Beam Trawl (Shrimp) on Peat and Clay Exposures

Introduction

The Assessing Welsh Fisheries Activities Project is a structured approach to determine the impacts from current and potential fishing activities, from licensed and registered commercial fishing vessels, on the features of Marine Protected Areas.

1. Gear and Feature	Beam Trawl (Shrimp) on Peat and Clay Exposures
2. Risk Level	Purple (High risk)
3. Description of Feature	Peat and Clay Exposures are comprised of several relevant biotopes (see annex 1 for full biotope descriptions). LR.HLR.FR.RPid refers to littoral peat and is characterised by the presence of a variety of boring piddocks. LR.MLR.MusF.MytPid refers to littoral firm clay characterised by small clumps of *Mytilus edulis, Elminius modestus* and *Littorina littorea* on the surface. This habitat includes littoral and sublittoral examples of peat and clay exposures, both of which are soft enough to allow them to be bored by a variety of piddocks, particularly *Pholas dactylus*, *Barnea candida* and *Barnea parva*. Peat and clay exposures with either existing or historical evidence of piddock activity are unusual communities of limited extent, adding to the biodiversity interest where they occur. These unique and fragile habitats are irreplaceable, arising from former lake bed sediments and ancient forested peatland (or ‘submerged forests’). Depending on erosion at the site, both clay and peat can occur together or independently of each other. Where peat is present on the shore or in shallow waters, the surface may be characterised by algal mats consisting of the red seaweed *Ceramium* spp. and the green seaweeds *Ulva lactuca* and *Ulva intestinalis*. However, sand scour can limit the cover provided by these seaweeds. The crabs *Carcinus maenas* and *Cancer pagurus* often

	occur in crevices in the peat, with hydroids in any small pools. On clay, seaweed cover is generally sparse with species such as *Mastocarpus stellatus* and *Ceramium* spp. attached to loose-lying pebbles or shells. On the surface of the clay, there may be small clumps of the mussel *Mytilus edulis*, together with barnacles and the winkle *Littorina littorea*. The polychaete worms *Polydora* spp. and *Hediste diversicolor* can sometimes be present within the clay. When the piddocks have died, their holes provide a micro-habitat for species such as small crabs and anemones such as *Cereus pedunculatus* and *Aulactinia verrucosa*. It is known that peat and clay beds exist sublittorally, but the extent and maximum depth of this habitat is not known. There is little information on the communities associated with subtidal examples of peat and clay exposures, but the flora and fauna is likely to be different to those found associated with intertidal examples. It is possible that subtidal exposures of this habitat support communities, which may or may not include piddocks. Surveys of a subtidal peat and clay exposure in the Menai Strait recorded the piddock *Zirfaea crispata*, a sparse cover of hydroids (e.g. *Sertularia cupressina*, *Hydrallmania falcata*, *Tubularia indivisa* and *Nemertesia antennina*), and crabs – *Cancer pagurus*, *Necora puber* and *Carcinus meanas.* Depending on its location, this habitat can experience periodic inundation and emergence from sediments. This habitat encompasses examples of peat and clay exposures with either existing or historical piddock activity (i.e. dead shells in piddock holes). This habitat also encompasses occurrences of peat and clay exposures with no evidence of either past or present piddock activity, but which have the potential for this community to develop on the basis of environmental conditions and presence of similar beds locally (BRIG, 2008). Following storms when the peat habitat may be covered in sand there may be a reduction in the amount of algal species.

	Many of the characterizing species that are present in the biotope are suspension/filter feeders, so productivity of the biotope would probably be largely dependent on detrital input (Tillin & Budd, 2008). Outcrops of fossilized peat in the littoral may project above sand level by >15cm and form extensive platforms up to 100m in length across the shore. Fossilized peat tends to be firm and relatively erosion resistant (Murphy, 1981). Many of the species associated with this biotope are commonly found on various shore types and are either mobile or rapid colonisers (Tillin & Budd, 2008).
4. Description of Gear	A beam trawl consists of a cone-shaped body of net ending in a bag or codend, which retains the catch. In these trawls the horizontal opening of the net is provided by a beam, made of wood or metal, attached to two solid metal plates called ‘shoes’. These ‘shoes’ are welded to the end of the beam which slide over the seabed when the beam and net are dragged by the vessel (FAO, 2001). When fishing for flatfish, mainly sole or plaice, the beam trawl is equipped with tickler chains to disturb the fish from the seabed. For operations on rough fishing grounds chain matrices/mats can be used. Chain matrices/mats are rigged between the beam and the ground rope to prevent damage to the net and to prevent boulders/stones from being caught by the trawl. A beam trawl is normally towed on outriggers with one 4m beam trawl on each side of a powerful vessel, the gear can reach a weight of up to 9000kg. A ‘Eurocutter’ beam trawler with an engine power <221Kw will leave parallel trawl tracks of approximately 4m wide and 11m apart on the seabed (ICES, 2014). The total length of the net used on a ‘Eurocutter’ should be between10 and 15m. Inshore vessels may use one smaller beam, approximately 2m, off the stern of the vessel. The total length of the net should be about 5m.

	The penetration depth of a beam trawl ranges from 1 to 8cm but depends on the weight of the gear and the towing speed, as well as on the type of substrate (Paschen *et al*, 2000). **Beam trawl (shrimp)** gear is lighter than a flat fish beam trawl, the trawl net has a smaller mesh size and does not use tickler chains. A ground rope with rubber bobbins is used, this rolls over the sea bed to flush up the shrimp, keeping the shrimp beam trawl in contact with the bottom and gives flatfish an opportunity to escape. There is a requirement for all trawls fishing for shrimp in Welsh waters to be fitted with a separator trawl (veil) or sorting grid (Welsh Government, 2008) to reduce bycatch of fish.
5. Assessment of Impact Pathways: 1. Damage to a designated habitat feature (including through direct physical impact, pollution, changes in thermal regime, hydrodynamics, light etc). 2. Damage to a designated habitat feature via removal of, or other detrimental impact on, typical species.	There are a lack of studies specifically investigating the impacts of beam trawl (shrimp) gear on peat and clay exposures; therefore it is necessary to widen the research parameters to include other comparable bottom contacting mobile gear and habitats. **1.** Demersal mobile fishing gear reduces habitat complexity by: removing emergent epifauna, smoothing sedimentary bedforms, and removing taxa that produce structure (Auster & Langton, 1999). Demersal beam trawl gear has a direct physical effect on the seabed wherever the beams, shoes, mats, nets and chains have contact with the seabed. Ways in which gear affects the seabed can be classified as: scraping and ploughing; sediment resuspension; and physical destruction, removal, or scattering of non-target benthos (Jones, 1992). Gears such as beam trawls and scallop dredges, are designed specifically to disturb surface sediments to increase the catch rate of the target species (Kaiser *et al*, 1996). Hall *et al* (2008) conclude that significant and long-lasting if not permanent damage may be caused by a single pass of the gear. Beam trawls can cause damage to this habitat by scraping away the

	surface layer, continuous contact will eventually erode the peat and clay reducing the habitat. Kaiser *et al* (2002) suggest that deep water habitats,such as mud are more adversely affected by trawling activities due to the fact that they are often relatively undisturbed by wave turbulence and meteorological impacts. This would also apply to sheltered peat and clay habitats. This theory is supported by research conducted by Hiddink *et al* (2006) into impacts of bottom towed trawl activity to disturbance of benthic biomass. **In conclusion,** the peat and/or clay habitat may be degraded by a single pass of beam trawl (shrimp) gear. Continued impacts from beam trawl gear will erode and remove more of the habitat, if the peat and/or clay is eventually removed entirely, recovery will not occur. **2.** Demersal mobile fishing gear reduces habitat complexity by: removing emergent epifauna, smoothing sedimentary bedforms, and removing taxa that produce structure (Auster & Langton, 1999). Beam trawls cause direct mortality to non-target organisms through shoe, tickler chain or chain mat impact on the seabed (Bergman & van Santbrink, 2000). Where mussels are present on the peat and/or clay exposures, a single pass of the gear will penetrate the substrate and the mussel matrix and cause ecological damage to mussel beds and non-target fauna (Hall *et al*, 2008). Piddocks (Pholadidae), a bivalve mollusc which burrows in the sediment live within the peat and clay habitat. Old or vacated burrows create microhabitats for other species such as crabs and anemones, increasing the local biodiversity (Wright, 2015). Collie *et al* (2000) undertook an analysis of published research into fishing activity impacts on the seabed, based on 39 research projects undertaken previously. They found an average of 46% decrease in

		total number of species individuals within the study sites that were disturbed with bottom towed gear **In conclusion** beam trawl (shrimp) gear impacts on peat and clay exposures could cause degradation of the feature and removal of typical species. Where part of the feature remains, recolonization could occur rapidly. If the feature is removed, no typical species can recolonise.
6. MPAs where feature exists	**Carmarthen Bay and Estuaries SAC**	Mid-Flandrian peat is present intertidally southwest of Amroth, Maross Sands, Pendine, both intertidally and subtidally in the Gwendraeth, at Whiteford Point, Broughton Bay and in the Burry Inlet at Llanridian Sands, at Port Eynon Bay and along the River Loughor (CCW, 2009a).
	Menai Strait and Conwy Bay SAC	An unusual subtidal reef habitat of clay deposits occurs subtidally near Gallows Point just west of Beaumaris and another outcrop has been recorded between Beaumaris and Penmon (CCW, 2009b). Intertidal peat and clay habitats can be found at various locations throughout the Menai Strait and also at Red Wharf Bay and near Moelfre. Intertidal peat and clay habitats are also be found beween Conwy Morfa and West Shore at Llandudno.
	Lleyn Peninsula and the Sarnau SAC	Intertidal exposures of peat and clay can be found within the SAC near Llanbedrog, the mouth of the river Artro, north of Barmouth, between Tywyn and Aberdovey and North of Borth (CCW, 2009c).
	Pembrokeshire Marine SAC	Intertidal exposure mapped with medium confidence at Castlemartin.
	Dee Estuary	There are two records within this SAC, one near Gronant and the other in the Dee estuary on the Wirral coast..

7. Conclusion

This habitat and its associated species are fragile and easily damaged by one pass of a beam trawl (shrimp). The irreplaceable nature of the peat and clay exposures means that, if erosion occurs to the habitat substrate by repeated passes of the beam trawl (shrimp) gear, then recovery will not occur. Although the species associated with these habitats could be initially lost, recovery may be possible if some of the feature remained.

8. References

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Annex 1
Biotope descriptions (version 15.03) (JNCC - http://jncc.defra.gov.uk/marine/biotopes/hierarchy.aspx)

LR.HLR.FR.RPid - *Ceramium* sp. and piddocks on eulittoral fossilised peat
Outcrops of fossilised peat in the eulittoral are soft enough to allow a variety of piddocks such as *Barnea candida* and *Petricola pholadiformis* to bore into them. The surface of the peat can be characterised by a dense algal mat, predominantly the red seaweed *Ceramium* spp. and with the green seaweeds *Ulva lactuca* and *Enteromorpha intestinalis.* Damp areas in the algal mat are covered by aggregations of the polychaetes *Lanice conchilega* and *Polydora* sp. The crabs *Carcinus maenas* and *Cancer pagurus* occur in crevices in the peat. Small pools on the peat may contain hydroids, such as *Obelia longissima* and *Kirchenpaueria pinnata*, the brown alga *Dictyota dichotoma* and the crustacean *Crangon crangon*.

LR.MLR.MusF.MytPid - *Mytilus edulis* and piddocks on eulittoral firm clay
Clay outcrops in the mid to lower eulittoral which are bored by a variety of piddocks including *Pholas dactylus*, *Barnea candida* and *Petricola pholadiformis*. The surface of the clay is characterised by small clumps of the mussel *Mytilus edulis*, the barnacle *Elminius modestus* and the winkle *Littorina littorea*. Seaweeds are generally sparse on the clay, although small patches of the red seaweeds *Mastocarpus stellatus*, *Halurus flosculosus* and *Ceramium* spp. can occur, usually attached to loose-lying cobble or mussel shells. Also the green seaweeds *Enteromorpha* spp. and *Ulva lactuca* may be present. The sand mason *Lanice conchilega* can sometimes be present in the clay, while the shore crab *Carcinus maenas* is present as well.

CR.MCR.SfR – Soft rock communities
This biotope complex occurs on moderately wave-exposed, circalittoral soft bedrock subject to moderately strong tidal streams. As this complex is found in highly turbid water conditions, the circalittoral zone may begin at the low water mark, due to poor light penetration. This complex is dominated by the piddock *Pholas dactylus*. Other species typical of this complex include the polychaete *Polydora* and *Bispira volutacornis*, the sponges *Cliona celata* and *Suberites ficus*, the bryozoan *Flustra foliacea*, *Alcyonium digitatum*, the starfish *Asterias rubens*, the mussel *Mytilus edulis* and the crab *Necora puber* and *Cancer pagurus*. Foliose red algae may also be present. Three biotopes have been identified within this complex: Pid, Pol and Hia.

CR.MCR.SfR.Pid – Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay
This biotope occurs on circalittoral soft rock, such as soft chalk or clay, most often in moderately exposed tide-swept conditions. As soft chalk and firm clay are often too soft for sessile filter-feeding animals to attach and thrive in large numbers, an extremely impoverished epifauna results on upward-facing surfaces, although vertical faces may be somewhat richer. The rock is sufficiently soft to be bored by bivalves. Species vary with location, but *Pholas dactylus* is the most widespread borer and may be abundant. Other species present may include the sponges *Dysidea fragilis* and *Suberites carnosus* and the polychaete *Bispira volutacornis*. Foliose red algae may be present on the harder, more stable areas of rock. Mobile fauna often include the crabs *Necora puber* and *Cancer pagurus*.