Assessing the impacts of the pump-scoop dredge fishery on the macrobenthos of Poole Harbour MPA.

Background to Natural England

Natural England is the government’s advisor on the natural environment. We provide practical advice, grounded in science, on how best to safeguard England’s natural wealth for the benefit of everyone.

Our remit is to ensure sustainable stewardship of the land and sea so that people and nature can thrive. It is our responsibility to see that England’s rich natural environment can adapt and survive intact for future generations to enjoy.

Natural England was formally established on 01 October 2006 following the successful passage of the Natural Environment and Rural Communities (NERC) Act 2006 through Parliament. We are an independent statutory Non-Departmental Public Body.

The NERC Act sets out Natural England's purpose: to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.

The Act states that this purpose includes:

* ​​​​​promoting nature conservation and protecting biodiversity
* conserving and enhancing the landscape
* securing the provision and improvement of facilities for the study, understanding and enjoyment of the natural environment
* promoting access to the countryside, open spaces and encouraging open air recreation
* contributing in other ways to social and economic wellbeing through management of the natural environment

Our vision

Our vision is of Thriving nature for people and planet.

Our ambition is not just to improve nature, but to see it thriving everywhere. This is because we recognise that a healthy natural environment is fundamental to everyone’s wealth, health and happiness.

Our definition of nature encompasses:

* natural beauty
* wildlife
* the geology that underpins natural character and habitats
* our cultural connections with nature

We include the whole natural world on earth and at sea and in towns and cities as well as the countryside.

Our mission

Our mission is Building partnerships for nature’s recovery. This reflects the need for us to work with and through a wide range of people and also the need for rapid action to re-build sustainable ecosystems and thereby protect and restore habitats, species and landscapes.

Our goals

Our work over the next few years will reflect the priorities set out in the government’s 25 Year Environment Plan. It will be focused around 4 goals:

* Resilient landscapes and seas
* Sustainable development
* Greener farming and fisheries
* Connecting people with nature

1. Introduction

Poole Harbour was designated an SPA under the Birds directive 1979, a Ramsar under the Wetlands Convention 1975, and SSSI notified under Section 28 of the Wildlife and Countryside Act 1981. Poole Harbour is a large natural harbour comprising of extensive tidal mudflats, seagrass beds and saltmarsh, together with associated reedbed, freshwater marsh and wet grassland. It has a narrow entrance and a small tidal range and as a result, although classified as an estuary (several rivers flow into it), it has many of the qualities of a large lagoon. The north side is largely urbanised while the west and south side abut heath, mire or grassland. Extensive intertidal mudflats provide an important feeding habitat for overwintering waterbirds, while the fringing saltmarsh and reedbed provide roosting areas and feeding habitat for a variety of bird species. Ducks, grebes and cormorant feed and loaf over the harbour’s shallow waters, with the ducks and grebes forming more compact roosts at night. The main areas of seagrass beds are in the north east of the harbour and provide a food source for dark-bellied brent goose as well as a supporting habitat for fish-eating species such as red-breasted merganser and goldeneye.

Brownsea Island lagoon is a particularly important feeding and roosting area for wintering birds, and in addition, it is a nesting site for internationally important numbers of common and Sandwich tern. Saltmarsh islands in the north west of the harbour are the main nesting sites for Mediterranean gull. A large dune slack lake within the Studland dunes is also included within the SPA due to its importance as a supporting feeding and roosting habitat to many of the SPA bird species. Areas outside the SPA contain important supporting habitats for the birds that use the site, including coastal grazing marsh and agricultural land.

Poole Harbour SPA was originally classified in 1999 for supporting qualifying numbers of non-breeding avocet, black-tailed godwit, shelduck, and breeding populations of common tern and Mediterranean gull. In 2017, the SPA was extended to incorporate subtidal, saltmarsh and wet grassland areas that support internationally important bird populations, and had three new species added that now exceed qualifying thresholds: breeding Sandwich tern, and non-breeding little egret and spoonbill.

The designated non-breeding features of the SPA are:

* Avocet (Recurvirostra avosetta), Non-breeding
* Black-tailed godwit (Limosa limosa islandica), Non-breeding
* Common tern (Sterna hirundo), Breeding
* Little egret (Egretta garzetta), Non-breeding
* Mediterranean gull (Ichthyaetus melanocephalus), Breeding
* Sandwich tern (Thalasseus sandvicensis), Breeding
* Shelduck (Tadorna tadorna), Non-breeding
* Spoonbill (Platalea leucorodia), Non-breeding
* Waterbird assemblage, Non-breeding

Historically, shellfish fishing in Poole Harbour has faced issues with illegal fishing and high risk of disturbance to protected feeding areas for over wintering birds. As such a new permit system came into effect in 2015 which regulates the area under a by-law (Clarke et al, 2017). This by-law restricts the use of a dredge to the open season which runs from May to December and within further spatial restrictions. Under this new management regime some areas of the harbour have been designated as "bird sensitive areas" for overwintering waders and waterfowl. Some areas are closed all year round, and some are only open to dredging between 1st July and 31st October. These areas were previously closed to fishing prior to 2015 and so have not been historically dredged.

Please see Figure 1 for an outline of the permanently closed and the seasonally closed areas of Poole Harbour for pump-scoop dredging.

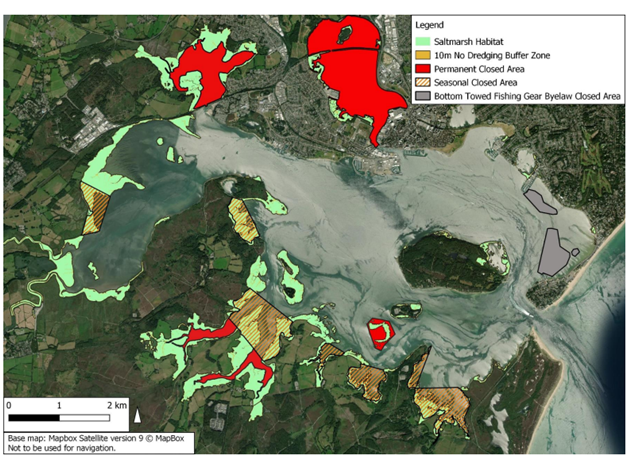


Figure 1: A map of Poole Harbour, showing saltmarsh habitat and a 10m no dredging buffer, and the areas closed permanently and seasonally to the pump scoop dredge fishery. Source: SIFCA Saltmarsh code of practice 2022.

1.1 Previous Surveys   
  
Previous work by Leo Clarke (2017) on the harbour as part of his PhD project included investigating the impacts of pump scoop dredging shell fishing gear on macrobenthos in Poole Harbour as well as shorebird distributions and feeding rates in relation to shellfish dredging in the harbour. The former study was published in Aquatic Living Resources in 2018.

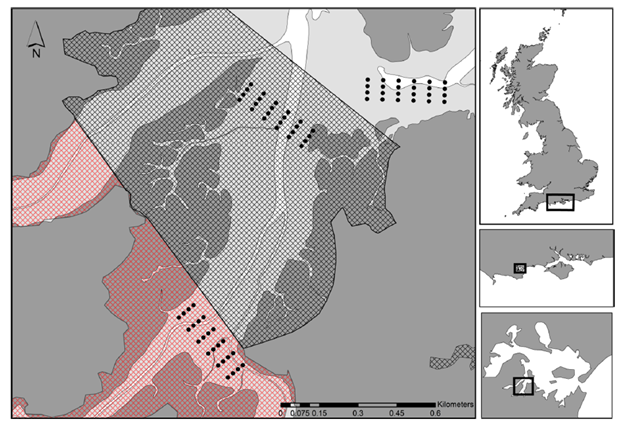
The sampling points and site information used in Clarke et al (2017) are outlined in Figure 2 and Table 1.    


Figure 2: The study area in Poole Harbour known as Wytch Lake, indicating the sampling stations visited in June and November, 2015. The southern red hatching represents the area closed to dredging (control). The Wytch Lake Bird Sensitive Area (BSA) is indicated by the black hatching and represents the area open July 1–October 31st (newly opened, short-term dredging). The most northerly sampling grid outside of the hatching has historically been heavily fished and dredging is permitted in this area from 25th May–24th December. The southern tip of Round Island is indicated immediately north of the study site. The location within Poole Harbour, the UK south coast and the UK is also indicated. (Clarke et al, 2017).

Table 1: Fishing intensity and seasonal openings of each site sampled under the dredge permit by-law in Clarke et al, 2017.

|  |  |  |
| --- | --- | --- |
| Site | Pre-by-law | Post by-law |
| Control | Closed | Closed |
| Newly opened | Closed | Open (1st July - 31st October) |
| Heavy dredging | Open | Open (25th May - 24th December) |

2. Aims & Objectives

2.1 Aim

Assess the impacts of the pump scoop dredge fishery on the invertebrate communities of Poole Harbour, and how changes in prey availability may impact the designated bird features of the site.

This study will address evidence gaps which will inform future advice regarding the sustainability of the pump-scoop dredge fishery. Specific focus should be centred on the possible reductions in the abundance and variety of non-target benthic invertebrates, making the communities less diverse and having lower biomass, which is an issue in relation to SSSI condition, as well as in relation to understanding prey availability of protected bird features of the SPA. Of particular concern, as noted in SIFCA’s HRA and based on Wetland Bird Survey (WeBS) data is the continued local decline of shelduck. An important prey item of this species is the gastropod, Peringia ulvae, which SIFCA’s HRA points out is potentially affected by dredging. Given the uncertainties of long-term impacts associated with this fishery further evidence is needed to be able to continue to conclude no adverse effect on site integrity is occurring.

Survey work should be scheduled to be completed in November 2023.

2.2 Objectives:

The main objectives for this contract are to, in collaboration with Natural England, plan, undertake and report on the impacts of the pump scoop dredge fishery on invertebrate communities in the autumn of 2023 to help inform condition of the site and its bird features. The survey should determine whether there are differences in the invertebrate communities between different treatment areas compared to the control area. In addition, under this contract samples will be collected, and infauanal analysis, Particle Size Analysis and organic content analysis carried out to help characterise sediments and assess biodiversity.  As well as:

* Conduct benthic sampling of invertebrate communities using the method employed by Clarke et. al. (2017);
* Identify any differences in invertebrate community structure and physical characteristics between the different treatment areas. The mudflats of Poole Harbour are supporting habitat for overwintering bird species and contain important prey, as well as having their own intrinsic value;
* Compare these results with those of Clarke et. al. (2017) to identify any change in community structure between treatment areas since the 2017 study;
* Identify and quantify the effect of scale on invertebrate community structure and physical characteristics to better contextualise any differences between treatment areas;
* Assess any change in community structure in the impact areas relative to that in the control area;
* Identify any shift in size range of invertebrates (both mobile and sedentary species) as a result of mechanical clam dredging with regards to implications for the feeding ecology of the bird populations present in Poole Harbour;
* Comment on if invertebrate abundance is a limiting factor for the survival of the overwintering bird features of Poole Harbour; and
* Compare any changes in the abundance of Peringia ulvae between the treatment areas and Clarke et al (2017) to inform potential reasons for Shelduck (Tadorna tadorna) decline.

Under this specification the successful Contractor(s) must:

* Develop, agree and implement, in collaboration with Natural England, a survey plan to collect data suitable for undertaking assessment of the direction of ecological change within the communities/habitats identified under this specification, integrating and interrogating previously obtained relevant data in the analysis.
* Where possible, ensure that newly collected data is compatible (analytically) with historical survey data, but at the very least will make reference to and utilise such historical data.
* In agreement with Natural England, implement a statistically robust survey design to enable future collection quantitative long-term analysis. This should seek to build on any previous work listed, and, where possible, enable temporal comparisons to be made with previous datasets.
* Provide fully detailed methodology for the work undertaken to ensure that methods can be repeated in the future.
* Infaunal, PSA and organic content analysis will be undertaken as part of this contract. Tenders should cost for these elements separately.
* Produce a concise field report.
* Produce a detailed scientific report
* Provide all data to the relevant standards including GI and Marine Recorder data (see details below).

3. Methods

3.1 Development of a suitable sampling design

A sampling design needs to be developed for this work. This should seek to build on any previous work listed in Section 1 and enable temporal comparisons to be made with previous datasets (where data has been collected at the same time of year).

3.2 Pre-survey Deskwork

Before the survey is carried out, the contractor will discuss any pre-survey work with Elanor James ([Elanor.James@naturalengland.org.uk](mailto:Elanor.James@naturalengland.org.uk)) including:

* Clarification of roles, responsibilities, and expectations.
* Review existing information provided by Natural England
* Ways of working and close collaboration with NE in developing project plan, particularly selection of survey sites, and finalising survey design and methodologies. For example, intertidal surveys may need to consider the use of hovercrafts and/or quad bikes to conduct surveys, which will require a Habitats Regulations Assessment (HRA).
* Ensure that up to date charts are used to position sample sites away from cables, pipelines or any other coastal infrastructure. Should any coastal infrastructure exist within an area to be sampled then a buffer should be used to ensure that sampling activity does not cause damage and this should be clearly displayed within the survey plan. Should coastal infrastructure be found during fieldwork then any sample sites should be relocated and the Nominated Officer informed.

3.3 Site Access

Natural England will work with the successful Contractor to obtain permission from seabed owners or leaseholders for survey work on the seabed and will supply a copy of these permissions. Where access is required to privately owned land (e.g. to deploy survey craft), Natural England will provide the contractor with a list of landowners and contact details. This data must be stored securely and all data deleted after completion of the survey. The contractor should ensure any system which holds authority data, including backup data, should be secure and compliant with Defra guidelines. Each member of the survey team must carry a letter from Natural England to confirm that they are doing this work on the behalf of Natural England. Survey work will not be able to begin until access permissions have been obtained by Natural England.

Contractors should allow for the option for inclusion of Natural England staff on surveys wherever feasible. The Natural England contract manager will liaise with the contractor regarding the availability of Natural England staff to join the survey.

Where contractors intend to use either a vessel or hovercraft to access sites this requirement should be made clear in the tender submission and any use of these vehicles will be subject to SSSI consent and Habitats Regulations Assessment (HRA). This should be discussed from the outset with the Nominated Officer and site leads.

The removal of sediment samples from the seabed must meet the terms of a marine licence exemption set out in Article 17 of the Marine Licence (Exempted Activities) Order 2011 (as amended) . The MMO require notification of any exempted activities occurring; Natural England will be responsible for submitting the relevant information to the MMO for this.

Natural England will be responsible for obtaining permissions from the Crown Estate 

3.4 Protected Species & Licensing

Natural England will ensure that legal requirements, such as SSSI Consent for the survey, have been attained and are valid before the survey commences. 

3.5 Field Survey and analysis

3.5.1 Invertebrate Sampling and analysis

Invertebrate sampling should be conducted using the same method as that of Clarke et. al. 2017 (or if the contractor can present a good case for deviation from this, alongside a method directly comparable to that of Clarke et. al. (2017), this would also be considered). The use of a vessel will be required for sample collection. In Clarke et al (2017) use of a local fishing vessel was possible; enquiries with SIFCA can be made as to whether this might be an option if required in this project, however this is not confirmed at this stage.

Please detail how long you would expect the following data collection to take.

Samples will be collected from three sites in Poole Harbour, shown in Figure 2 and Table 1. These are:   
Impact site 1 - Control area, always closed to fishing   
Impact site 2 - Newly opened, seasonal restrictions apply   
Impact site 3 - Heavily dredged, always open to fishing.

These three sites were used in Clarke et al (2017). The proximity of the sites to each other means they have similar tidal flow and hydrological regimes, as well as similar intertidal assemblages and sediment types.

A sampling grid should be placed over each of the 3 areas. The number of sample points will comprise of 24 sampling points in a 6x4 rectangular design at 50m intervals. Samples will be collected using a hand-held suction corer of 30cm depth and 10cm diameter, and at high water. Poole Harbour experiences two high tides a day, with a relatively long slack water period at high tide that results in a water level above that of mean tide level for the majority of the day (Humphreys, 2005), so tide should not be a limiting factor to data collection.

Invertebrate cores will be sieved with a 0.5mm sieve, macrofauna separated and preserved for analysis.

Please conduct POWER analysis to determine the minimum sample size required for further analysis, whilst still maintaining statistical confidence and accuracy.

Invertebrate analysis should be delivered to the below requirements:

* Species nomenclature (including epibiota) should go to the lowest possible taxonomic level.  To standardise identification levels where this is not possible, the NMBAQC’s Taxonomic Discrimination Protocol (TDP) in the latest version of the PRP document (Worsfold et al., 2010) should be used. Currently this covers high level taxonomic groups along with a detailed TDP for oligochaetes.  Contractors must work from the World Register of Marine Species (WoRMS, http://www.marinespecies.org/), endorsed by the Healthy and Biologically Diverse Seas Evidence Group (HBDSEG). Where there is evidence that information in WoRMS has been omitted, is outdated or erroneous, this should be reported to the Project Lead and WoRMS Database Management Team (http://marinespecies.org/contribute.php).
* Epifauna presence/absence.
* Species abundance and biomass should be recorded.
* A minimum of 5% of subsamples should be subject to AQC analysis.
* Any rare or scarce and non-native marine species should be highlighted in the data matrix.
* Retain picked biota and residues until the external assured quality control process is complete and any agreed remedial action has been carried out.
* Biomass: Blotted wet weight biomass analysis to the nearest 0.0001g.
* Biotope: Samples assigned to the lowest JNCC 15.03 MNCR and EUNIS biotopes (Parry, 20191).
* Bird Prey size fractions outlined, for example:

|  |  |
| --- | --- |
| Species | Size fractions |
| Hediste diversicolor + other polychaetes | <25mm, 25-50mm, 50-75mm, 75-100mm, >100mm |
| Carcinus maenas | <10mm, 10-20mm, 20-30mm, 30-40mm, 40-50mm, >50mm |
| Corophium volutator + other corophiid species | <3mm, >3mm |
| Peringia ulvae | <3mm, 3-5mm, >5mm |
| Cerastoderma edule | <5mm, 5-10mm, 10-15mm, 15-20mm, 20-30mm, >30mm |
| Macoma balthica | <9mm, 9-15mm, 15-20mm, >20mm |
| Other bivalve species | < 5mm, 5-10mm, 10-15mm, 15-20mm……… |
| Crangon crangon | <15mm, 15-30mm, >30mm |

3.5.2 Sediment Sampling

A sediment core should also be taken at each invertebrate sampling location, with a total of 72 samples being collected. Sediment cores should be stored at -80C until particle size and organic content analysis is undertaken.

Please conduct POWER analysis to determine the minimum sample size required for further analysis, whilst still maintaining statistical confidence and accuracy.

Organic content analysis and particle size analysis should be completed on all sediment samples, including laser diffraction techniques.

3.6 Data Analysis

Natural England expects robust and appropriate statistical analysis to be completed, and the results presented and discussed. This should be achieved using the same method as, or another which is compatible with, that of Clarke et. al. (2017) to allow the drawing of meaningful comparisons between the present survey and their previous surveys.

This will likely be multivariate analyses of the benthic community in order to:

* Characterise community composition in each sample;
* Assess the variation between sampling locations and treatment areas;
* Test the difference in community composition between sampling locations and treatment areas.

The results should be compared to Clarke et al (2017) to pick up trends over time, and between treatments. Any observed changes should be set into context using other existing information.

3.7 Invasive Non-Native Species

Invasive non-native species (INNS) are considered to be one of the top five pressures directly driving biodiversity loss globally. Prevention is the key focus, particularly in marine environments. The contractor shall be aware of and work in accordance with standard good practice biosecurity measures to avoid spread of INNS:

* Equipment, clothing and footwear should be clean before carrying out any work on site.
* When on or near water it is important that equipment is drained after use and as far as possible dried
* Boats to be used in survey work should have their hulls cleaned on a regular basis. Best practice guidelines should be followed as outlined by The Green Blue.
* INNS species previously recorded in this region and/or to particularly look out for during this survey. See GB non-native species secretariat.T he Contractor must report any records of INNS observed on site on Marine Recorder and to the Natural England project officer as part of the survey report. Any species currently listed as ‘alert’ species should be flagged immediately to the GB Non-Native Species Secretariat <http://www.nonnativespecies.org/alerts/index.cfm>. More information and guidance including ID guides can be found at [www.nonnativespecies.org](http://www.nonnativespecies.org/) and the Marine Aliens Project.

3.8 Risk Assessments

Please ensure all necessary risk assessments are carried out, including Covid-19 safety precautions are in line with any national or local guidance and/or restrictions. Risk assessments need to be provided by the Contractor.

3.9 Weather downtime & contingency

Survey windows should be allocated in accordance with the best tides available. Contractors will be expected to check weather regularly (daily) prior to agreed survey windows.  If contractors have 48 hours’ notice of impending poor weather then they will be expected to make alternative arrangements for the duration of the poor weather and reschedule survey work to be completed at a later date.  If contractors have not yet mobilised, then Natural England does not expect to be charged for any weather downtime.  It is the responsibility of the contractor to contact Natural England in the event that impending poor weather is putting the survey at risk. Natural England does not envisage paying for downtime or contingency time for intertidal contracts, but in the event of unforeseeable weather events, a maximum of 1 day may be paid.

In the event of uncertainty or other unforeseen events that impact upon the ability of the contractor to undertake the survey, the Natural England Nominated Officer should be contacted immediately. 

4. Survey Outputs

4.1 Reporting requirements

The successful contractor should produce a field report and brief report outlining:

* The survey methodology used,
* A timeline of events and actions
* Any difficulties encountered
* A discussion and interpretation of the data
* Inclusion of infaunal and sediment data analysed
* Draft reports should be provided in electronic MS Office Word \*.DOCX format for comment. A template and guidance exists for writing Natural England commissioned reports and will be sent to the contractor upon award of the tender. All reports should retain a clear suggested citation stating that it is a ‘Report to Natural England’.

4.2 Data requirements

Data must be interpreted, analysed and presented in light of the overarching hypotheses stated above. Contractors should pay particular consideration to the data and GIS required formats for information compatibility including MEDIN metadata standards and Marine Recorder provision:

* All sample data (grab sample analyses, video/still photography analyses, diver survey species, PSA analysis and biotope lists etc) need to be entered into Marine Recorder and delivered with the final reports. Natural England will provide licence keys for Marine Recorder to the winning contractors for use in this contract. A Snapshot file of the data should also be provided. <https://www.esdm.co.uk/marine-recorder>. Guidance ‘Marine Recorder Evidence for Contractors’ will be provided to the winning contractor.
* All GIS datasets need to be provided in ESRI ArcGIS format compatible with ArcGIS 10.2 and have attached metadata
* If not included in the GIS data layers listed above all sampling locations, vessels tracks, and links to data obtained should also be included as a single GI layer.
* Copies of the original data spreadsheets or databases are to be provided in the appropriate Microsoft Office format.
* Copies of the original drop down videos and drone imagery are to be provided on DV tape and on indexed DVDs or USB compliant external hard drives.
* Stills photographs to be provided in their raw format on CD/DVD or USB compliant external hard drives.
* Copies of the original data spreadsheets or databases are to be provided in the appropriate Microsoft Office format. However please be aware that using MEDIN marine biodiversity data guideline spreadsheets (available online under the marine biodiversity tab at [MEDIN data guidelines](http://www.oceannet.org/marine_data_standards/medin_data_guidelines.html)) will ensure that biological taxon data is prepared correctly for entry into Marine Recorder and will facilitate the efficient entry of data into this system and the data archiving process in general. Natural England welcomes and supports the provision of raw data spreadsheets in the MEDIN format and expects that all raw datasheets will contain the mandatory fields in the MEDIN guidelines, regardless of their format.
* High quality imagery which has been selected to form part of the image reference collection for the survey need to be labelled appropriately, including the habitat/species which is represented. These should be provided as a separate folder on the storage device to the standard survey imagery.
* All data products and electronic files must be appropriately named so they sufficiently describe the contents and are not purely a numerical value. All products should be named appropriately so that they can be clearly linked to the report/project.
* Any species lists submitted will be compliant with current taxonomic names and synonyms (e.g. [Marine Species of the British Isles and Adjacent Seas (MSBIAS)](http://www.marinespecies.org/msbias/), World Register of Marine Species (WoRMS))
* Video and still camera filenames must include the recording start date and time. Position data must be included within the overlay information.

4.3 Timeline for project delivery

|  |  |  |
| --- | --- | --- |
| Event | Date | Payment schedule |
| Field work – invertebrate and sediment sampling | November 2023 | December 2023 |
| Analysis and draft report, and any associated products to be provided by contractor to Natural England | 01/03/2024 | March 2023 |
| Final report and output to be delivered | 26/04/2024 | Payment upon completion |

4.4 Sustainability

Natural England protects and improves the environment and is committed to reducing the sustainability impacts of its activities directly and through its supply chains.  We expect the Contractor to share this commitment and adopt a sound, proactive sustainable approach in keeping with the 25 yr environmental plan/our commitments compliant with all applicable legislation. This includes understanding and reducing direct and indirect sustainability impacts and realising opportunities, including but not restricted to; resilience to climate change, reducing greenhouse gas emissions, water use and quality, biosecurity, resource efficiency and waste, reducing the risk of pollution, biodiversity, modern slavery and equality, diversity & inclusion, negative community impacts.

As a delivery partner, the successful contractor is expected to pursue sustainability in their operations, thereby ensuring the Contracting Authority is not contracting with a supplier whose operational outputs run contrary to the Contracting Authority’s objectives. The successful contractor will need to approach the project with a focus on the entire life cycle of the project.

5. References

Clarke, L.J Ecosystem impacts of intertidal invertebrate harvesting: from benthic habitats to bird predators (2017) Available at: [CLARKE, Leo J.\_Ph.D.\_2017.pdf (bournemouth.ac.uk)](https://eprints.bournemouth.ac.uk/31136/1/CLARKE%2C%20Leo%20J._Ph.D._2017.pdf)

Clarke, L.J., Esteves, L.S., Stillman, R.A. and Herbert, R.J., 2017 . Impacts of a novel shellfishing gear on macrobenthos in a marine protected area: pump-scoop dredging in Poole Harbour, UK. Aquatic living resources, 31, p.5.

Humphreys J. 2005. 3. Salinity and tides in Poole Harbour: Estuary or lagoon? Proc Mar Sci 7, 35–47.

Southern IFCA Saltmarsh Protection Code of Practice 2022. Available at: [PH-Saltmarsh-Protection-CoP-2022.pdf (toolkitfiles.co.uk)](https://secure.toolkitfiles.co.uk/clients/25364/sitedata/Redesign/Codes_of_Practice/PH-Saltmarsh-Protection-CoP-2022.pdf)