8 metres in length, which in turn makes them unable to work with safety more than about eight kilometres from the coast, owing to the suddenness with which the weather can turn nasty. The bigger boats, up to 10m or so in length, working out of Brancaster, Blakeney Harbour, or Wells-next-the-Sea, are faster (the maximum speed of a boat's hull being mathematically related to its length) and more able to cope with rough seas, so that they can work as far as 48km - 56km from Wells to the Haddock Bank, which lies due east of Cromer Knoll and due north of Happisburgh, between 53°16' and 53°19'N, and between 01°30' and 01°36'E, but more often from 16km - 40km from Wells (or Blakeney), mainly in any direction from NNW to almost due E, but sometimes off Lincolnshire or in the Wash. Several fishermen are kind enough to collect samples for me when they find it convenient, and these have produced many additions to the Norfolk fauna from stations which I could not have reached in my own little crab boat. All my offshore stations up to 1967 (i.e. just before I left for Australia in 1968) are listed in Hamond.1969; there is no published list of my stations sampled after my return in 1985.

On pages 3-6 of my (1963a) paper I showed how the offshore tidal current moves approximately in a circle further out, but close to the coast this becomes squashed into an elongated ellipse parallel to the coastline, with concomitant cyclical changes in the deposition and re-suspension of silt; thus, in Blakeney Deep (just north of Blakeney Point), the brittle-star *Ophiura albida* and the amphipod *Ampelisca tenuicornis* are extremely common in certain places, but much less so further out, because they seem to prefer a rain of settling sediment for about 20 minutes about every six hours at slack water, alternating with a flush of clean water that sweeps it all away (providing oxygen and removing excretions) until it is time for the next slack water. This deduction of cyclical turbidity from chart data, since it was written, has received confirmation from scuba-divers, who have



described to me how, at the start of slack water, the light intensity on the seabottom and the distance to which one can see clearly both increase very rapidly within the first few minutes; whereas at the end of slack water, as the first flow of the new tide begins to be felt, a dark cloud of silt is seen approaching like a sandstorm and the ambient visibility falls rapidly to its original level, putting an end to diving until the next slack water. These observations were made off North Norfolk west of Cromer; it is a pity that there are no such data from east Norfolk (roughly from Overstrand to Yarmouth) where the tides along the coast are even stronger. However, these stronger tides can be seen (and felt!) in a crab boat as far west as a line from about Cromer Knoll to Cromer itself, and it was just east of this line, and southeast of the Knoll, that Mr Allan Frary (now the coxswain of the Wells lifeboat) found on a few occasions in the summer of 1989 multitudes of "little white lice with red eyes" which, he complained, devoured most of the bait in his whelk pots, and which I found to be the amphipod *Tmetonyx similis*; Yorkshire was the previously recorded furthest south for both this and its congener *Tmetonyx cicada*, which, however, has not yet been found here. A week or two later, in the same area, he rescued for me another large amphipod (about 1 cm long, as was *T. similis*) of a brownish colour, as it lay kicking and squirming on the gunwale of his boat; this turned out to be one of an undescribed species of *Epimeria*, known otherwise only from the deep water off Northumberland, where it is common. I am quite unable to explain how such a large amphipod could have eluded recognition in such a well-explored area as the North Sea. These two amphipods, and several harpacticoids, are found only east of the line from Cromer to Cromer Knoll, which at present I ascribe to the difference in sedimentation patterns on either side of this line. A further point is that *T. similis* resembles the sun-star *Crossaster papposus* in coming into the pots either in numbers or not at all, suggesting that each of them tends to go about in droves.

One phylum whose members hate being smothered in silt is the Bryozoa (see Hamond, 1973b for a detailed discussion of their ecological preferences); many of them form colonies on over-hanging surfaces (such as inside the mouths of whelk shells tenanted by our common hermit crab

*Pagurus bernhardus*), or share with the entoprocts *Pedicellina* and *Barentsia* a propensity for living "lifted up" on algae, hydroids, or arborescent bryozoans, away from the epibenthic silt-layer as far as possible. This forms an interesting contrast with the remaining entoprocts (the loxosomatids), which seem to prefer waters with less wave-action and current-strength than we get here, and a narrower annual temperature range. Other animals which prefer a strong current are the brittle-star *Ophiothrix* and the pink sea-urchin *Echinus* (both common in wrecks), the soft coral *Alcyonium* ("dead men's fingers", common on sublittoral chalk slopes inshore and on large dead shells, mostly of bivalves, further out, but unaccountably rare on wrecks, at least off North Norfolk), the green or dirty yellow sponge *Halichondria panicea* (formerly common under Wells Quay (Hamond 1971a, but see Hamond 1972a), and still at extreme low water of spring tides along the west side of Hunstanton Scaup, often with *Ophiothrix* on or under it), and the hydroid *Clytia hemispherica* (formerly *C. johnstoni*) on other hydroids offshore and thickly on the tubes of the worm *Sabella pavonina* all along the west side of the Scaup (as for *H. panicea*), where *Sabella* forms regular fields. Other possible rheophiles (= current-lovers), taken together at haul MB.09 (just west of the Dudgeon Light Vessel) for the first time south of Northumberland, are the brittle-star *Ophiactis balli* and the nudibranch sea-slug *Limacia clavigera*. A final strategy for evading smothering by silt is by settling on the sides and/or undersides of floating objects; for instance, certain hydroids (such as *Tubularia larynx*) prefers the buoys and ropes of crab pots and whelk pots, less often the upper parts of the pots themselves. Of bottom-living animals, small sea-cucumbers (holothurians) have been seen by fishermen, though not by me, to climb up the sides of pots to a vantage point, in a strong current well above the silt-layer and likely to supply the most food.

The Race Bank and the North Ridge are connected by the West Ridge (really a system of ridges) to form collectively a horseshoe-shaped assembly of ridges opening to the southeast; at the southeast corner of the Race Bank, the South Race Buoy is about 17 to 18 km from either Wells Bar or Blakeney Bar. The precipitation of silt must conform to a locally unique pattern here, because on 06.05.1992 station MB.17 (at 53°10.34'N,

00°56.34'E, right in the middle of the horseshoe) yielded, not only a great deal of dark grey silt, but two harpacticoids new to science (*Archesola hamondi* and *Normanella paratenuifurea*) and the following new to Norfolk: two amphipods (*Corophium crassicorne* and *Harpinia crenulata*), the only adult I have ever seen of the polychaete worm *Poecilochaetus serpens* (whose very long lived larvae are common here in summer plankton), and the front half only of another polychaete, *Lumbrineris* sp. (closest to *L. gracilis*), all of which are at least strongly suspected of preferring unpolluted but very silty sand. A completely different state of affairs seems to prevail about a mile northwest of the South Race Buoy, at a place where the Race Bank consists of a hard, flat or gently sloping, clean sandy shelf which is the only North Sea locality for the ostracod *Euphilomedes sinister sinister*.

### Norfolk's Isolation

In what is now a classic paper, Waugh (1954) showed that the North Norfolk and Wash population of the edible mussel *Mytilus edulis* was isolated from its nearest neighbours by long stretches of shallow coastal waters whose bottoms were unsuitable for this species. These are (a) sand and mud running northwards to Flamborough Head, and (b) barren sand and shingle, from Cromer southward to Felixstowe, these places (Flamborough and Felixstowe) being the nearest localities to Norfolk whose mussels are infected with the damaging parasitic copepod *Mytilicola intestinalis* (as is the case with virtually all other west European populations of *Mytilus*). This is very lucky for our mussel-farming industry, but unfortunately our only rocky shore (between Cromer and Sheringham, especially at West Runton) is equally the only one between Flamborough and the North Foreland (the northeastern tip of Kent); this is a very long way for planktonic larvae of rocky-shore species to float to West Runton, so that, if such a species becomes extinct there, the chances of re-settlement are very slim. Lucernarians (= Stauromedusae, on p.59 of Hamond & Williams, 1977) are no longer found at West Runton, and it is some years since I have seen the hydroid *Coryne* there, or any compound tunicate save *Morchellium argus*. Nudibranch sea-slugs, admittedly notoriously capricious in their



occurrence, are also much less common there now, than they were in the 1960s and before.

### **Pollution**

Mayer (1910) regarded pollution as the main cause of the then extreme rarity of lucernarians along the New England coast; but, even if this is also true here, it does not apply to other recently extinct animals at West Runton (see above), because:-

1. Up to the mid-sixties they were common there, in spite of the sewer (laid in about 1900) going full blast; it extended across the shore from beneath where the final slope of Water Lane came down to the beach, and was in line with it. Standing on the beach at low tide about 0.5km west of the sewer, with a moderate easterly breeze, the smell was remarkably strong, and rinsings of algae usually contained fine fibres of pink and blue toilet paper;
2. The subsequent decline of any of these species was not related to any change in the volume or nature of the discharge that I know of.
3. None of these species has returned since mid-September 1995, when this sewer was removed and replaced by a buried pipe whose opening is about 2.2km out to sea.
4. The overall rise in sea temperature in recent years has not so far enabled their return (even though they are common in the Channel), probably because the unsuitable terrain (see above, under Norfolk's isolation) extends for too far in either direction to enable their larvae to cross the gap.

It is of interest to notice here an extremely insidious form of pollution which has come to light only in recent years, and that is pheromonal pollution, whereby one marine species can emit a pheromone that can inhibit the pheromone system of an allied species that would otherwise compete with it. For instance, two species of the harpacticoid genus *Tisbe* never share an Italian shore pool for very long because the sex-pheromone



put out by the female of species A renders the male of species B incapable of perceiving (or at any rate acting upon) the sex pheromone of his own species! This is a fascinating and very under-investigated field of research.

### Substrates

One very conspicuous animal that is strictly limited to the rocky shore at West Runton and nearby is the blood-red Beadlet Anemone, *Actinia equina*; it is purely intertidal. Subtidally, these rocks extend about 2km offshore at West Runton and progressively less to east or west of it; their fauna is too little known to discuss in detail, except to say that the persistent rumour of large kelp-beds (laminarian seaweeds) there in the middle and late 19th century seems ill-founded because (1) even the heaviest flints could not have afforded a sufficiently stable anchorage, and (2) if the laminarians occurred there then, why don't they occur there now?

Going to the other extreme, the intertidal sands of the Blakeney Harbour area vary in their fauna roughly according to how wave-beaten they are, or, conversely, how much mud or silt they contain; the cleanest sand of all is the most wave-beaten, along the seaward edge of Stiffkey High Sand where it abuts onto Warham Hole. This kind of sand contains, among several other species of harpacticoid small enough to live between the sand grains, three species of *Kliopsyllus*, all of them undescribed and found elsewhere only in clean sand offshore. Moving away from this area towards the sand opposite the end of Blakeney Point, these copepods progressively drop out until, in the harbour itself, they are succeeded by other species which can stand silt or mud, and in some cases actively prefer it: sand in brackish water (in the estuary of the Stiffkey River, or in the end of the harbour furthest from the sea towards Blakeney and Cley) contain very few interstitial copepods but quite a few on the surface of the sand (or mud). Polychaete worms show a similar tendency; in pure sand with *Kliopsyllus* spp. one finds *Paraonis fulgens*, but opposite the end of the Point *Nephtys cirrosa* and isolated deep-burrowing lugworms (*Arenicola marina*), the latter of which extends right into the harbour as far east as near the Watch House, and westward over much of Stiffkey High Sand away from its seaward edge, being accompanied almost everywhere by silver rag

(*Nephthys hombergi*), *Scoloplos armiger*, and, on mussel shells which are rarely dried out, *Pomatoceros lamarcki*. The *Kliopsyllus* sand contains a few amphipods (mostly *Pontocrates arenarius* and *P. altamarinus*), but muddier sands, especially in the harbour, have mostly members of the Gammaridae as well as *Bathyporeia sarsi* (though this has largely disappeared in the last few years) and *Urothoe brevicornis*. *Corophium volutator* prefers pure mud, and its close relative *C. arenarium* very muddy sand. The fauna of marsh-top pools will be discussed below.

Offshore substrates show a different range of varieties. The bottom muds within a few miles of Blakeney Point are somewhat clayey, mixed with silt; they are preferred by whelks (mostly *Buccinum undatum*, but quite a few *Neptunea antiqua* and fewer *Colus gracilis* (Hamond 1972b), but the only Norfolk animal restricted to such bottoms is the wentletrap *Epitonium clathrus*, whose few living Norfolk specimens were all found in the "Muddy Hole" about half a kilometre southwest of the South-East Docking Buoy. This buoy was removed some years ago, the hole has been filled in by drifting sand, and I very much fear that our only known wentletrap population is no more. This leaves us with the following grades of sand and grit, for which the following animals are more or less certain indicators:-

**1. Fine sand.** This occurs nearly everywhere west of a line from Blakeney Point to Skegness; of the harpacticoids, the two characteristic diosaccids are *Amphiascus parvus* and *Amphiascus propinquus*, whether or not the sample in question also contains stones, shells and large or small invertebrates. Both these species also occur at West Runton, but in Blakeney Harbour no further east than the lowest reach of Morston Creek, especially among algae.

**2. Sharp sand.** Slightly coarser than in (1)) with a very poor macrofauna, no algae, and in which both the above *Amphiascus* spp. are replaced by *Robertgurneya ilierecensis* (first North Sea record, but often quite numerous where it does occur) in only a few places, all east of the Blakeney to Skegness line.

**3. Amphioxus-grit.** In a small patch about 50 to 100m east of where the Dudgeon light vessel used to be; it has been replaced by a buoy. In haul MB.08 a single specimen (the only Norfolk one) of *Branchiostoma lanceolatum* (the lancelet, or amphioxus) was accompanied by the rare acochliidiacean opisthobranch (a kind of sea-slug) *Hedylopsis suecica* and another, so far unidentified, species rather like it, many specimens of the rare isopod *Microcharon harrisi*, and about 20 species of small invertebrates (nearly all harpacticoids) which were at that time new to Norfolk; it was a fantastic haul! The grain size was about 5 to 8mm each way, and thus much coarser than any other kind of sand in Norfolk, but finer than any normal gravel, and close to the preferred kinds of sediment recorded for *B. lanceolatum* elsewhere.

**4.** A bed of coarse clean **dead oyster shells** at D.2 (about 2 to 3km north of Blakeney Point) in which the only large invertebrate was the polychaete *Ophelia borealis*; not having suitably fine filters at that date (23.05.1955), the associated fauna could not be sampled.

**5.** If the dredge bites at all deeply into **moorlog** (= submerged peat), which is tunnelled by worms and bivalves so as to offer an immense number of "hidey-holes" for other invertebrates, the resulting fauna may well be very rich indeed, although only a few of its constituent species are not so far recorded elsewhere in the Norfolk area. One of these was (and still is) the only known specimen of the copepod *Clausia uniseta* Bocquet & Stock (1960). Off north Norfolk, intermittent disturbance by storms upsets many of the equilibria between sediment-composition and biological community-structure, in that most of the sediments are geographically displaced; after this each ecologically sensitive species has to recolonise a suitable sediment if it can find it, and this is certainly true of the indicator species mentioned above.

**Overfishing.** During the last half-century systematic overtrawling has left hardly any marketable fish, on grounds where formerly there were plenty, or at least some. Mackerel, sea-trout and the spur-dog (*Squalus acanthias*) are now almost non-existent here, due to overfishing elsewhere, while local



fish that are nearly extinct include the roker (the thornback ray, *Raja clavata*) and to a lesser extent here several other well known commercial species; masses of undersized fish, or those of no commercial interest, have been converted into fish-meal to be fed to pigs.

The situation with regard to shellfish is equally alarming, but much clearer. Of the local edible molluscs, the edible mussel is maintained by its cultivators, but cockles are far less common than formerly off north Norfolk (no precise figures) and their massive decline in the Wash (due to overfishing) has been carefully analysed, resulting in the closure of certain cockling-grounds where necessary. How abundant whelks were before the second World War is unknown, but after the end of it they were so numerous (after five years' respite from fishing) that the first-comers completely filled the pots and late-comers, being unable to get in, stuck to the outside, so that they made the pots (as the fishermen put it) look like the heads of cauliflowers. For the first decade or so after the war the Wells fishermen earned record amounts, and 14 hovellers (like crab boats but up to 8m-10m long) were employed there; then the progressive reduction in whelk numbers caused several boats to drop out, so that only nine were active, as long as they were working only the traditional grounds (Hamond 1961, fig. 3; 1972, p.278). By the early 1970s the hovellers were being replaced by bigger, faster, and more comfortable boats with a greater radius of action but also with a higher daily consumption of diesel oil, making it necessary to go ever further from Wells, in the hope of finding fresh populations of whelks (enough to justify the trip, even if localised) as the old grounds became exhausted. Going further also implies more time spent in travel, and thus less time for hauling pots. The inevitable result is that one reaches a cut-off point, about 56km from Wells, beyond which no whelking (or crabbing) trip between successive tides could possibly pay for itself; it remains to be seen whether the whelks on the old grounds will ever recover enough to furnish a commercially viable population, and whether future fishermen will have learned their lesson well enough so as not to overexploit the populations as their forerunners did. Making due allowance for irregularities in the distribution of the whelks, the progressive exploitation of whelk grounds further and further from Wells has rather the

same effect as a fairy-ring mushroom whose population spreads in a circle of ever-increasing radius due to exhaustion or poisoning of the ground where it grew before.

One factor possibly impeding recovery is the occupation of fished-out whelk grounds by edible crabs. In the absence of concrete evidence, I can only assume that both crabs and whelks scavenge on any corpses that they can find, and also eat small bivalves and polychaete worms. Thus, the removal of all the whelks from a patch of sea bottom leaves not only the living-space, but the food supply, entirely open to crabs who move in in numbers; moreover, crabs are known to eat whelk spawn, and whereas whelks in dense concentrations produce many egg-masses, of which the occasional crab could eat at most only a few before being caught itself, the few remaining whelks on a fished-out ground (even if they managed to find one another, to mate) would have produced only a small amount of spawn before numbers of hungry usurping crabs would rush at it and gobble up the lot. This supposition is borne out by the only very slight signs of recovery of the whelks on the old grounds of Wells in recent years, coincident with overfishing at last beginning to reduce the crab population.

**Marsh-top pools.** These comprise the last habitat to be considered, and contain several species which are at most seldom found elsewhere, including the small sabellid polychaete *Manayunkia* and various harpacticoids, among which argument has raged for many years as to whether *Amphiascoides debilis* and *A. limicolus* are distinct species or not. I hope to show that they are, but this is not the place to explain why, nor to name various undescribed harpacticoids of which more specimens are needed to (a) guard against a unique specimen being destroyed by a bungled dissection, or (b) obtain the less common sex, so that both sexes can be described together, or (c) determine the range of variation and the constancy of diagnostic characters in relation to similar forms elsewhere. However, I can mention the mainly brackish harpacticoid genus *Nitocra*, of which *N. fragilis* (mainly in Australia and New Zealand) has occurred once in Stiffkey Freshes Backwater Creek, and *N. dubia* (very ineptly first described from a single female in a pool near Cape Town; found by me in

the brackish Narrabeen Lagoon on the northern outskirts of Sydney; and later in large numbers by a colleague in the Salton Sea (a man-made inland saline lake in California, where it was the only harpacticoid), was found for the fourth time in Cley Marshes! together with *N. psammophila* whose only other record is from its original find in West Germany. All such finds I regard for the moment as due to airlifting by waterfowl, which makes it very difficult for zoogeographers to determine the true place of origin of any species. In the same way, certain rare offshore species may have been brought here on the bottoms of ships, or in their ballast tanks, without (as far as I know) being able to set up indigenous Norfolk populations.

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## ORTHOPTERA REPORT, 2001

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*Grasshoppers and allied insects of Norfolk* (Richmond 2001) described the status of the county's Orthoptera at the end of the 20th century. It was perhaps inevitable that the first year of the 21st century would bring significant new observations.

One of the most important finds was the rediscovery of **stripe-winged grasshopper** *Stenobothrus lineatus* in the north-west of the county where it had not been recorded since the 1920s. The new site, discovered by the author, was in a disused chalk pit near North Creak (TF8738) where it was found with the aid of a bat detector among eyebright *Euphrasia* sp. and lady's bedstraw *Galium verum*.

Of similar importance was the discovery of a new site for **bog bush-cricket** *Metrioptera brachyptera* some way to the west of the known colonies at Horsford and Buxton Heaths. The new colony was found by Alec Bull at Swannington (TG1418) occupying classic habitat of purple moor grass *Molinia caerulea* and cross-leaved heath *Erica tetralix* in an area shown as Felthorpe Heath on Faden's map of 1797.

During the year the author continued his study of the distribution of **short-winged conehead** *Conocephalus dorsalis*, with particular reference to 'empty' 10km squares in the west of the county. This led to the discovery of new 10km square records at TF60 (Sluice Common, Denver), TF64 (Holme), TF81 (Castle Acre), TG14 (Muckleburgh) and TL69 (Queen's Ground, Methwold). This species had a particularly long season in 2001 with stridulating males still present at Lynford on 3<sup>rd</sup> November.

Other significant records during the year were a new 10km square for **lesser earwig** *Labia minor* at Catfield (TG3821) and a 1999 record of a macropterous **Roesel's bush-cricket** *Metrioptera roeselii* from a new 10km

square at Weeting Heath (TL 7390). There was also a report of an established colony of this species at Barnham Cross Common (TL 8781) in the same 10km square as the known colony at Santon Warren.

An interesting observation of the high densities reached by newly hatched Orthoptera was given by the author's count of over 100 first and second instar **speckled bush-cricket** nymphs *Leptophyes punctatissima* in a 20m length of nettle bed bordering a footpath at Thorpe St Andrew in early June. This species also provided the latest date of the year with a record of a female on 11<sup>th</sup> November in the author's garden at Reepham, a survivor of heavy hailstorms on the 8<sup>th</sup> of that month.

**Reference:** Grasshoppers and allied insects of Norfolk, *Norfolk Norwich Nats' Soc.* Occasional Publication No. 7 (May 2001).

## RECENT RECORDS OF SOME SCARCE NORFOLK BEETLES

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A few species collected in the county in recent years are worthy of mention. The first of these *Stenus proditor* Erichson, is a small rove beetle (Staphylinidae) found in fens and marshland. According to Hyman & Parsons (1994) its status is Red Data Book Indeterminate (RDB 1). It has only been recorded from four, widely scattered, vice-counties in England - Cambridgeshire, Middlesex and East Norfolk before 1970, and South-West Yorkshire since 1969. However, there were in fact some post-1970 Norfolk records. The Rev Canon Fowler (1888) records that it was first taken at Finchley, Middlesex, by E W Janson, and was subsequently found at Horning, Ranworth and Wicken Fens. The Horning Fen record was evidently derived from a note by W Rye in the *Entomologist's Monthly Magazine* 1:63 (1864-1865). J Edwards (1893) says "Horning, rare (Crotch)". It was found at Horning Fen again on 27<sup>th</sup> August 1928 (Collins 1929). On 21<sup>st</sup> September 1910 it was taken at Stalham (Hudson Beare



1910 & 1911). There were no further records for 59 years until it was found at Sutton Broad on 18<sup>th</sup> August 1988 by A P Foster, who took it there again on 22<sup>nd</sup> June 1989 and 22<sup>nd</sup> June 1990. On 4<sup>th</sup> October 2001 I found this species in a fen-type habitat at Carbrooke (TF9401) near Watton, this being the first west Norfolk record away from The Broads area.

The false darkling beetle *Melandrya caraboides* (L.) is a Nationally Notable B species of the family Melandryidae. It is a large metallic blue-black beetle whose larvae live in rotten wood. It is widely distributed but very local in England and Wales. There are very few Norfolk records. J Edwards (1893) gives "(Burrell)-Yarmouth, rare (Paget)" but no further details. It is on a list of Coleoptera recorded from Wheatfen by the late Dr Ted Ellis who gives a date of 1937, but no further details. It is included in a list of species recorded at Redgrave and Lopham Fen during the course of a survey of the Coleoptera carried out from 7<sup>th</sup> July 1965 to 15<sup>th</sup> September 1966 (Pope 1969). On 3<sup>rd</sup> June 2000 a specimen was found in a moth trap operated by Robert Baker (English Nature warden) in Swanton Novers Great Wood (TG0131). It was shown to Martin Collier at the time and is now in my collection. This is an indicator species for ancient broad-leaved woodland.

On 11<sup>th</sup> September 2000 whilst collecting in the Stanford MoD training area near Thetford (TL8593), I found the remains of a beetle in a fungus on a tree. This later proved to be *Mycetochara humeralis* (Fab.) (Tenebrionidae), and the first to be found in Norfolk since it was added to the county list in a note by Tyrer in the *Entomologist's Weekly Intelligencer* (data etcetera?). This record was referred to by Morley (1904). The locality where this first specimen was taken was Brockdish, approximately 39 kilometres south-east of my site. In Hyman & Parsons (1992) this is listed as a Notable A species and its normal habitat is wood and under bark. This also is an indicator species for ancient broad-leaved woodland.

The final species is a large weevil *Barynotus moerens* (Fab.) (Curculionidae), a mainly woodland species particularly associated with dog's mercury *Mercurialis perennis*. In England it is widely but locally

distributed and is distinctly less common in the south and south-west. It is widespread in Wales, Ireland, and much of lowland Scotland; also in some of the island vice-counties. The Rev Canon Fowler (1891) records it from Aylsham (date?). A most extraordinary record is that by Bird (1891) who, writing from Stalham, reports killing 580 specimens which were attacking lilies of the valley *Convallaria majalis* in the garden of a friend. I have some doubts about the accuracy of this record and wonder if the weevils were, in fact, one of the *Otiorhynchus* species. The species was not recorded in Norfolk again for 110 years until, whilst attending a field meeting of the Norfolk & Norwich Naturalists' Society at Sporle Wood (TG8512) on 6<sup>th</sup> May 2001, I swept a single specimen from dog's mercury *Mercurialis perennis* in an area of fairly open oak woodland.

### Acknowledgements

I am indebted to Martin Collier for supplying details of the historical records mentioned above, and for drawing my attention to literature references. Ken Durrant kindly tracked down a literature reference for me. I am grateful to Professor M G Morris for discussion on the status of *Barynotus moerens*. Geoff Nobes kindly invited me to collect on his land at Carbrooke. I have also to thank Berit Pederson, librarian at the Royal Entomological Society of London, for kindly supplying photocopies of papers from early issues of *The Entomologists Record* and the *Entomologist's Monthly Magazine*.

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## FLAT-FOOTED FLY *AGATHOMYIA WANKOWICZI* SCHNABL NEW TO NORFOLK

Alec Bull

Hillcrest, East Tuddenham, Dereham, NR20 3Jj

Members of the Norfolk Bryological Group were visiting Bloom's of Bressingham on 2<sup>nd</sup> February 2002, and having followed the railway towards the River Waveney, turned off to explore a belt of mainly hybrid poplar woodland about fifty metres wide. The whole belt had been devastated by the 1987 hurricane, and it was interesting to note that many of the trees which had been uprooted had sent up secondary trunks along their length which were themselves approaching six or seven metres in height. On the south side of the belt which had taken the full force of the gale, many had broken off rather than uprooting. One stump about two metres high and its associated trunk and branches lying nearby, were found to be heavily infested with the bracket fungus *Ganoderma applanatum*. Close examination of the brackets revealed that they were heavily galled, with clusters of nipple-like galls up to 7 or 8mm high, whilst older fruitbodies had their under surfaces heavily encrusted with the now open ended galls from which the mature gall causers had escaped, the escape hole being 1-1.5mm across.

Brietenbach and Kranzlin (Fungi of Switzerland) include an illustration of a galled *Ganoderma applanatum* stating that, in Switzerland the gall can be

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found wherever the fungus occurs, naming its cause as being *Agathomyia wankowiczi*. Photographs were taken and a specimen was exhibited next day at a meeting of the Norfolk Fungus Study Group held at Easton College, where it was discovered that the gall was new to everyone present. Rex Hancy also photographed the specimen and telephoned the author that evening with the news that the latest key published by the British Plant Gall Society includes this species and states that it is only known from a few sites in Surrey and Kent, so it would appear to be another species that is rapidly extending its range in Britain. Rex also stated that at present, only the early stages have found their way into the National Collections.

*Agathomyia wankowiczi* belongs to the family *Platypevidae* or flat-footed flies, a family of five genera and 23 species (perhaps 24 now!) in Britain, many of whom are reliant on fungi for their livelihood, and most are only a few mm long (Collyer and Hammond, *Flies of the British Isles*, Warne 1951).

The larva that lives in the gall was not described until 1962 when an account appeared in *Entomologische Mitteilungen aus dem Zoologischen Staatsinstitut u. Zoologischen Museum Hamburg* by Prof Dr H Weidner. It was described as being when full grown, 4-5mm long and 2mm broad, roughly oval and flattened. At that stage, the adult fly had not been hatched in the laboratory. The first account of the adult stage appeared in 1966 and was by I Eisfelder and K Herschel in *Westfälische Pilzbriefe* 6:5-10, *Agathomyia wankowiczi* Schnabl die Zitzengallenfliege aus *Ganoderma applanatum*.

However, it would appear from a paper by H A van der Aa, translated by Paul P Vergeer from the Dutch, on galls on Polypores, that there may have been confusion with other fungus gall causers in the past as he states in one paragraph "Ulbrich (1926) writes about "die Diptere *Scardia boleti* which causes a gall on *Fomes (Ganoderma) applanatum*, for unknown reasons also mentioned by Buhr (1964). This insect is often pictured as a fly in old literature possibly misidentified with *Agathomyia wankowiczi*, the fly responsible for the Tepelgall (the Dutch name) whilst *Scardia boleti* is a

butterfly” (Vergeer should have translated this as “*Scadia boleti* is a moth”).

By the time Van der Aa was writing (the article is undated but other references suggest the mid to late 1970s) the Tepelgall was becoming quite frequent in Holland. It was first found in Britain by Spooner in Kent in 1991, with the latest published distribution given as five sites in Kent, Surrey and Sussex (K C Durrant pers.comm).

*Ganoderma applanatum* is a perennial bracket fungus with a new layer being added each year. Following examination of those at Bressingham, it is suggested that the gall causer had been at that location for two or even three years at least, so it may well prove to be more widespread than is realised if mycologists start looking at the undersides of brackets of this species.

On 28<sup>th</sup> February, whilst examining brackets of *Ganoderma applanatum* growing on fallen poplar at East Tuddenham, it was discovered that these also had two year’s growth of galls of *A.wankowiczi*, but others discovered at Gressenhall Old Carr on 2<sup>nd</sup> April were quite unaffected.

**Acknowledgements.** Thanks are due to Mr Rex Hancy, Mr K C Durrant and Mr R E Evans for help with background information included in this paper.

### **Miscellaneous observations**

**Choke** of grasses (*Epicloe typhina*) first appears as a white crust around the culm which thickens as orange perithecia develop. They probably infect other grasses by the spores adhering to the stigmas, where they grow and enter the seeds. The fungus prevents the grasses from flowering and forming seed heads. In June 2002 Yorkshire fog (*Holcus lanatus*) was heavily infected with choke in some parts of Marston Marshes, Norwich. Feeding on the fungus were numerous fly larvae of *Egle radicum*. These larvae make tracks on the fungus as they eat the host before pupating. The emerging fly is rather like a miniature house-fly.

Janet Negal





Bracket fungus heavily galled with *Agathomyia wankowiczi* (R. Ellis).





**OTHER INTERESTING GALLS**  
(*Tony Howes*)



Knopper gall.



Robin's pin cushion.



Marble gall.



Marble galls.

## WILDLIFE 2000

### THE MOLLUSCAN FAUNA OF EAST WALTON COMMON

Roy Baker & Derek Howlett

The Ted Ellis Trust, Wheatfen Broad, NR14 7AL

East Walton Common (TF 735164) is an extensive, spring-fed pingo-field forming the headwaters of a tributary stream (Silver Stream) of the River Nar. The wet depressions are surrounded by calcareous grassland in the open area, though some examples also occur in the adjoining woodlands. Only a few hollows contain open water. They mostly contain a range of fen vegetation types ranging from *Carex elata*, *Cladium mariscus* or *Phragmites* swamp and fen through *Potentillo-Caricetum* and *Acrocladio-Caricetum* stands to examples of rich-fen meadow and *Schoeno-Juncetum*. These latter, whilst they may receive some direct, perhaps intermittent, seepage input, are often best described as moist and tend to occupy a zone between the wetter communities and drier *Molinia* (and other) grassland. More defined springs emerge in various places and support more characteristic *Schoeno-Junceta*.

#### Geology

The eastern part of the Common is situated over uncapped Lower Chalk. In the west there is a superficial deposit of alluvium over Lower Chalk or Gault Clay. The soil type is referred to Isleham 2.

#### Geomorphology

East Walton Common is an important geomorphological site for ground ice depressions. These are amongst the finest examples of their kind in Britain and are some of only a few that remain in a natural uncultivated condition. The features comprise a series of water or marsh-filled depressions surrounded by drier ramparts. Pollen evidence from the site indicates that ground ice (permafrost) may have developed on two separate occasions during the Late Devensian about 11,000 - 10,000 years B.P. Subsequent collapse of the ground ice is thought to have been responsible for the formation of the depressions. East Walton Common has generally been regarded as a type-locality for ground ice depressions in East Anglia.

The features at East Walton Common have been discussed by B.Sparks *et al* (1972). They described a section through one of the ridges which suggests the subsurface accumulation of ground ice, doming, the downslope movement of surface shattered chalk, thawing, and the formation of depressions. Sparks *et al* were unable to produce an unequivocal explanation for the features, but they suggested they were due to the “development of periglacial ground ice depressions”. Researchers from the Geomorphology Section of English Nature (1993) considered the depressions to be thermokarst in origin and not collapsed pingo mounds. They reasoned that East Walton was dominated by a lake basin where each of the small depressions represents a former thaw lake which is now filled in with marsh vegetation. In a review of periglacial work Worsley (1977) considered that Sparks *et al* had adopted a cautious approach, preferring to use the non-committal term “ground ice depressions”. Worsley argues that the evidence from Sparks *et al* suggests that the East Anglian features are comparable with the Welsh fossil pingos.

### **Hydrogeology**

Part of this site is spring-fed, probably from water derived from the Lower Chalk as it thins against the underlying impermeable Gault Clay. It is less obvious if all of the ground ice depression/pingos are irrigated from this source, as some show some considerable seasonal water level flux. The Common drains SW to the River Nar through a series of streams.

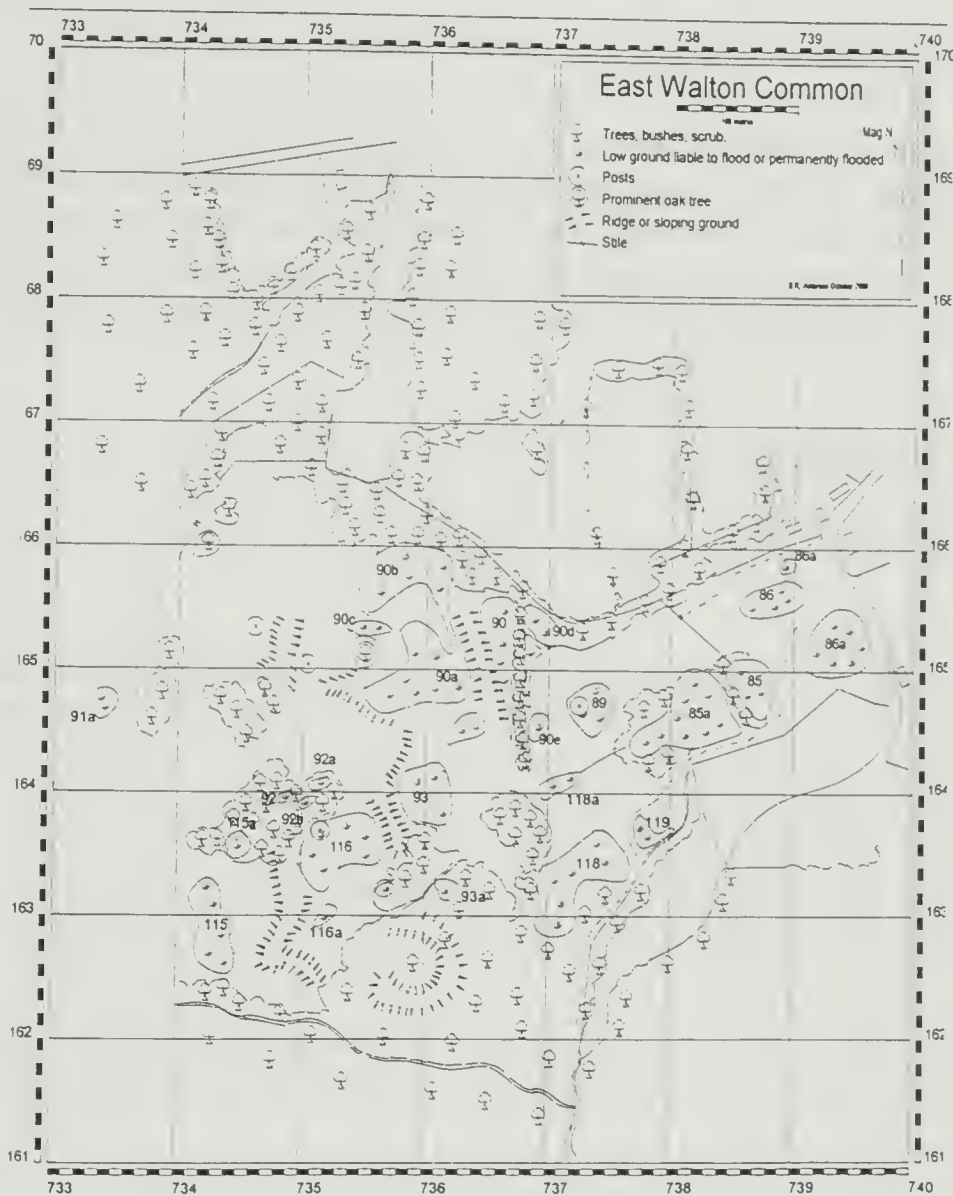
### **Silver Stream**

Of special interest in the current survey is the stream (Silver Stream) which originates in various chalk springs near the watercress beds shown on the 1:2500 Ordnance map. The source is marked “Spring” on the 1:2500 sheet at TF 73551684.

Keith Clarke studied the Silver Stream on 25<sup>th</sup> June 2000. He it gauged at two points about 150m apart so that one gauging would confirm the other. The flow at the upper site was 0.0489 cubic metres per second (cumecs) whilst the flow at the lower site was 0.1375 cumecs, about three times greater. The gauging was repeated on 13th July 2000. By this date the



stream at the plank bridge was completely overgrown with watercress. A new site was chosen upstream for the gauging with no weed and a better flow regime, almost most of the flow was in the centre section. The flow was 0.058 cumecs which confirmed the earlier gauging.



Surveyed by B.R.Ambrose October 2000 using land surveying procedures, GPS positioning and aerial photographs. Pingo numbering relates to older system with additions where necessary.

The stream flows through an area of upflow from the chalk, it rises only a few hundred metres away. It is evident that the flow is being augmented by springs within the section between the gauging points. The flow of the Silver Stream is considerable and represents a large contribution to the flow of the River Nar. The median daily flow at Marham of 0.51 cumecs is quoted by Boar *et al* (1995).

The Trophic Diatom Index, as defined by Kelly & Whitton (1995), was 1.86 for the Silver Stream. The percentage of pollution tolerant valves is only 1.0%. This indicates a stream with low pollution and eutrophication and this figure would be a good base value to adopt in assessing Norfolk streams and rivers. It compares with values of over 3 in the River Nar at Castle Acre. (Clarke *pers. comm.*).

### **Water abstraction**

1987: One licenced boreholes within a 2km radius (in Greensand aquifer). Total licenced quantity (tcma): 31.8 (BUWSD, 1987)

### **Land Use History**

This site has survived remarkably well up till recently; it has been given favourable management and was not subject to reclamation. However, there has been strong evidence for dehydration in 1989 and 1990. It is also possible that cattle stocking densities may have been too high. Towards the end of the 20th C. Soay sheep were introduced onto the Common. Soay sheep crop the vegetation closely. They dislike rank vegetation and prefer to eat shrubs and tree bark when food becomes scarce. Soay sheep feed on ragwort and in three years they have cleared the weed from the Common. Thistles and nettles thrive on the enriched soils resulting from sheep droppings. Alien plants also benefit from the sheep dung. Soay sheep have two or three lambs each and flocks can rapidly expand in numbers (Soay sheep breeder at Norfolk Agricultural Show).

### **Freshwater Mollusca**

The influence of calcium availability on the distribution of freshwater mollusca has been well documented. Species richness is a function of the intercorrelation between total hardness, calcium concentration, pH,

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alkalinity and conductivity. Boycott (1936) divided the British molluscan fauna into 30 'calciphile' species that under normal conditions require a minimum of 20mg Ca<sup>++</sup>/l and 26 species which can be found in soft waters but which are also found in hardwaters.

However, the effects of calcium and related water chemistry variables may be largely indirect, since harder waters generally support a richer plant life - both macrophytic and planktonic. It may follow that it is the greater availability of food which is critical to molluscan diversity richness. The East Walton Common pingos, spring fed pools and streams are all calcium rich. The spring fed stream has a pH 7.79 and a conductivity level of 507 microsiemens. Pingo 90a has a pH 7.35 which is typical of the system as a whole.

A number of freshwater habitats are identifiable at East Walton Common.

- ◆ permanent waters rich in macrophytes - pingos.
- ◆ temporary waters dominated by rushes
- ◆ spring fed streams
- ◆ fen mires dominated by reed and reed sweet-grass
- ◆ spring fed ponds with starwort.

Ian Killeen surveyed the Common in February and July 1991 for English Nature. He recorded 20 species of freshwater mollusca. In the current millennium survey, when the Common has been visited by the authors on numerous occasions, 4 species have been added to the Killeen list.

*Valvata cristata* Müller. Flat Valve Snail. Restricted to well-oxygenated still waters. Common in pingos with standing water and in spring fed mire at seepage site for stream.

*Potamopyrgus antipodarum* (Gray) Jenkin's Spire Snail. Rare in spring fed stream.

*Bithynia tentaculata* (L.) Common Bithynia. In water filled pingos with macrophytes.

*Bithynia leachii* (Sheppard) Leach's Bithynia. In water filled pingos. The numbers of this species rarely attain those of the Common Bithynia in the same pingos.



*Aplexa hypnorum* (L.) Moss Bladder Snail. In a small, shallow depression subject to drought to the south of pingo 116 amongst wet litter in reed bed. On the adjacent Adcock's Common the Moss Bladder Snail is abundant and the site is one of the best for the species in Norfolk.

*Physa fontinalis* (L.) Common Bladder Snail. In pingo 116 amongst reed swamp.

*Lymnaea truncatula* (Müller). Dwarf Pond Snail. In dried up depressions with rushes.

*Lymnaea glabra* (Müller) Mud Pond Snail. This species lives in waters low in nutrients, especially in places which dry out periodically. There is only one other current record for Norfolk. Discovered in two small, shallow pools shaded by birch and hawthorn. (116a & 93a). We strongly recommend that minimal management occurs near these two depressions, other than some phased scrub cutting if the trees become too dominant. **Red Data Book 2 -Category Vulnerable.**

*Lymnaea palustris* (Müller) Marsh Pond Snail. In open waters of pingos.

*Lymnaea peregra* (Müller). Wandering Snail. In spring fed pool 91 and reed dominated pingos.

*Planorbis planorbis* (L.) Margined Ram's-horn. In open waters of pingos with macrophytes.

*Bathymophalus contortus* L. Twisted Ram's horn Snail. In shallow pingos with reed.

*Anisus leucostoma* (Millet) Button Ram's-horn. Common in open waters of pingos, reed dominated pingos and in spring fed streams. .

*Anisus vortex* (L.) Whirlpool Ram's-horn. In open water pingos.

*Hippeutis complanatus* (L.) Flat Ram's-horn. In shallow depressions subject to drying.

*Gyraulus crista* (L.) Nautilus Ram's-horn. In shallow pingos/depressions subject to drought, reed dominated pingos and in more open water pingos.

*Acroloxus lacustris* (L.). Lake Limpet. In spring fed pond (91) and some of the larger open water pingos.

*Sphaerium corneum* (L.) Horny Orb Mussel. This is a common species throughout Norfolk in both running and standing waters. Boycott (1936) considered it to be a very good indicator of good conditions for molluscs. In water filled pingos.

*Pisidium casertanum* (Poli). Caserta Pea Mussel. This species has a wide ecological tolerance and can be found in a whole range of habitats. Arthur Ellis (1978) considers this species to be the most successful of freshwater bivalves, living in all types of habitats, good and bad, hard and soft waters indifferently. Recently dug out pingo (90a) previously shaded by birch.

*Pisidium personatum* Malm. Red-crust Pea Mussel. A species often found in reed swamp and in polluted places such as dirty outfalls and cattle drinking areas. Found

in shallow ponds/pingos surrounded by birch and hawthorn, in pingos beneath pine canopy, and in reed swamp.

*Pisidium obtusale* (Lamarck). Porous Pea Mussel. This pea mussel shows a preference for polluted places where few other molluscs are found. In water filled pingos and shallow depressions in East Walton Common.

*Pisidium milium* Held. Quadrangular Pea Mussel. Most Norfolk records are from Broadland and the south of the county. In water filled pingo near houses (86a).

*Pisidium subtruncatum* Malm. Short-ended Pea Mussel. This is one of the commonest of Norfolk Pea Mussels, especially in habitats with flowing water.

*Pisidium nitidum* Jenyns. Shining Pea Mussel. Generally distributed in Norfolk in ponds, lakes, broads, dykes, streams and rivers. Found in spring fed stream amongst silts in eddy pools.

*Pisidium pseudosphaerium* Schlesch. False Orb Pea Mussel. This **Red Data Book** species discovered in an overgrown pingo (116) in shallow water in 2002. The current management project is to burn off reed and birch scrub (March 2002) above the shallow water and to monitor invertebrate changes. Initial evidence (May 2002) indicates that burning has had little or no effect on densities.

## Terrestrial Mollusca

East Walton Common offers a range of terrestrial habitats. At one extreme there are wet primary reed and saw-sedge fens which merge into wet grassland with rushes. Some of the reed fens have developed into mixed fen communities rich in terrestrial mollusca. On higher ground there is grazed chalk grassland, currently overgrazed by Soay sheep. Woodland ranges from wet alder/sallow carr to mature woodland dominated by deciduous trees. However, even in the mature woodland there are numerous swampy depressions suitable for snail species.

In 1991 Ian Killeen recorded 37 species of terrestrial molluscs. The current survey has added a further 7 species to the list to make a total of 44 slugs and snails.

*Carychium minimum* Müller. Herald Snail. A common species of fens and marshes. Occasional in reed/sedge beds at East Walton Common.

*Carychium tridentatum* (Risso) Slender Herald Snail. A characteristic species of moist, sheltered places. Common in reed/sedge beds and occasional in grazed grassland.

*Succinea putris* (L.). Large Amber Snail. Typical of wet places and fens. Noted on vegetation bordering pingos and in water filled depressions (116a).

*Oxyloma pfeifferi* (Rossmässler). Pfeiffer's Amber Snail. A species of wetland fens. Noted in reed filled pingo 116. This pingo has subsequently been burnt-off to remove reed and scrub (March 2002) and the site will be re-surveyed later.

*Cochlicopa lubrica* (Müller). Slippery Moss Snail. Common in reed and sedge fens and amongst grazed grassland.

*Columella edentula* (Drap.) Toothless Chrysalis Snail. Common in reed/sedge fens.

*Vertigo antivertigo* (Drap.). Marsh Whorl Snail. Wetter, open areas of fen.

*Vertigo substriata* (Jeffreys) Striated Whorl Snail. Occasional in reed and sedge fens. Rare in sheep grazed grassland. A very local snail in East Anglia.

*Vertigo pygmaea* (Drap.) Common Whorl Snail. occasional in reed/sedge beds and in grazed grassland.

*Vertigo moulinsiana* (Dupuy) Des Moulin's Whorl Snail. Occasional in mixed fens. Although classified as a Red Data Book species this snail is to be found in many sites in Norfolk and in huge numbers. **Red Data Book 3 - Category Rare.**

*Lauria cylindracea* (da Costa) Common Chrysalis Snail.

*Vallonia costata* (Müller) Ribbed Grass Snail.

*Vallonia excentrica* Sterki Eccentric Grass Snail.

*Vallonia pulchella* (Müller) Smooth Grass Snail.. In wet grassland.

*Ena obscura* (Müller) Lesser Bulin. On birch trees.

*Punctum pygmaeum* (Drap.) Dwarf Snail. Common in reed, sedge and grazed grassland.

*Arion ater* (L.) Large Black Slug. Widespread.

*Arion intermedius* Normand. Hedgehog Slug. Common in a range of habitats.

*Arion circumscriptus* Johnston.

*Arion distinctus* Mabille. A common slug of moist habitats. Only a few sites recorded in Norfolk.

*Vitrina pellucida* (Müller). Pellucid Glass Snail. Occasional in mixed reed fens.

*Vitrea crystallina* (Müller) Crystal Snail. Occasional in sedge fens.

*Vitrea contracta* (Westerlund) Milky Crystal Snail. In swampy grassy areas.

*Aegopinella pura* Clear Glass Snail. Common in reed and sedge fens.

*Aegopinella nitidula* (Drap.) Smooth Glass Snail. Rare in mixed fens.

*Zonitoides nitidus* (Müller) Shiny Glass Snail. Rare in reed fens, in wet moss and litter.

*Nesovitrea hammonis* (Ström). Rayed Glass Snail. Swampy and grazed grassland.

*Oxychilus alliarius* (Miller) Garlic Snail. Occasional in reed fens.

*Oxychilus cellarius* (Müller) Cellar Snail. Swampy grassland.



*Boettgerilla pallens* Simroth. Worm Slug. Introduced species first noted in Windermere 1972. It has excellent powers of dispersal and is spreading rapidly. I.J.Killeen 1991.

*Limax maximus* L. Great Grey Slug. In wooded areas.

*Deroceras laeve* (Müller) Marsh Slug. A typical slug of wetland places.

*Deroceras reticulatum* (Müller) Field Slug. Open spaces. Common.

*Euconulus fulvus* (Müller) Tawny Glass Snail. Occasional in reed/sedge fens, rare in grazed grassland. .

*Euconulus alderi* (Gray). Typical of marshy sites and boggy woodland.

*Cochlodina laminata* (Montagu) Plaited Door Snail. In wood climbing trees with smooth barks. Rarely found on rough barked trees such as oak.

*Clausilia bidentata* (Ström) Common Door Snail. On sallow.

*Ashfordia granulata* (Alder) Silky Snail. Rare in mixed fens. This is surprising since in similar habitats elsewhere in Norfolk densities attain levels in excess of 300m<sup>2</sup>. A

### **European Biological Diversity Species.**

*Trichia striolata* (Pfeiffer) Strawberry Snail. Common on ash trees and nettles in wood. .

*Trichia hispida* (L.) Hairy Snail. Occasional in reed and sedge fens; rare in grazed grassland.

*Cepaea nemoralis* (L.) Brown-lipped Snail. Occasional in fens; common on trees., often climbing above 10m from the ground.

*Cepaea hortensis* (Müller) White-lipped Snail. In reeds.

*Helix aspersa* Müller. Garden Snail. In wood's edge on ash, sycamore and sallow.

*Monacha cantiana* (Montagu) Kentish Snail. Occasional amongst stinging nettles bordering grazed chalk grassland.

### **Summary**

East Walton Common has a rich assemblage of snails and bivalves. With 68 species recorded, out of a current total Norfolk non-marine molluscan fauna of 142, it is an extremely important site. The diversity of ecological habitats available for non-marine molluscs has produced a high level of species diversity in a relatively small area of Norfolk.

### **Acknowledgements**

We would like to thank Peter Lambley (English Nature) for initiating this survey and to Mr Henry Birkbeck for permission to freely use the Common and for his invaluable background information on past management of the land.

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## Miscellaneous observations

**An extremely rare hoverfly.** Every year I get the contents from a number of ultraviolet traps sited in various cafes in north Norfolk. Occasionally I get a surprise find.

In June 2001, whilst sorting through a heap of various insects from the cafe in the car park of Sheringham Hall, I came across the headless body of an extremely rare hive bee minic hoverfly, black bodied with a parallel sided abdomen and the hind legs with swollen black and yellow femora, the tibia of which were arched.

Its name being *Brachypalpus laphriformis* Flin, but despite the loss of its head, possibly due to touching the potential bars of the trap, it now resides beside a much older specimen in my collection.

This species is found in southern ancient forests like the New Forest and seems to be found in the area of dead beech and ash trees. Another southern species heading northwards in recent years.

Ken Durrant



## ORCHIDS (*Tony Howes*)



Lesser butterfly orchid.



Fen orchid.

Common spotted orchid.



Bee orchid.







Viper's bugloss (*Tony Howes*).



Creeping cinquefoil (*Tony Howes*).

## JOHN DREW SALMON, A PRE-VICTORIAN NATURALIST IN NORFOLK

Gillian Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF

John Drew Salmon was a naturalist with a wide range of interests. He was probably born in 1802 and so was 23 years old when he made the first entry in his natural history diaries. When he began, he was living at Stoke Ferry, certainly with his brother Richard. We know little about his family though a Mr Salmon of Stoke was a subscriber to Robert Forby's *The Vocabulary of East Anglia* of 1830. He was a good observer and his natural history interests were wide, he reared moths and butterflies, collected birds and their eggs and also plants and in his diary comments on a wide variety of topics. Typically one of the first entries concerns a visit to the Netherlands when he records to his surprise that all the cows he saw between Rotterdam and the Hague were black and white, the Friesian cow had yet to make its appearance in England. As well as keeping his diary he collected bird specimens and had them stuffed and presented to the Castle Museum in Norwich, he notes that he intended replacing the existing ones which were very stiff and unreal. In 1834 he wrote to the *Magazine of Natural History* suggesting that the movements of migrating seabirds should be recorded 'by the co-operative agency of naturalists residing near headlands on the coasts', this is recorded in D.E.Allen's *The Naturalist in Britain*. In fact John Salmon was a good forty years ahead of his time as migration studies did not begin until the 1880s. He also kept a Herbarium which eventually ran to 28 volumes, recording and collecting most of the Breckland specialities giving us an insight into habitats now changed out of all recognition, or sometimes completely lost.

For the first few years the diary holds only a few, sparse entries, in 1826 for example noting the first cuckoo of the year heard on April 22<sup>nd</sup>, and in 1827 the first sand martins seen on March 30<sup>th</sup> and swallows on April 11<sup>th</sup>. In 1828, like so many of his interested contemporaries, he and his brother Richard start an egg collection and in the same year he adds to it the eggs of the Great or Norfolk Plover (Stone Curlew) "2 eggs on the ground taken at



Whittington Hill" [Between Stoke Ferry and Northwold]. In 1831 he notes that he has put a pair of carolina duck on his pond, later adding some teal, three gadwall and a female shoveller. In the same year he went on an expedition to the Orkney islands noting especially the birds he saw - and mostly shot - and the eggs he was able to acquire. In 1832 he lists new acquisitions to his egg cabinet, many very familiar such as a clutch from the heronry at Didlington, but also including ravens' eggs from Oxborough, those of the wryneck from a garden nearby in Stoke Ferry, hen harrier from Northwold Fen and in 1833 great bustard from Massingham. These latter were part of the well documented collection from that heath and were purchased from "a Mr Ashby of Lynn".

John Salmon's diary has no personal entries and it is only by interpreting his comments that we can find that he was a brewer by trade, though his exact position in the business is not possible to ascertain and he is just too early for the Trade Directories. He certainly had money and position and had free access to the warrens and other lands around Thetford to which town he moved at the end of 1833. From February 1834, perhaps because he seems to have been living on his own, his diary becomes more descriptive though still concerned almost entirely with natural history. Salmon's Thetford was a small agricultural town with regular markets and annual Lamb and Wool Fairs. Farming was still relatively prosperous and he records good local crops of wheat, barley, oats, rye, turnips and field peas. The town also had a large acreage of heath and warren, the latter managed by a Warrener who was responsible for looking after the rabbits which lived and bred there, not wild, but a commercial crop. The wildlife he records gives us a feel for the area before the bustle and noise of the modern world took over. It also shows us why virtually all birds of prey disappeared during his century.

The following excerpts are mostly verbatim, most of the entries are in almost note form, but occasionally he allows himself a short piece of prose. Any additions and explanations I have made are in square brackets. With plant names, Salmon sometimes used English, sometimes Latin names, I have added to them only where it seems necessary for information.

*Trans. Norfolk Norwich Nat. Soc.*



1834

**January** - a very mild month, ravens croaking.

**January 16<sup>th</sup>** - pipistrelle flying. No snow this winter. A few ravens and many hooded crows

**February 4<sup>th</sup>** - several white, also black rabbits on the warren

**February 6<sup>th</sup>** - a camel (with two humps) and a bear led about the streets of Lynn.

**February 7<sup>th</sup>** - immense number of ladybirds (7-spots) hanging in clusters of 20-30 on the lower branches of a spruce fir, thousands of them

**February 23<sup>rd</sup>** - a huge flint embedded in the chalk pit at St Helen's Well 6ft 6in long and not exceeding 6in in thickness, the water at the spring is beautifully clean.

**March 8<sup>th</sup>** - sand drifting very much.

**March 9<sup>th</sup>** - to Stanford Warren, about 12 pairs of black-headed gulls wheeling about at a considerable height over the pond. [This is Bagmore Pit] The place is by no means a very secure place the pond being very small and close by the road. From the appearance of the old nests, I should think there are a great many resort hither, the nests are placed on the tops of small hassocks [*Carex elata*?] which abound all round the pond, standing just above the water. I understand these birds had made their appearance at Scoulton Mere about ten days ago and that they were tolerably numerous there on the 7<sup>th</sup>, still the main body of them has not yet arrived. There has been 6 peregrine falcons trapped on the warren within the last month, all but one immature females.

**March 22<sup>nd</sup>** - riding back from Brandon to Thetford between 9 and 10 p.m. in moonlight, lapwings continually uttering their well known cry as I passed over the warren, evidently considering me as an intruder, the whole warren appeared to be alive with them, their notes resounding from all parts and accompanied by the shrill whistle and contented noise of the ringed plovers. The evening was still, scarcely a breath stirring. The pipe of the snipe and the drumming of others added much to the chorus of the evening and he who could listen to such with apathy and indifference must be without feeling and knows not half the joys that are in store for him in examining the wonders of the creation. A plaintive whistle from some supposed stranger overhead arrested my attention, nor could I call to mind

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any similar sound. It died away in the distance and left me pondering of the possibility its turning out to be a well known friend performing one of its nightly migrations.

**March 23<sup>rd</sup>** - a blowing day, some of the fields drifting like the billows of the sea, the banks only arresting them. Much damage must be done to young peas and more particularly the oats and barley.

**March 24<sup>th</sup>** - the Norfolk or Great plover [Stone curlew] has made its appearance on the warren as I heard several uttering their peculiar cry.

**April 6<sup>th</sup>** - found a stonechat nest placed on the ground in front of a furze bush in a hole scraped by a rabbit, also a coal tit, this in a small hole in the ground in the slope of a hill.

**May 2<sup>nd</sup>** - took a walk to Fowlmere, a fine piece of water, the distance from hence four miles. There are an immense number of tench, perch and some carp in it, none very large, it is supposed in consequence of them being so numerous. Put up a greenshank. I had from an old man who has lived there in a cottage for nearly 40 years and has always been in the habit of walking round the mere in general every Sunday, that his grandfather has always remarked that when the mere is very high, wheat is dear and on the contrary when the water is low. At present the water is unusually low - there is no outlet for the water to run away being surrounded with high land. A great many ducks resort hither during the winter but is very soon freezes over. The black-headed gulls in general pay a visit early in the morning and late in the evening during the time they are at Stanford Warren. They have never been known to breed nearer to the Mere than Stanford. The water is very clear. In the immediate vicinity there is a pond called the Devil's Punchbowl. This is a rather singular pond being very nearly perfectly round and deep and I should most be supposed to think that this was dug out. It is supplied by a spring on one side of it.

**May 7<sup>th</sup>** - walking by the river put up about 50 pied wagtails from reeds growing close to the water. Between the 2<sup>nd</sup> and 3<sup>rd</sup> stanch on the warren side put up a green sandpiper. The white rabbits very conspicuous on the warren as they kept moving about. Great, ringed plovers and lapwings calling, a myriad of gnats flying, the whole atmosphere alive with them at the same time keeping up an incessant hum as if they were several swarms of bees.

**May 29<sup>th</sup>** - collected two blue [brown] argus butterflies and a lappet moth cocoon, hay being cut, sheep sheared.

**June 11<sup>th</sup>** - some pupa hatched, cream spotted tiger moths. To Stanford Warren, several thousands of black headed gulls. The eggs still 3p a dozen. As I approached I was obliged repeatedly to hold up my umbrella to prevent them from striking me in the face. When they made the stoop they invariably dropped their legs at the same time uttering a shrieking, clamorous noise indicating great displeasure at my invasion. The whole body was in commotion, wheeling and twisting in all directions and as dense as a swarm of bees upon the wing, still in all their convolutions none touched each other. Hundreds left the pond and settled upon the ground at a short distance no doubt waiting for my departure before they ventured to return to their nests.

**June 19<sup>th</sup>** - saw a male of the red-backed shrike, it had a large beetle in its mouth when it alighted and immediately put it under its foot. I frightened it off the tree in expectation it would have dropped it, but no such thing, as it flew away it carried it in its foot which hung down as it flew along, across the field to the opposite fence

**June 22<sup>nd</sup>** - four green sandpipers, I suppose to be two pairs, they were very near Euston bridge. Afterwards a walk alongside the river put up another which put up a pair of others, perhaps the same birds as previously seen as they (the two pairs) flew in the direction that I found the latter. Do they breed in this district, I feel sure those I saw were all adult birds.

**July 1<sup>st</sup>** - field peas cut and carted. At Hilborough they are called nimble tailors!

**July 7<sup>th</sup>** - found pair of red-backed shrike with young. Found the nest empty but for the elytra of beetles.

**July 23<sup>rd</sup>** - rode to Stanford Warren, not a single black-headed gull either young or old to be found at the pit and they evidently appear to have left some time, the piece of water almost dry. The birds did not leave last season until the 16<sup>th</sup> August.

**August 3<sup>rd</sup>** - 200 lapwings at Kilverstone

**August 9<sup>th</sup>** - swallowtail butterfly (*Papilio machaon*) in Mews [name not certain] Lane Thetford.



**August 27<sup>th</sup>** - walked across the warren, all three plovers have gone, wheatears still present.

**September 1<sup>st</sup>** - saw a female pied flycatcher feeding a young bird on the lime trees opposite the town hall.

**October 23<sup>rd</sup>** - Aurora Borealis about 7 p.m., seen by Richard at Northwold.

**November 1<sup>st</sup>** - a large flock of siskins accompanied with a flock of goldfinches upon some alder trees against Place Farm.

**November 18<sup>th</sup>** - saw a flock of about 50 snow buntings near the warren on Mr Gardiner's land, some of them appeared to be almost white. Earlier than usual.

**December 22<sup>nd</sup>** - Brilliant display of Aurora Borealis this evening at about 6 p.m, forming an arch below and shooting upwards nearly to Ursa minor with streams of light, not a breath of wind and the stars very bright, the air chilly. Lasted until 7.p.m.

## 1835

**January** - [notes] rough-legged buzzard, short-eared owl, peregrine falcon, 5 dotterel, a fine male crossbill all shot over the Warren.

**March 5<sup>th</sup>** - Reynolds [the local taxidermist] received a polecat and 2 stoats.

**March 13<sup>th</sup>** - pairs of lapwing scattered over the Warren. Ring plovers very numerous, they have already commenced scratching the holes amongst the stony parts of the warren preparatory to their breeding.

**March 19<sup>th</sup>** - black-headed gulls have arrived at Stanford Warren.

**April 19<sup>th</sup>** - Golden plover have left. Wheatear nesting. I find the wheatear does not build in the rabbit burrows but in the small false burrows that do not go far underground, the nests are easily to be detected by the bird gathering a considerable number of small pieces of the stalks of bracken at the entrance to the hole on the outside. Having received this information from the Warrener, I was induced to ascertain the correctness of the statement which I found was right, having discovered two nests by these means.

**April 20<sup>th</sup>** - Stock dove eggs found on the ground under gorse bushes.

**May 1<sup>st</sup>** - to Stanford, the gulls lay over rather more than a fortnight. The person who collects the eggs leaves a few to hatch replacing others with

stones etc.

**May 30<sup>th</sup>** - snipe and water rail eggs in the turf pits on the warren.

**July 19<sup>th</sup>** - found a yellow wagtail's nest below the 4<sup>th</sup> stanch \*, the nest was placed amongst the ling and contained three young ones.

**July 29<sup>th</sup>** - six green sandpipers near Euston bridge.

**August 6<sup>th</sup>** - it has been dry since St Swithin's (July 15<sup>th</sup>) clouds of dust are blowing about, grasshoppers chirping merrily all the evening. Nightjar hawking by the river, quite silent.

**August 17<sup>th</sup>** - Thetford Lamb Fair.

**August 24<sup>th</sup>** - Ringmere now quite dry.

**August 25<sup>th</sup>** - rain, thunder and lightning.

**October 5<sup>th</sup>** - four swifts left from the brewhouse roof. [In May and June as an experiment, JS had removed their nests and eggs and they laid again late. He climbed up to look in early September and notes there are two young. The parents fed them throughout the month, they were still there, though almost fledged on the 1<sup>st</sup> and apparently left on the 5<sup>th</sup>, both adults and young].

**October 13<sup>th</sup>** - Two woodlarks sent to me [from out of the county], "the first I have ever seen." [Does this mean they were not then in the Thetford area?] Comet seen with a flashing, lengthened tail.

**October 15<sup>th</sup>** - A very fine day. This was quite an autumn day, frosty in the morning and calm during the day with sunshine, all nature appeared to be silent, not a single bird pouring forth its song. The cawing of the rooks as they sported about in the air, apparently enjoying their aerial gambols, the hoarse croak of the crow as he winged his way towards the warren, the cry of the heron on being disturbed with the distant tramp of horses on the road were almost the only sound that broke upon the stillness of the scene.

**November 18<sup>th</sup>** - display of Aurora Borealis

**November 22<sup>nd</sup>** - a large flock of golden plover at Rushford.

**December 2<sup>nd</sup>** - J.D.S. was made an honorary member of the Norfolk and Norwich Museum at a dinner with Professor Sedgewick in the chair. Notes "am much gratified." This was for supplying the Museum with new bird specimens.

**December 3<sup>rd</sup>** - in passing through Hethersett saw a great quantity of mistle

-toe growing in some old apple trees in an orchard by the road side, between 30 and 40 bunches in the different trees.

**December 26<sup>th</sup>** - snow, temperature 18<sup>0</sup>F at eight in the morning. Navigation stopped by the ice. A black woodpecker taken at Billingford near Diss in a wood with alder buckthorn and guelder rose.

## 1836

**January 17<sup>th</sup>** - Fowlmere partially frozen over.

**February 14<sup>th</sup>** - towards Rushford trees and bushes are lopped during the severe weather for the use of the deer in Euston Park. They eat only the bark. Elder and ash appear to be their favourite, also the bark of ivy by the bark-less arms and branches that lie scattered about the park. Large flocks of greenfinches feeding on barley stubble. A wryneck on the park pale. Stock doves appeared on Kilverstone Warren this week.

**February 15<sup>th</sup>** - observed a bat hawking about for flies between 3 and 4 o'clock, the sun shining all the time.

**February 23<sup>rd</sup>** - [on reading through some old parish records, locality not stated] .... In one small parish I found £54.5.10d had been charged to the poor rate in 3 years for killing sparrows. They are paid at the rate of 3d a dozen and consequently there must have been 52,600 sparrows which allowing 12 sparrows to weigh 1lb, makes of the whole 4,383 lbs of sparrows.

**March 16<sup>th</sup>** - went to Swaffham, waters much out at Mundford and Hilborough.

**April 8<sup>th</sup>** - to Shropham to the Rev. Leathe's sale [the Rev. W. Heading Leathes of Shropham Hall was a keen amateur botanist and sheets from his Herbarium are now scattered in a number of Museums while those John Salmon obtained are included in his own Herbarium in Norwich ].

**April 13<sup>th</sup>** - *Veronica triphyllos* [fingered speedwell] in flower in great abundance in almost every field around Thetford. [now a Red Data Book species and almost lost].

**April 14<sup>th</sup>** - 58 rook nests in Thetford this year, last year there were 90, the young rooks were all shot last season. The colony has been decreasing for the last few years owing to the incessant persecution

**April 16<sup>th</sup>** - stonechats nesting on Stanford Warren.

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**April 29<sup>th</sup>** - Sharp frost. Ice as thick as a half crown on the tops of the barrels in the brewhouse yard. Green sandpipers near the second stanch and at Brettenham.

**May 1<sup>st</sup>** - Reynolds had an otter caught last week at Snarehill.

**May 3<sup>rd</sup>** - jackdaw plucking the hair from a donkey's back for its nest. Neddy appeared to take it very patiently.

**May 15<sup>th</sup>** - walked out on the warren, several nests of wheatears on the warren, one held young ones a few days old, it appears that the entrance is almost always facing southward, I have found this to be the case with all the nests I have examined this spring.

**May 18<sup>th</sup>** - I find the jackdaws build in the rabbit burrows on the warren near the Lodge.

**May 28<sup>th</sup>** - 2 whinchat nests taken from the warren, also a nightjar.

**June 3<sup>rd</sup>** - found a skylark's nest with three [of its own] eggs and a cuckoo's. *Hottonia*, water violet, flowering in the turf pits by Euston bridge.

**June 12<sup>th</sup>** - walked around Kilverstone, Brettenham and Shadwell. Found maiden pink, *Dianthus deltoides*, burnet rose, *Rosa spinosissima* and hogweed in flower. [This record is interesting as Dixon Hewitt's find of burnet rose at Kilverstone a hundred years later has always been considered by botanists to be an error but is presumably not so].

**June 23<sup>rd</sup>** - corn cockle and bluebottle [cornflower] in flower around Thetford.

**July 7<sup>th</sup>** - gathered cranberry, *Vaccinium oxycoccus* with berries on but not ripe, cross-leaved heath, *Erica tetralix*, two sundews, *Drosera anglica* and *rotundifolia*, on Breccles heath and petty whin, *Genista anglica* on Wretham heath [all in the Cranberry Rough area].

**July 13<sup>th</sup>** - Thetford wool fair

**July 18<sup>th</sup>** - Along Kilverstone Lane in a clay pit I gathered bladderworts, *Utricularia vulgaris* and *U. minor* also perennial knawel, *Scleranthus perennis* on the heath.

**July 27<sup>th</sup>** - Water soldier, *Stratiotes aloides*, in the ditches between the river and Castle Lane.

**August 1<sup>st</sup>** - Milk thistle, *Silybum marianum* in Roudham churchyard, from

there went on to Brettenham. Rock rose and lesser dodder plentiful on the heath.

**August 11<sup>th</sup>** - found pennyroyal, *Mentha pulegium*, on Mr Wright's land adjoining the Croxton Road.

**August 12<sup>th</sup>** - to Stanford Warren, gathered Fragrant Orchid, *Gymnadenia conopsea*, Marsh Helleborine, *Epipactis palustris* and the sundews, *Drosera rotundifolia* and *anglica*. [this area of rich fen was destroyed when Stanford Water was created in about 1847]. Five ravens among the sheep and red-backed shrikes present.

**August 21<sup>st</sup>** - Breckland mugwort, *Artemis campestris*, in flower on the heath [another RDB species now almost lost from Norfolk].

**October 17<sup>th</sup>** - a heavy mist hung over the surrounding countryside early this morning which cleared away as the sun advanced towards his median height. Took a walk in the afternoon by the side of the river, all nature appeared to be revelling with delight, a few pairs of swallows were careering to and fro over the surface of the stream, here and there a solitary lark was hanging on the air carolling forth its joyous notes, myriads of ephemera [mayflies] and phryganea [caddis flies] were sporting over the surface of the river and were constantly falling into the water and as eagerly became food for fishes as they lay struggling on the surface. Saw a solitary admiral butterfly displaying its splendid scarlet and black wings in the genuine warmth of the day as it rested upon the flowerless heads of ragwort. Large patches of *Peziza coccinea* on the surface of the ground with their beautiful scarlet cups amongst the furze bushes which here and there sported a few yellow flowers. Several pairs of hooded crows were flying along the margins of the river. Crossed at the second stanch to the warren, disturbed a pair of herons which uttered their harsh scream as they slowly winged their way to a distance further down the stream. The low ground was covered with the webs of the gossamer spider. Flushed several snipe amongst them a jack snipe which silently removed to a very hidden spot amongst the turf pits. Saw a large flock of lapwings wheeling high up in the air. The caterpillar of the cream spotted tiger moth was changing his pasturage and several other insects were enjoying themselves on a sunny bank.

**October 28<sup>th</sup>** - a sharp frost.





Sedge tussocks of *Carex elata*.

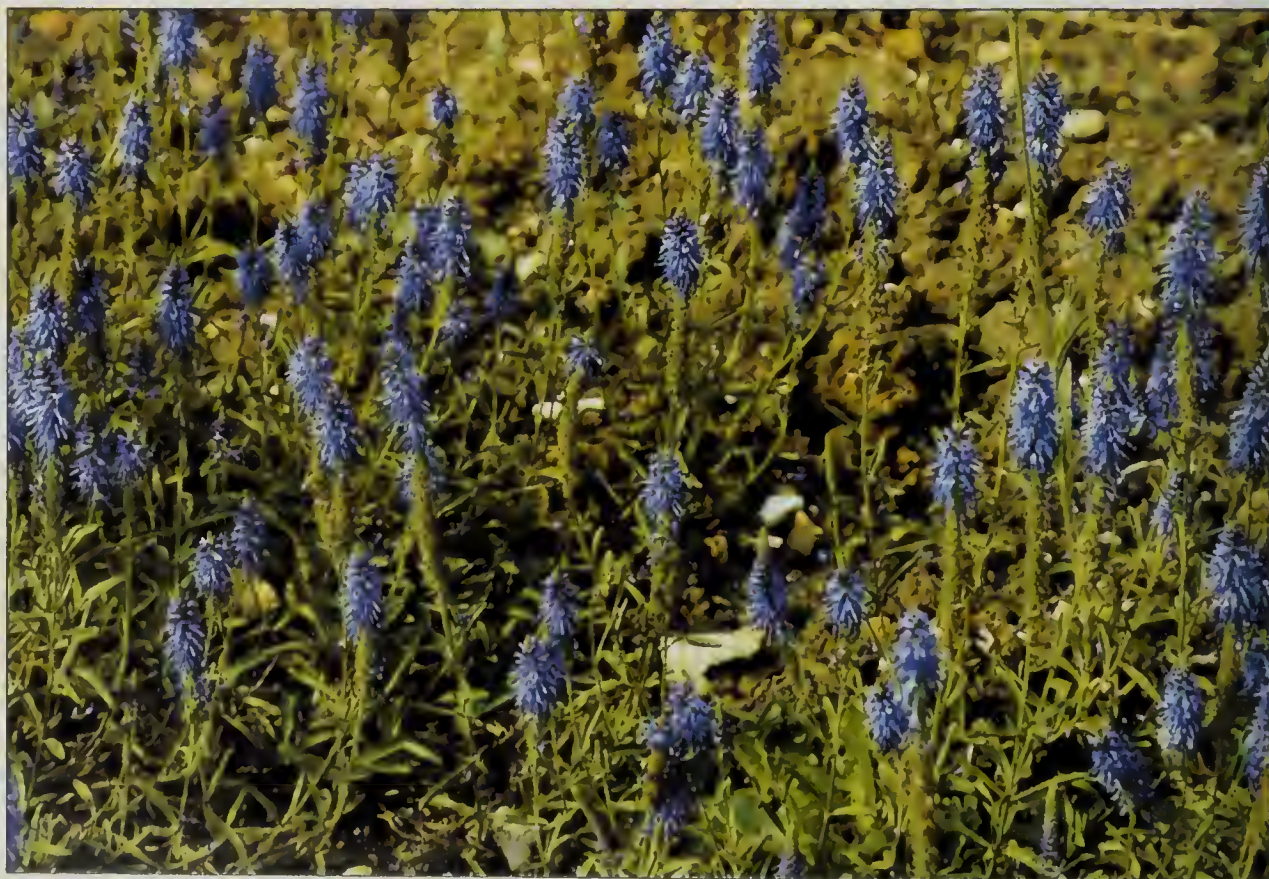


pring vetch: *Veronica verna*.





Marsh helleborine (*Epipactis palustris*) and  
Fragrant orchid (*Gymnadenia conopsea*).



Spiked speedwell; *Veronica spicata*.

**October 29<sup>th</sup>** - heavy snow, such a heavy fall so early has not accrued in the memory of man.

**November 24<sup>th</sup>** - the Norfolk plover [stone curlew] have all left the warren.

**December 12<sup>th</sup>** - missel thrushes seem to be very fond of the berries of the mountain ash, resorting to a tree against St. Cuthbert's church for the purpose of feeding on any berries and at the same time driving away with great clamour every hapless sparrow that chance to perch amongst the branches.

**December 23<sup>rd</sup>** - much snow, the mail from Norwich arrived at 10.30.p.m. and coaches had to turn back.

**December 28<sup>th</sup>** - the Mundford Road has 5-7 feet of snow. Immense flocks of small birds around the corn stacks standing in the fields.

## 1837

**January 1<sup>st</sup>** - the Mundford road passable. I walked through the cutting, it is as if there were a wall on each side, in some instances 10ft in height. It was only completed yesterday having occupied between 30 and 40 men and boys for the last four days, a distance of about 2 miles. Walking near the springs on Place Farm I observe that they were regularly steaming, this not the case from the river running alongside.

**January 6<sup>th</sup>** - start of a thaw.

**January 27<sup>th</sup>** - all the meadows adjoining the river quite under water.

**February 17<sup>th</sup>** - saw a pair of yellow butterflies today, I suppose them to be brimstones.

**March 7<sup>th</sup>** - walked across the warren to see Mr Gardner's new stock of rabbits, they came from Lincolnshire and are of a silver-blue colour, the fur is considered of more value than the common grey.

**March 30<sup>th</sup>** - [at Scoulton] the gulls are very numerous and at a distance appeared like a fall of snow over the Mere. [obviously no encircling trees].

**April 3<sup>rd</sup>** - fine day, blowing a gale of wind from the south-west, sand drifting very much. Still cold, this is a cheerless and backward season.

**April 26<sup>th</sup>** - the first swallows and a cuckoo.

**May 11<sup>th</sup>** - Saw a garden warbler, the first bird of this species I have seen since I have been at Thetford.



**June 1<sup>st</sup>** - By Place Farm gathered spring speedwell, *Veronica verna*, *Veronica triphyllos* and bogbean, *Menyanthes* by the river.

**June 25<sup>th</sup>** - *Silene otites*. Spanish catchfly, [RDB] in flower by Oak Wood. [Brettenham.]

**July 5<sup>th</sup>** - Had a delightful shower of rain but scarcely a sufficiency to lay the dust still it was grateful having been nearly suffocated by dust for some considerable time past. The evening quite still, not a breath of wind stirring, close and warm with a thick haze all round except to the eastward which was clear. Sickie medick, *Medicago falcata*, in flower

**July 30<sup>th</sup>** - walked towards Rushford, found *Veronica spicata*, spiked speedwell in flower sparingly against the fir plantation not far from the oakwood. Although I looked over a considerable portion of this heath, I could not find a single specimen anywhere else, the space occupied does not exceed half a dozen square yards. [This is the first Norfolk record of this plant, another RDB species for which we now have only one native site].

**August 17<sup>th</sup>** - Branched Bur-reed, *Sparganium ramosum*, opposite the Castle and a single plant of Thorn-apple, *Datura stramonium*, near the Gallows Pit on the common.

**August 22<sup>nd</sup>** - near Bridgham gathered three immense specimens of puffball 12in in diameter, also wild succory (chicory).

**October 6<sup>th</sup>** - brilliant display of *Aurora borealis*.

**October 13<sup>th</sup>** - total eclipse of the moon.

**October 14<sup>th</sup>** - a frost, ground quite white.

Two weeks later, on October 26-27th the brewery plant and all its contents were auctioned and on November 26<sup>th</sup> after two days saying goodbye to his friends, he left Thetford "in all probability for ever" and moved to a new Brewery at Godalming in Surrey.

On leaving Thetford, he seems to have had less time for his observations, perhaps he married or had a more responsible post at the new brewery and he does not appear to have visited Thetford again, apparently moving eventually to London. He continued his collection of plants though increasingly he gained his specimens from other botanists through the British Exchange Club and relatively few later additions were of his own



collection. His plants were put in specially designed books each containing about 50 folders with names of the species, details of finder and site written on the outer page and the specimens within. They are beautifully preserved and arranged with a very artistic as well as botanical eye, the best I have seen. At one time he appears to have gone through his collection and labelled all the remaining pages with the species he had yet to find, perhaps when he was ill and confined to the house, but sadly many of these remain empty as he died in 1859 at the age of only 57. His memories of Norfolk were, however, happy enough for him to have left both his diaries and his Herbarium to the Castle Museum at Norwich where they remain.

### Acknowledgements

My thanks are due to the Norfolk Museums and Archaeology Service for permission to print these extracts and to Tony Irwin and John Goldsmith for making it possible for me to study both diaries and herbarium.

\* A stanch or staunch is a wooden weir, the boards of which can be lifted to allow boats through as well as wash away any weeds which might have collected against it.

### Miscellaneous observations

**Drone Flies.** On 5<sup>th</sup> April 2002 swarms of Drone-Flies *Eristalis pertinax* (Scop.) were seen on the wing and sunning themselves on the leaves of kingcup in the dyke margins of Surlingham Wood and Carr at Wheatfen. Upwards of thirty specimens settled on each leaf. Ken Durrant noted similar numbers at Beeston Common and in Sheringham. **Roy Baker**

**Ivy broomrape - *Orobanche hederæ*.** It is curious that we have found no difficulty in growing this parasitic plant from seed in Stratford upon Avon, Sutton Coldfield and Welborne. In each case when we moved homra capsule was taken and placed in ivy roots. In Welborne this year we have seen seven flowering shoots. This is not the best annual record but they have appeared annually for the last 27 years. Last year it was seen in our neighbours garden and could well have dispersed its seeds further. We wonder why it has not reached Norfolk before? **Reg. Evans**

# WILDLIFE 2000

## NORFOLK TERRESTRIAL HETEROPTERA.

K.C.Durrant

18, The Avenues, Sheringham, Norfolk NR26 8DG

### Introduction

This complete section of bugs form a total of 514 different species in Great Britain where they form separate groups called in the vernacular Flower bugs Damsel bugs; Plant bugs; Lace bugs; Assassin bugs; Shore bugs; Squash bugs; Broad-headed bugs; Scentless Plant bugs; Ground or Seed bugs; Stilt bugs; Burrowing bugs; Stink or Shieldbugs. They range in size from 16mm to the very small ones of 1.5-2mm.

They pass through an incomplete metamorphosis i.e. egg; a larval life of five instars ( changes of skin ) where they resemble small forms of the adults but minus wings ; to the final sexual adult, as there is no pupal stage they are therefore continual feeders all their lives. Adults hibernate during the winter months or lay eggs that hatch the following spring.

Some species stridulate to attract the opposite sex at mating time. Many species can emit a strong pungent smelling fluid when disturbed or attacked to repel potential predators, this can kill other insects and it can even stain human skin or produce nausea in sensitive individuals if not handled carefully.

Many species are herbivorous and feed by means of a rostrum or beak upon shoots, buds, unripe seeds, or berries. Others are predatory and feed on the larvae of other insects or even the adults if they can capture them, some however are omnivorous.

The easiest species to recognise in the field because of their size and colour are the Shieldbugs, they all have five jointed antenna, whereas all the other

groups only possess four joints. Every autumn I have visitors who produce a box or a jar in which according to them contains a very pretty beetle, but more often than not it turns out to be one of the large Shieldbugs.

*Pentatoma rufipes* L. Forest bug. 11-13.5mm (figure 1A). Fairly common in woodlands and orchards.

*Acanthosoma haemorrhoidale* L Hawthorn shieldbug. 13-15mm. (figure 1B). Common in the autumn. A regular visitor to gardens.

*Picromerus bidens* L. 12-13.5mm (figure 1C). A great predator of moth caterpillars.

**Figure 1.**



*Palomena prasina* L. Green shieldbug. 12-13mm (figure 2A). Common in woodland rides especially where hazel grows.

*Piezodorus literatus* Fab. Gorse shieldbug. 10-12mm. (figure 2B). Found wherever gorse grows in quantity.

*Troilus luridus* Fab. 10-12mm. (figure 2C). A great predator of moth and beetle larvae. It can hold its prey at the tip of its rostrum by mandibular stylets that spread out to hold its victim once inserted.



Figure 2.

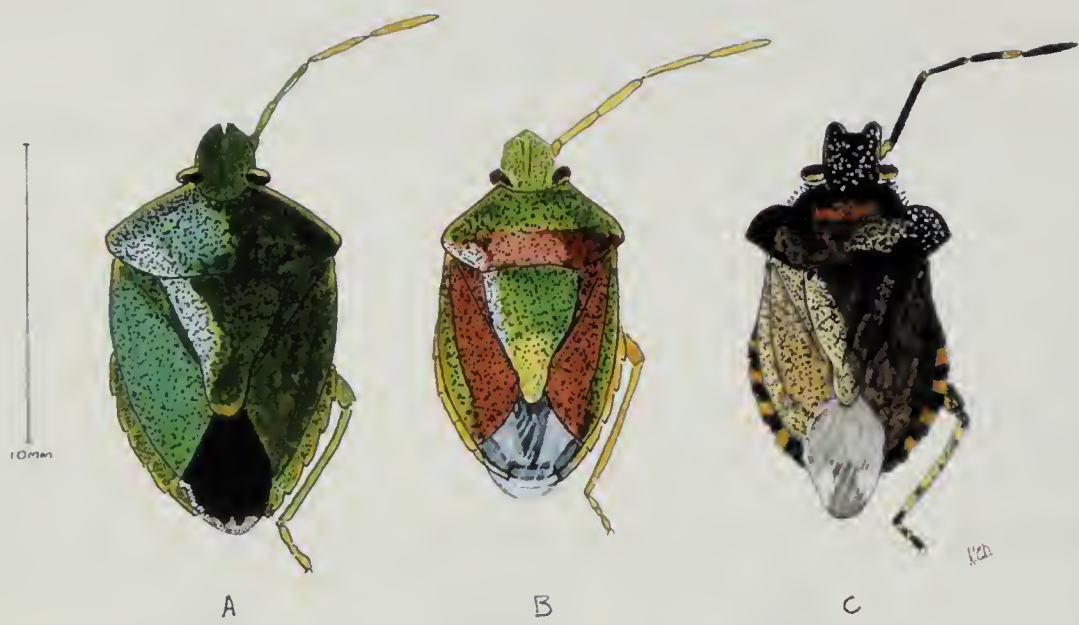


Figure 3.



*Elasmotethus interstinctus* L. Birch shieldbug. 8-10mm. (figure 3A). A common Shieldbug of mixed woodlands.

*Elasmucha grisea* L. Parent shieldbug. 7-9mm. (figure 3B). Common in birch woodland from May until October.

*Elasmotethus tristriatus* Fab. Juniper shieldbug. 10mm. (figure 3C). This bug was restricted in the southern counties in juniper woods. It came to Norfolk in 1976 as odd individuals, but in 1983 large numbers were recorded arriving in the thermals and they are now to be found breeding on *Chamaecyperis* even in Norwich.

*Eysarcoris fabricii* Kky. 5-6mm. (figure 3 D). Sometimes found in large numbers in early June in the area of its food plant.

*Sehirus bicolor* L. Pied shieldbug. 5.5-7.5mm. (figure 3E). After emerging from hibernation in May and then mating, the female deposits 30-40 eggs in a hollow of dry earth. She remains with the eggs, occasionally cleaning them until they hatch after twenty days. She will then lead them to their first food plant - white deadnettle- where she leaves them.

*Zicrona caerlea* L. Blue shieldbug. 6-7mm. (figure 3F). A great predator of beetles and their larvae. Also small caterpillars.

**Figure 4.**



*Aelia acuminata* L. Bishop's mitre. 5-9mm. (figure 4A). A local insect in Norfolk but often common where found.

*Dolycoris baccarum* L. Sloebug. 11-12mm. (figure 4B). Usually found around the edges of woodland on herbage flowers during summer.

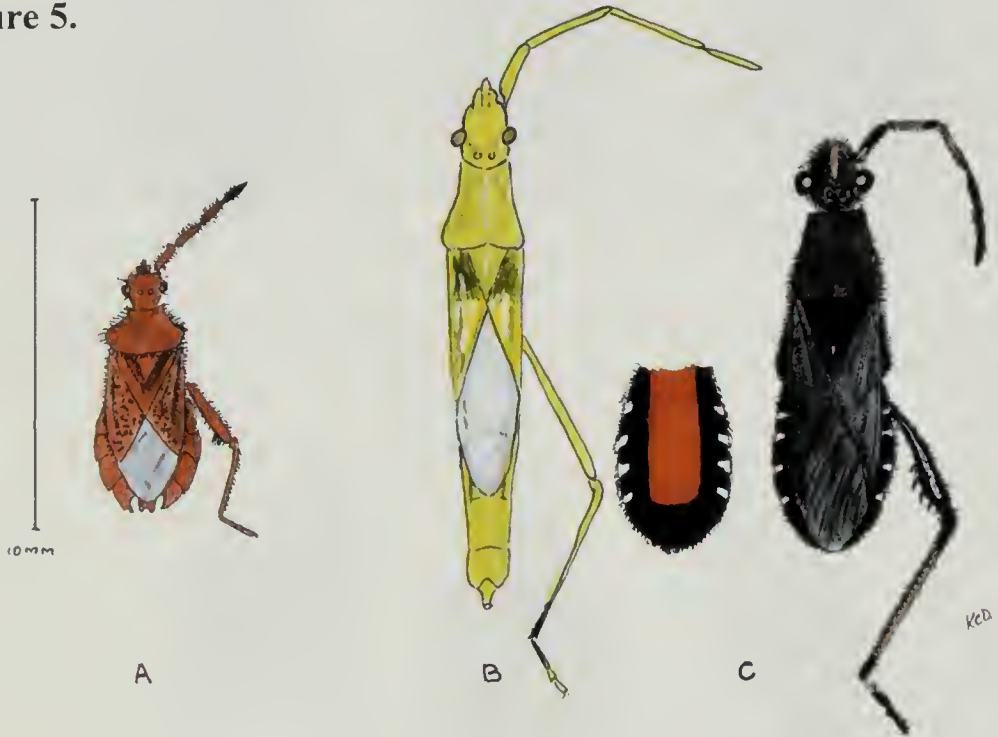
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*Podops inuncta* Fab. European turtlebug. 5.3-6.2mm. (figure 4C). The scutellum is large and covers nearly all the abdomen. Notice the hooked process on the side margins of the pronotum, and flaps (parandria) over the genital segments of the male.

*Sciocoris cursitans* Fab. 4.5-6mm. (figure 4D). Frequently taken by sweeping during summer in grassy areas.

**Figure 5.**



*Coriomeris denticulatus* Scop. 7-8mm. (figure 5A). A very bristly and hairy insect. On the wing in August.

*Chorosoma schillingi* Schml. Stick insect bug. 15-16mm. (figure 5B). mainly found on coastal sand dunes, also in Breckland. It is perfectly camouflaged on the seed-heads of grasses, especially marram grass.

*Alydus calcaratus* L. 15-16mm (figure 5C). They run and fly extremely fast. They are a perfect mimic of the pompilid sand-wasps that are found with them, even to the orange colour on the dorsum of the abdomen when in flight.



*Elasmucha grisea* L. Parent bug. This very common bug lays 30-40 eggs on a suitable birch leaf during June and then proceeds to stand over and cover them for at least two weeks until they hatch. She will place herself between them and any potential predator. She then leads them onto other young leaves with the juveniles all following her in line. She will remain with them throughout their instar periods. An excellent parent indeed.



Species of seven families recorded in Norfolk are listed here.  
Watson/Praeger Vice Counties 27 & 28

**HEMIPTERA**  
**HETEROPTERA**

**Shieldbugs**

**Acanthosomidae**

<i>Acanthosoma haemorrhoidale</i> L	Hawthorn berries & leaves	27	28
<i>Elasmucha grisea</i> L.	Birch	27	28
<i>Elasmotethus intestinctus</i> L.	Birch, Hazel & Aspen	27	28
<i>Elasmotethus tristriatus</i> Fab.	Juniper & Cypress spp.	27	28

**Pentatomidae**

<i>Podopa inuncta</i> Fab.	various grasses	27	
<i>Sciocoris cursitans</i> L.	various grasses & chickweeds	27	28
<i>Aelia acuminata</i> L.	seedling grasses & Wild Carrot	27	28
<i>Neottiglossa pusilla</i> Gml.	seedling grasses		28
<i>Eysarcoris fabricii</i> Kirk.	Hedge Woundwort flowers/seeds	27	28
<i>Palomena prasina</i> L.	var. trees & shrubs, especially Hazel	27	28
<i>Dolycoris baccarum</i> L.	Blackthorn flowers/fruits/ aphids		28
<i>Piezodorus literatus</i> Fab.	Gorse seeds	27	28
<i>Pentatoma rufipes</i> L.	various trees, caterpillars, aphids	27	28
<i>Eurydema dominulus</i> Scop.	Ladies Smock	27	
<i>Zicrona caerulea</i> L.	beetle larvae & caterpillars	27	28
<i>Rhacognathus punctatus</i> L.	beetle larvae, Lochmaea spp	27	

<i>Picromerus bidens</i> Fab.	beetle larvae & aphids	27	28
<i>Triolus luridus</i> Fab.	beetle larvae & caterpillars	27	28

## Burrowing bugs

### Cynidae

<i>Thyreocoris scarabaeoides</i> L.	unknown, suspect grass roots	27	28
<i>Sehirus bicolor</i> L	White Dead-nettle	27	28
<i>Sehirus biguttatus</i> L	Cowwheat		28
<i>Sehirus luctuosus</i> M&R	Forget-me-not		28
<i>Legnotus limbosus</i> Geof.	Goosegrass & Bedstraw spp.		28
<i>Legnotus picipes</i> Fln.	Bedstraw spp.	27	28

### Scutelleridae

<i>Odontoscelis fuliginosa</i> L.	suspect grass roots on dunes	27	
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## Broad-headed bugs

### Alydidae

<i>Alydus calcaratus</i> L.	possibly carnivorous. larvae found in ants nests	27	
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## Scentless Plantbugs

### Rhopalidae

<i>Rhopalus parumpunctatus</i> Schml.	Cocksfoot grass and Mouse-ear Chickweed		28
<i>Rhopalus subrufus</i> Gml.	St. John's Wort & Herb Robert		28
<i>Rhopalus maculatus</i> Fieb.	Marsh Thistle		28
<i>Chorosoma schillingi</i> Schml.	var. grasses, especially Marram	27	28
<i>Myrmus miriformis</i> Fln.	var. grass seeds	27	28

## Squash bugs

### Coreidae

<i>Coreus marginatus</i> L.	Sorrel, Dock, Knotgrass & Blackberries		28
<i>Coriomeris denticulatus</i> Scop.	Black Medick, Haresfoot Trefoil	27	28

## Reduviidae Assassin bugs

The adults and larvae are active predators, catching their prey by means of their forelegs in a similar action to that of praying mantis. Their prey

consists of aphids and other small arthropods and their larvae. Once captured they insert their rostrum or beak to suck the victim dry.

Assassin bugs possess a three segmented rostrum (figure 7A) which when not in use is held in a ridged recess between the front legs. If the insect is disturbed the rostrum scrapes the ridges and produces an audible squeak. Some of them take two years to complete their life cycle.

*Empicoris vagabundus* L. 6-7mm (figure 6A). A fairly common species usually found on tree trunks, especially oak, where they prey upon bark lice and aphids. They are hard to see unless they are moving about. VC27

*Empicoris culisiformis* De Geer. 4.5-5mm. This species resembles *E.vagabundus* but is much smaller. Adults can be found every month throughout the year, but usually inside buildings. VC27 28

*Reduvius personatus* L. Fly bug. 16-17.5mm. (figure 6B). Our largest assassin bug. It is not as common as it was in yesteryear, when it was known as the Bed bug killer. Both adults and larvae are great predators of other insects. The larvae are usually found in older houses where they cover their sticky bodies with dust and debris. Many reports have been received from people who have been sitting at home in the evening then observing a small heap of dust etc moving across the carpet. It invariably turns out to be one of the juvenile stages out hunting for the odd fly or silver fish for a meal.

Both adults and larvae are capable of giving a painful jab with their rostrum if not handled with care. Adults are dark brown, almost black, in colour whilst the larvae appear greyish. VC27 28

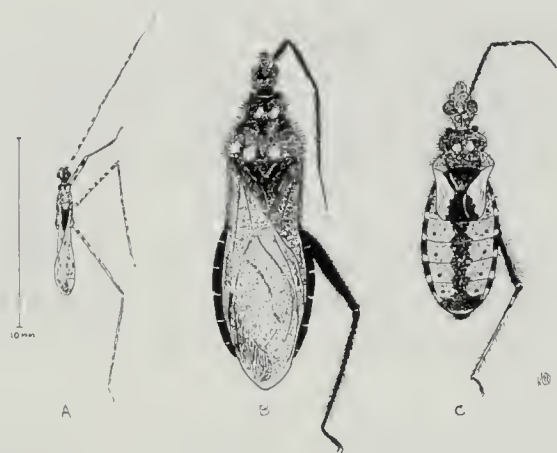
*Coranus subapterus* De Geer. Heath assassin bug. 9-12mm (Figure 6C). A common bug often found on open patches of heaths and sand dunes where they prey upon spiders and other insects and their larvae. Most species are brachypterus but macropterus are sometimes found. They overwinter as



eggs. Note that the spine at the apex of the scutellum unusually points upwards from the body.

VC27 28

Figure 6.

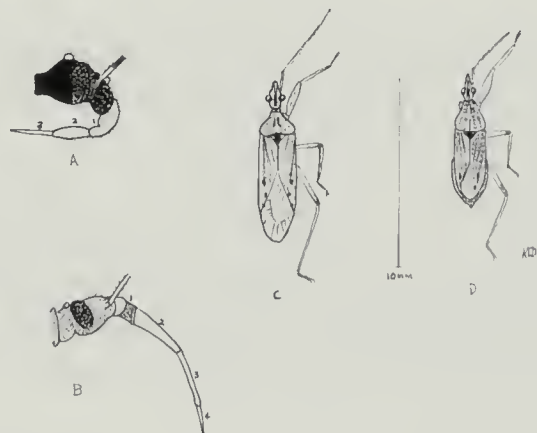


**Nabidae Damsel bugs**

Also active predators of other invertebrates and their larvae, even victims much larger than themselves such as spiders and Ichneumon flies. They help to control pests in crops.

When not in use the rostrum, which is four segmented (figure 7B), is held out in front of the head ready for action. After the prey has been seized by the front legs and the rostrum inserted the victim very quickly ceases to struggle. The front legs then release their grip and the victim is retained only by the tip of the rostrum. Their colour ranges from light brown to reddish brown with darker markings.

Figure 7.



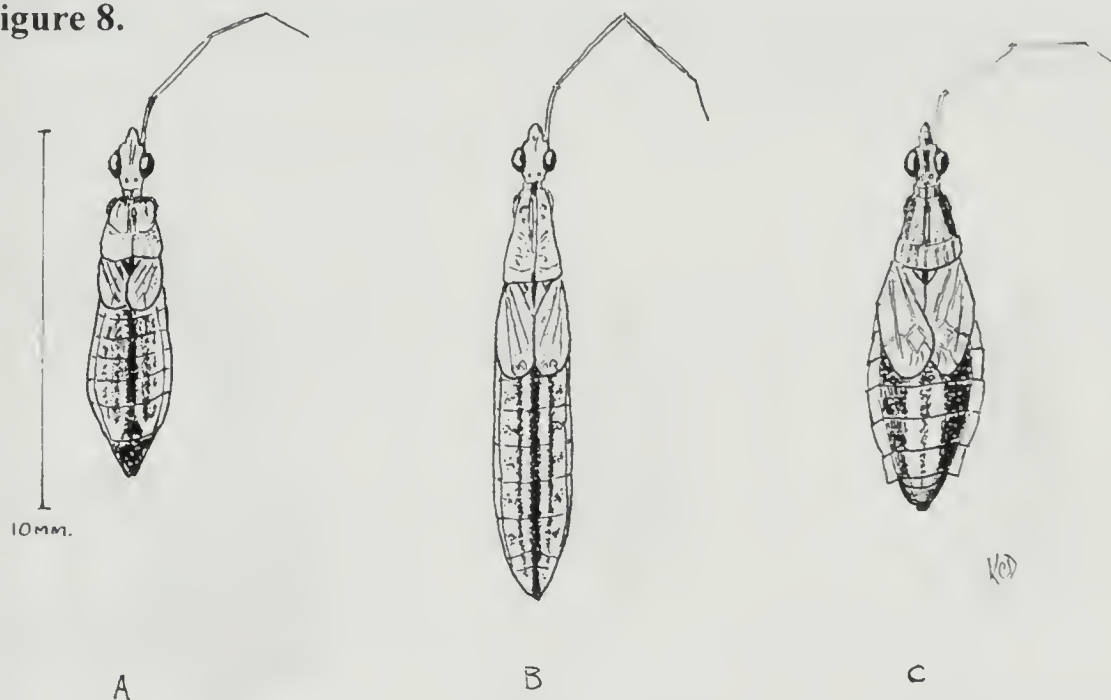
*Nabis ferus* L. Field damsel bug. 8-8.5mm. (figure 7C). A common bug especially in corn and hay fields in spring where they have flown after hibernation. They are classified as beneficial insects because they feed on aphids and leaf hoppers which are pests. They are always macropterous, in appearance somewhat greyish due to the dense fine pubescence of their forewings.

VC27 28

*Nabis ericetorum* Scholtz. Heath damsel bug. 6.5-7.2mm (figure 7D). Usually found in heathy areas. Their colour is reddish brown, their wings, however, do not quite reach the end of the abdomen. They hibernate as adults. There are two other nabids recorded in Norfolk in the past which are very similar to *ericetorum* but they have not been seen for decades. These are *Nabis rugosa* and *Nabis brevis*. They differ in minute details and require specialist examination to determine.

VC27 28

**Figure 8.**



*Nabicula limbatus* Dahlm. Marsh damsel bug. 7.5-9mm. (figure 8A). Found on marshes and wet areas amongst rank vegetation. Their colour is light brown with reddish brown markings. Normally micropterous with the forewings just covering the 2<sup>nd</sup> abdominal segment.

VC27 28

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*Nabigula lineatus* Dahlm. Reed damsel bug. 9.5-12mm. (figure 8B). Usually found around the bases of reeds, rushes and sedges. A long shaped bug, always micropterous, colour yellowish brown to reddish brown with darker markings.

VC27 28

*Nabigula flavomarginata* Scholtz. Broad damsel bug. 7-9mm. (figure 8C). Found amongst rough grasses where its eggs are left to pass the winter. Colour yellowish brown with darker markings. The abdomen is covered with short golden pubescence. Normally brachypterous with wings under half the length of the abdomen, long winged forms are sometimes found.

VC27 28

*Anaptus major* Costa. Great damsel bug. 7.9-9mm. (figure 9A). Adults are awlays macropterous and appear to be parallel sided by the pale markings down their sides. This makes them fairly easy to identify in the field. They are nearly always to be found close to the ground around grass clumps on sandhills and salt marshes.

VC27 28

Figure 9.





*Aptus mirmicoides* Costa. Ant damsel bug. 7-8mm. (figure 9B). This bug gets its name because the larvae bears great resemblance to the common black ant *Lasius niger*. It is often found in their company in gardens and lawns in warm situations. Adults hibernate. They prey upon aphids and other small insects including their eggs. Their colour is reddish brown. They do, however, resemble a small edition of *Himacerus apterus*. VC27 28

*Himacerus apterus* Fab. Tree damsel bug. 9-11mm. (figure 9C). This is the only nabid that is a tree dweller. usually micropterous but fully winged females are sometimes found. They feed on aphids, small insects and small caterpillars, unlike other nabids who do not hesitate to attack prey larger than themselves. Their colour is light brown but the sides of the abdomen called the connexium are black with yellow triangles. VC27 28

**Rarities**

Two species have been recorded in Norfolk in the past but they have not been seen for many decades. *Nabis brevis* Scoltz was last recorded on Swannington Common on 17<sup>th</sup> September 1927 and *Stalia boops* Schiodte on Mousehold Heath in July 1885.

**Imports**

Nowadays with the increased trade by aircraft of vegetables and fruit from overseas, imports of insects which would not normally migrate to this country can now reach us in a few hours if well concealed in produce.

Many species of Heteroptera have arrived by this means, they are usually to be found in market areas of our towns and city.

<i>Eurydema dominulus</i> Scop.	1.8.1962.	Norwich
<i>Eurydema oleracea</i> L.	20.6.1965	East Dereham
<i>Nezara viridula</i> L.	1984	Norwich - Italian produce
<i>Rhaphigaster nebulosa</i> Poda.	12.8.1984	Norwich
<i>Stictopleurus abutilon</i> Rossi.	11.9.1996	Beeston Common
(see <i>Trans. Norfolk Norwich Nats. Soc.</i> <b>31</b> , (1) 1997)		

## Acknowledgements

My thanks to Dr A.G.Irwin for his assistance and co-operation in access to the various collections in the Castle Museum, Norwich.

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## Miscellaneous observations

**Starfish Wreck.** The strandline in Wells normally consists of seaweed detritus, Hornwrack (*Flustra*), Thornback Ray egg-cases, cast crab exoskeletons and shells of a dozen or so mollusc species. Occasionally, however, spectacular “wrecks” of individual organisms occur; for example, in the 70’s we had enormous numbers of the small Sea Urchin *Psammechinus miliaris*, hardly ever seen before or since.

In March 2002 there was a sudden appearance of large numbers of Common Starfish *Asterias rubens*, exciting enough interest to merit a mention in the local paper. They were reported to me as being “a foot deep”. This proved to be an exaggeration, but they were dense enough to be lying one on another. I was not unexpectedly asked to account for the phenomenon. A couple of weeks before, there had been an exceptionally rough sea, and I believe the disturbance at the surface reached down far enough to penetrate the sea bed in areas normally unaffected. Evidence for this was provided by the equally large numbers of Razor Shells *Ensis americanus*, (not reported

by the press), most of which were juveniles. As they would not dig in as far as the adults, they would be more likely to be torn out by rough-water scouring.

**Paul Banham**

## PLANT NOTES 2001.

Gillian Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF

With very limited access to the countryside because of foot and mouth precautions, the Flora Group, at least for the earlier part of the season, concentrated largely on forest, coast and urban areas. This by no means lessened the flow of new records with perhaps an emphasis on plants more recently introduced. Few-flowered leek, *Allium paradoxum* has long been known in a few sites, but the colony found on Swanton Hill by Bob Leaney seems to be a new one, two more sites for musk storksbill *Erodium moschatum* were found in the outskirts of Norwich by Shane Plant and slender rush, *Juncus tenuis* seems to be increasing its range in a rather low key way, being found at Bergh Apton by David Lester and at Stow Bedon and Cranwich by Jean Gaffney, three sites all very far apart. The very familiar introduction, Canadian Fleabane, *Conyza canadensis*, was first recorded in the county in the early 1880s, but within 10 years was being described as abundant in the fields around Thetford. Equally quickly it spread to all parts of the county. Now another species of the same genus, Guernsey fleabane, *Conyza sumatrensis* has come to Norfolk arriving just in time to get a mention in the 1999 *Flora of Norfolk*. This year Arthur Copping found *C. sumatrensis* at Norwich Station and it is obviously a plant to look out for while another species, *C. bilboana* seems to be progressing northwards towards us.

Ron Payne has provided the following information about the group. He writes: '*Conyza sumatrensis*, has been known in England since 1974, but for some time it was apparently restricted to London and Thames-side localities. In recent years, however, it has been spreading north, and by the



time our *Flora of Norfolk* was being prepared it had been seen in King's Lynn and Great Yarmouth. In 2001 there were several colonies of this species in King's Lynn in streets and on waste ground near the railway station and it should now be looked for in other urban areas. It is generally a much taller plant than the common Canadian fleabane, *Conyza canadensis*, with a pyramidal rather than a columnar inflorescence, but at all times of the year it can be distinguished by its leaves. These are softly hairy both above and below, and the margins have very short, curled hairs, whereas the leaves of *C. canadensis* are glabrous but with markedly ciliate margins. A third species *C. bilbaoana*, first seen in Southampton in 1992, has now spread at least as far north as Bucks and Middlesex and seems likely to follow *C. sumatrensis* further northwards. It can be distinguished by its very dark green leaves, the lower part of the stem stiffly hairy and very wide inflorescence, usually widest above the middle.'

Another transatlantic weed, gallant soldier, *Galinsoga parviflora*, was first recorded in this county in 1927 and was described by Petch and Swann (1968) as 'increasingly frequent'. Since that date, however, it shows little sign of spreading farther and in some sites a second species, shaggy soldier, *Galinsoga quadriradiata* (syn. *G. ciliata*) for which our first record is 1957, seems to be commoner and John Williamson found it at Roydon during the summer where previously *G. parviflora* had been known. Shaggy soldier has thick, flexuous stem hairs (hence its name) while gallant soldier has hairless stems, otherwise they are quite similar and the botanical difference depends upon the scales in the fruiting heads. We would be happy to receive any records or name specimens (preferably in fruit), to find if this change in the abundance of the species is a fact. Another small plant to be looked out for is the New Zealand bitter-cress, *Cardamine corymbosa* (syn. *C. uniflora*). It is very like its too familiar relative hairy bitter-cress, *Cardamine hirsuta*, but is a smaller plant with much larger flowers; like *Cardamine hirsuta* it is a plant which could well become more common in nurseries and hence in gardens. As well as its W.Norfolk site, it has now been seen by Stella Taylor in the south of the county. Watch this weed!



Shepherd's Needles *Scandix pecten-veneris* (photo R. Ellis).



Lesser Water-plantain *Baldellia ranunculoides*.





Above left: Narrow-leaved Marsh-Orchid *Dactylorhiza traunsteineri*

Above right: Marsh St John's-wort *Hypericum elodes*

Below left: Sulphur Clover *Trifolium ochroleucon*

Below right: Small-flowered Catchfly *Silene gallica*





On the coast the Flora Group extended the range of sea club-rush, *Bolboschoenus (Scirpus) maritimus* and sea fern-grass, *Catapodium marinum*, finding both at Overstrand, while Paul Banham found yellow horned poppy, *Glaucium flavum* for the first time at Wells, colonising some small, defensive features which have been filled with suitable shingle. Members of the Flora Group were pleased to see good colonies of creeping lady's tresses, *Goodyera repens* at both Wells and Holkham.

There have been many records of plants of wet ground, perhaps a reflection of two wet seasons. The little star sedge, *Carex echinata* was found on Swanton Abbott Common by Bob Leaney and at East Winch by John Williamson while dioecious sedge, *Carex dioica* and narrow-leaved marsh Orchid, *Dactylorhiza traunsteineri* were seen by the Flora Group during a meeting at Southrepps Common, also Marsh St. John's-wort, *Hypericum elodes* at Swannington Ugate. Mary Ghullam also found the true bistort *Persicaria bistorta* in Metton Carrs. At South Lopham Fen Arthur Copping noted a yellow sedge, *Carex viridula* ssp *viridula* (*Carex serotina*), lesser water-plantain. *Baldellia ranunculoides*, floating club-rush, *Eleogiton fluitans* and slender spike-rush, *Eleocharis uniglumis*, a scarce quartet. Lesser marshwort, *Apium inundatum* was found on Sweet Briar Marshes by the Flora group but our best *Apium* record is 150 years too late. Gillian Beckett has been looking at plants kept in the Norwich Herbarium, now housed in the Castle Study Centre in Norwich, and came across a specimen of creeping marshwort, *Apium repens*. This small umbellifer is now one of the rarest plants in Britain being known to survive in only one site, that in Oxfordshire and is considered a critically endangered species. A perfect specimen of this small marshwort was collected in 1850 by William Notcutt, a chemist and keen amateur botanist then living in Fakenham. The plant was found on Hempton Green together with pennyroyal, *Mentha pulegium*, also now lost from the county. Both are typical species of moist greens where grazing, often by geese, kept the turf very short with bare patches. The plant was well pressed and showed all the diagnostic characteristics of the species and so is a first for us. At the same time E.L.Swann's specimen of the prostrate form of fools' water-cress, *Apium nodiflorum* var *repens* from Beeston was examined. This plant is often

misidentified as *A. repens*, but as one would expect from such a good botanist, the naming is quite correct. Amongst W.L. Notcutt's Herbarium was also a fine collection of plants from Sculthorpe Fen also made in 1850 and it was good that Rob Yaxley found many of them this year including *Carex lasiocarpa* and *Thelypteris palustris*, still thriving in the same site. Thanks must go here to Tony Irwin and his staff at Norwich for making access to the herbarium possible.

Dry ground records were in the minority but catmint, *Nepeta cataria* was seen in a hedgebank at Gayton by Bill Mitchell, a typical native site on chalk and also at Felthorpe by Laurie Hall while Mossy stonecrop, *Crassula tillaea* was seen at Hoe by the Becketts who also found wall bedstraw, *Galium parisiense* on a wall at Keninghall. This plant was also seen at Ickburgh by Eric Rogers growing on a disused runway while Mary Ghullan found clustered clover, *Trifolium glomeratum* at Sustead. Arable weeds feature only a little this year but shepherd's needle, *Scandix pecten-veneris* and narrow-leaved fluellen, *Kickxia elatine* were found by Mary Cooper and a large colony of small-flowered catchfly, *Silene gallica* at Snettisham by the Becketts was the first West Norfolk record for 15 years.

From last year's report, *Bromus racemosus* at Warham was finally identified as not this species and has been deleted from the record. Looking forward to a new season, a few thoughts of things to look for. Several species have been divided into sub-species and many of these are not too difficult to identify, for example there is the bulbiliferous form of lesser celandine, *Ranunculus ficaria* ssp. *bulbilifera* which is the one usually found in gardens and waste places, while the normal wild form (ssp. *ficaria*) does not have bulbils. Look for them on the flowering stems once they have elongated near the end of their season. Common milkwort, *Polygala vulgaris* also has a subspecies, *collina* which is recorded as scattered through the country but still has to be recognised for Norfolk. Bur-reed, *Sparganium erectum* has three subspecies which are separated on their fruits so a task for later in the season. Details of all of these are to be found in Stace's *Flora of the British Isles* and also in *The Plant Crib*, Rich &

Jermy, 1998 an invaluable book for problem plants. A plant which has caused just such identification problems recently is the hybrid St John's-wort, *Hypericum x desetangsii*. There have been a number of records in recent years, but the national referee for the species says that many are in fact forms of the common *H. perforatum*. We would be happy to see specimens of any plant you suspect may be this hybrid, or of the subspecies above.

This summer the Norfolk Flora group (no longer two separate entities) is organising an county-wide survey of sulphur clover, *Trifolium ochroleucon* and detailed records of this plant, current or from notebooks will be very welcome. It was once widespread throughout much of the county growing on the calcareous clay soils of many areas of pasture and especially Greens. A hundred years ago it could be found widely in the county from East to West, but is now decreasing fast and so that some steps can be taken to preserve it we need to know the where the remaining colonies are. Knowledge of its past distribution is also valuable.

If anyone would like a list of Norfolk Flora group meetings, please contact one of us. Please keep all records coming in, a discovery, however remarkable, is useless unless the details are received by the County Records, Gillian Beckett and Bob Ellis. (Photographs by Bob Ellis)

### **Miscellaneous observations**

**Willow or Purple toothwort - *Lathraea clandestina*** is a member of the broomrape family which we first found at Fincham in Norfolk in 1973 under poplars. There appears to have been no other record in Norfolk, although it is said to be quite abundant in alder carrs in the Midlands. In the south of England it is found under willows and poplars. The flowers are bright purple, up to 5cm long and with hooded corollas. They are developed from clusters at ground level, springing from the roots of their host on which they are parasitic. The scented flowers are attractive to bumble-bees. We have recently seen this in flower at the base of an old willow tree in rough grass in an established garden in Essex.

**Lil. Evans**



## WEATHER SUMMARY FOR 2001

J.G.Hilton

Morley Weather Centre, Morley, Wymondham NR18 9DB

Details of rainfall, sunshine and mean temperature for 2001 compared with the long-term averages are given in Table 1. Data on the rainfall for the year and how they compare to the 33 year mean are presented graphically in Figure 1, while the same is shown for sunshine hours in Figure 2 and mean temperature in Figure 3.

The mean temperature for 2001 ( $9.7^{\circ}\text{C}$ ) was  $0.2^{\circ}\text{C}$  above the long-term average, but was the lowest for five years. Rainfall (806.6mm) was the highest since 1960; 28% above the long-term normal. It was the fourth consecutive year with more than 750mm rainfall. Sunshine (1526.5 hours) was 27.5 hours below the average.

**January** was the sunniest (86.9 hours) in our records which began at Sprowston in 1925. The mean temperature was the lowest for four years and was  $0.4^{\circ}\text{C}$  below normal. Rainfall was 77% of the long-term normal. It was noticeably sunny from the 9<sup>th</sup> to the 17<sup>th</sup> and long sunny spells were recorded on several days towards the end of the month.

**February** was the cloudiest since 1993 and the wettest (85.6mm) since 1995 with 205% of the long-term average rainfall. It was the coldest for five years but was still  $0.6^{\circ}\text{C}$  above normal. Significant falls of rain were recorded on the 4<sup>th</sup> (23.0mm), 8<sup>th</sup> (14.8mm) and the 12<sup>th</sup> (12.6mm).

**March** was the wettest since the Sprowston recording of 123.2mm in 1947. Precipitation either as rain or snow was recorded on 27 days. It was the coldest for five years and the duller for three. It was particularly cold for the first five days; snow showers fell at times and sharp frosts formed at night. Rain or snow fell on the first thirteen days and the rain was heavy on the 8<sup>th</sup> (14.6mm) and the 11<sup>th</sup> (13.6mm).

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**April** was much wetter than normal. The mean temperature was 0.2°C below the long-term average and it was the coldest since 1989. Sunshine was 11.1 hours below normal. Showers of hail and snow fell mid month and ground frosts occurred from the 17<sup>th</sup> to the 21<sup>st</sup>, the latter being particularly sharp (-5.2 °C).

**May** was the driest for three years and the sunniest for four. The mean temperature was 0.9°C above normal. The first eight days were cooler than normal with ground frosts on four nights. A warm, dry and sunny spell was recorded from the 9<sup>th</sup> to the 13<sup>th</sup>. Heavy rain (26.2mm) fell on the 14<sup>th</sup> and showers continued for the next four days. The last significant rainfall was on the 18<sup>th</sup>.

**June** was drier than normal, and 0.3°C below the long-term average. Sunshine was the lowest for three years. No rain fell between the 5<sup>th</sup> and the 14<sup>th</sup>. Heavy rainfall was recorded on the 16<sup>th</sup> (27.2mm). The 18<sup>th</sup> to the 26<sup>th</sup> were completely dry.

**July** was the wettest since 1988 with nearly twice the normal rainfall, but sunshine was only marginally below the long-term average. The mean temperature was 0.7°C above normal. Heavy rain fell on the 7<sup>th</sup> (12.0mm) and the 10<sup>th</sup> (10.0mm) and a thunderstorm on the 14<sup>th</sup> produced a fall of 14.6mm. Additional days of heavy rain were recorded on the 16<sup>th</sup> (9.8mm), 17<sup>th</sup> (11.4mm), 18<sup>th</sup> (12.2 mm) and the 19<sup>th</sup> (16.0mm). Temperatures from the 22<sup>nd</sup> to the end of the month were above the long-term average with 25°C exceeded on six days. This period was predominantly dry.

**August** was warmer and slightly wetter than normal and sunshine was marginally below the long-term average. Persistent rain fell on the 12<sup>th</sup> (9.8 mm). Heavy showers occurred on both the 18<sup>th</sup> (6.8mm) and the 19<sup>th</sup> (10.2mm). It then remained dry for the rest of the month apart from a light fall on the 30<sup>th</sup> and the 31<sup>st</sup>. This period was mainly sunny.

**September** was much wetter than normal with 160 per cent of the long-term average rainfall, but it was still the driest for three years.

Sunshine was the lowest since 1994. It was the coolest since 1993, with the mean maximum temperature at  $1.4^{\circ}\text{C}$  below normal whilst the mean minimum was  $0.2^{\circ}\text{C}$  above. Daytime temperatures were below normal from the 3<sup>rd</sup> to the 27<sup>th</sup>. Notable falls of rain were recorded on the 6<sup>th</sup> (8.6mm), 18<sup>th</sup> (7.4mm), 19<sup>th</sup> (16.0mm) and the 23<sup>rd</sup> (6.2mm), and a thunderstorm in the afternoon of the 25<sup>th</sup> resulted in a fall of 8.2mm in less than one hour. The warmest day of the month was late in the month on the 28<sup>th</sup> ( $21.8^{\circ}\text{C}$ ).

**October** had normal rainfall, but sunshine was 13.4 hours below the long-term average. The mean temperature was the highest in our records and was  $0.5^{\circ}\text{C}$  above that of September. This figure was caused mainly by the high average minimum temperature, which again was the highest in our records, but the mean maximum was the highest since 1995. No ground frosts were recorded; the last time this occurred was in 1968. This warm weather was a result of the wind remaining in the southerly half for all but one day of the month. An indication of the predominantly high temperatures was that the lowest maximum of  $13.5^{\circ}\text{C}$  (29<sup>th</sup>), the lowest minimum of  $5.7^{\circ}\text{C}$  (31<sup>st</sup>), and the lowest grass minimum of  $1.4^{\circ}\text{C}$  (27<sup>th</sup>), all recorded during the last week were the highest in our records. The first eight days were much warmer than normal particularly at night when the temperature did not fall below  $10^{\circ}\text{C}$ . Days of significant rain were the 2<sup>nd</sup> (11.2mm), 21<sup>st</sup> (12.2mm) and the 26<sup>th</sup> (7.6mm)

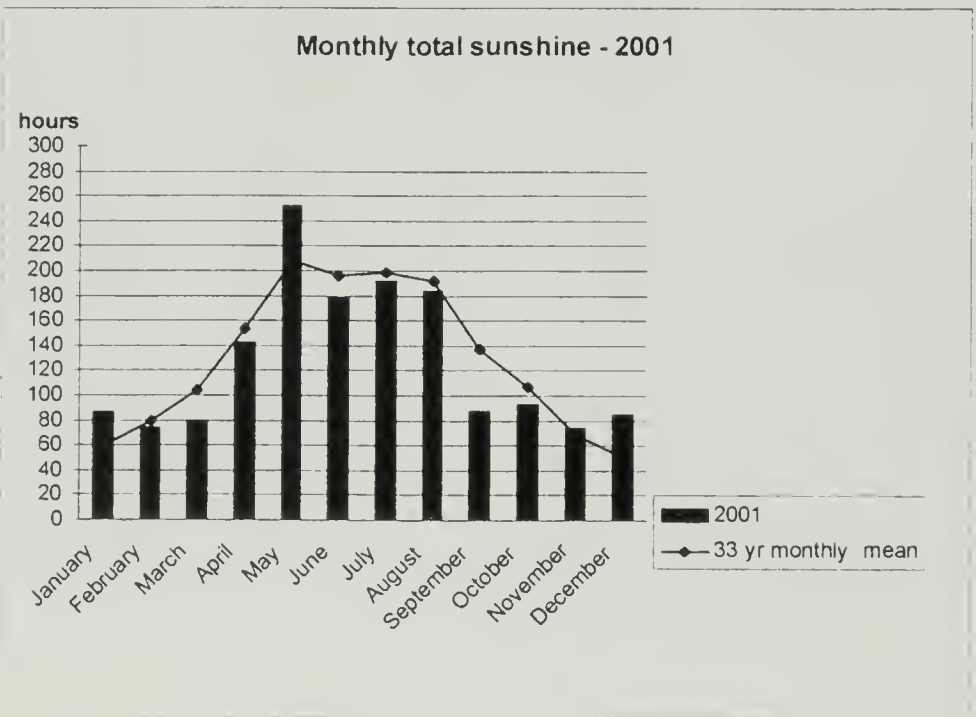
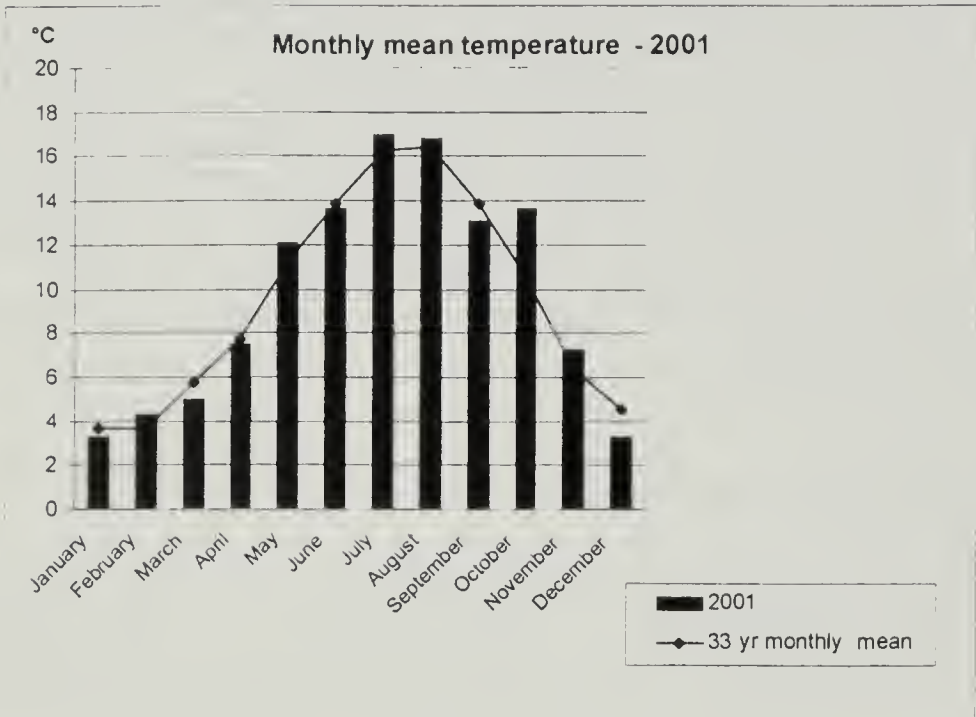
**November** was the sunniest for three years (6.2 hours above the mean), but rainfall was slightly above normal. It was the third consecutive November with the mean temperature above  $7.0^{\circ}\text{C}$  ( $7.2^{\circ}\text{C}$ ;  $0.8^{\circ}\text{C}$  above the long-term average). Maximum temperatures were above normal for the first week, and the minimum recordings were near to the average at first but rose to well above normal on the 6<sup>th</sup> and the 7<sup>th</sup>. It was mainly dry until the 5<sup>th</sup>. The first air frost of the autumn was recorded on the 10<sup>th</sup>. Heavy rain (14.0mm) on the 8<sup>th</sup> was followed by 5.6mm the next day. Temperatures were variable for the rest of the month but the last two days were very mild. A cool, sunny period around the 26<sup>th</sup> resulted in frosts at night.

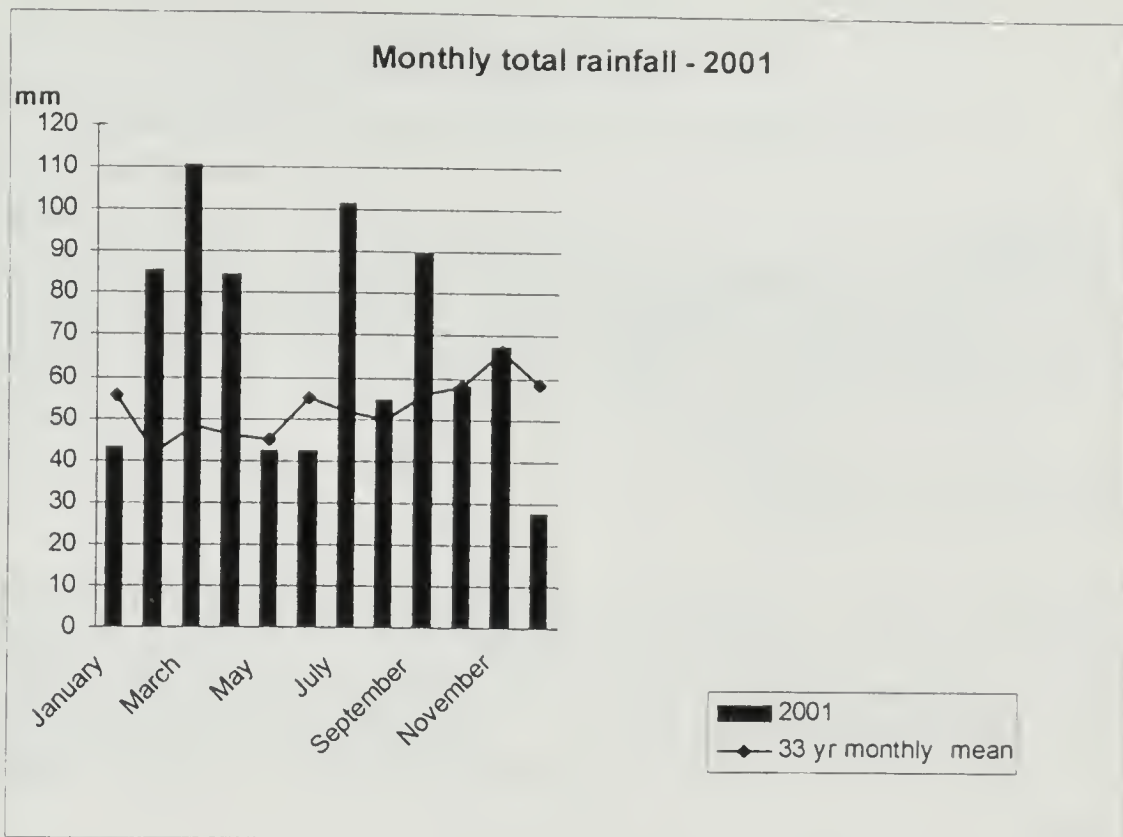


**December** was the sunniest in our record which began in 1925 at Sprowston. It was the driest since 1988. The mean temperature was 1.2°C below normal and was the lowest for five years. The first eight days were warmer than normal and it was noticeably mild on the 1<sup>st</sup> (14.0°C), 4<sup>th</sup> (10.1°C) and the 5<sup>th</sup> (12.8°C). This was in sharp contrast to later in the month when it was noticeably wintry. Several cold spells were interspersed with periods of near to normal conditions. Snow showers fell overnight on the 22<sup>nd</sup>/23<sup>rd</sup> and again on the 30<sup>th</sup>. It was particularly sunny from the 7<sup>th</sup> to the 11<sup>th</sup>, and for several days during the last week when the maximum possible sunshine was recorded

**Table 1.** Weather records for Morley 2001

	Rainfall (mm)		Sunshine (hours)		Mean temp. °C	
	1969-2001 33 yr mean	2001	1969-2001 33 yr mean	2001	1969-2001 33 yr mean	2001
January	55.5	43	58.5	86.9	3.7	3.3
February	41.7	85.6	79.8	74.1	3.7	4.3
March	48.5	110.4	104	78.9	5.8	5
April	46	84.6	153.3	142.2	7.7	7.5
May	44.8	42.2	208.5	254.4	11.2	12.1
June	54.8	42.4	195.7	177.8	13.9	13.6
July	51.9	101.4	199.1	191.9	16.3	17
August	49.7	54.6	191.5	183.3	16.4	16.8
September	55.9	89.8	137.1	87	13.9	13.1
October	58	58	106.9	93.5	10.5	13.6
November	66.6	67.2	68	74.2	6.4	7.2
December	59.4	27.4	49.6	84.3	4.5	3.3
<b>Total Mean</b>	<b>626.5</b>	<b>806.6</b>	<b>1,554</b>	<b>1,526.5</b>	<b>9.5</b>	<b>9.7</b>





### Miscellaneous observations

In late November 2001 I accompanied Neil Sanderson, a lichenologist from Hampshire, in surveying the Biodiversity Action Plan lichen *Enterographa sorediata* at its only East Anglian station in Cottage Wood, Northrepps. After recording and surveying the site which is an ancient oak in a sunken lane we then went to look for it at other sites with ancient oaks. We called at Thursford Woods (TF 978333), vice county 28, and whilst in the unsuccessful search for this species, came across a small lichen parasite growing on the lichen *Schismatomma cretaceum* on an ancient oak. This was sent to Brian Coppins of Edinburgh Botanic gardens, who identified it as *Chaenothecopsis retinens*. This is only the second ever record of this species. The first was made in Jersey, also on an ancient oak, by Charles du Bois Larbalestier in 1866.

Peter Lambley



# DIATOMS ON A SALTMARSH AT SCOLT HEAD

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## Introduction

In June 2000 an opportunity presented itself to carry out a preliminary study of the salt marsh diatoms on the Hut Marsh at Scolt Head Island. The main purpose of the study was to extend the taxonomic work done by Salah (1953,1955) in similar situations at Blakeney Point, 20 kilometres along the coast to the east. In addition to the taxonomy, Salah studied the distribution of diatoms at Blakeney,

The algae of marine saltmarshes have been known since the 1930s (Carter (1933)). Brockmann (1950) reported on the North German coastal diatoms but his work concentrated on the sand and mud flats (Watten) there. Round (1960) examined the diatom flora of a saltmarsh on the River Dee and investigated the seasonal cycle, comparing his results with those of earlier workers

Carter's work gave a rather simple role to algae as collectors of mud. The role of algae, especially diatoms is much more complicated. The investigations funded by the Wash Barrage Scheme studied the role of diatoms (Coles (1979)). More recently workers from the University of Bristol have used a Low Temperature Scanning Electron Microscope to investigate the behaviour of diatoms on mudflats, the precursors of saltmarshes (Paterson 1989).

As an extension of the work of Zong (1997) on Scottish isolation basins, Zong & Horton (1998) studied diatom zoning on a number of saltmarshes in Britain including one at Thornham, Norfolk, 8 kilometres along the coast to the west of Scolt Head. There, freshwater input from the adjacent upland produces a wide range of salinity, while at Scolt Head, being an island there is little freshwater contribution. However, dune systems are a storage and

source of fresh water, even when surrounded by salt water environments as in our case. The system of freshwater drainage from the dunes at Scolt Head was investigated by Chapman (1937).

### **Scolt Head Island**

The area of the island has already been well described (Steers 1976). The study area (Figure 1) is bounded by high dunes along the edge of the sea to the north and is separated from the mainland by the wide Norton's Creek to the south. The saltmarsh studied has a shingle ridge to the west (Butcher's Beach) and further saltmarshes to the east. It is known as Hut Marsh.

There is a tidal range, at springs, of about 3m. The marsh is only inundated at spring tides. It was never under water at the time of our visit and appeared not to have been submerged for some time. Although the marsh presents a picture of an almost level area, it has a number of vertical sided gullies running almost parallel and at right angles to Norton's Creek. Between two of them a path runs from the hut to a landing point on Nortons Creek. The samples were taken along this path.

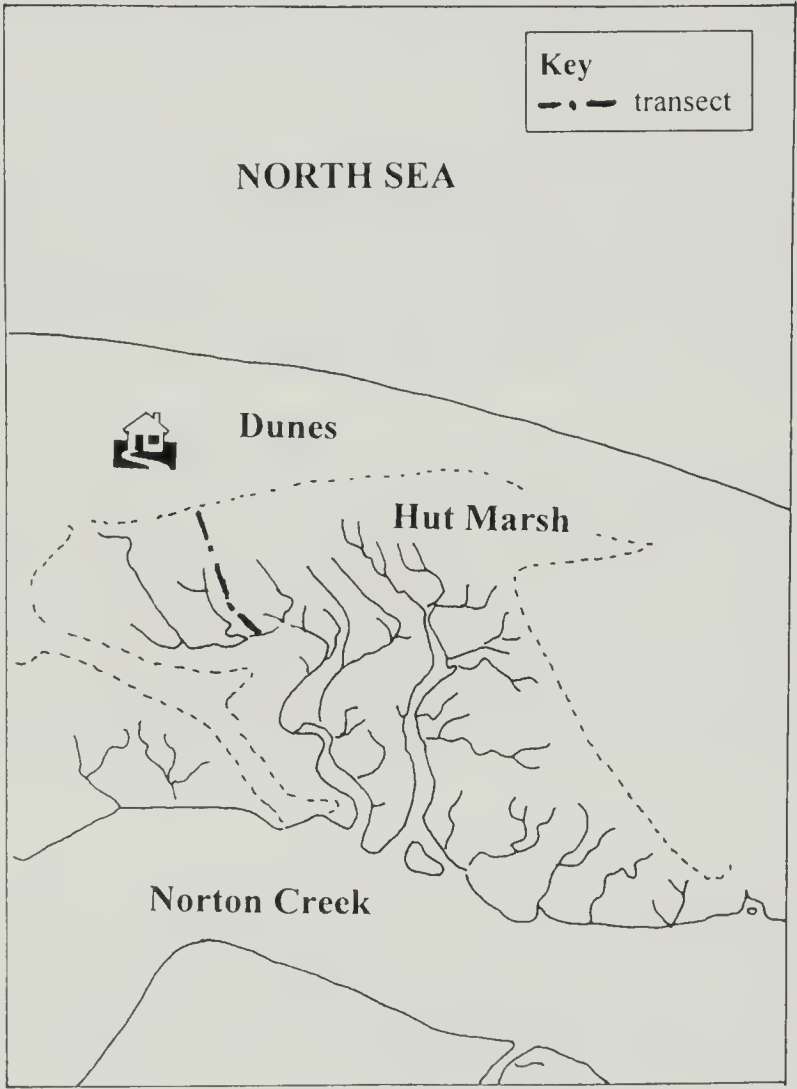
The area is famous for the rapid coastal changes which are known to occur. Many of Salah's sites at Blakeney have disappeared. However, the drainage of Hut Marsh was compared with that fifty years ago and appears to have changed little. Comparison was made between a detailed 6 inches to one mile map made in 1954 (Steers & Grove) and air photographs taken for English Nature in 1988. Although there were major changes to the coastline and to the drainage of a dune slack near the Hut, the system of drainage gullies on the marsh itself had not altered and has remained the same for half a century.

### **Methods**

Samples were taken at measured intervals along the line running from the dunes to Norton's Creek following the footpath from the Hut to the landing place on Norton's Creek. At the sampling spots on bare earth or dried out pans, a piece of the surface 5cm square was lifted including about 5mm of the soil.

Also, nearby plant material was bagged. In the laboratory distilled water was added to the dry material in the bag, the bag agitated for a while and the diatom bearing washings were treated with concentrated nitric acid and boiled for half an hour. The acid was washed out by serial settlement and a strew preparation made. 200 valves were counted and the result expressed as a percentage of the total valves counted (% TDV).

**Figure 1.** Map showing the location of the survey line and drainage of the Hut Saltmarsh at Scolt Head Island.





## Results

45 taxa were identified, many in small numbers. (Appendix 1) Those above 5% TDV or equal to 5% TDV are given in the tables 1 & 2

**Table 1. Diatoms on marsh surface**

Taxon	10m	100 m	200 m	300 m	360m
<i>Achnanthes brevipes</i>	1	20	33	1	
<i>Amphora coffeaeformis</i>	0.5	3.5	1		34.5
<i>Cocconeis scutellum</i>			37.5		
<i>Fallacia pygmaea</i>	0.5				53.5
<i>Navicula</i> sp.1		0.5	6.5	49	5.5
<i>Navicula gregaria</i>	40	19	5.5	5.5	1
<i>Navicula digitoradiata</i>	5	8.5	3.5	7	
<i>Nitzschia cf frustulum</i>	26.5			2.5	
<i>Staurosirella pinnata</i>	15.5				
<i>Tryblionella apiculata</i>	1	6	1	25	
<i>Tryblionella navicularis</i>		27	4.5	3	

**Table 2. Diatoms on vegetation**

Taxon	10m	100m	200m	300m	360m
<i>Achnanthes delicatissima</i>	5			1	1
<i>Achnanthes brevipes</i>	7.5	2	75	76.5	
<i>Amphora coffeaeformis</i>	2.5	10	5	1.5	1.5
<i>Campylosira cymbelliformis</i>					10.5
<i>Navicula</i> sp 1	59	33.5	2	2	
<i>Navicula incertata</i>					9.5
<i>Navicula salinicola</i>				0.5	45
<i>Navicula digitoradiata</i>	4.5	27			6
<i>Scoliopleura tumida</i>	8.5	9.5			1

## Discussion

### Comparison with neighbouring sites

In Thornham Marsh 3 zones are apparent from the cluster analysis (Zong & Horton 1998 Figure 7).

**Zone TM-A** is related to the tidal flat and pioneer marsh. The assemblages are dominated by *Navicula digitoradiata*, an epipellic taxon living on sandy substrate (Zong 1997). Occurring locally in high numbers are other taxa such as *Opephora pacifica*, *Navicula retusa*, *Paralia sulcata*, *Trachyneis aspera*, and *Achnanthes delicatula*,

**Zone TM-B** covers the low and middle marshes around the local MHWST. The assemblages from the lower part of the zone are dominated by *Navicula digitoradiata* and some other brackish species. In the upper part of the zone the assemblages are characterised by a mixed community dominated by freshwater *Denticula subtilis* and *Nitzschia dubia* with localised *Navicula digitoradiata*.

**Zone TM-C** towards the landward end comprises salt tolerant freshwater *Tryblionella hungarica* and *N. frustulum* and brackish *Navicula halophila*.

The results from our stations do not fit easily into the Thornham results. Of the eight stations studied by Salah (1952) on Blakeney Point, only two were truly saltmarsh. Our observations, however, correspond much closer to those given by Salah for the saltmarsh at Blakeney than to those of Zong and Horton for Thornham. This may be because of the similarity of situation between Blakeney Point marshes and Scolt Head. This correspondence has been reinforced by a study of Salah's preserved slides. Slides from Salah's work were deposited at the Natural History Museum in London. Three slides were deposited from each station. It has been possible to study these and to have two of these slides on long loan.

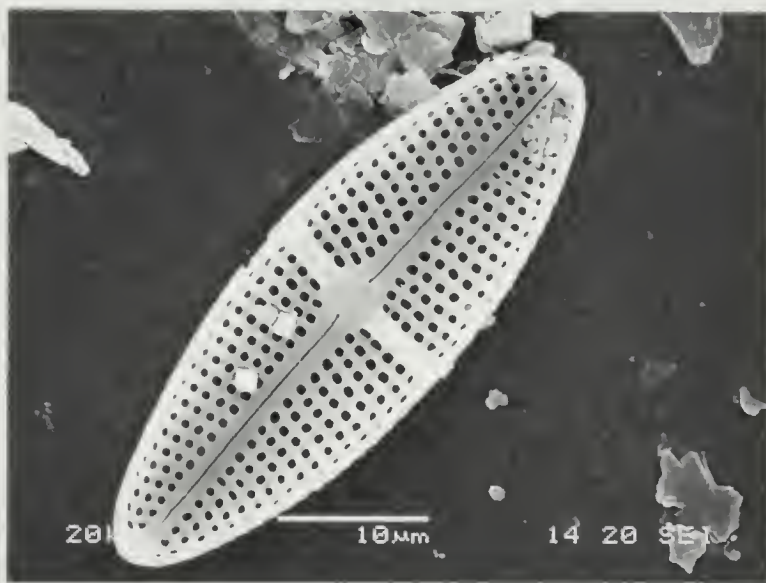
The station 10m from the foot of the dunes at Scolt may show a freshwater influence with its high count of *Nitzschia cf frustulum* *Staurosirella pinnata* and *Navicula gregaria*, which together form 83 % of the %TDV.

### ***Achnanthes* and *Amphora***

The distribution of *Achnanthes brevipes* (Figure 2) is confined to the 200m and 300m stations. It would seem to be associated with the vegetation, as the counts at 300m suggest, where it comprises 76.5% of frustules on the

vegetation but only 1% of those on the marsh surface. The position with *Amphora* is the reverse, it is confined to the mud surface at 360m and *Cocconeis scutellum* is concentrated similarly in the surface at 200m while *Fallacia pygmaea* occurs in considerable numbers only on the mud surface at 360m. This occurrence of groups suggests that diatoms are to be found in communities on the marsh and that sampling should not be confined to averaging a few samples.

**Figure 2.** *Achnanthes brevipes* Agarth 1824



### *Navicula*

*Navicula digitoradiata*, which was a common feature at both Thornham and Blakeney is present at Scolt and here, also, it seems to be associated with rather sandy substrates, being found more towards the dunes at the back of the marsh. The two tiny *Naviculas*, *N. incertata* and *N. salinicola*, in contrast are associated with the small mudflat at the Norton's Creek end of the marsh.

The situation of the other *Naviculas* is more complex and is not helped by problems of identification. Indeed the position of one taxon, *Navicula* sp. 1, the most common in some habitats, suggests that it may be an overlooked



and undescribed species. It is obviously related to the *Navicula gregaria* group of *Naviculas*. Some species in this group, related to *N. gregaria* and *N. cryptocephala* were studied by Cox (1995) but this taxon was not among those reviewed by her. Although Salah described many new species from Blakeney Point none of the species which he listed correspond to this one.

The length of the Scolt Island *Navicula* (Figure 3) is 10 to 15 microns with a median length of 12.2 microns. This is smaller than any of the taxa dealt with by Cox (1995). The closest resemblance is to *N. phyllepta* which also lacks the rostrate, sub-rostrate or sub-capitate apices of the rest of the group. But *N. phyllepta*, besides being larger has more distinct striae which are wider spaced (13-15 in 10  $\mu$ m against 19.5 - 22.4 in 10 $\mu$ m of our *Navicula*). The inside of the striae appears to be more complex in *N. phyllepta* than in our material (Underwood 1994 Figure 11, Cox 1995 Figures 58,59).

It would thus be most convenient to regard this as a new species of *Navicula* on the grounds of its shape, its size and the closeness of its striae.

***Navicula scoltensis* (n.sp.)**

(*Navicula* sp.1)

Type specimens on slide 2515 in the K.B.Clarke collection.

Type locality Hut Marsh, Scolt Head Island Norfolk.

Figures 3 & 4

Valva lata lineari lanceolata, apicibus subobtusis, non protractis. l1 longa, 4 lata. Raphe recta, filiformis, area axili angusta, area centralis admodum elliptica. Striae leniter radiantibus Habitat in salinis ad Scolt Head Island Norfolk.

**Outline.** In outline this *Navicula* is "broadly linear lanceolate" (Cox 1996 Figure 5g). The ends are not produced as those of *N. gregaria* and *N. veneta*. The valve face is slightly arched and curves down into the undecorated mantle. The axial area is not raised as Cox found with *N. phyllepta*. Kützing (1844) gives two figures of *N. phyllepta* which are both elongate lanceolate, tapered..In his descriptions he describes the valve view

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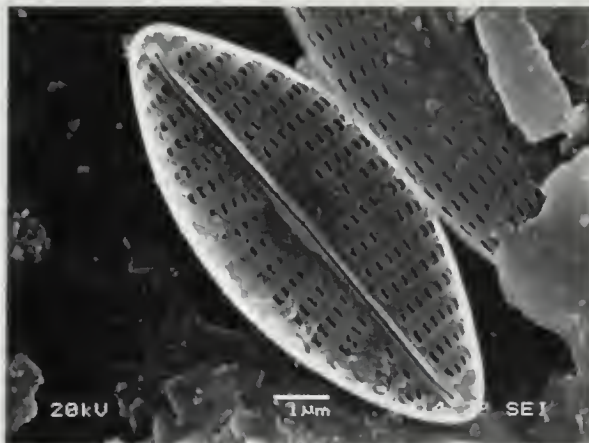
as “anguste lanceolata acuta” and (as *Schizonema Lenormandi*) as “lanceolato acuto”.

**Figure 3.** *Navicula scoltensis* n.sp. External view. The sharpness of the left hand end is deceptive and is caused by the protrusion of the girdle.

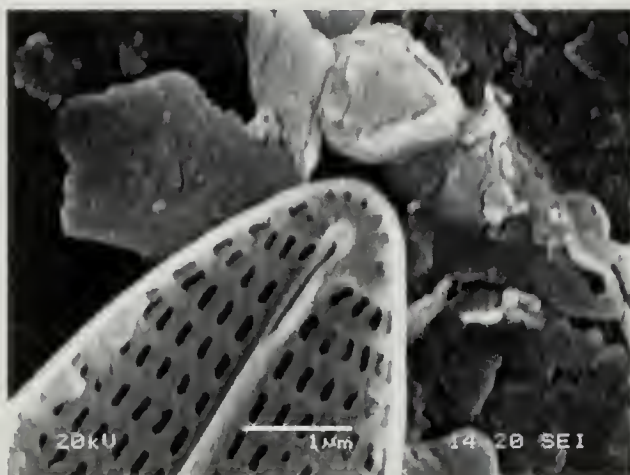


**Striae.** The striae are made of short longitudinal slits with the same appearance both externally and internally. (Figures 4 & 5). They are often slightly radiate near the centre of the valve, angles to the perpendicular, measured on SEM photographs give 0, 0, 4, 10, 10, degrees. moving away from the central stria. (Figure 6) There are occasionally inserted short striae near the centre as often happens with *N. phyllepta*. Some of the striae are curved but straighter ones are more common.

**Figure 4.** *Navicula scoltensis* n.sp.

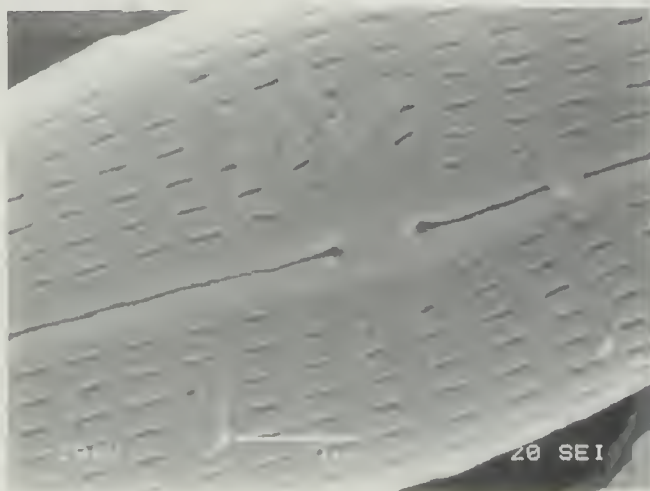


**Figure 5.** *Navicula scoltensis* n.sp. internal view. Note the striae are formed of longitudinal slits, similar in appearance to the external slits. Striae can be seen round the tip of the valve.



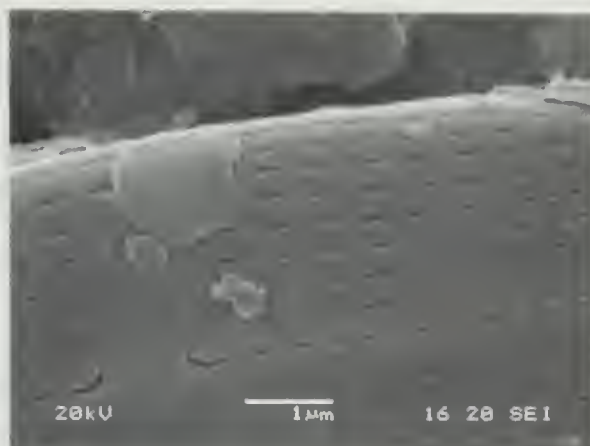
**Raphe.** Our material has centrally placed rounded central pores, (Figure 6) about 600 nm apart while *N. gregaria* has strongly deflected (hockey stick) central pores (Figure 7) and the central nodule is markedly asymmetrical. As in others of this group, the raphe ends in an helictoglossa and striae continue round the end of the valve. There is no additional rib on the primary side of the valve as is shown by Cox (1995) in her SEM photographs of the type material. (Kützing packet 1471) of *N. phyllepta*.

**Figure 6.** *Navicula scoltensis* n.sp. External view of the central part of the valve. Note the circular form of the two central pores.





**Figure 7.** *Navicula gregaria* Donkin. Note the deflection of the central pores.



### *Nitzschia*

Again the common *Nitzschia* in the samples from close to the dunes (10m), listed as *N. cf frustulum* does not fit that taxon. Most importantly no central nodule or widening of the spacing of the central fibulae can be seen in the many specimens on the slides. Otherwise it resembles *N. frustulum* which was recorded both by Zong and Horton and by Salah. The variability of this taxon has been studied by Wendker (1990) on the Schlei in Schleswig-Holstein. She found, in the case of *N. frustulum*, that while the presence of a central nodule was constant, the distant position of the central fibulae was not. This fact renders identification of *Nitzschia frustulum* difficult with the light microscope.

A similar taxon, *Nitzschia libetruthii* has no central nodule. In Grunow's collection in Vienna this species is present from Breydon, which is a somewhat similar situation of saltmarshes and mudflats in Norfolk.

A further taxon which has great similarity is *N. aequorea* Hustedt. It also lacks a central nodule and was found "abundant" by Salah at Blakeney. The spacing of the striae and the fibulae both agree with our material. Only, our *Nitzschias* are below the range of length given by Lange Bertalot, although he allows for smaller dimensions by saying "das ganze Spektrum der Schallendimensionen damit bei weitem nicht erfasst". Salah gave the

dimensions at Blakeney as 13-30 $\mu$ m long 3.5-6 $\mu$ m broad with 16-19 fibulae in 10 $\mu$ m. and our specimens fall within these limits

*Nitzschia inconspicua* Grunow has the right dimensions and has often been regarded as belonging to this group or confused with *N frustulum*. However, in most Norfolk material it is recognisable as a very distinct taxon especially by its very small size (down to 3 $\mu$ m long) and thickish fibulae. It occurs occasionally at Scolt Head (Figure 8).

### Conclusions

It is hoped to repeat the survey, studying the conductivity of water at various points across the marsh.. It would be useful to obtain levels across

**Figure 8.** *Nitzschia inconspicua* Grunow. 6.74 x 2.27 $\mu$ m. The central two of the coarse fibulae are wider spaced than the others.



the marsh. Although the marsh surface appears virtually level, the gradual slope towards Nortons Creek must be an important factor in the distribution of diatoms and of the vegetation to which many are attached. Also there are minute changes in level which result in shallow pools being left behind. The water in these evaporates, causing the remaining water to increase in salinity very considerably. These effects are very local and conditions can vary considerably within a few metres.

The treatment of material did not allow us to differentiate between diatoms living in an environment and those deposited by the incoming tide from

elsewhere. Examination of living material would allow us elucidate this to some extent. However, the wide variation between taxa in the material suggests that this is not such an important factor as one might think by watching the tidal scum advancing across a marsh.

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Appendix 1

Diatoms on soil surface: Percentage of total diatom valves

Taxon	10m	100m	200m	300m	360m
<i>Achnanthes delicatissima</i>	1.5	0.5			
<i>Achnanthes brevipes</i>	1	20	33	1	
<i>Achnanthidium minutissimum</i>	3.3				
<i>Actinoptychus sennarius</i>				0.5	1
<i>Amphora coffeaeformis</i>	0.5	3.5	1		34.5
<i>Caloneis westii</i>		0.5			
<i>Campylosira belgica</i>					0.5
<i>Cocconeis placentula</i>		2		0.5	
<i>Cocconeis scutellum</i>			37.5		

<i>Diploneis didyma</i>		4	1		
<i>Fallacia pygmaea</i>	0.5				53.5
<i>Hyalodiscus scotica</i>		1	2.5		
<i>Navicula</i> sp 1		0.5	0.5	49	5.5
<i>Navicula digitoradiata</i>	5	8.5	3.5	7	
<i>Navicula flantica</i>		0.5			
<i>Navicula gregaria</i>	40	19		5.5	1
<i>Navicula humerosa</i>				0.5	
<i>Navicula menisculus</i>	0.5				
<i>Navicula pargemina</i>		1			
<i>Navicula peregrina</i>				0.5	
<i>Navicula perminuta</i>	1		2	0.5	
<i>Navicula salinarum</i>	0.5	2			
<i>Nitzschia bilobata</i>				1	
<i>Nitzschia dissipata</i>	0.5				
<i>Nitzschia incognita</i>			1		
<i>Nitzschia cf frustulum</i>	26.5			2.5	
<i>Nitzschia obtusa</i>		0.5			
<i>Nitzschia palea</i>		1.5	0.5	1	
<i>Nitzschia punctata</i>		0.5			
<i>Nitzschia sigma</i>				1	
<i>Paralia sulcata</i>				0.5	0.5
<i>Raphoneis ampiceros</i>					1
<i>Raphoneis minuta</i>		0.5	0.5		0.5
<i>Scoliopleura tumida</i>					2
<i>Staurosirella pinnata</i>	15.5				
<i>Surirella brebissonii</i>	0.5				
<i>Synedra ulna</i>	2				
<i>Thalassionema</i>				1	
<i>Tryblionella apiculata</i>	1	6	1	25	
<i>Tryblionella hungarica</i>		0.5			

<i>Tryblionella levidensis</i>		0.5			
<i>Tryblionella navicularis</i>		27	4.5	3	
<i>Tryblionella punctata</i>		0.5			
<i>Tryblionella</i>		0.5			

#### Diatoms on turf: Percentage of total diatom valves

Taxon	10m	100m	200m	300m	360m
<i>Achnanthes delicatissima</i>	5			1	1
<i>Achnanthes brevipes</i>	7.5	2	75	76.5	
<i>Actinoptychus sennarius</i>			0.5		
<i>Amphora coffeaeformis</i>	2.5	10	5	1.5	1.5
<i>Biddulphia alternans</i>		0.5			
<i>Campylosira cymbelliformis</i>					10.5
<i>Cymatosira belgica</i>				1	
<i>Cocconeis placentula</i>			0.5		0.5
<i>Cocconeis scutellum</i>			2	0.5	
<i>Cyclotella striata</i>				0.5	
<i>Denticula</i>	0.5	1		1.5	1.5
<i>Diploneis didyma</i>		1.5	0.5		
<i>Fallacia pygmaea</i>	2.5	1.5			
<i>Fragilaria capucina</i>				2.5	
<i>Gomphonema ? gracilis</i>		2.5			
<i>Gramatophora</i>				1	
<i>Gyrosigma</i>		0.5	1		2
<i>Hantzschia</i>					1
<i>Luticola mutica</i>			0.5		1.5
<i>Mastogloia</i>		0.5			
<i>Melosira</i>			0.5		
<i>Navicula</i> sp 1	59	33.5	2	2	



<i>Navicula brehmeyeri</i>				0.5	
<i>Navicula cryptocephala</i>			0.5		
<i>Navicula gregaria</i>				0.5	1.5
<i>Navicula incertata</i>					9.5
<i>Navicula salinarum</i>				0.5	
<i>Navicula salinicola</i>				0.5	45
<i>Navicula digitoradiata</i>	4.5	27			6
<i>Navicula palpebralis</i>					0.5
<i>Navicula perminuta</i>	1		1.5		4.5
<i>Navicula sp (oval)</i>		1			
<i>Nitzschia</i>			1	2	1.5
<i>Nitzschia bilobata</i>	3				
<i>Nitzschia dissipata</i>	2				0.5
<i>Nitzschia frustulum</i>		2			1.5
<i>Nitzschia hybrida</i>			3		
<i>Nitzschia microcephala</i>					1
<i>Nitzschia palea</i>	3				
<i>Nitzschia sigma</i>				1	3.5
<i>Paralia sulcata</i>			0.5	0.5	0.5
<i>Pleurosigma normanii</i>				0.5	
<i>Raphoneis ampiceros</i>				1.5	
<i>Raphoneis minuta</i>		0.5	1.5	3.5	3.5
<i>Raphoneis surirella</i>				0.5	
<i>Scoliopleura tumida</i>	8.5	9.5			1
<i>Staurosirella pinnata</i>		4			
<i>Thalassiosira nan</i>					3.5
<i>Thalassionema</i>			0.5	0.5	
<i>Toxonidea</i>			0.5		
<i>Tryblionella apiculata</i>	1		2.5		
<i>Tryblionella navicularis</i>		2.5	0.5		0.5
<i>Tryblionella</i>			0.5		



## NOTES FOR AUTHORS

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