GEOMORPHOLOGICAL CHANGE AND ITS IMPACT ON HABITATS IN THE CAMEL ESTUARY, CORNWALL, UK

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The Camel Estuary, Cornwall, UK, supports a diverse range of habitats which are of primary marine biological importance. This paper describes how the extent and distribution of these habitats are influenced by the morphological evolution of the estuary and considers their likely future evolution within the context of morphological change. Historical trend analysis shows that in the late 1920s, the main subtidal channel switched from the western to the eastern side of the outer estuary, leading to changes in the distribution of sandflat and sand dune areas. Since then, the outer estuary has remained relatively stable with a positive sediment budget. The main changes to the morphology of the inner estuary have been caused by human impact. Areas of saltmarsh are stable or very slowly accreting, but there appears little scope for future expansion within the current estuary boundaries. Large areas of previous saltmarsh have been isolated from tidal flow and are now freshwater marshes and grazed farmland. Long-term potential acceleration of sea-level rise will increase pressure on habitats, particularly in the inner estuary, where they are dependent on a limited fluvial sediment supply and are restricted by artificial stabilisation.

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INTRODUCTION

The Environment Agency South West Region has identified the need to improve our understanding of morphological change in the Camel Estuary, Cornwall, UK, in relation to mobile Biodiversity Action Plan (BAP) habitats, including saltmarsh, mudflat, sandflat, subtidal channels, grazing marsh and sand dune (Royal Haskoning, 2005). The Camel Estuary is a dynamic system within which these habitats are prone to changes in shape and extent, through their interaction with sediment supply and loss. Muddy and sandy sediments accumulate to build mudflats and sandflats, respectively. Sediment from the sandflats is reworked by currents and wave action or blown onshore to feed sand beaches and dune systems. These interactions occur gradually over decades or by catastrophic change during extreme storm events (John Merefield, personal communication, 2009). Accreting mudflats support the development of saltmarsh communities. A combination of tidal flows and sediment redistribution across intertidal areas drives migration of subtidal channels (Royal Haskoning, 2005).

This paper provides analysis and interpretation of historical and contemporary geomorphological data (historical trend analysis) to construct a conceptual understanding of the estuarine functioning of the Camel. This provides the background against which the likely future evolution of morphological features and habitats in this estuary can be predicted.

There is a clear relationship between geomorphological and ecological change in estuarine systems. This paper provides one example of how that link can be studied using historical trend analysis. Although this study is specific to the Camel Estuary, the trend analysis methodology can be tailored and/or adopted to, deliver solutions to similar concerns in other dynamic estuarine (and coastal) settings.

SEDIMENTARY ENVIRONMENTS

The Camel Estuary is a deep valley that has been drowned by post-glacial sea-level rise, extending 15 km upstream from Trebetherick Point (Figure 1). The bulk of the estuary is now shallow and sandy, only deepening at its mouth (Padstow Bay), with a narrow meandering low-water channel that shifts position across the intertidal flats. The total intertidal area is around 6 km^2 with 92% of this being intertidal flat (Buck, 1993). For ease of description, the estuary is divided into outer, middle and inner reaches (Figure 1).

The north-facing mouth of the estuary is approximately 1 km wide and dominated by Doom Bar, a large intertidal sandflat connected to the west bank (Figure 1). The subtidal channel flows between Doom Bar and intertidal sandflats of Daymer Bay along the east side of the estuary. Two main areas of sand dune exist in the outer estuary, on the east bank north-west of Rock and in Harbour Cove on the west bank, south of Doom Bar. These dunes support rich calcareous vegetation and a diverse invertebrate fauna and associated rare plant species (Gill and Mercer, 1989; ABP Research and Consultancy, 1995).

The estuary narrows upstream from Brea Hill and then widens again into the middle estuary (Figure 1). Here, the subtidal channel currently follows the east bank, passing close to the Rock shoreline. The west side of the middle estuary is dominated by two large intertidal sandflats known as Town Bar and Halwyn Bank. On the south margin of Town Bar, Little Petherick Creek drains into the estuary.