

Evidence for damage to marine habitats: a literature review.

Horse Mussel Beds (*Modiolus modiolus*)

Introduction:

The horse mussel, *Modiolus modiolus*, is a northern species which occurs in both the Atlantic and Pacific Oceans. *M. modiolus* can occur as relatively small, dense beds of epifaunal mussels which cover steep rocky surfaces, as in some Scottish sea lochs, but are more frequently found recessed into mixed or muddy sediments in a variety of tidal regimes. Although *M. modiolus* is a widespread and common species, true beds forming a distinctive biotope are much more limited and are not known south of the Humber and Severn estuaries. In a few locations, beds are more or less continuous and may be raised up above the surrounding seabed by an accumulation of shell, faeces, pseudofaeces and sand. These *M. modiolus* beds are recognised as an important element of Scotland's nearshore marine environment and are identified as biogenic reefs under the EU Habitats Directive description of reefs (Mair et al., 2000). The natural heritage importance of these beds is also recognised by the UK Biodiversity Action Plan (UK BAP). Scottish beds regarded as biogenic reefs are reported from Lochs Creran, Eil and Leven, off the Ards Peninsula, relatively small areas in Lochs Duich, Long and Alsh, and the Shetland Voes and probably occur elsewhere, particularly in the west of Scotland (Holt et al., 1998; Mair et al., 2000). Although dense populations of very young *Modiolus* do occasionally seem to occur subtidally in estuaries, the species is more poorly adapted to fluctuating salinity than many other mussel species and dense populations of adults are not found in low salinity areas (Bayne, 1976, quoted in Holt et al., 1998).

The importance of *Modiolus modiolus*:

The byssus threads secreted by *M. modiolus* have an important stabilising effect on the seabed, binding together living *M. modiolus*, dead shell, and sediments. As *M. modiolus* is a filter feeder, the accumulation of faeces and pseudofaeces probably represents an important flux of organic material from the plankton to the benthos through the process of benthic-pelagic coupling (Holt et al., 1998) although there are no detailed publications of this aspect of *M. modiolus* beds for UK waters. This rich food source, together with shelter provided by the distinctive 3-dimensional habitat of shells and byssus threads of *M. modiolus* results in extremely rich associated faunas occurring on dense beds. For example, Mair et al. (2000) recorded nearly 300 taxa of fauna and flora from clumps of *M. modiolus* collected at three sites in Loch Creran, Busta Voe and Loch Alsh. The composition of the associated biotopes is variable, and is influenced by the depth, degree of water movement, substrate, and density of *M. modiolus*. Sponges, ascidians, soft corals, anemones, hydroids, bryozoans, tubeworms, brittlestars, urchins, starfish, barnacles, crabs, spider crabs and other decapods, whelks and other gastropods, scallops and fish all tend to be abundant as epifauna, while there may also be coralline algae and other red seaweeds in shallower areas (UK Habitat Plan for *Modiolus modiolus* beds).

The possible role of *Modiolus* reef communities in providing a nursery refuge for other species is occasionally mentioned but does not appear to have been investigated (Holt et al., 1998). Generally an area is termed a nursery if juvenile fish or invertebrate species occur at higher densities, avoid predation more successfully, or grow faster there than in a different habitat (Beck et al., 2001). Dense growths of bushy hydroids and bryozoans could conceivably provide an important settling area for spat of bivalves such as the scallops *Pecten maximus* and *Aequipecten opercularis*, adults of which are often abundant in nearby areas (Holt et al., 1998). Magorrian & Service (1998) noted that while queen scallops were occasionally observed in areas of soft muddy

sediment, they were more often viewed in *M. modiolus* communities in Strangford Lough, Northern Ireland.

Evidence of damage to *Modiolus modiolus*:

M. modiolus is a very long-lived species and animals in reef communities are frequently 25 years old or more (Holt et al., 1998). Spawning seasons are variable and the larvae spend a long time in the plankton with slow and sometimes sporadic recruitment. *M. modiolus* reef areas have almost certainly suffered widespread and long lasting damage due to the activities of bottom fishing (Holt et al., 1998). Fishing, particularly using trawls and dredges for scallops and queen scallops, is known to have caused widespread damage to beds in Strangford Lough and off the south-east of the Isle of Man (MacDonald et al., 1996; Magorrian & Service, 1998; Service & Magorrian, 1997). The most obvious effect trawling has on the Strangford Lough *M. modiolus* communities is the removal of emergent epifauna, such as *A. digitatum* and the disruption of the *M. modiolus* clumps to give an overall flattened appearance to the beds (Magorrian & Service, 1998). Trawling consequently reduces the habitat complexity of the *M. modiolus* communities and therefore if the hard substratum provided by *M. modiolus* coverage declines, as a result of repeated trawling, the associated epifauna would also decline (Magorrian & Service, 1998).

Modiolus beds are likely to be damaged by physical impacts, such as aggregate extraction, trenching and pipe/cable-laying, dumping of spoil/cuttings, or use of jack-up drilling rigs. At a site in Sullum Voe, Shetland the waste water diffuser pipe from the Sullum Voe Oil Terminal discharges in the centre of an extensive *Modiolus* bed, and there has been annual monitoring of the discharges and their effects since 1979 (Mair et al., 2000). Despite some slight elevations in contaminants measured in sediments and the flesh of *M. modiolus*, there were no observable changes to the community in this area, perhaps due to the local strong tidal currents. Successful recruitment of an area of the *M. modiolus* bed, which was destroyed during the original placement of the pipe in a trench in the 1970s, has also occurred, with small *M. modiolus* observed growing in the gravel mound supporting the diffuser pipe (Mair et al., 2000). Limited short-term surveys in connection with drilling of a single oil well using water based muds, detected barium contamination up to at least 250 m from the well but no obvious damage to gravel-embedded *M. modiolus* beds (Holt et al., 1998). The authors concluded that sensitivity to impacts may depend on the nature of the reefs concerned, including the local current regime.

Conclusion:

Modiolus reefs appear to be relatively stable communities in which any detectable changes over periods of a few years are likely to be regarded as unacceptable (Holt et al., 1998). The most significant potential impact on this important habitat would appear to be physical impacts such as the documented evidence of damage from scallop dredging.

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UK Habitat Plan for *Modiolus modiolus* beds (<http://www.ukbap.org.uk/UKPlans.aspx?ID=37>).

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