

## RECENT COLONISATION OF EAST ANGLIAN ESTUARIES BY *HAMINOEA NAVICULA* (DA COSTA, 1778)

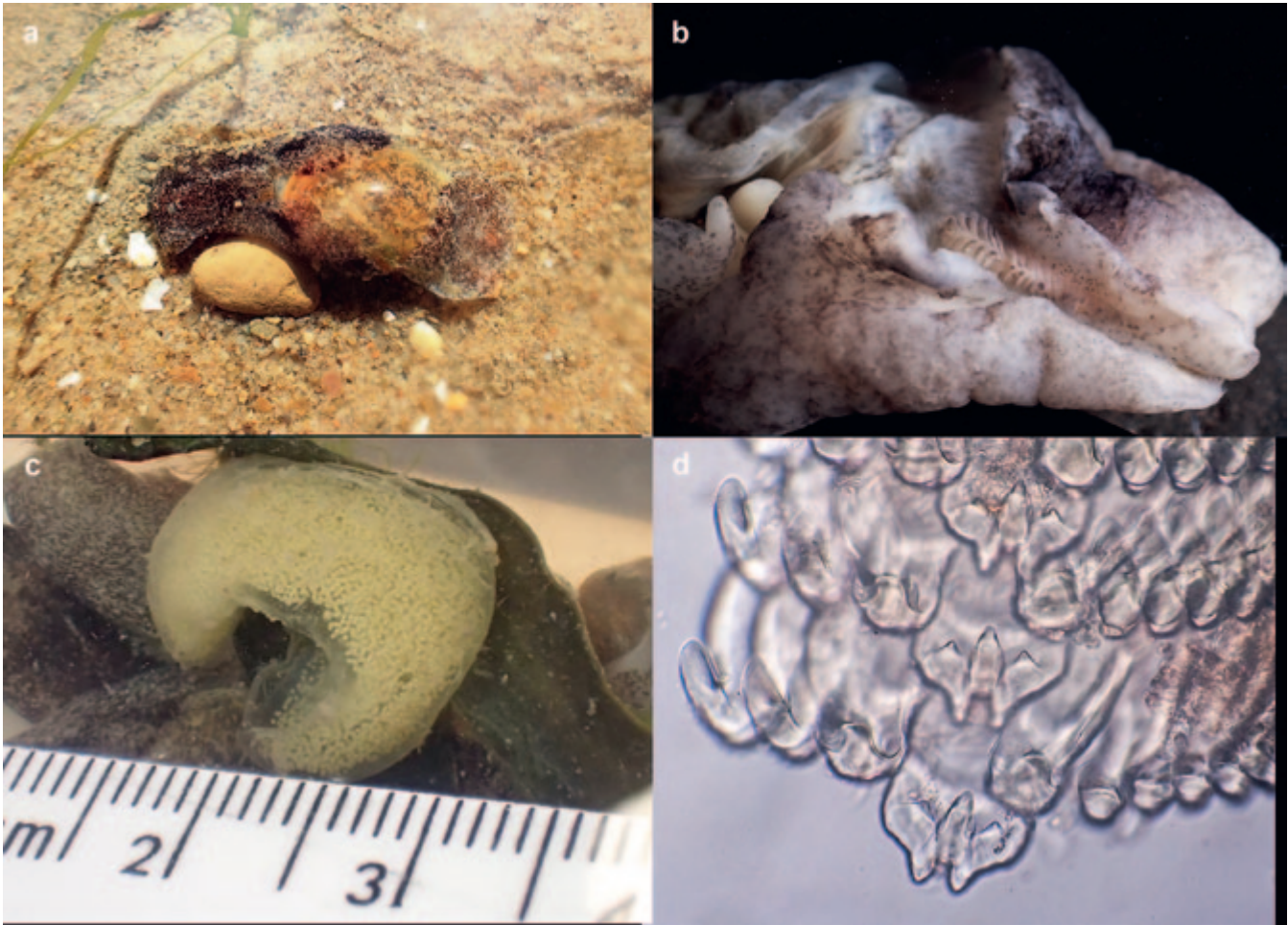
Late in 2019 the first author was approached by a local ecological consultant regarding some bubble shells, tentatively identified as *Bulla* sp., which had been reported from a locality at Wrabness (Fig. 1), on the southern shore of the Stour estuary between Essex and Suffolk. The site being a known locality for *Akera bullata* Müller, 1776, a specimen was requested for determination. A sample of over 20 shell specimens was supplied, all collected at the same site on the same day, and all clearly specimens of a species of *Haminoea*. The nearest UK record for *Haminoea* is from Chichester Channel and there were no previous UK records for any site on the North Sea coast; Seaward<sup>1</sup> notes that old North Sea records were the result of confusion with *Roxania utriculus* (Brocchi, 1814). With no *Haminoea* being recorded despite numerous previous visits to the site in question, the find clearly required further investigation. A subsequent site visit confirmed the continued presence of *A. bullata* but now considerably outnumbered by individuals of *Haminoea* (Fig. 2a), the latter present over a short length of shore (c. 200 metres) but alive and in considerable numbers. Although present across the entire

intertidal zone on a lower than average tide, live animals were concentrated in pools formed as a result of bait digging some days or weeks earlier.

Historically, as again referenced by Seaward<sup>1</sup>, in the UK there has been some confusion in determining between the two *Haminoea* species considered as resident: *H. navicula* (da Costa, 1778) and *H. hydatis* (L., 1758). In recent years the situation has potentially become further complicated by the arrival on nearby continental European shores (the group being inhabitants of intertidal and very shallow subtidal environments) of at least two non-indigenous species: *H. (Haminella) solitaria* (Say, 1822), a native of the eastern seaboard of North America, now established on the Baltic coast of Germany<sup>2</sup>; and *H. (Haloa) japonica* Pilsbry, 1895, a Japanese native which has colonised the western seaboard of North America and has also now established populations on the shores of Italy, Spain, France and the Netherlands<sup>3,4</sup>. Detailed examination of specimens was therefore required in order to establish which species had, evidently rather suddenly, established a population in the Stour estuary. Several further haminoeid species are



Figure 1 Wrabness *Haminoea navicula* habitat.



**Figure 2** *Haminoea navicula* a Live in situ b Dissected to show Hancock organ c Egg mass d Radula. a & c were taken by Simon Taylor, b & d by Marco Faasse.

known from further south on European and North African shores and in the Mediterranean and again had to be ruled out given the frequent discovery over recent years of species in southern UK waters whose northern distribution was previously thought to fall short of the UK.

Following the observations of Malaquias & Cervera<sup>5</sup>, various characters were examined in order to provide a conclusive determination of the species present in the Stour. The perfoliate nature of the sensory Hancock's organ (Fig. 2b) in the Stour specimens immediately ruled out *H. japonica*. Although the radula (a single line of central, rachidian teeth (Fig. 2d) with several rows of laterals) is generally not a very useful determining character in the family, the three-cusped rachidian tooth of *H. solitaria* is very distinctively denticled compared to other species in Europe where it is smooth<sup>2,4</sup>. A combination of other characters – shell shape and sculpture, anatomy of the cephalic lobes, structure of the gizzard plates –

permits confident determination of the species as *H. navicula*, which was further verified by Dr Malaquias when provided with the collated evidence (pers. comm.). Subsequent site visits during 2020 have enabled further confirmation on the basis of the structure of egg masses (Fig. 2c) observed, confirming the presence of a breeding population.

In August 2020, while snorkelling near Waldringfield on the River Deben, Adrian Ashley observed and was later able to photograph and collect voucher specimens of what he described as “thousands, if not hundreds of thousands, of what I thought were sea hares”<sup>6</sup>. Upon further investigation these again proved to be *H. navicula*, also seemingly restricted to a relatively small area of the estuary but nevertheless somewhere which is visited with sufficient frequency such that had the population been present for any number of years it would have been recorded previously.

The conclusion, therefore, is that both populations are recently established, the large number of individuals present in each case suggesting an initial population boom. At Wrabness there were many dead, fully adult shells so if the life span of individuals is taken to be between 12–18 months (analogous with *H. orbignyana* (Férussac, 1822)<sup>7</sup>) then the population must have been present for at least that period of time.

*H. navicula* is known to inhabit beds of *Zostera* and a large population has, in recent years, been extensively observed in such habitat in Portland Harbour<sup>8</sup>, close to the species' type locality of Weymouth. While *Zostera* is recorded from both the Stour and Deben it is not understood to form extensive beds. Observations of both new populations suggests the preferred habitat to be shallow lagoon areas which remain flooded at low tide. Both are quite sheltered in estuaries facing east/south-east into the southern North Sea and significantly upstream such that, although still tidal, there is sufficient influx of freshwater for the water to be brackish rather than fully marine. Presence in tidal lagoon habitat suggests a possible preference for optimum shelter from tidal flow and variation while still maximising water salinity.

It has been suggested that the vector responsible for the extended distribution of *H. japonica* from its native area is an association with bivalve aquaculture, particularly fisheries stocked with *Magallana gigas* (Thunberg, 1793) and *Ruditapes philippinarum* (A. Adams & Reeve, 1850)<sup>3</sup>. Although both species are present in both estuaries, it is not thought that stocks may have been moved there recently from the existing range of *H. navicula* hence this vector is considered unlikely. Both estuaries are well used by inshore leisure craft and they are therefore considered the most likely vector, *H. navicula* having a veliger larva which could potentially have been transported to East Anglia from other leisure craft centres on the Hampshire or Dorset coast. The reason why such potential colonisation has not happened until very recently may possibly be symptomatic of climate change or perhaps, more mundanely, a reflection of the recent increase in popularity of water ballast systems on smaller inshore leisure vessels.

Despite relevant workers having been made aware of both new populations, no reports of

any further east coast populations of *H. navicula* have been forthcoming. There are numerous other estuarine rivers widely accessed by leisure craft between Chichester Channel and the Essex/Suffolk Stour and the Deben so possibly the seemingly very specific habitat requirements simply do not occur, or perhaps it is simply a matter of time.

- 1 SEAWARD DR 1990 Distribution of the marine molluscs of north west Europe. 114 pp.
- 2 WRANIK W & MALAQUAIS MAE 2018 Zum Auftreten der Kopfschildschnecke *Haminoea solitaria* (Say, 1822) im Bereich der deutschen Ostseeküste. Mitteilungen der Deutschen Malakozologischen Gesellschaft **99**: 1–20.
- 3 HANSON D, HIRANO Y & VALDÉS A 2013 Population genetics of *Haminoea* (*Haloa*) *japonica* Pilsbry, 1895, a widespread non-indigenous sea slug (Mollusca: Opisthobranchia) in North America and Europe. *Biological Invasions* **15**: 395–406.
- 4 FAASSE M 2018 *Haminoea japonica* Pilsbry, 1895 (Gastropoda: Cephalaspidea) new to the Netherlands. *Spirula* **416**: 16–19
- 5 MALAQUIAS MAE & CERVERA JL 2006 The Genus *Haminoea* (Gastropoda: Cephalaspidea) in Portugal, with a review of the European species. *Journal of Molluscan Studies* **72**: 89–103.
- 6 ASHLEY A 2020 19 August [online]. Available at: <https://www.facebook.com/groups/british.marine.mollusca/permalink/1466792623505043> (Accessed: 20 August 2020).
- 7 ZABBEY N & MALAQUAIS MAE 2013 Epifauna diversity and ecology on intertidal flats in the tropical Niger Delta, with remarks on the gastropod species *Haminoea orbignyana*. *Journal of the Marine Biological Association of the United Kingdom* **93**(1): 249–257.
- 8 TREWHELLA S 2020 30 December [online]. Available at: <https://www.facebook.com/groups/british.marine.mollusca/permalink/1581291608721810/> (Accessed: 30 December 2020).

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