The Lyme Bay Experimental Potting Project

A collaborative programme to assess the impact of potting density on seabed biodiversity and target species within the Lyme Bay Marine Protected Area

Plymouth University Marine Institute in collaboration with the Blue Marine Foundation and local inshore fishing community

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Introduction

The Lyme Bay "Statutory Instrument" was designated in 2008 providing, at the time, the largest Marine Protected Area (MPA) in the UK. The justification for designation was to protect vulnerable and valuable temperate reef communities from the damaging impact of bottom-towed fishing gear; consequently, such activity (scallop dredging, trawling) has been excluded from a 200 km2 area across the inshore reefs of Lyme Bay (Figure 1), but the use of static fishing gear (pots, nets), hand-diving for scallops and recreational activity remains permitted. The impact of the closure on the ecology and socio-economics of the Lyme Bay area has been monitored and assessed for Defra and Natural England since 2008 by a Plymouth consortium led by Plymouth University's Marine Institute (Attrill et al 2011; Mangi et al 2011).

This ongoing survey focuses on the changes associated with the removal of bottom-towed fishing gear on seabed biodiversity, but concern has also been raised, particularly from the local small-boat fishermen who are keen to develop sustainable levels of fishing activity, about the potential impact of the increased level of potting that has been evident since closure. Consequently, they have been working with Blue Marine Foundation, who have coordinated relevant stakeholders to develop a Memorandum of Agreement between all involved parties to agree to work towards a sustainable future for the Lyme Bay area in terms of both biodiversity and the small boat fishing industry.

To enable a suitable potting management policy to be developed, it became clear that data were required on the level of impact that different densities of pots have on the seabed biodiversity and, in particular, the populations of target crabs and lobsters. Such data would need to be obtained by further research and this document outlines the methodology for an experimental potting project that would deliver such information. By controlling the density of potting activity within a range of test areas across the MPA (from no potting to high potting intensity), the project will aim to assess a sustainable level of potting for this region.

This project will be novel in many respects, but mostly in that it will involve a direct collaboration between scientists and fishermen in designing and maintaining the study areas and collecting the data. Each main fishing port along the length of the MPA (Beer, Axmouth, Lyme Regis, West Bay) will have ownership over an area of experimental treatments that the fisherman will help designate and maintain in terms of controlled level of potting activity. The fishermen will also collect some of the experimental data through quantitative pot sampling to complement data being collected by scientists from the Marine Institute using remote High Definition video technology.

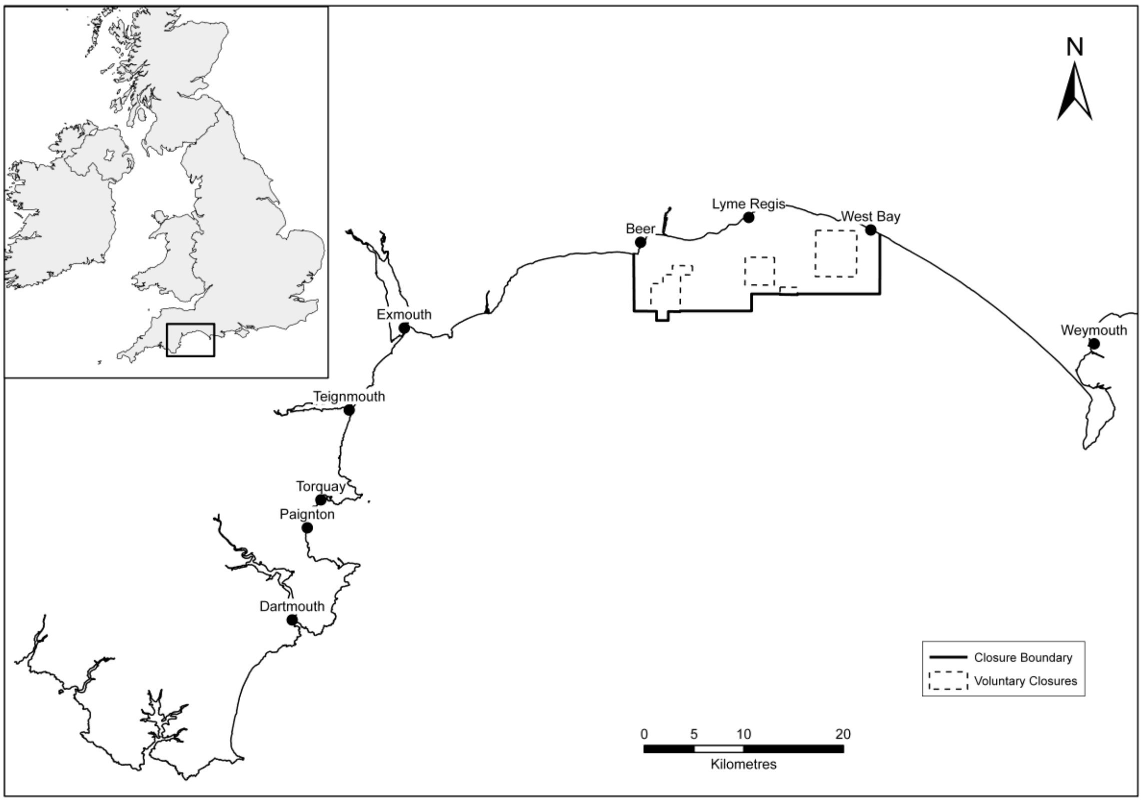

Figure 1. Location of the Marine Protected Area in Lyme Bay. Dotted areas are original voluntary exclusion areas to bottom towed fishing gear.

<u>Study Design</u>

The objective of the study is to designate a set of test areas across the MPA where potting activity can be regulated by the fishing community and samples regularly taken to assess differences between the treatments and whether any spillover is occurring. Each test area will be 500m x 500m and located on mixed ground or rocky reef for comparability. Four types of treatment are planned (Figure 2a): no potting, low density pots, mid-density pots and high density pots, with actual numbers of pots per 500x500 area determined in discussion with fishermen. The four treatments will be replicated four times across the MPA, with a set of treatments located near each local fishing port, giving a total of 16 experimental areas (Figure 2b).

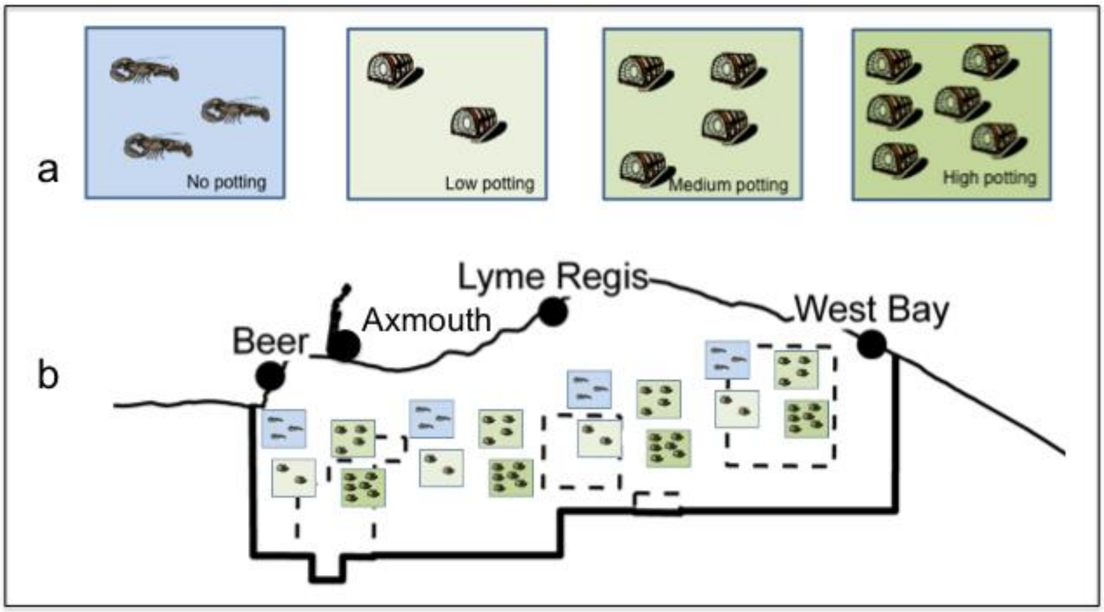

Figure 2. a. Four experimental potting treatment areas, each 500x500m in size. b. Schematic showing spread of experimental areas across the MPA (areas are not to scale).

The test areas will be located in areas of similar depth and seabed type to ensure maximum comparability, which will be jointly decided by the fishermen and scientists. The no potting zones may be marked using buoys to aid compliance.

Once designated, agreed levels of commercial potting will be undertaken from within the test areas as part of regular fishing activity. This will be monitored and regulated by the fishermen within each local port. The no potting zones also have the potential to act as lobster refugia, allowing sites for release of stock from hatcheries, return sites for berried females, etc. Such activities can be factored into the data collection to prevent bias, but could allow further engagement of the fishing community and additional potential projects.

Data Collection

Four types of data will be collected from experimental areas to enable comparisons of the impact of different potting densities. Surveys 1 and 2 will be undertaken by Marine Institute staff, surveys 3 & 4 being undertaken by fishermen with MI data collectors on board. The project will run for 3.5 years to allow 3 full years of samples and to provide enough time for the changes in potting density to take effect.

1. *Towed underwater HD video transects*. Non-destructive high-definition video sampling has been developed by the Marine Institute (Sheehan et al. 2010) and was the major tool for assessing change in the seabed community within the main Lyme Bay monitoring programme. In summary (details in Appendix 1), a flying array consisting of a floating frame, with HD camera equipment that is towed behind a boat. Its position above the seabed is maintained by a drag chain which is the only contact with the

floor, but this enables the array to float over obstacles whilst maintaining a constant height above the seafloor. Three 200 m video transects will be taken within each experimental area giving a record of the organisms living on the seabed. The HD video transects are used to identify, count and measure the organisms living on the seabed including the key species of importance such as pink sea fans. Frame grabs are also randomly taken from each transect to give data on the distribution of smaller species, the HD video providing a resolution suitable for identification. This survey will be undertaken annually in summer.

2. *Baited Remote Underwater Video (BRUV) survey.* The video transects are targeted at organisms fixed or settled on the seabed. This methodology is used to obtain quantitative data on the mobile organisms in each experimental area. Here, the HD video cameras are mounted on frames and dropped to the bottom of the sea, with a fixed weight portion of mackerel bait in front of the camera (see Appendix 1). After a settling period, the video is recorded for 30 minutes documenting all species attracted to the bait (e.g. fish, molluscs and crustaceans). Three separate replicate films are recorded at each site, with three sites located within each experimental area. Data on the number of individuals of each species recorded in the films is then extracted, using the maximum number seen at any one time as the key measure to prevent counting the same individuals more than once. This survey will be annual in late spring/summer.

3. *Quantitative experimental potting survey.* Data on target species to complement Survey 2 can be obtained using quantitative potting. For this survey, standard sets of pots will be constructed for each of the 4 local ports (e.g. for each port four strings of 10 identical pots to give replication). During the survey each port will sample their experimental areas within the same week using the experimental pots. On day 1 the four strings will be deployed in the first experimental area and left for a suitable length of time (24 or 48 hours soak time depending on pot design used). The pots are then hauled and all organisms caught within the pots identified and measured and released back into the experimental area. The pots are then deployed in the next experimental area until all four areas off each port have been surveyed. Data will be collected on board (MI data recorder present on each boat) and the survey will be completed every season (i.e. every 3 months) to allow for seasonal changes in species abundance.

4. *Assessment of potential spillover from control areas.* As well as assessing levels of target (and other) species within the four experimental treatments, data will be collected from a narrow (50 m) zone outside of each treatment area to assess whether there is any overspill from the areas where there is no use of static gear. The survey design and methodology will be identical to the experimental potting trial in Survey 3, using four replicate strings of 10 pots deployed along the sides of the experimental areas within 50 m of the area edge (Figure 3). Results will be tested between the four treatments as for all three other surveys,

assessing whether there is any significant difference in catches from the experimental pots between control and actively fished treatments. If spillover is occurring, it would be expected that with time control samples will have higher catches than other treatments.

This experiment is potentially compromised by an elevated fishing effort targeted at “fishing the line” around the control no-potting areas, which would remove any potential spillover catch. It is therefore important for the fishermen to prevent any particular concentration of effort in these areas. This can be partially mitigated by a second aspect of this study where fishermen log their catches with accurate positions and thus these data can be utilised to investigate any changes in commercial catches over time, particular close to the experimental areas.

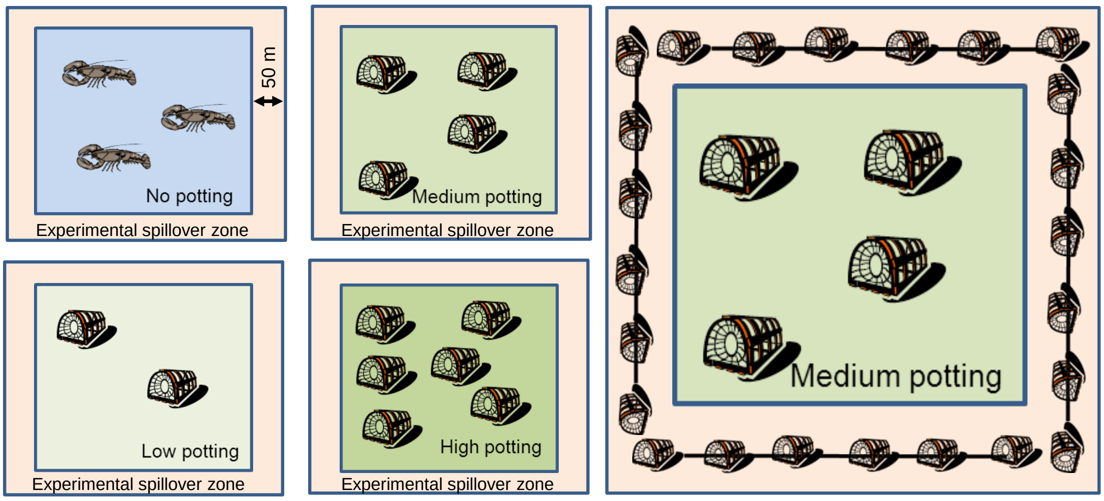

Figure 3. Design of Survey 4 to assess any spillover occurring from the No potting control areas (one set of treatments illustrated). A 50 m zone will be surveyed using experimental potting within the zone around each treatment using the methods for Survey 3 (right hand schematic).

<u>Data analysis and outcomes</u>

The aim of the data analysis will be to determine if there is any difference in the variables recorded between treatments and whether this changes over time. Consequently data analysis can be undertaken on an annual basis to give regular reports on the results of the three surveys, although the final outcome will be after the third year. Data analysis techniques will use the most up to date and suitable methods for assessing significance of differences (e.g. ANOVA, PERMANOVA and other multivariate methods within the PRIMER package), with all results provided in both academic outputs and reports designed for a general audience. Full details of experimental design and statistical framework can be provided if required.

<u>Resources required</u>

This novel collaborative project will be based around a PhD student to give a single full time position dedicated to the project for 3.5 years that can interact and work with all stakeholders within the programme. They will be responsible for the coordination of all surveys and the actual undertaking of surveys 1 and 2. They also have the opportunity to develop further projects with existing or new project partners as the project evolves and, with the other key members of the MI team, be in regular contact with other members of the Blue Marine Foundation's steering group.

In addition to the PhD student (which includes fees for supervision time, etc.), there will be further resources, including: staff time for other lead researchers from the MI to contribute to the project beyond supervision; hire of boat time for video transect and BRUV work; hire of video sampling equipment; consumables and small equipment; travel and subsistence for survey teams; new sets of experimental pots; use of fisherman time to sample survey 3.

Appendix 1

Video sampling methodology as defined in Attrill et al. 2011.

To remotely sample the reef epibenthic fauna we employed two methods using High Definition (HD) video. The HD video system included a camera (Surveyor- HD-J12 colour zoom titanium camera, 6000 m depth rated, 1080i/720p), LED lights (Bowtech Products limited, LED-1600-13, 1600 Lumen underwater LED), two laser pointers (Apinex.com Inc. BALP-LG05-B105 Green laser pointer for scuba diving) and a mini CTD profiler (Valeport Ltd). The umbilical was connected topside to a Bowtech System power supply/control unit allowing control of the camera, focus, zoom and aperture, and intensity of the lights. Firstly, a towed flying array was developed to fly the camera over the seabed to sample sessile and sedentary taxa, ensuring sampling was relatively non- destructive and allowing us to sample a variety of habitats without snagging on rocky ledges or boulders (Sheehan *et al.*, 2010). Secondly, we deployed the camera on a baited, static frame to sample reef-associated nekton and mobile benthic fauna. These taxa typically take refuge under rocks and would therefore be missed using the towed array. Using the static frame and bait attracts these organisms into the field of view.

The methods for the towed and baited video are set out below; however, please refer to Sheehan *et al*. (2010) for detailed information regarding equipment and sampling method. All fieldwork was carried out from the vessel "Miss Pattie", a 10 m traditional displacement trawler.

Towed video

Underwater HD videography was used due to its suitability as a cost-effective method of rapidly surveying large areas (e.g. Stevens and Connolly 2005). This very low-impact sampling method is necessary to avoid confounding assessments of change over time by impacts associated with the sampling equipment and is applicable to areas of high conservation importance.

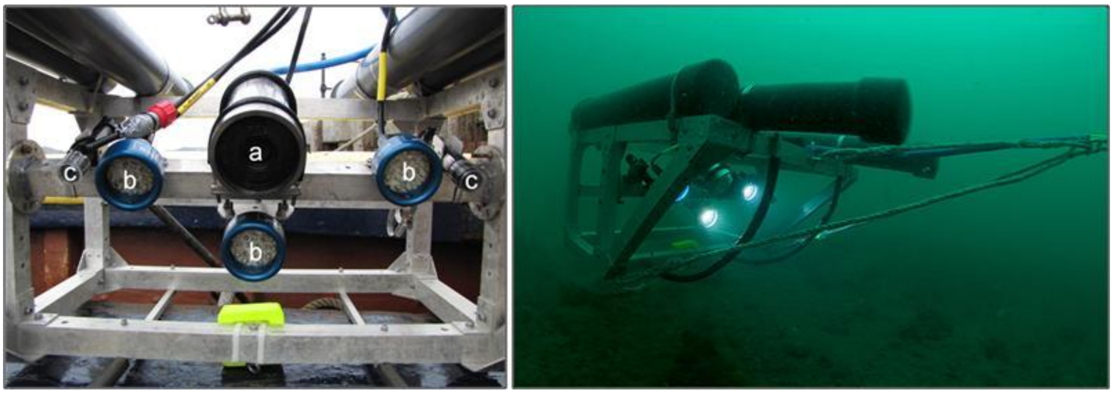

Figure A1: Flying array used for the towed video survey. a = high definition video camera, b = LED lights, c = lasers

The camera was positioned at a 45° angle to the seabed, and three artificial light sources were fixed to the array in front of the camera to provide improved image definition and colour. Two lasers were mounted to display a pair of dots within the video image at a fixed distance apart (50 cm), allowing calibration of the field of view (Figure A1).

Remote Baited Underwater Video

To determine whether the closure affected reef-associated nekton species, and mobile benthic fauna, Remote Baited Underwater Video (RBUV) was undertaken. Methods were based on a pilot program completed in 2008 (Hately-Broad *unpubl*.).

The HD video camera used on the towed flying array was attached to a static metal frame that was lowered to the seabed. Fresh mackerel (100 g) was used to bait each replicate sample and was held within a wire cage attached to a pole extending outward from the camera’s field of view (Figure A2). The bait was replenished at the start of each sample.

The boat was anchored at each site, and 3 replicate 15 minute camera deployments were made from 3 points on the boat (bow, side starboard stern and port stern) to maximise the distance between replicates.

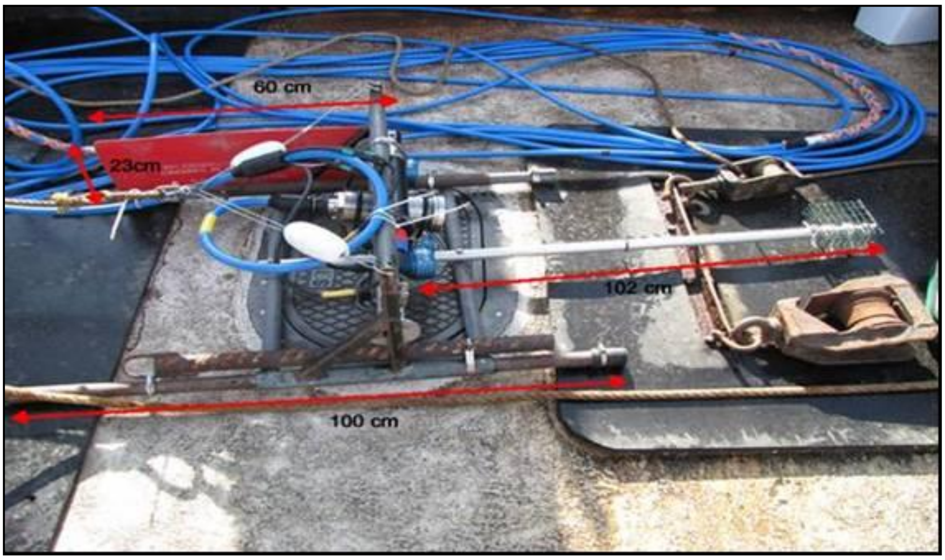

Figure A2: Static frame with bait box attached used for the towed video survey

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