Pots, Traps & Creels Interactions with Subtidal Mussel Bed on Rock

1. Introduction

The Assessing Welsh Fishing Activities (AWFA) Project is a structured risk-based approach to determining impacts from current and potential fishing activities (undertaken from licensed and registered commercial fishing vessels), upon the features of European marine sites (EMS) in Wales.

Further details of the AWFA Project, and all completed assessments to date, can be found on the AWFA website.

The methods and process used to classify the risk of interactions between fishing gears and EMS features, as either purple (high), orange (medium) or green (low) risk, can be found in the AWFA Project Phase 1 outputs: Principles and Prioritisation Report and resulting Matrix spreadsheet.

2. Assessment summary

Assessment Summary: **Pots, Traps & Creels Interactions with Subtidal Mussel Bed on Rock**	**Assessment of impact pathway 1: Physical damage to a designated habitat feature:** No studies were found that directly measured or estimated impacts of potting on the Subtidal Mussel Bed on Rock feature. Indirect evidence, expert judgement and indicative MarLIN sensitivity assessments suggest the impacts from pots, weights or anchors making contact with Subtidal Mussel Bed on Rock habitat could cause damage to the biogenic substrate. **Assessment of impact pathway 2: Damage to a designated habitat feature via removal of, or other detrimental impact to, associated biological communities:** No studies were found that directly measured or estimated the impacts of potting on the Subtidal Mussel Bed on Rock feature. Indirect evidence, expert judgement and indicative MarLIN sensitivity assessments suggest the impacts from pots, weights or anchors making contact with Subtidal Mussel Bed on Rock habitat could cause damage to the biological communities. Confidence in this assessment is **medium** (please see section 8).

3. Feature description

Feature Description: Subtidal Mussel Bed on Rock	Juvenile mussels (spat) settle on a variety of seabed types including sediments, mixtures of pebbles, cobbles and boulders, through to bedrock (JNCC, 2015a). Under certain environmental conditions high densities of mussels persist for multiple years, binding together the substrates, to form mussel beds (JNCC, 2015a). Subtidal Mussel Bed on Rock includes mussel beds overgrowing bedrock and stable boulders and cobbles. Where sediments are present, the rock component is dominant (>50%). In Wales, Subtidal Mussel Bed on Rock comprises three core biotopes briefly described below (full biotope descriptions in Annex 1, including sensitivities to relevant pressures and ‘biotope’ definition). *Mytilus edulis* beds on reduced salinity infralittoral rock (IR.LIR.IFaVS.MytRS) occur in shallow, often tide-swept, reduced salinity conditions, comprising dense beds of blue mussel *M. edulis* (JNCC, 2015b). Mussel shells and bare patches of rock provide substratum for a range of algae and invertebrates to settle, gaps between mussels provide refuge for small mobile organisms and patches of sediments provide habitat for burrowing infaunal species (Tillin and Mainwaring, 2015). The starfish *Asterias rubens* is an avid predator of blue mussels and in high abundances can affect the mussel population (Tillin and Mainwaring, 2015). *Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock (CR.MCR.Cmus.Cmyt) occurs in strong tides on a variety of rocky and mixed sediment substrates (JNCC, 2015c). *A. rubens* and crabs such as *Cancer pagurus, Carcinus maenas* and *Necora puber* are common predators of mussels in this habitat (Tyler-Walters, 2016a). Scour resistant hydroids (*Sertularia argentea* and *Tubularia indivisa*) and bryozoans *(Flustra foliacea)* are often present, as are ascidians (*Molgula manhattensis* and *Polycarpa* spp.), particularly in silty conditions (Tyler-Walters, 2016a). *Musculus discors* beds on moderately exposed circalittoral rock (CR.MCR.Cmus.Mdis: The mussel *Musculus discors* occurs in dense mats, up to 60,000 individuals per m² and can cover all available surfaces of bedrock, boulders and cobbles (Hopkinson, 2011; Tyler-Walters, 2016b; JNCC, 2015d). A layer of pseudofaeces bound together by byssus threads forms a thick, silty matrix providing refuge and food for a variety of mobile and infaunal invertebrates (Tyler-Walters, 2016b). Hopkinson (2011) identified 88 infaunal species associated with Welsh *Musculus discors* beds. A relatively diverse epifauna of cushion and branching sponges, bryozoans and hydroids can occur on rocky outcrops and other hard substratum free of mussels (Tyler-Walters, 2016b).

4. Gear description

Gear Description: Pots, Traps & Creels	Pots, traps and creels (pots) are rigid cage-like structures designed to capture fish or shellfish species living on or near the seabed (FAO, 2001; Seafish, 2020a). They typically comprise one or more funnel-shaped entrances that guide fish or shellfish into one or more easily accessed and usually baited compartments (FAO, 2001; Seafish, 2020a). UK pot designs, sizes and construction materials vary geographically and according to target species, environmental conditions and fisher's preference (Seafish, 2020a). Top-entry inkwell pots (0.28-0.47 m^2 footprint) and side or top-entry parlour pots or 'D-creels' (0.24-0.55 m^2 footprint) weighing 15-20kg are used to catch crab or lobster and are made from wire, rubber, metal and netting (Gravestock, 2018; Cornwall Creels, 2020; Seafish, 2020a). Solid sided 20-30 litre rectangular containers with holes in the sides (0.09-0.14 m^2 footprint), a mesh funnel at the top, a concrete bottom and weighing 6-12kg are used to target whelks (Channel Pots, 2020; Seafish, 2020c). Lightweight plastic tubular pots with small-mesh sides and funnel entries at either end are used to target prawns (Coastal Nets, 2020; Seafish, 2020a). Pots can be fished individually or in strings (fleets), where several pots are attached to a length of rope, laid along the seabed and marked at either end with a rope to the surface and a marker buoy (Seafish, 2020a). The number of pots in a fleet will depend on factors including pot design, target species, habitat fished, fisher's preference, vessel size and the available deck space to store the pots once they have been hauled (Seafish, 2020b). Fishers can have multiple strings of pots deployed at any one time, hauled following a soak time of 24-48 hours (Seafish, 2020a). Multi-compartment 'parlour' pots generally retain catch for longer periods making them more suitable for longer soak times, whereas single compartment 'inkwell' pots are subject to more escapees during longer soak times (Swarbrick and Arkley, 2002). Strings of lighter traps, such as prawn creels, use anchors or weights at either end to reduce movement in tides (Seafish, 2020a). Other pots are designed to be heavy or utilise concrete-weighted end-pots that replace the need for anchors or weights (Seafish, 2020b). Strings of pots are deployed (or shot) one at a time whilst the boat slowly moves over the target fishing ground (Seafish, 2020a). Single pots are generally set in rocky inshore areas and can be bounced along the seabed until they contact rock or reef (FAO, 2001). Baited pots can capture undersized target species, non-target invertebrates and occasionally fish species (Pantin, *et al*., 2015). However, the use of appropriate-sized mesh coverings, or the addition of large-mesh panels or escape-gaps, can ensure smaller individuals and non-target species are able to escape (Seafish, 2020a).

5. Assessment of impact pathways

Assessment of impact pathway 1	**1. Physical damage to a designated habitat feature (Physical Impacts)** No studies were found that directly measured or estimated physical impacts of potting on the Subtidal Mussel Bed on Rock. Indirect studies highlight that abrasion could result in small areas of mussel bed being damaged or dislodged (Sørensen *et al.,* 2015), with recovery dependant on the frequency of the interaction and the area of impact (Tyler-Walters, 2016a). When cleared patches occur in blue mussel beds, rapid recovery is possible following a period of good recruitment (Holt *et al.,* 1998). However, damaged mussels can attract scavengers which could increase predation on undamaged mussels (Tillin *et al.,* 2016). Assessments based on expert knowledge suggest that potting is of limited concern to Subtidal Mussel Bed on Rock (Roberts *et al*., 2010; Hall *et al.,* 2008; JNCC and NE, 2011). If potting were to occur across Subtidal Mussel Bed on Rock, the general physical impacts from static gear, including pots, weights or anchors making contact with the seabed during gear deployment could cause minor surface disturbance and abrasion (JNCC and NE, 2011; Walmsley, *et al*., 2015). Where pots are fixed in strings, the retrieval of pots, or incidences of rough weather, could lead to ropes, pots and anchors dragging over or entangling seabed structures, potentially causing physical damage or abrasion to the seabed (MacDonald *et al*., 1996; Roberts *et al*., 2010; JNCC and NE, 2011). During spring tides, strong wind and large waves, unintentional movement of pots and any associated seabed abrasion could be increased (Eno *et al*., 2001; Stephenson *et al*., 2015). In addition to the abiotic physical substrate, the Subtidal Mussel Bed on Rock habitat is comprised of a biogenic physical structure created by the mussels. Subtidal Mussel Bed on Rock biotopes have been assessed to a range of pressures by MarLIN (Tyler-Walters *et al.*, 2018). Relevant pressures for the assessment of potting impacts is primarily abrasion of the rock. MarLIN abrasion sensitivity assessments for Subtidal Mussel Bed on Rock biotopes shown in Annex 1 conclude: both blue mussel (*M.* edulis) and *M. discors* beds on rock as have a ‘medium’ sensitivity to abrasion (Tillin and Mainwaring, 2015; Tyler-Walters, 2016a; Tyler-Walters, 2016b). Depending on the footprint and the intensity of potting, it is possible that the physical impacts from pots, weights or anchors making contact with Subtidal Mussel Bed on Rock habitat could cause damage to the biogenic substrate. The recruitment potential of blue mussels and *M. discors*, could allow rapid recovery if significant parts of the original bed remain, with recovery to pre-impact levels expected within 2-10 years depending on the severity of the impact (Tillin & Mainwaring, 2015; Tyler-Walters, 2016a; Tyler-Walters, 2016b).

Assessment of impact pathway 2	**2. Damage to a designated habitat feature via removal of, or other detrimental impact to, associated biological species (Impacts on Biological Communities)** No studies were found that directly measured impacts from potting on typical species of Subtidal Mussel Bed on Rock. UK experimental potting studies conclude potting has minimal or no impacts on biological communities of subtidal rocky reef (bedrock, boulders and cobbles), including habitats with fragile organisms such as branching sponges, the bryozoan ross coral (*Pentapora foliacea)* and the soft coral (*Alcyonium digitatum*) (Eno *et al*., 2001; Hoskin, 2009; Coleman *et al*., 2013; Haynes *et al*., 2014; Vance and Ellis, 2016). However, several researchers acknowledge the risk of cumulative damage, especially to sensitive fragile species, from repeated impacts and higher intensities of potting (Hartnoll, 1998; Eno *et al*., 2001; Roberts *et al*., 2010; Coleman *et al*., 2013; Walmsley *et al*., 2015; Rees *et al*., 2019, 2021). Rees *et al*. (2019, 2021) assessed impacts to typical and common species and communities of subtidal rocky reef that were exposed to increasing intensities of potting during a three-year study in Lyme Bay and Torbay SAC. Total abundance of all sessile epifauna showed a decreasing trend over time in the medium and higher potting treatment areas. This contrasted with the control areas (where no potting occurred), which showed an increasing trend in total abundance of all sessile species over time (Rees *et al*., 2019, 2021). Rees *et al*. (2019, 2021) demonstrated higher and medium intensity potting levels significantly impacted two fragile epibenthic reef species in particular; the bryozoan 'ross coral' (*P. foliacea*) and a seasquirt (*Phallusia mammillata*). In the case of ross coral, only the complete cessation of potting (i.e. the non-fished control group) resulted in a recovery trend (Rees *et al*., 2019, 2021). In another Lyme Bay rocky reef potting study, Gall *et al*. (2020) reported damage to almost a third of epifauna during the hauling of pots. The epifauna in this study included fragile species also found on Subtidal Mussel Beds on Rock e.g. branching sponges, the bryozoan ross coral and the soft coral dead man's fingers (Gall *et al*., 2020). This suggests repeated potting could potentially affect local populations of these fragile species Mobile species are less vulnerable to physical damage from potting compared to sessile epifauna (Gall *et al*., 2020). Echinoderms (*Asterias rubens*, *Echinus esculentus* and *Holothuria forskali*) rolled or were gently moved away from the pot impact zone by the pressure wave preceding the moving pot (Gall *et al*., 2020). Assessments by Langmead *et al*. (2010) classified the soft coral 'dead-man's fingers' (*A. digitatum*), found on horse mussel beds, as 'fragile' in relation to physical impacts, whilst blue mussel, the boring sponge (*Cliona celata*) and anemones (e.g. *Urticina* spp.) were classified as having 'intermediate' vulnerability to physical impact. If potting were to occur across subtidal Subtidal Mussel Bed on Rock, the general physical impacts from static gear including pots, weights or anchors making contact with the seabed during gear deployment could cause

	surface disturbance and abrasion to biological communities (JNCC and NE, 2011; Walmsley *et al*., 2015). Where pots are fixed in strings, the retrieval of pots, or incidences of rough weather, could lead to ropes, pots and anchors dragging over or entangling seabed structures, potentially causing physical damage or abrasion to the biological communities (MacDonald *et al*., 1996; Roberts *et al*., 2010; JNCC and NE, 2011; Gall *et al*., 2020). During spring tides, strong wind and large waves may cause unintentional movement of pots and any associated seabed abrasion could be increased (Eno *et al*., 2001; Sørensen *et al*., 2015; Stephenson *et al*., 2015). Subtidal Mussel Bed on Rock biotopes have been assessed to a range of pressures by MarLIN (Tyler-Walters *et al.*, 2018). Relevant pressures for the assessment of potting impacts is primarily abrasion of the rock. MarLIN abrasion sensitivity assessments for Subtidal Mussel Bed on Rock biotopes shown in Annex 1 conclude: both blue mussel (*M. edulis*) and *M. discors* beds on rock as have a 'medium' sensitivity to abrasion (Tillin and Mainwaring, 2015; Tyler-Walters, 2016a; Tyler-Walters, 2016b). Please refer to the MarLIN website which provides further information about the assessment methodology and the supporting evidence (www.marlin.ac.uk/). Depending on the footprint and the intensity of potting, it is possible that the impacts from pots, weights or anchors making contact with Subtidal Mussel Bed on Rock habitat could cause damage to the biological communities. The recruitment potential of blue mussels and *M. discors*, could allow rapid recovery if significant parts of the original bed remain, with recovery to pre-impact levels expected within 2-10 years depending on the severity of the impact (Tillin and Mainwaring, 2015; Tyler-Walters, 2016a; Tyler-Walters, 2016b).

6. SACs where the habitat occurs as a component of a designated feature

Lleyn Peninsula and the Sarnau SAC	The Lleyn Peninsula and the Sarnau SAC contains examples of the Subtidal Mussel Bed on Rock habitat, as evidenced by data and relevant literature (NRW, 2018a). Please see the latest SAC feature condition assessment for information on the location and condition of features. The following features contain Subtidal Mussel Bed on Rock habitat within the Lleyn Peninsula and the Sarnau SAC: 1. Reefs

Menai Strait and Conwy Bay SAC	The Menai Strait and Conwy Bay SAC contains examples of the Subtidal Mussel Bed on Rock habitat, as evidenced by data and relevant literature (NRW, 2018b). Please see the latest SAC feature condition assessment for information on the location and condition of features. The following features contain Subtidal Mussel Bed on Rock habitat within the Menai Strait and Conwy Bay SAC: 1. Reefs
Pembrokeshire Marine SAC	The Pembrokeshire Marine SAC contains examples of the Subtidal Mussel Bed on Rock habitat, as evidenced by data and relevant literature (NRW, 2018c). Please see the latest SAC feature condition assessment for information on the location and condition of features. The following features contain Subtidal Mussel Bed on Rock habitat within the Pembrokeshire Marine SAC: 1. Large Shallow Inlets and Bays
Cardigan Bay SAC	The Cardigan Bay SAC contains examples of the Subtidal Mussel Bed on Rock habitat, as evidenced by data and relevant literature (NRW, 2018d). Please see the latest SAC feature condition assessment for information on the location and condition of features. The following features contain Subtidal Mussel Bed on Rock habitat within the Cardigan Bay SAC: 1. Reefs
Carmarthen Bay and Estuaries SAC	The Carmarthen Bay and Estuaries SAC contains examples of the Subtidal Mussel Bed on Rock habitat, as evidenced by data and relevant literature (NRW, 2018e). Please see the latest SAC feature condition assessment for information on the location and condition of features. The following features contain Subtidal Mussel Bed on Rock habitat within the Carmarthen Bay and Estuaries SAC: 1. Large Shallow Inlets and Bays

7. Evidence Gaps

- Direct studies to measure impacts from potting on the Subtidal Mussel Beds on Rock feature.
- A study comparing the impacts from different types of pots and methods of potting.
- Map the distribution and extent of the AWFA Subtidal Mussel Bed on Rock habitat

8. Confidence assessment

The confidence score is the sum of scores from three evidence components: quality, applicability and agreement. These are qualitatively assessed as high, medium or low using the most appropriate statements in the table below, and these are numerically represented as scores of 3, 2, or 1 respectively.

A total confidence score of 3 – 5 represents low confidence, 6 or 7 shows medium confidence and 8 or 9 demonstrates high confidence in the evidence used in the assessment.

This assessment scores 6, representing medium confidence in the evidence.

Confidence	Evidence quality	Evidence applicability	Evidence agreement
High	**Based on more than 3 recent and relevant peer reviewed papers or grey literature from established agencies. Score 3.**	Based on the fishing gear acting on the feature in the UK.	Strong agreement between multiple (>3) evidence sources.
Medium	Based on either relevant but older peer reviewed papers or grey literature from less established agencies; or based on only 2-3 recent and relevant peer reviewed evidence sources.	Based on similar fishing gears, or other activities with a similar impact, acting on the feature in the UK.	**Some disagreement but majority of evidence agrees. Or fewer than 3 evidence sources used. Score 2.**
Low	Based on either less relevant or older grey literature from less established agencies; or based on only 1 recent and relevant peer reviewed evidence source.	**Based on similar fishing gears acting on the feature in other areas, or the fishing gear acting upon a similar feature in the UK. Score 1.**	Little agreement between evidence.

N.B. When evidence is indirect the evidence quality and applicability will be capped to medium, to ensure that direct evidence gaps are captured in this approach.

9. References

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Annex 1: Welsh biotopes included in the AWFA potting and Subtidal Mussel Bed on Rock habitat assessment

The term 'biotope' refers to both the physical environment (e.g. substrate) and the unique set of species associated with that environment (Tyler-Walters and Jackson, 1999). Biotopes are defined by the JNCC Marine Habitat Classification for Britain and Ireland Version 15.03 (https://mhc.jncc.gov.uk/) and sensitivities to abrasion and penetration are from the Marine Evidence based Sensitivity Assessment (MarESA) (https://www.marlin.ac.uk/sensitivity/sensitivity_rationale). The MarESA approach considers a range of pressures and benchmarks for all biotopes using all available evidence and expertise (Tyler-Walters *et al*., 2018). The MarESA sensitivity to abrasion and penetration assessments highlighted in the table below consider any type of potential abrasion to the surface substratum and associated biology and do not specifically refer to potting activity (Tyler-Walters *et al*., 2018). High sensitivity indicates a significant loss of species combined with a recovery time of more than 10 years. Medium sensitivity indicates either significant mortality combined with medium recovery times (2-10 years) or lower mortality with recovery times varying from 2 to 25+ years. Whilst a low sensitivity indicates a full recovery within 2 years.

Biotope code	MarESA sensitivity to abrasion	MarESA sensitivity to penetration
IR.LIR.IFaVS.MytRS	Medium	Not Relevant
CR.MCR.CMus.CMyt	Medium	Not Relevant
CR.MCR.CMus.Mdis	Medium	Not Relevant