Resilience of Coastal Communities (ROCC)

Trade-off analysis of proposed management measures for the Lyme Bay sole fishery

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Project team: Angela Phan, Matt Fortnam, Tomas Chaigneau, Louisa Evans (University of Exeter)

Project Partners: Marine Management Organisation (MMO)

Key messages

1. Changes to quotas and catch limits for sole has led to increased competition for space and gear conflicts between fixed and mobile fishers, and commercial fishers and recreational anglers, and reports of smaller and fewer sole in Lyme Bay.

2. Drawing upon available evidence, consultations and their knowledge, MMO staff participated in an experimental trade-off analysis process called MaPTA to assess two suggested interventions aimed at making progress towards addressing these issues. The analysis was exploratory and the interventions only suggestions for consideration at the time of the analysis.

3. The first suggested intervention, a reduction in the catch limit for sole for non-sector dredge vessels, was assessed as offering potential benefits to benthic habitats by disincentivising dredge trawling in Lyme Bay and helping to reduce the pressure on the sole stock. It was also considered likely to alleviate gear and space conflicts between dredge and other fishers. The profitability of the non-sector dredge trawlers could however be reduced because of the reductions to catch limits.

4. This trade-off was deemed acceptable since: it aligns with objectives of the Fisheries Act and Joint Fisheries Statement by improving fisheries sustainability and supporting the inshore fisheries sector; dredge vessel operators are economically positioned to absorb the costs of the measure, with sole only relatively recently becoming a target species; and general support for the measure from the fishing industry.

5. The second suggested intervention, banning commercial fishing within 200 yards of the shoreline (that emerged from the consultation responses), was assessed as benefiting recreational anglers most by reserving this area for their activities with potential knock-on benefits for the local economy. The ban also has the potential to protect and restore critical nearshore habitats, which could generate longer term benefits for fisheries sustainability. These gains will however come at the cost of inshore commercial fishers that would be unable to fish in this area.

6. These trade-offs of the second intervention were not considered outright unacceptable by some of the practitioner participants because, in the longer-term, small-scale fishers would benefit from the fisheries gains resulting from protection of nearshore marine ecosystems and it would be unlikely to cause significant harm to the wellbeing and commercial activities of inshore fishers. Participants acknowledged that perceptions of the acceptability of this trade-off would vary among commercial fishers according to the extent they fished nearshore. While recognising current uncertainties, implementing the intervention as a pilot was regarded as an opportunity to evaluate its costs and benefits, with the potential for replication elsewhere if successful.

7. Response options to mitigate adverse outcomes were discussed, including transparent communication before implementation to concerned and affected stakeholders and research on, and promotion of and uptake of, more sustainable fishing gear.

8. Following the MaPTA workshops, the first intervention on setting a catch limit was taken forward in the Decision Document on Management Measures for the Lyme Bay Sole Fishery.

Introduction

The Marine Management Organisation (MMO) is working with local stakeholders to design new management measures for the sole fishery of Lyme Bay. This has been in response to feedback from fishers resident to Lyme Bay that they are experiencing a reduction in the amount and size of sole caught, increased competition for space, and associated gear conflict, such as fixed gear being damaged by mobile gear fishers. The fishers attribute these issues, in part, to an increase in sole catch limits for inshore vessels that encouraged, and made it economically viable for, fishers from ports outside Lyme Bay to target the bay's sole stocks. Following evidence gathering and consultations with stakeholders, the MMO considered a range of measures to alleviate the situation.

To review the potential impacts and costs and benefits, or potential trade-offs, of the proposed measures, the MMO team piloted a new tool with researchers in the **SMMR Resilience of Coastal Communities (ROCC) project** at the University of Exeter. **Marine Planning and Trade-off Analysis (MaPTA)** is a participatory tool for assessing the acceptability of trade-offs in marine management. During two, two-hour online workshops, the trade-offs of two suggested interventions were assessed:

1. Restricting sole catch limits for dredge fishing to disincentivize their activity in Lyme Bay
2. Ban or partial ban on commercial fishing within 200 yards of the shore-line (an intervention suggested during public consultations).

This report presents the results of this rapid analysis of trade-offs to document the deliberation around whether these interventions are deemed appropriate and acceptable or not, and why. The analysis fed into decision-making on management measures for the Lyme Bay sole fishery. First, we provide some background information to the sole fishery and its management in Lyme Bay. Second, we provide further information on the MaPTA process. Third, we introduce the two proposed interventions and present the potential trade-offs, justifications for their acceptability, and options for mitigating negative impacts, before concluding with what steps have been taken since the analysis.

Background of the sole fishery in Lyme Bay

Lyme Bay (2,460 km²) is in the Southwest of England and bordered by the coastal counties of Dorset and Devon. It is an economically important area for commercial and recreational fishing and tourism. There are a multitude of quota and non-quota species of significance in Lyme Bay. Species subject to the International Council for the Explorations of the Sea (ICES) quota regulations include Dover sole (*Solea solea)* and plaice (*Pleuronectes platessa).* Non-quota

species include the brown crab (*Cancer pagarus),* king scallop *(Pecten maximus),* and lemon sole (*Microsomus kitt)* (MMO, 2021b). Ecologically, it is a biodiversity hotspot for species of national importance such as seagrass (*Zostera marina)*, pink sea fans (*Eunicella verrucosa),* and the nationally rare sunset cup coral (*Leptopsammia pruvoti)* (Morgan et al., 2020).

Lyme Bay is broadly defined in line with ICES rectangles 30E6 and 30E7, which is part of the larger ICES Area 7.e, shown in **Figure 1** (MMO, 2023d, UK Government, 2023).

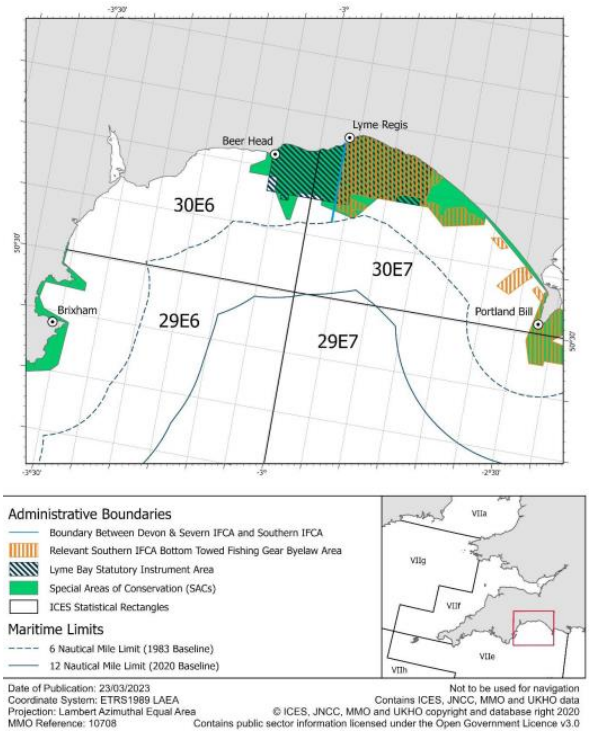

Figure 1: Lyme Bay ICES Statistical Rectangles and Management Areas. Source: MMO, 2023d.

Both commercial mobile and static gear fishers target sole in these areas (Desender and Santos, 2023). In 2022, otter trawls, beam trawls, and fixed nets were responsible for landing the most sole within Lyme Bay (**Table 1**). Most dredge vessels in the area are over-10m and only account for 1% of sole landings in the Bay, however, they have increased in numbers in the wider 7.e area, landing 9% of the total sole caught in 7.e in 2022.

Gear Type	Sole Landing (tonnes)
Beam trawls	18
Otter trawls	37
Fixed nets	26
Dredges	1
Pots and traps	<1
Hooks and lines	<1
Seines	<1

Table 1: Sole landing based on gear type in 2022. Source: Desender and Santos, 2023

Several management measures have been implemented to protect Lyme Bay's biodiversity. In 2008, the UK Department of Environment, Food and Rural Affairs (Defra) established a Statutory Instrument (SI), The Lyme Bay Designated Area (Fishing Restrictions), which restricts mobile fishing gear, primarily trawling and dredging, in 206 km² of Lyme Bay (Rees et al., 2021b). In 2010, under the European Union Habitats Directive, a 312 km² Special Area of Conservation (SAC) was designated to protect Annex I reef features that overlaps with the SI (Fleming and Jones, 2012, Rees et al., 2021b). In addition to these two designated areas, the Devon and Severn Inshore Fisheries Conservation Authority (IFCA) and the Southern IFCA have specific regulations in place to control the use of mobile and fixed gear in Lyme Bay (MMO, 2023d).

Lyme Bay is also a hotspot for recreational

anglers, with many sea angling clubs contributing to the local economy (Fleming and Jones, 2012). One study published over a decade ago estimated that the value of Lyme Bay recreational activities could be over £3.9 million a year (Rees et al., 2010). Recreational anglers are still permitted to fish within the boundaries of Lyme Bay Designated Area and SAC. While they have received general benefits from the closures, recreational anglers are still reporting negative impacts due to fixed net entanglements with their gear (Hattam et al., 2014).

The MMO is directly responsible for setting catch limits for non-sector fishing fleets in the UK, including the sole fishery in Lyme Bay. Non-sector is defined as fishing vessels that are not members of a producer organisation[1], which are official bodies set up by fishing or aquaculture producers to manage quotas and market the products of their members (MMO, 2017). ICES provides advice on maximum sustainable yields for each fishery, based upon which a total available quota is established, split between producer organisations and the non-sector. The total annual quota for the non-sector is then distributed across the year through the setting of catch limits for periods of the year. The MMO work collaboratively with industry stakeholders to allocate catch limits through regional fisheries working groups and ad hoc steering committees.

The total available quota for sole has increased in recent years in Area 7.e, from 513t to 1211t between 2015 and 2022 (MMO, 2023c). This in turn led the MMO to increase monthly sole catch limits for the non-sector under-10m and over-10m vessels from 30kg in 2015 up to approximately 2.8t-3.0t between 2019 and 2022 (MMO, 2023c). In general, the reported landings of sole in area 7.e have doubled since 2015 (+102%) (Desender and Santos, 2023). Despite the increased allowed catch within the sole fishery, some fishers report that they are negatively impacted by the change in sole quota due to spatial and gear conflicts. In response, in 2021, the MMO facilitated meetings with the fishing industry to understand their perspectives on fishing effort in Lyme Bay (MMO, 2023d). Then, in 2022, the MMO established an ad hoc steering group comprised of representatives from the fishing industry, the Devon and Severn IFCA, the Southern IFCA, and Defra to agree on best practice voluntary measures for Lyme Bay (MMO, 2023d). These included:

1. 5-inch mesh size for gill nets catching sole;
2. Fixed net marked with buoys at both ends of the net, marking the port letter and number of vessel; and
3. The use of flags and radar reflectors, when possible, to mark net locations

Additionally, preliminary engagement with fishers confirmed a perception that increased catch limit for sole has resulted in increased effort in Lyme Bay. The catch limit was claimed to attract more visiting boats to the area, which local fishers argue conflicts with their traditional fishing grounds (MMO, 2023f). Fixed netters have reported that their gear is being damaged and lost due to long nets (>1000 m) operating in the area and are concerned about ghost fishing (MMO, 2023f, MMO, 2023a). Fixed gear and mobile gear fishers are therefore often in conflict with one another.

[1] There are currently 22 UK Producer Organisations, 9 of which are in England (MMO, 2017)

In 2023, the reporting of these conflicts prompted the MMO, in line with the precautionary principle, to consider potential new management interventions for the sole fishery in Lyme Bay (MMO, 2023d). A 2-month consultation (March 28, 2023 – May 29, 2023), followed by a multi-stakeholder workshop, aimed to record the perceptions of stakeholders on the environmental, social, and economic sustainability of the sole fishery and gather their opinions on potential management measures. Measures proposed to, and suggested by, the consultees included changes to the minimum landing size and net mesh sizes, separate catch limits, gear separation, visibility requirements for fixed net markers, changes to scallop dredges, and spatial restrictions to commercial fishing.

The MMO sought to develop and decide upon appropriate management measures to implement based on the evidence gathered to date and objectives defined in the Fisheries Act (2020), Joint Fisheries Statement, and the Equality Act 2010. To support this decision-making process, an MMO team followed the MaPTA process, facilitated by ROCC researchers, to consider the trade-offs based on different sources of knowledge and evidence collected so far and their own knowledge and expertise. Since the MaPTA analysis, a decision has been made, as described in the **Decision Document** for Management Measures for the Lyme Bay Sole Fishery (MMO, 2023e). The decision is briefly justified at the end of this report.

MaPTA methodology

MMO decision-makers and scientific advisors and University of Exeter researchers participated in two, two-hour online workshops to trial suggested Lyme Bay interventions using MaPTA as a framework (held 17 and 21 July 2023). **MaPTA** is a participatory, low-tech 10-step tool structured for participants to systematically evaluate trade-offs and their acceptability pre-, intra-, or post- intervention implementation. Importantly, a trade-off is not considered to be negative but to be about the resultant distribution of costs and benefits that is inherent in any policy decision or intervention, including doing nothing. The tool helps to facilitate open discussions and negotiations about trade-offs to ensure that intervention outcomes are sustainable and equitable for diverse stakeholders and marine ecosystems. MaPTA also enables decision-makers to identify and consider response options to avoid or mitigate harmful and unacceptable outcomes. The full methodology for MaPTA is presented in this **Facilitation Guide**.

The acceptability of a trade-off varies according to who is asked what is acceptable or not, and the perspectives, values and knowledge of that person or group. Therefore, agreements and disagreements about the acceptability of trade-offs identified using MaPTA depend on who is participating at the workshop. In the case of this pilot, the MMO participants considered,

among other factors, evidence, consultation results and their knowledge of: potential social and ecological impacts; the current status of ecosystem features and stakeholder groups, and whether their intervention would cause harm; and the ability of affected features and stakeholders to cope with and adapt to those impacts. Guiding legislation and policy was also accounted for when discussing whether the potential trade-offs of each intervention were acceptable. The purpose of the MaPTA exercise for this group was to inform and track the reasoning behind the decision-making process. If stakeholders participated in the MapTA exercise, the purpose would instead be to capture perspectives on acceptability from different stakeholder groups and how they thought trade-offs could be made more acceptable, the outputs of which would inform a decision. MaPTA can thus be used with different groups for different purposes in decision-making processes.

Participants fed different forms of evidence into the MaPTA tool to identify the types of trade-offs that could emerge from two new management measures suggested for Lyme Bay.

INTERVENTIONS

1. The reduction of monthly catch limit for non-sector dredge vessels targeting sole
2. Banning commercial fishing within 200-yards of the shore

The following sections introduces the suggested measures, outlining their potential trade-offs, rationales for acceptability, and the options to mitigate potential detrimental impacts.

Trade-off analysis results

INTERVENTION 1

Restrictions on sole catch limits for dredge vessels

Problem Statement

Dredging is an effective method for capturing scallops, where a dredge is dragged along the seabed and captures target species using rakes that penetrate the seabed. In 2019, the general requirements for landing obligations changed in the UK to requiring all fishing vessels to land and count all quota species (MMO, 2019). For dredging vessels, the only quota species that can be discarded are skates and rays (MMO, 2019). Scallop dredgers were previously only allowed to land 5% of fish in their total catches. Today, since the landing obligation changes, in the wider 7.e area, dredges are catching fivefold the volume of fish compared to 2015 (Desender and Santos, 2023). Sole is therefore increasingly being landed by dredge vessels. In Lyme Bay, there are four main sediment types; subtidal sand, subtidal coarse sediment, subtidal mixed sediment, and

rocky reef (MMO, 2023b). Although the status of the seabed and habitats in Lyme Bay are unknown, an evidence synthesis conducted by Natural England found that, while the impact of dredging is variable among different habitat types, it generally has extreme adverse effects on marine ecosystems (Cantrell et al., 2023), in particular rocky reefs and coarse sediments. The rocky reef habitat in Lyme Bay is contained within the Marine Protected Area (MPA) and thus protected from fishing activity, but there are areas of subtidal coarse sediment that are fished by bottom trawling and dredging which is a particular sustainability concern in Lyme Bay. While the sole stock is considered healthy, there is local concern about the damage caused by dredging on the local habitats when sole (as opposed to scallops) is specifically targeted with dredges. There is concern from local and inshore fishers that the impacts of dredging will affect their catches of sole in the long-term and that is not adequately regulated in Lyme Bay. Due to these perceived risks, over half of the respondents (52.4%) in the MMO formal consultation believe that dredges should have increased selectivity requirements to reduce the bycatch of sole when dredging for scallops.

Proposed intervention

The proposed measure aims to restrict the catching of sole by dredge vessels by setting a reduced catch limit for sole when fishing with non-sector dredge vessels.

Impacts, synergies and trade-offs

These restrictions are expected to reduce the degradation of benthic habitats and reduce the bycatch of sole. The restrictions will likely improve the status of benthic habitats since earlier monitoring studies within the Lyme Bay Designated Area found that banning mobile fishing, primarily trawls and dredges, had positive impacts among reef assemblages and there were early signs of general recovery (Attrill et al., 2011, Sheehan et al., 2014, Stevens et al., 2014). Fixed-gear fishers, at all scales, and recreational anglers will most likely benefit from the intervention because it will relieve some of the spatial and gear conflicts, mentioned above, with dredge vessels. Trawlers were expected to be unaffected by the intervention and are performing relatively well economically (Quintana and Wilkie, 2022). The benefits will come at a cost to dredging vessel operators, as restrictions on the landing of sole as bycatch will affect the profitability of their operations. In short, benefits for the ecosystem, fixed gear fishers, and recreational anglers will most likely come at an economic cost to non-sector dredge vessels.

These potential benefits are highly uncertain, however, as there are significant evidence gaps of the magnitude of impact of the restrictions for the sole stock, and other ecosystem features. For the inshore fixed-gear fishers, the intervention does not alleviate pressure on the sole stock by the increasing number of visiting vessels exploiting the stock, because they are not all dredgers, nor does it resolve spatial conflict

with trawlers and other offshore fixed-gear vessels. Similarly, the intervention does not address the tensions between the commercial fishing industry and recreational fishing sector as commercial fishing continues in the nearshore area. However, despite some of the uncertainties and relatively small benefits that could result, the intervention was thought to be a potential catalyst for further interventions and positive change in the Lyme Bay area. **Table 2** displays an output from the MaPTA tool on the current status of key ecosystem features and stakeholder groups, the perceived degree of positive or negative impact on them, and perceptions of whether the status of the feature or stakeholder would change in the future given the intervention and other broader factors.

	Impacted feature	Current status	Degree of Impact						Future status	Justification summary
			-3	-2	-1	+1	+2	+3		
Ecosystem features	Sole stock (abundance and sizes)									No ICES advice at scale of Lyme Bay but available scientific evidence suggest stock is healthy; difficult to ascertain impact but future benefit anticipated.
	Brown crab									According to CEFAS, brown cab is declining and in poor status; while the bycatch restrictions could reduce dredge impacts, brown crab status will not be significantly improved.
	Seabed/benthic habitats and species									Because status of Lyme Bay benthic habitats is unknown (except data within MPA boundaries), assessed status based on assumptions. Reduced dredging activity will likely improve status given evidence from elsewhere, but unclear whether it would be restored to good status from this intervention alone.
	Climate/ GHG emissions									Engine sizes of dredges have GHC contribution, but unlikely to have major emissions reduction because of this intervention.
Stakeholders	Inshore fixed gear fishers									Inshore fishers are concerned about number of fishing vessels in Lyme Bay and Seafish has evidence that income is decreasing steadily in the sector. However, not at 'cliff edge' in terms of their wellbeing and the viability of fishing. They may be maintaining wellbeing through diversification (not clear if out of choice or forced). Despite the intervention, they will still be impacted by trawlers and medium fixed gear vessels.
	Medium fixed gear fishers									Seafish evidence that income is decreasing steadily in sector, but performing slightly better than inshore smaller fixed gear vessels. The group is experiencing some 'spatial squeeze', but is generally doing better than inshore smaller fixed gear. Despite intervention, they will still be impacted by trawlers and offshore fishing vessels.
	Trawlers									Considered to be doing well as a sector and better than fixed gears, but are involved in gear conflict and profitability has declined since 2017. Intervention will not have significant benefit or adverse impact on trawlers.
	Dredge vessels									Dredge fishers target sole in addition to normal target of scallop. Scallop productivity decreased as a result of existing restrictions. There may be a significant impact of this intervention on some of the fleet but they are small minority. Their impact will be variable according to the proportion of current catch that is sole.
	Recreational anglers									Complain of fewer fish and area becoming less attractive for recreational angling. When sole come inshore they claim they are trawled and netted, leaving little for them. Knock-on effects on local businesses benefiting from recreational anglers. This intervention will have little benefit for this group.

Table 2: Synergy and trade-off dashboard for intervention 1. The colour and degree the icon is filled up demarks the status of the ecosystem feature (from degraded to healthy) and stakeholder groups (low, medium of high level of wellbeing). These scores are subjective and are generalised for an ecosystem feature or stakeholder group to inform discussions, while recognising that there is variability of status within each of the features or groups. Notes on justifications for scoring for each part of the dashboard were recorded and reported in the right column. The table informed a discussion amongst participants about the key trade-offs.

Acceptability of trade-offs

The acceptability of the key trade-off between the benefits of the intervention for the seabed and inshore fishers at the expense of dredger vessel operators was discussed with social, environmental, and economic reasonings:

- The intervention aligns with the objectives of the Fisheries Act and Joint Fisheries Statement, which encourages decision-makers to support gear selection measures that mitigate environmental impacts and prioritises fisheries sustainability.
- The MMO have statutory obligations under the Equality Act 2010 to adhere with the public sector equality duty that states that considerations for people with any protected characteristics must not result in unequal opportunity that may cause discrimination (MMO, 2023e). While the MMO has limited data on protected characteristics for people fishing in Lyme Bay, it is not believed that the decisions made will negatively impact individuals with protected characteristics.
- Dredging vessel operators are in a better economic position, with an increase in annual average operating profit since 2020, than other fishing groups such as the inshore fixed gear fishers. They are not dependent on income from the sole fishery, previously did not exploit it, and are therefore deemed able to buffer the economic impact of the restrictions.
- Dredge operators still maintain the ability to fish for the sole quota, either by using the appropriate fishing gear or the leasing of quotas from other operators.
- While there were concerns over the fairness of penalizing one group, namely the non-sector dredge vessels, the restrictions will be limited to a small number of dredging operators who have large amounts of sole bycatch.
- The intervention could be a catalyst for promoting future changes, such as incentivising dredge vessels to use alternative fishing methods for targeting sole in Lyme Bay and elsewhere, and opening discussions with Producer Organisations about what their members could implement to reduce sole bycatch.
- Overall, the economic consequences of the intervention on scallop dredgers are outweighed by the wider social, environmental, and economic benefits.

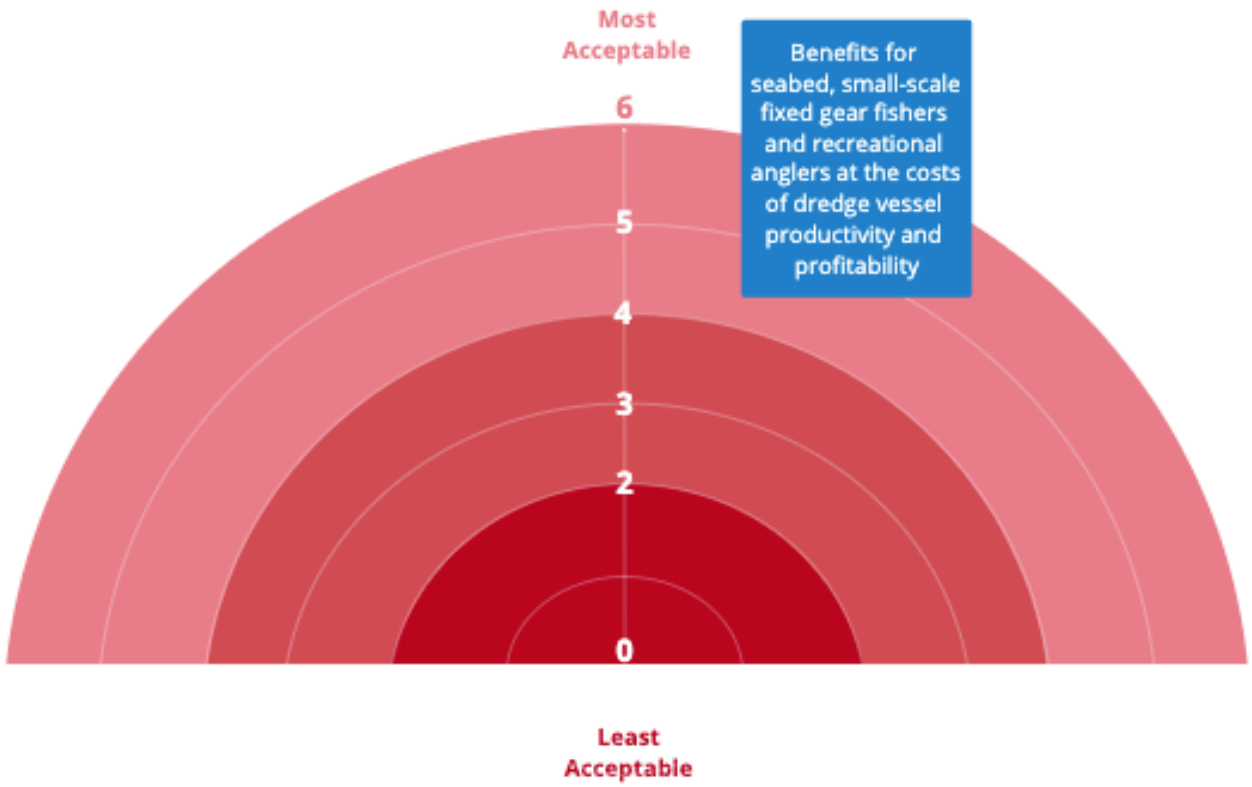

Figure 2: Acceptability analysis. Participants only identified one key trade-off, which they considered acceptable (scoring 5-6, i.e. most acceptable).

Mitigation options

Mitigation measures were considered to address the concerns and potential grievances from affected stakeholders:

- The promotion of transparent communication with impacted dredging vessels before the intervention is announced publicly in order to foster understanding and goodwill towards the intervention.
- Explore and promote research on management measures and technological alternatives, such as increasing the minimum conservation size and mesh sizes for the sole stock and dredge modifications, such as robotics, to improve the selectivity of their gear.

INTERVENTION 2

Nearshore commercial fishing ban

Problem Statement

Recreational anglers have expressed concern over the proximity of commercial fishing to the shoreline, which they said restricts where they can fish and has affected the size and abundance of fish. As mentioned previously, recreational anglers compete for space with fixed net gear fishers (Hattam et al., 2014) and there is an overlap between the species targeted by recreational fishers and those targeted by commercial fishers. The impact of commercial fishing on the amenity value of the area for recreational angling was thought to have potential knock-on effects for the local economy since it could dissuade recreational anglers from visiting the area and therefore reduce the clientele for local businesses (Rees et al., 2010, Hyder et al., 2020).

Suggested intervention

The prohibition of all commercial fishing (mobile and static gear) within a 200 yard distance from the shoreline.

Impacts, synergies and trade-offs

The intervention is expected to have negative consequences on the commercial fishing industry, most notably for the under-10m fishing vessels, by restricting their activities in the nearshore area. This cost will come at the benefit of nearshore marine ecosystems and the recreational angling community. Lyme Bay is an ecologically important rocky reef habitat that is important for many organisms due to its function as a nursery and spawning area for important species (Rees et al., 2021a, Davies et al., 2021), including sole and brown crab. Protection of the nearshore area should improve the status of these habitats. This assumption is supported by a recent study in the Lyme Bay designated area that found mobile gear fishing restrictions supported the recovery of commercial fish species (Davies et al., 2021). Participants indicated that the intervention on its own is unlikely to reverse the declining trend for the brown crab. The study by Davies et al. (2021) concluded that the benefits to the brown crab due to the Lyme Bay designation are inconclusive and require further studying. Participants said that the ecological impact of the intervention may vary depending on many factors. For example, sessile and sedentary organisms were said to more likely benefit from the intervention than mobile species.

Among the stakeholders, recreational anglers were expected by participants to benefit most from the intervention as they will no longer compete for space with commercial fishing. A past study found that the current bans on mobile gear types in the Lyme Bay Designated Area have improved the wellbeing of recreational anglers due to improved protection of their target species and increased numbers of fish to catch (Hattam et al., 2014).

The improved attractiveness of recreational fishing in Lyme Bay from having the nearshore zone reserved for them was perceived to offer positive opportunities for the local economy. The ban on commercial fishing in the area may boost nature-based tourism by protecting and restoring marine biodiversity, although there is no evidence to substantiate this potential benefit in the UK (Ruiz-Frau et al., 2015, Rodríguez-Rodríguez et al., 2015). On the other hand, some participants considered the possibility that the absence of fishing boats in the nearshore area may actually harm tourism given their presence being an important part of the place-based identity of the area (Reed et al., 2013).

The stakeholder group most adversely affected by the proposed intervention is the commercial fishing industry, distinctly the under-10m fishing operators, since larger-scale fishing vessels access fishing areas further offshore. While the prohibition is likely to cause economic losses for the under-10s in the short-term, protection of nearshore spawning areas may support fish stocks in the future for the benefit of the sustainability of the sector in the longer-term (Di Franco et al., 2016, Ford and Stewart, 2021). Overall, the intervention will potentially benefit the nearshore marine environment and the recreational angling community but at the potential cost of the commercial fishing industry, especially for small-scale fishers. For the recreational and tourism sectors, this intervention may result in both positive and negative outcomes.

Table 2 displays the synergy and trade-off dashboard from the MaPTA tool for intervention 2.

Similar to the previous intervention, assumptions about the potential benefits are based on existing evidence, with varying degrees of uncertainty. There are gaps in the understanding of the current and future status of ecosystem features, and evidence gaps at the local scale resulting in uncertainties regarding the local economic benefits derived from recreational angling and the current and future status of recreation and tourism in the area.

	Impacted feature	Current status	Degree of Impact						Future status	Justification summary
			-3	-2	-1	+1	+2	+3		
Ecosystem features	Sole stock (abundance and sizes)									No ICES advice at scale of Lyme Bay but available scientific evidence suggest stock is healthy; difficult to ascertain impact since 80% of sole is caught further offshore but future benefit anticipated as study shows that mobile gear fishing restrictions benefit commercial species.
	Brown crab									According to CEFAS, brown cab is declining and in poor status; intervention as a standalone management measure unlikely to improve the abundance of the brown crab.
	Seabed/benthic habitats and species									Because status of Lyme Bay benthic habitats is unknown (except data within MPA boundaries), assessed status based on assumptions. Nearshore commercial fishing ban expected to yield positive results for habitats, however, degree of improvement may be variable (i.e. mobile vs. sedentary species, mobile vs. stable sediment types).
	Other static species									Because status of Lyme Bay benthic habitats is unknown (except data within MPA boundaries), assessed status based on assumptions. Static species will likely benefit from commercial fishing ban more than mobile species.
Stakeholders	Inshore fixed gear fishers									A nearshore commercial fishing ban will most negatively affect the inshore fixed gear fishers economically. In the long-term, the ban may support long-term sustainability of the fishing sector.
	Medium fixed gear fishers									Medium fixed gear fishers will be negatively impacted by a nearshore fishing ban but will fare better than the small-scale group. In the long-term, the ban may support long-term sustainability of the fishing sector.
	Trawlers									Large-scale trawlers can more easily access offshore fishing areas; will still be negatively impacted but less so than other fishing groups such as the fixed-gear groups. In the long-term, the ban may support long-term sustainability of the fishing sector.
	Dredge vessels									Most dredge vessels operate offshore and will be minimally affected by a nearshore fishing ban. In the long-term, the ban may support long-term sustainability of the fishing sector.
	Recreational anglers									Wellbeing improvements for recreational fishers as nearshore zone will be preserved for them and their target species will be protected. This is anticipated to have positive economic knock-on effects for the local economy.
	Tourism/ recreation									Both positive and negative impacts; removal of under 10m commercial vessels from operating near shoreline could affect identity and aesthetic values of the local fishing community, however, it may boost nature-based tourism in the area.

Table 3: Synergy and trade-off dashboard for intervention 2. See caption in Table 2 for further information.

Acceptability of trade-offs

Discussions regarding the acceptability of the trade-offs from the suggested intervention centred on:

- While commercial fishers will be unhappy with this policy, the benefits that could be accrued in the long-term for the marine environment and the sustainability of the fisheries could be substantial.
- While evidence of the benefits is lacking, better to act now and learn from trialling this in Lyme Bay to test the assumptions. If it works, this could be a policy that could be scaled up to other parts of the UK.
- However, may need to understand impact on individual fishers, e.g. fishers that launch boats from the beach to consider potential mitigations to reduce the most adverse effects.

Mitigation options

- Specific mitigations were not discussed due to time constraints, decision-makers reaffirmed the importance of mitigation responses, as it provides a mechanism to understanding and developing an intervention further.

Decisions and next steps

The MaPTA analysis of suggested sole fishery management measures in Lyme Bay identified potential trade-offs and facilitated deliberation amongst participants about the acceptability of adverse impacts and trade-offs. The findings, summarised under key messages on page 1, were considered alongside further deliberations within the MMO about the best course of action to take in Lyme Bay to address the concerns of commercial fishers and recreational anglers while seeking to achieve objectives under the Marine Coastal Access Act, the Fisheries Act, Joint Fishery Statement, and Equality Act.

Intervention 1, to restrict sole catch limit when fishing with dredges, was taken forward because it was determined that there were significant environmental benefits to be gained from deterring fishermen from targeting sole with a scallop dredge. Furthermore, it was clear from the economic assessment of the different fisheries that the scallop fishery was financially stable if not increasing in profitability. Limiting the by-catch of sole and the associated economic benefit gained from catching sole alongside the scallops was deemed an acceptable trade-off for the benefit of the wider environment and sole stock.

Intervention 2 was not implemented because a nearshore commercial fishing ban would have (at this time) an unacceptable negative economic impact on the small-scale inshore fishermen. The potential benefits of impleme-

nting an intervention of this nature for the environment and recreational fishery were unclear. The widespread social impacts of a nearshore commercial ban would warrant additional consultation and inquiry.

Since the MaPTA analysis, MMO have publicly announced the first round of decisions for the management of sole in Lyme Bay in a **Decision Document** (MMO, 2023e). Put into effect November 2023, the non-sector scallop dredge fleets will have a monthly catch limit of 200kg for sole in area 7.e that will be enforced via licensing. Several environmental and economic considerations were made in reaching this decision. Setting this catch limit for area 7.e., as opposed to limiting it to Lyme Bay, will support the protection of the wider environment in line with sustainability objectives. Landings data from 2017-2023 were assessed and found to be well under 200kg for sole and scallops. Thus, this decision will have a minimal impact on most dredge vessels but will target dredge vessels that are intentionally targeting sole. Natural England was consulted on the proposed catch limit measure and support its implementation on environmental grounds. Furthermore, MMO will work with producer organisations to develop approaches for their members to reduce sole bycatch when using scallop dredgers. Other measures (not discussed during the MaPTA analysis) being implemented include new licensing conditions for enhanced visibility of passive gear in Lyme Bay and the creation of an online anonymous form for reporting lost gear located on the **South West Regional Fisheries Group** website. Additional concerns involving minimum landing size, gear modifications, and spatial conflict are under development and will be considered in the future, notably during a proposed meeting with industry stakeholders in early 2024.

The MMO will coordinate two independent evaluations pertaining to Lyme Bay (MMO, 2023e).

1. **Process evaluation:** To evaluate the stakeholder engagement process in order to consider the approaches used to support collaboration and ways forward for co-design of management outputs.
2. **Evaluation on management measures**: To evaluate the effectiveness of the management measures, to be shared with stakeholders and allow for adaptation in partnership with industry.

The significant evidence gaps of the magnitude of impact of the restrictions for the sole stock, and other ecosystem features, identified during the MaPTA analysis, will be considered in the evaluations.

List of abbreviations

Cefas	Centre for Environment, Fisheries and Aquaculture Sciences
Defra	Department for Environment, Food and Rural Affairs
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authorities
MaPTA	Marine Planning and Trade-off Analysis
MMO	Marine Management Organisation
MPA	Marine Protected Area
ROCC	Resilience of Coastal Communities
SI	Statutory Instrument
SAC	Special Areas of Conservation

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Contact:

If you have any further comments or questions, please contact Angela Phan: **H.phan@exeter.ac.uk**

For more information on MaPTA, please refer to the demo video here:
https://www.smmr.org.uk/funded-projects/resilience-of-coastal-communities/outputs/mapta-demo-video/

To download the facilitator instruction pack, please refer to the guide here:
https://www.smmr.org.uk/wp-content/uploads/2022/07/MaPTA_Facilitator-Pack_Final.pdf

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