Pots, Traps & Creels Interactions with Subtidal Bedrock Reef

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 Bedrock Reef**	**<u>Assessment of impact pathway 1: Physical damage to a designated habitat feature:</u>** No studies were found that directly or indirectly measured or estimated physical impacts of potting on Subtidal Bedrock Reef or similar habitats. Expert judgement suggests the physical impacts from pots, weights or anchors making contact with Subtidal Bedrock Reef habitat is unlikely to cause damage to the substrate. **<u>Assessment of impact pathway 2: Damage to a designated habitat feature via removal of, or other detrimental impact to, associated biological communities:</u>** Direct evidence, expert judgement and indicative MarLIN sensitivity assessments suggest the impacts from pots, weights or anchors making contact with Subtidal Bedrock Reef habitat could cause damage to some of the biological communities. Confidence in this assessment is **high** (please see section 8).

3. Feature description

Feature Description: **Subtidal Bedrock Reef**	Subtidal Bedrock Reef is typically a continuous solid mass of rock, arising from the seabed and remaining covered by the sea at all states of the tide (BGS, 2020; JNCC, 2020a). For AWFA assessment purposes, bedrock reef was separated from boulder and cobble reef and is assessed separately. Whilst both reef types share common supporting biological communities, the effects of heavy fishing gear on the structure of bedrock reef could differ from boulder and cobble reefs. An explanation of how these two feature types were separated is detailed in Annex 1, whilst Annex 2 provides a list of biotopes commonly associated with Welsh Subtidal Bedrock Reef, including their sensitivity to relevant pressures. See Annex 1 for a definition of 'biotope'. Subtidal Bedrock Reef communities vary according to many factors, such as water depth, levels of exposure to wave action and tidal currents, water clarity (turbidity), salinity, temperature, rock type and the presence of topographical seabed features such as vertical rock walls, gully and canyon systems and outcrops from sediment (JNCC, 2020a). Shallower infralittoral bedrock reefs in clearer waters are typically covered by red and brown seaweeds, whilst deeper or more turbid circalittoral reefs are usually animal-dominated, comprising varying communities of hydroids, bryozoans, sponges, anemones, corals, echinoderms and sea squirts (JNCC, 2020a). In comparison with some other areas of the UK, Welsh reefs have relatively low densities of the urchin *Echinus esculentus*, which results in low grazing pressure and diverse red algal turfs in some areas (NRW, 2018a). In sheltered areas, with strong tidal currents and turbid waters, subtidal bedrock communities include extensive areas of filter-feeding animals, such as sponges, hydroids and anemones, (JNCC, 2020b; NRW, 2018b; NRW, 2018c). Exposure to stronger wave action tends to reduce the biological community to fewer hardier species, such as keel worms, barnacles and encrusting sponges and bryozoans (JNCC, 2020c). Water temperature has an important influence on the biological communities present on reefs (JNCC, 2020a). Off the Pembrokeshire coast in south-west Wales a biogeographic boundary separates the warmer Celtic Sea to the south and the cooler more northerly waters of the Irish Sea (JNCC, 2004). Welsh distributions of southern species such as the pink sea-fan (*Eunicella verrucosa*) are typically only found to the south of this area (NRW, 2018c). The most commonly occurring Subtidal Bedrock Reef biotopes found in Welsh waters include mixed faunal turf communities (CR.HCR.XFa), bryozoan turf and erect sponges on tide-swept circalittoral rock (CR.HCR.XFa.ByErSp), foliose red seaweeds on exposed lower infralittoral rock (IR.HIR.KFaR.FoR) and sponges and anemones on vertical circalittoral bedrock (CR.HCR.XFa.SpAnVt). Species associated with

	subtidal bedrock reef that are known to be particularly fragile include the pink sea fan *E. verrucosa*, coral species (*Caryophyllia* spp.) and branching sponges, such as *Axinella* spp. (Northen and Irving, 2008; Langmead *et al*., 2010).

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 or indirectly measured or estimated physical impacts of potting on Subtidal Bedrock Reef or similar habitats. An assessment based on expert knowledge concluded that Subtidal Bedrock Reef is unlikely to be significantly impacted by potting (Walmsley *et al*. 2015). If potting were to occur across the Subtidal Bedrock Reef, 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 (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 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). Considering the stable and robust nature of rock, the physical impacts from pots, weights or anchors making contact with Subtidal Bedrock Reef habitat is unlikely to cause damage to the substrate.
Assessment of impact pathway 2	**2. Damage to a designated habitat feature via removal of, or other detrimental impact to, associated biological communities (Impacts on Biological Communities):** UK experimental potting studies on Bedrock Reef have concluded potting does impact the biological communities of subtidal rocky reef including habitats with fragile organisms such as branching sponges, the bryozoan ross coral (*Pentapora foliacea),* the soft coral (*Alcyonium digitatum*) and pink sea fan *(Eunicella*

	verrucosa) (Eno *et al*., 2001; Hoskin, 2009; Coleman *et al*., 2013; Haynes *et al*., 2014; Vance and Ellis, 2016; Rees *et al*., 2021). 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). Rees *et al*. (2019; 2021) assessed impacts to typical and common species and communities of Subtidal Bedrock 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). 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; Rees *et al*., 2021). In another Lyme Bay potting study, Gall *et al*. (2020) reported damage to almost a third (32%) of epifauna during the hauling of pots. The epifauna in Gall's (2020) study included several fragile typical species of Subtidal Bedrock Reef, e.g. branching sponges, the bryozoan ross coral, the soft coral dead man's fingers and pink sea fan. This suggests repeated potting could potentially affect local populations of these fragile species. Where these species occur on Subtidal Bedrock Reef in higher abundance, the biological communities are called 'Fragile Sponges and Anthozoan Communities' and MarLIN considered this habitat to have a high sensitivity to surface abrasion (Tillin *et al*., 2010; Readman *et al*., 2018). Annex 2 provides information on the sensitivity to abrasion for all component biotopes of the Subtidal Bedrock Reef feature. 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; Eno *et al*., 2001). In an experimental potting study of two relatively robust bedrock biotopes in Northumberland, no significant declines in species abundances were reported (Stephenson *et al*., 2017). If potting were to occur across Subtidal Bedrock Reef, the general physical impacts from static gear, including pots, weights or anchors, making contact with subtidal rock 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 rock 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). If there is a sensitive species present further assessment of the potting activity is recommended (Walmsley *et al.*, 2015). Subtidal Bedrock Reef biotopes have been assessed to a range of pressures by MarLIN (Readman *et al*., 2018). Relevant pressures for the assessment of potting impacts are primarily abrasion and penetration of the sediment. MarLIN abrasion and penetration sensitivity assessments for Subtidal Bedrock Reef biotopes shown in Annex 1 conclude: the majority of biotopes have a low to medium sensitivity to abrasion. 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 Bedrock Reef habitat could cause damage to the biological communities.

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 Bedrock Reef 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 Bedrock Reef habitat within the Lleyn Peninsula and the Sarnau SAC: 1. Reefs 2. Large Shallow Inlets and Bays
Menai Strait and Conwy Bay SAC	The Menai Strait and Conwy Bay SAC contains examples of the Subtidal Bedrock Reef 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 Bedrock Reef habitat within the Menai Strait and Conwy Bay SAC: 1. Large Shallow Inlets and Bays 2. Reefs

Pembrokeshire Marine SAC	The Pembrokeshire Marine SAC contains examples of the Subtidal Bedrock Reef habitat, as evidenced by data and relevant literature (NRW, 2018c). Please see the latest SAC feature condition assessment information on the location and condition of features. The following features contain Subtidal Bedrock Reef habitat within the Pembrokeshire Marine SAC: 1. Large Shallow Inlets and Bays 2. Reefs 3. Estuaries 4. Sandbanks
Cardigan Bay SAC	The Cardigan Bay SAC contains examples of the Subtidal Bedrock Reef 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 Bedrock Reef habitat within the Cardigan Bay SAC: 1. Reefs
Carmarthen Bay and Estuaries SAC	The Carmarthen Bay and Estuaries SAC contains examples of the Subtidal Bedrock Reef habitat, as evidenced by data and relevant literature (NRW, 2018e). Please see the latest SAC feature condition assessment for up to date information on the location and condition of features. The following features contain Subtidal Bedrock Reef habitat within the Carmarthen Bay and Estuaries SAC: 1. Large Shallow Inlets and Bays

7. Evidence Gaps

None identified.

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 9, representing high 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. Score 3.**	**Strong agreement between multiple (>3) evidence sources. Score 3.**
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.
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.	Little agreement between evidence.

9. References

BGS. (2020). BGS Geology - Bedrock theme. British Geological Society. [Accessed 5th May 2020] www.bgs.ac.uk/products/digitalmaps/digmapgb_solid.html.

Channel Pots. (2020). Suppliers of whelk pots since 2015. [Accessed 10th August 2020]. https://www.channelpots.co.uk.

Coastal nets. (2020). Crab, Lobster, Crayfish, Cuttlefish, Whelk Pots & Potting Components. [Accessed 10th August 2020]. https://www.coastalnets.co.uk.

Coleman, R.A., Hoskin, M.G., Von Carlshausen, E. & Davis, C.M. (2013). Using a no-take zone to assess the impacts of fishing: Sessile epifauna appear insensitive to environmental disturbances from commercial potting. Journal of Experimental Marine Biology and Ecology, 440: 100–107.

Cornwall Creels. (2020). Plastic coated pot frames. [Accessed 28th July 2020]. https://www.cornwallcreels.co.uk.

Eno, N.C., MacDonald, D.S., Kinnear, J.A.M., Amos, C.S., Chapman, C.J., Clark, R.A., Bunker, F. StP.D., & Munro, C. (2001). Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science, 58: 11–20.

FAO. (2001). Fishing Gear types. Pots. Technology Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 13 September 2001. [Accessed 04th February 2020]. www.fao.org/fishery/geartype/225/en.

Gall, S. C., Rodwell, L. D., Clark, S., Robbins, T., Attrill, M. J., Holmes, L. A., & Sheehan, E. V. (2020). The impact of potting for crustaceans on temperate rocky reef habitats: Implications for management. Marine Environmental Research, 105134.

Gravestock, V. (2018). The Needles MCZ – Part B Fisheries Assessment – Potting.

Hartnoll, R.G. (1998). Circalittoral faunal turf biotopes: An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. Scottish Association of Marine Sciences (UK Marine SAC Project), Oban, Scotland. 109 pp.

Haynes, T., Bell, J., Saunders, G., Irving, R., Williams, J.& Bell, G. (2014). Marine Strategy Framework Directive Shallow Sublittoral Rock Indicators for Fragile Sponge and Anthozoan Assemblages Part 1: Developing Proposals for Potential Indicators. JNCC Report No. 524, Nature Bureau and Environment Systems Ltd. for JNCC, JNCC Peterborough.

Hoskin, M.G., Coleman, R.A. & von Carlshausen, L. (2009). Ecological effects of the Lundy No-Take Zone: the first five years (2003-2007). Report to Natural England, DEFRA and WWF-UK.

Irving, R. (2009). The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432.

JNCC. (2004). Developing regional seas for UK waters using biogeographic principles. Joint Nature Conservation Committee.

JNCC. (2020a). 1170 Reefs. Description and ecological characteristics [Accessed 24th February 2020] https://sac.jncc.gov.uk/habitat/H1170/.

JNCC. (2020b). Very tide-swept faunal communities. Description of biotope or habitat type. [Accessed 24th February 2020] https://mhc.jncc.gov.uk/biotopes/JNCCMNCR00002121.

JNCC. (2020c). Infralittoral surge gullies and caves. Description of biotope or habitat type. [Accessed 24th February 2020] https://mhc.jncc.gov.uk/biotopes/JNCCMNCR00001531.

JNCC and Natural England. (2011). Advice from the Joint Nature Conservation Committee and Natural England with regards to fisheries impacts on Marine Conservation Zone habitat features. 113 pp.

Langmead, O., Jackson, E.L., Bayley, D.T.I., Marshall, C., Gall, S.C., (2010). Assessment of the long-term effects of fishery area closures on long-lived and sessile species. Report to Defra from the Marine Life Information Network (MarLIN). p. 68. Defra contract No. MB0101, Plymouth: Marine Biological Association of the UK.

MacDonald, D.S., Little, M., Eno, N.C. & Hiscock, K. (1996). Disturbance of benthic species by fishing activities: a sensitivity index. Aquatic Conservation: Marine and Freshwater Ecosystems, 6(4), 257-268.

Northen, K.O. & Irving, R.A. (2008). An Atlas of selected marine habitats and species listed on Section 42 of the NERC Act 2006. CCW Contract Science Report No: 833, 72pp. + appendices.

NRW. (2018a). Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau Special Area of Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. Natural Resources Wales, Bangor pp 143.

NRW. (2018b). Menai Strait & Conwy Bay / Y Fenai a Bae Conwy Special Area of Conservation. Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. Natural Resources Wales, Bangor pp 107.

NRW. (2018c). Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation. Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. Natural Resources Wales, Bangor pp 131.

NRW. (2018d). Cardigan Bay/ Bae Ceredigion Special Area of Conservation. Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. Natural Resources Wales, Bangor pp 87.

NRW. (2018e). Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd European Marine Site Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. Natural Resources Wales, Bangor pp 116.

Pantin, J.R., Murray, L.G., Cambiè, G., Le Vay, L. & Kaiser, M.J. (2015). Escape Gap Study in Cardigan Bay: consequences of using lobster escape gaps. A Preliminary Report. Fisheries & Conservation report No. 44, Bangor University. 43 pp.

Readman, J.A.J., Jackson, A. & Hiscock, K. (2018). Eunicella verrucosa and Pentapora foliacea on wave-exposed circalittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [Accessed 24th August 2020]. Available from: https://www.marlin.ac.uk/habitat/detail/77.

Rees, A., Sheehan, E.V., Attrill, M.J. (2019). The Lyme Bay experimental potting study: A collaborative programme to assess the ecological effects of increasing potting density in the Lyme Bay Marine Protected Area. A report to the Blue Marine Foundation and Defra, by the Marine Institute at the University of Plymouth.

Rees, A., Sheehan, E. V., & Attrill, M. J. (2021). Optimal fishing effort benefits fisheries and conservation. *Scientific reports*, *11*(1), 1-15.

Roberts, C., Smith, C., Tillin, H. Tyler-Walters, H. (2010). Review of existing approaches to evaluate marine habitat vulnerability to commercial fishing activities. November 2010.

Seafish. (2020a). Fishing Gear Database: Pots and traps - general. [Accessed 04th February 2020]. https://seafish.org/gear-database/gear/pots-and-traps/.

Seafish. (2020b). Fishing Gear Database: Pots and traps - lobster. [Accessed 24th February 2020]. https://seafish.org/gear-database/gear/pots-and-traps-lobster/.

Seafish. (2020c). Fishing Gear Database: Pots and trap – nephrops. [Accessed 24th February 2020]. https://seafish.org/gear-database/gear/pots-and-trap-nephrops/.

Sørensen, T.K., Larsen, F. & Bridda, J. (2015). Impacts of bottom-set gillnet anchors on the seafloor and associated flora – potential implications for fisheries management in protected areas. In von Nordheim, H. & Wollny-Goerke, K. (eds) Proceedings of the Conference "Progress in Marine Conservation in Europe 2015" in Stralsund, Germany, 14-18 September 2015. Published 2016 and available online: https://www.bfn.de/fileadmin/BfN/service/Dokumente/skripten/Skript451.pdf.

Stephenson, F., Mill, A.C., Scott, C., Polunin, N.V.C. & Fitzsimmons, C. (2017). Experimental potting impacts on common UK reef habitats in areas of high and low fishing pressure. ICES Journal of Marine Science. 74 (6), 1648–1659.

Swarbrick, J. & Arkley, K. (2002). The evaluation of ghost fishing preventers for shellfish traps. Seafish Report No SR549. 46 pp.

Tillin, H.M., Hull, S.C. & Tyler-Walters, H. (2010). Development of a sensitivity Matrix (pressures-MCZ/MPA features). Report to the Department of Environment, Food and Rural Affairs from ABPmer, Southampton and the Marine Life Information Network (MarLIN) Plymouth: Marine Biological Association of the UK. Defra Contract No. MB0102 Task 3A, Report No. 22.

Tyler-Walters, H. & Jackson, A. 1999. Assessing seabed species and ecosystems sensitivities. Rationale and user guide, January 2000 edition. Report to English Nature, Scottish Natural Heritage and the Department of the Environment Transport and the Regions from the Marine Life Information Network (MarLIN). Plymouth, Marine Biological Association of the UK. (MarLIN Report No. 4.).Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F., Stamp, T., 2018. Marine Evidence-based Sensitivity Assessment (MarESA) – A Guide. Marine Life Information Network (MarLIN). Marine Biological Association of the UK, Plymouth, pp. 91. Available from https://www.marlin.ac.uk/publications.

Vance, T. & Ellis, R. (2016). Lundy SAC: Subtidal Reef Condition Assessment and No Take Zone Benthic Monitoring Survey 2014/15 (RP02178). Report to Natural England. Marine Monitoring Framework. 63pp.

Walmsley, S.F., Bowles, A., Eno, N.C. & West, N. (2015). Evidence for Management of Potting Impacts on Designated Features. MMO1086 Defra Marine Biodiversity Impact Evidence Group (IEG). Final Report pp1 – 111.

Annex 1: Separation of Bedrock from Boulder and Cobble Reef

For the purposes of the Assessing Welsh Fishing Activities (AWFA) project, 'Bedrock Reef' was separated from 'Boulder and Cobble Reef' to align with the approach taken by Natural England for a related piece of work.

Using Welsh habitat maps derived from historic surveys, an analysis of substratum components determined areas defined as boulder and cobble or bedrock reef as follows:

Boulder and Cobble Reef equates to Habitats Directive Annex I Stony Reef, which was previously defined by Irving (2009) as:

1) An area of seabed >25m^2 and comprising no less than 10% cobbles or boulders (i.e. rock particles ≥64mm in diameter), and
2) a biological community dominated by epibiota i.e. organisms that would normally be associated with rock habitats as opposed to sediment dwelling organisms (infauna).

The remaining substratum could be smaller particles such as pebbles, gravel, sand and mud, and stony reef may be consistent in its coverage or may form patches with intervening areas smaller particles and sediments (Irving, 2009).

Bedrock Reef, as defined by the AWFA project, included substratum meeting two conditions:

1) there was greater than 10% hard substratum (bedrock, boulders or cobbles), and
2) the percentage of bedrock (of the total rock component) was recorded as ≥50% bedrock (it is acknowledged that the substratum could comprise up to 50% cobbles and boulders and still be classed as subtidal bedrock reef).

Only subtidal biotopes (infralittoral and circalittoral) were included in the subtidal bedrock reef definition. All intertidal (littoral) rock or sediments were omitted from this habitat type.

Annex 2: Welsh biotopes included in the AWFA potting and Subtidal Bedrock Reef 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 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 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.

Circalittoral rock	MarESA sensitivity to abrasion	Infralittoral rock	MarESA sensitivity to abrasion
CR.FCR.Cv	High	IR.FIR.IFou	Not Assessed
CR.FCR.Cv.SpCup	High	IR.FIR.SG	Not Assessed
CR.HCR.FaT	Not Assessed	IR.FIR.SG.CC	Low
CR.HCR.FaT.BalTub	Low	IR.FIR.SG.CC.BalPom	Low
CR.HCR.FaT.CTub	Low	IR.FIR.SG.CC.Mo	Low
CR.HCR.FaT.CTub.Adig	Low	IR.FIR.SG.CrSp	Low
CR.HCR.FaT.CTub.CuSp	Low	IR.FIR.SG.CrSpAsAn	Low
CR.HCR.XFa	Not Assessed	IR.FIR.SG.CrSpAsDenB	Low
CR.HCR.XFa.ByErSp	Medium	IR.FIR.SG.DenCcor	Low
CR.HCR.XFa.ByErSp.DysAct	Medium	IR.FIR.SG.FoSwCC	Low
CR.HCR.XFa.ByErSp.Eun	High	IR.HIR.KFaR	Not Assessed
CR.HCR.XFa.ByErSp.Sag	Medium	IR.HIR.KFaR.Ala	Low
CR.HCR.XFa.CvirCri	Low	IR.HIR.KFaR.Ala.Ldig	Low
CR.HCR.XFa.FluCoAs	Low	IR.HIR.KFaR.Ala.Myt	Low
CR.HCR.XFa.FluCoAs.SmAs	Low	IR.HIR.KFaR.FoR	Low
CR.HCR.XFa.FluCoAs.X	Low	IR.HIR.KFaR.FoR.Dic	Low
CR.HCR.XFa.FluHocu	Low	IR.HIR.KFaR.LhypFa	Medium
CR.HCR.XFa.Mol	Low	IR.HIR.KFaR.LhypR	Medium
CR.HCR.XFa.SpAnVt	Medium	IR.HIR.KFaR.LhypR.Ft	Medium

Circalittoral rock	MarESA sensitivity to abrasion	Infralittoral rock	MarESA sensitivity to abrasion
CR.HCR.XFa.SpNemAdia	Medium	IR.HIR.KFaR.LhypR.Pk	Medium
CR.HCR.XFa.SubCriTf	Medium	IR.HIR.KFaR.LhypRVt	Medium
CR.MCR.CFaVS	Medium	IR.HIR.KSed	Not Assessed
CR.MCR.CFaVS.CuSpH	Medium	IR.HIR.KSed.DesFilR	Medium
CR.MCR.CFaVS.CuSpH.As	Medium	IR.HIR.KSed.LsacSac	Medium
CR.MCR.CFaVS.CuSpH.VS	Medium	IR.HIR.KSed.ProtAhn	Low
CR.MCR.CMus	Not Assessed	IR.HIR.KSed.Sac	Medium
CR.MCR.CMus.CMyt	Medium	IR.HIR.KSed.XKHal	Medium
CR.MCR.CMus.Mdis	Medium	IR.HIR.KSed.XKScrR	Medium
CR.MCR.CSab	Medium	IR.LIR.IFaVS.MytRS	Medium
CR.MCR.CSab.Sspi	Medium	IR.LIR.K.LhypLsac	Medium
CR.MCR.CSab.Sspi.As	Medium	IR.LIR.K.LhypLsac.Pk	Medium
CR.MCR.CSab.Sspi.ByB	Medium	IR.LIR.K.Lsac	Low
CR.MCR.EcCr	Not Assessed	IR.LIR.K.Lsac.Ldig	Low
CR.MCR.EcCr.AdigVt	Low	IR.LIR.K.Lsac.Pk	Low
CR.MCR.EcCr.CarSp	Low	IR.MIR.KR	Not Assessed
CR.MCR.EcCr.CarSp.Bri	Medium	IR.MIR.KR.HiaSw	Medium
CR.MCR.EcCr.CarSp.PenPcom	Low	IR.MIR.KR.Ldig	Low
CR.MCR.EcCr.FaAlCr	Low	IR.MIR.KR.Ldig.Bo	Medium
CR.MCR.EcCr.FaAlCr.Bri	Medium	IR.MIR.KR.Ldig.Ldig	Low
CR.MCR.EcCr.FaAlCr.Car	Low	IR.MIR.KR.Ldig.Pid	Medium
CR.MCR.EcCr.FaAlCr.Flu	Low	IR.MIR.KR.Lhyp	Medium
CR.MCR.EcCr.FaAlCr.Pom	Low	IR.MIR.KR.Lhyp.Ft	Medium
CR.MCR.EcCr.FaAlCr.Sec	Low	IR.MIR.KR.Lhyp.GzFt	Medium
CR.MCR.EcCr.UrtScr	Medium	IR.MIR.KR.Lhyp.GzPk	Medium
CR.MCR.SfR	Not Assessed	IR.MIR.KR.Lhyp.Pk	Medium
CR.MCR.SfR.Hia	Medium	IR.MIR.KR.LhypT	Medium
CR.MCR.SfR.Pol	Medium	IR.MIR.KR.LhypT.Ft	Medium
		IR.MIR.KR.LhypT.Pk	Medium
		IR.MIR.KR.LhypTX.Ft	Medium
		IR.MIR.KR.LhypTX.Pk	Medium
		IR.MIR.KR.LhypVt	Medium

Circalittoral rock	MarESA sensitivity to abrasion	Infralittoral rock	MarESA sensitivity to abrasion
		IR.MIR.KR.XFoR	Low
		IR.MIR.KT	Not Assessed
		IR.MIR.KT.FilRVS	Low
		IR.MIR.KT.LdigT	Medium
		IR.MIR.KT.LsacT	Medium
		IR.MIR.KT.XKT	Medium