

THE DISTRIBUTION OF FORAMINIFERA IN THE FAL ESTUARY (CORNWALL)

M.B. HART^{1,2}, G.S. MOLINA^{1,3}, C.W. SMART^{1,2} AND J.M. HALL-SPENCER^{2,4}



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The Fal Estuary (Cornwall) is a part of the Fal and Helford Special Area of Conservation (SAC). It contains a nationally important accumulation of calcareous red seaweeds commonly referred to as maerl. Maerl beds are often associated with high benthic diversity but there has been little research done on the associated microfossil assemblages. This investigation has studied the foraminifera that are found within samples that contain maerl as well as the other sediments in the estuary. Samples from the Truro, Tresillian, Fal and Percuil rivers, coupled with samples from Restronguet and Calenick creeks, have been supplemented by over 50 samples collected from the marine part of the estuary in autumn 2016. Foraminifera from the whole of the Fal Estuary are typical of saltmarsh, estuarine and near-shore marine assemblages reported elsewhere in South-West England, including diverse, and variable, assemblages of *Ammonia* spp. This genus, though abundant in many estuarine and near-shore marine assemblages, has a complicated taxonomy and remains a problem for many micropalaeontologists. Despite rDNA and morphometric analysis identification of the various 'species' is so difficult that consistency is a problem. In the Fal Estuary and adjacent marine areas unornamented to highly ornamented forms are present, often in the same samples.

¹ School of Geography, Earth & Environmental Sciences, Plymouth University, Drake Circus, Plymouth PL4 8AA

² Marine Institute, Plymouth University, Drake Circus, Plymouth PL4 8AA

³ Faculdade de Oceanografia, Universidade do Estado do Rio de Janeiro (UERJ),
Rua São Francisco Xavier 524, Rio de Janeiro RJ, CEP 20550-900, Brazil

⁴ School of Biological and Marine Sciences, Plymouth University, Drake Circus, Plymouth PL4 8AA and
Shimoda Marine Research Centre, Tsukuba University, Japan

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INTRODUCTION

Under the Habitats Directive of the European Union (Natura 2000), a number of areas have been designated as Special Areas of Conservation (SAC). One such area is the 6387.8 ha of the Fal and Helford SAC which encompasses the Helford River, part of Falmouth Bay and the Fal Estuary (Figure 1). This area includes sea inlets, tidal rivers, estuaries, mud flats, sand flats, salt marsh, salt pasture, sand dunes, beaches, machair, cliffs and islets. This SAC is one of the most important ria (drowned valley) systems in South-West England, with a central, sinuous, relatively deep (20–30 m) channel (Sheehan *et al.*, 2015). The low fresh water input from a number of small rivers (e.g., Carnon, Fal, Percuil, Tresillian, Truro, etc.) has allowed the development of a range of fully marine habitats from the extremely sheltered to the wave-exposed, tide-swept open coastline. Of particular importance are the maerl beds that are found on St Mawes Bank and extensive areas of maerl 'gravel' (Sheehan *et al.*, 2015) which extend within an area of the Carrick Roads, Falmouth Bank and Falmouth Bay (Hart *et al.*, 2015, fig. 2). These are the largest known maerl beds in South-West England and they provide habitat for an extremely high diversity of algae and a great many infaunal and epifaunal species (Bosence and Wilson, 2003; Peña *et al.*, 2014; Hart *et al.*, 2015). Maerl is the collective name for a number of species of red seaweeds (Rhodophyta) that develop hard, calcareous skeletons (Corallinaceae). Maerl forms twig-like, branching forms and, as the living alga, requires sunlight to grow, occupies shallow water areas within the open marine part of

the SAC. The maerl in the Fal Estuary is composed of two species: *Phymatolithon calcareum* (Pallas) and *Lithothamnion corallioides* (P. & H. Crouan) and has been described by Bosence (1976), Farnham and Bishop (1985), Irvine and Chamberlain (1994), Birkett *et al.* (1998) and Hall-Spencer *et al.* (2010). Beds of maerl are concentrated along the western coastline of Europe in the NE Atlantic Ocean (Peña *et al.*, 2014, fig. 1; Dutertre *et al.*, 2015), including SW England, Brittany, Western Ireland, the Inner Hebrides and Iceland. The maerl was dredged for agricultural use until 2005, when the Board of Falmouth Harbour Commissioners ceased to licence its extraction, following UK Government advice from English Nature and the Department for the Environment, Fisheries and Rural Affairs (Defra): see Hall-Spencer (2005).

MATERIAL AND METHODS

Aside from the samples of maerl from the Fal Estuary (see Sheehan *et al.*, 2015), a number of other samples have been collected from the headwaters of the Tresillian River near Pencalenick (SW 860454), Fal River near Lamorran (SW 877417), Percuil River near Trethem Mill (SW 862363), Calenick Creek east of Calenick (SW 827432), Tallack's Creek east of Devoran (SW 802389), and in a boatyard near St Just-in-Roseland (SW 847357). These are in addition to the extensive sampling of Restronguet Creek over the past 20+ years, and described by Stubbles (1993, 1999), Olugbode *et al.* (2005) and