Title: Pilot Highly Protected Marine Areas (HPMAs) **IA No:** **RPC Reference No:** **Lead department or agency:** Department for Environment, Food & Rural Affairs **Other departments or agencies: Cefas, MMO**	**Impact Assessment (IA)** **Date: 02/03/2022** **Stage:** Consultation **Source of intervention:** Domestic **Type of measure:** Regulation **Contact for enquiries:** Amy Anderson (amy.anderson@defra.gov.uk)

Summary: Intervention and Options

RPC Opinion:

Cost of Preferred (or more likely) Option (2019 prices, 2020 present value)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status**
TBC	TBC	TBC	TBC

What is the problem under consideration? Why is government intervention necessary?

A biologically diverse and thriving marine environment is of high value to society. Although recent evidence[1] indicates some improvement in the quality of the UK marine environment, significant areas of concern remain. Market failure in the marine environment occurs because no monetary price is attached to many goods and services provided by habitats and species, and market mechanisms cannot ensure that actions are fully paid for by users. In such cases, individuals do not have an economic incentive to secure the continued existence of these goods and services. It is therefore necessary for government to intervene and designate sites to protect ecologically valuable habitats and species for the long-term benefits to both users and non-users.

What are the policy objectives and the intended effects?

Higher biomass, density, diversity, and individual organism size have been reported in MPAs with high levels of protection compared to partially protected MPAs in the same area, with commercially and non-commercially important species demonstrating a significant increase in biomass, abundance, and species diversity[2,3,4,5,6]. HPMAs (Highly Protected Marine Areas) would be areas of the sea designated for biodiversity recovery. By setting aside some areas of sea with high levels of protection, HPMAs will allow nature to fully recover, helping the ecosystem to thrive. They will prohibit extractive, destructive, and depositional uses, allowing only non-damaging levels of other activities to the extent permitted by international law, making them the areas of the sea with the highest level of protection. HPMAs will have their conservation objectives set to maximise potential for full recovery and applied to all habitats and species within the HPMA. They will also support the government to reach its wider objectives, including the 25 Year Environment Plan[7] commitment to leave the environment in a better state than we found it, and the government's vision for 'clean, healthy, safe, productive and biologically diverse ocean and seas.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Option 0 or the "do nothing option"

Under the do-nothing option, no pilot HPMAs would be designated, all current protection and legislation would remain as it currently stands. Current protections and legislation for each site varies by each site but is detailed in the site sheets in section 7 of this IA. This option is not viable as the government has publicly committed to designating a number of pilot HPMAs in English waters using powers under the Marine and Coastal Access Act[8] .

Option 1: Prioritisation of ecological criteria with no use of the exclusion filter

This option entails selecting pilot sites that score most highly against the ecological criteria, outlined in

[1] OSPAR 2017. Intermediate Assessment Report: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

[2] Lester, S. and Halpern, B. (2008). Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series 367, 49–56.

[3] Sala, E. and Giakoumi, S. (2018). No-take marine reserves are the most effective protected areas in the ocean. ICES Journal of Marine Science, 75(3), 1166–1168.

[4] Lester, S., Halpern, B., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B., Gaines, S., and Warner, R. (2009). Biological effects within no-take marine reserves: a global synthesis. Marine Ecology Progress Series 384 33–46.

[5] Sciberras, M., Jenkins, S. R., Mant, R., Kaiser, M. J., Hawkins, S. J., and Pullin, A. S. (2015). Evaluating the relative conservation value of fully and partially protected marine areas. Fish and Fisheries 16 58–77.

[6] Stewart, G. B., Kaiser, M. J., Côté, I. M., Halpern, B. S., Lester, S. E., Bayliss, H. R., & Pullin, A. S. (2009). Temperate marine reserves: global ecological effects and guidelines for future networks. Conservation Letters 2 243–253.

[7] 25 Year Environment Plan. https://www.gov.uk/government/publications/25-year-environment-plan

[8] Marine and Coastal Access Act 2009 (legislation.gov.uk)

section 6. No other criteria are applied during site selection in this option. This option entails excessive costs as it requires removal of a large number of current usages, such as cables and active pipelines (outlined in more detail in section 5) from the site. This option does not align with the Benyon review[9] recommendations.

Option 2: Prioritisation of ecological criteria with use of the exclusion filter
This option entails selecting pilot sites that most closely met the ecological criteria, outlined in section 6. As explained in section 5, we have excluded locations with existing and/or consented physical structures and activities that would not be allowed in an HPMA (i.e., they are extractive, depositional, or destructive). Whilst, this option considers both ecological and social and economic criteria, it fails to capture economic metrics related to key sectors, such as fishing and recreation, which are important to consider during site selection for successful designation. This option does align with the Benyon review[10] recommendations.

Option 3: Prioritisation of ecological criteria with use of the exclusion filter and minimisation of economic costs
This option entails the same process as option 2. Sites are then scored against economic risk criteria, outlined in section 6, and those with the lowest level of risk are selected. Taking the approach of minimising economic costs could lead to some sites with the highest potential for ecological benefit being removed, reducing the likelihood of the policy meeting its objectives. This option aligns with the Benyon review[11] recommendations.

Option 4: **This is the preferred option -** Prioritisation of ecological criteria with use of the exclusion filter and balancing of economic costs with ecological and economic benefits
This option entails the same process as option 2. Sites are then scored against economic risk criteria, outlined in section 6, and those with the highest level of risk are removed. Final proposed sites are based on the balance between ecological and economic factors. Taking the approach of balancing economic costs and benefits with ecological costs and benefits should mean that the sites that are selected represent the best chance of the policy meeting its objectives, whilst also ensuring value for money. This option aligns with the Benyon review[12] recommendations.

Option 5: Prioritising minimising economic costs with use of the exclusion filter and then selecting sites which score highly based on the ecological criteria
This option entails the same process as option 2. If further filtering is required, remaining sites that score most highly against the ecological criteria, outlined in section 6, are selected. This option does not align with the Benyon review[13] recommendations.

Option 6: Sites with no or extremely low activity with use of the exclusion filter
This option entails selecting pilot sites that with no or extremely low site activity. As explained in section 5, we have excluded locations with existing and/or consented physical structures and activities that would not be allowed in an HPMA (i.e., they are extractive, depositional, or destructive). This option would not allow the policy to meet its objectives.

A non-regulation option was not considered at the shortlisting of options stage of appraisal as it would not be viable. However, a non-regulation option was considered earlier in the process, at the longlisting stage. It was discounted from further consideration as it would involve multiple stakeholders having to unanimously agree on a site. Experience from the stakeholder led process to identify the initial Marine Conservation Zones showed the challenges of this. The HPMA type sites (known as reference areas then) that were agreed by stakeholders were highly contentious and many were not considered to be ecologically viable by the project's Science Advisory Panel. This would be unlikely to happen as any viable site would reduce the economic productivity of at least one of these stakeholders meaning that they would veto this option and it could not be selected[14]. The market failure in this case is that the marine environment is a public good and so is open for anyone to access and therefore there are no private incentives to provide protection. This means that stakeholders are not focused on ecosystem services

[9] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Science Advisory Panel Assessment of the Marine Conservation Zone Regional Projects Final Recommendations (publishing.service.gov.uk)

valuation but rather their own private costs. The best outcome under a non-regulatory option would be the selection of a voluntary area that is not currently used by any of the stakeholders.

It is reasonable to assume that if the chosen area is not used by any stakeholders, then there are no existing examples of extractive, destructive, and depositional activity taking place within the area. Therefore, any implementation of agreement to remove these activities from within the chosen area will not result in any changes as stakeholders will continue to use other areas for extractive, destructive, and depositional purposes and continue not to use the chosen area for these purposes.

For this reason, there is no scope to protect and recover ecosystems as the areas with damaged ecosystems will not be in scope, and the areas in scope will likely not be subject to damaging activities, will not require protection at present and will not provide opportunities for recovery. As such, this approach and the associated best outcome do not allow the policy to meet its objectives.

In terms of ecological objectives it particularly cannot meet those set out by Benyon to allow "marine ecosystems to recover to a mature state"[15], the government's objective for HPMA's to protect and recover ecologically valuable habitats and species for the long-term benefits to both users and non-users, conservation objectives which aim to maximise potential for recovery of all habitats and species and the supporting processes within the HPMA.

In terms of wider government objectives it particularly cannot contribute meaningfully to the following:

- Leaving nature in a better state than we found it as set out in the 25 Year Environment Plan
- Reaching 'Good Environmental Status' as set out in the UK Marine Strategy
- Sustainably managing, protecting, and preserving the ocean through a co-ordinated approach as set out The Commonwealth Blue Charter
- Conserving at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information as set out the United Nations Sustainable Development Goals (SDGs) (this objective has already been reached but pilot HPMAs will build on the existing 40% coverage[16] by providing high levels of site wide protection to some areas which will benefit from it)
- Being consistent with government's Blue Belt policies for the ocean under its control

It will also not allow for learning to be gained through the implementation of HPMAs, in particular in the understanding of the following:

- how the marine ecosystem will recover in the absence of direct human pressures;
- how to best monitor and manage HPMAs;
- the suitability of the Marine and Coastal Access Act for the designation of HPMAs; and

the effects of HPMAs on sea users and coastal communities. This will include understanding any displacement of fishing effort at a site level and how we can best improve our understanding of this in the future.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** To be agreed with ministers.

Is this measure likely to impact on trade and investment?		No		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** No	**Large** No
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** Not known	**Non-traded:** Not known	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits, and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

[15] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[16] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

Summary: Analysis & Evidence Policy Option 4 (preferred option)

Description:

INTERIM ECONOMIC ASSESSMENT

Price Base Year 2022	PV Base Year 2023	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	**High:** N/A	**Best Estimate:** N/A

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	TBC	TBC	0.1	0.5
High	TBC		5.3	45.6
Best Estimate	0.0328		2.7	23.1

Description and scale of key monetised costs by 'main affected groups'

The main affected groups of this policy will be those who use the pilot HPMA for leisure and for employment, for example fishers, the local community, and tourists.

While these cannot be fully monetised at present, we have estimated costs to business using average annual UK revenues within the sites. We estimate that costs to businesses will be between £0.006m- £9m depending on which sites are designated. We will look to provide further, more robust costs in the next iteration of the IA, post-consultation.

Other key non-monetised costs by 'main affected groups'

We will look to include the key non-monetised costs in the next iteration of the IA.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	TBC		TBC	TBC
High	TBC		TBC	TBC
Best Estimate	TBC		TBC	TBC

Description and scale of key monetised benefits by 'main affected groups'

We will look to include the key monetised benefits in the next iteration of the IA.

Other key non-monetised benefits by 'main affected groups'

HPMAs are likely to provide many benefits, primarily ecological. Other benefits may include carbon storage and sequestration, future benefits for fisheries and benefits for tourism. However, these benefits will vary per site which makes it difficult to predict the extent of effects that can be expected. While the exact links between biodiversity and the ecosystem services are not well understood, it is generally agreed that biodiversity contributes to the generation of ecosystem services. An example of literature that supports this is NEAFO[17]. This and other literature are discussed in greater detail in section 9.

Key assumptions/sensitivities/risks **Discount rate (%)** N/A

All monetised figures in this IA are indicative and need further refinement. Boundaries for some sites are likely to still be refined to enable easier monitoring and enforcement and therefore the economic assessment may change.

BUSINESS ASSESSMENT (Option 4)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m: 11.1
Costs: £2.7	**Benefits:** **TBC**	**Net:** 2.7	

[17] NEAFO 2014. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=2&ProjectID=18081

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1. Policy background

1.1. With a mainland coastline of over 11,000 miles, the UK has a large marine area rich in marine life and natural resources. The UK's marine environment is not only important in terms of biological diversity, but also provides us with a variety of goods and services, such as recreation and tourism opportunities (and associated income and wellbeing), the provision of marine products (e.g., fish and shellfish), regulating services (e.g., climate regulation, flood mitigation and prevention of coastal erosion), cultural value and existence values. This makes the marine environment essential to our social, economic, and environmental wellbeing.

1.2. At present, according to JNCC's (Joint Nature Conservation Committee) UK Marine Protected Area network statistics[18], there are 178 Marine Protected Areas (MPAs) covering 40% of English waters (an area of over 92,000 square kilometres). There are three no-take zones where fishing is banned (Lundy, Flamborough Head and Medway Estuary). However, there are currently no Highly Protected Marine Areas (HPMAs) in English waters. MPAs and HPMAs are important tools to prevent biodiversity loss and support delivery of Good Environmental Status. In MPAs the marine environment can recover to a good, healthy state while HPMAs, which are more highly regulated than MPAs, will allow full recovery to as most natural a state as possible.

1.3. Following the independent Benyon review[19] into HPMAs, the government committed to designate a number of pilot HPMAs in English waters using powers under the Marine and Coastal Access Act (2009).

1.4. HPMAs were defined in the Benyon review and government response as "*Areas of the sea that allow the protection and recovery of marine ecosystems by prohibiting extractive, destructive and depositional uses and allowing only non-damaging levels of other activities to the extent permitted by international law*[20]". The primary intention of HPMAs is biodiversity recovery. By setting aside some areas of sea with high levels of protection, HPMAs will allow nature to fully recover to a more natural state, allowing the ecosystem to thrive. They will contribute to the government's vision for, 'clean, healthy, safe, productive and biologically diverse ocean and seas'[21].

1.5. The Department for Environment, Food and Rural Affairs (Defra) is responsible for the designation of Marine Conservation Zones (MCZs) in waters where the Secretary of State is the "appropriate authority" under MCAA (Marine and Coastal Access Act). Pilot HPMAs will be designated as MCZs. These are English inshore waters (up to 12 nautical miles from the coastline) and offshore waters adjacent to England and Northern Ireland (12 to 200 nautical miles or to the agreed administrative boundary with neighbouring countries). The Devolved Administrations are responsible for designating HPMAs within their own waters and these are not examined here. This impact assessment considers English waters only.

1.6. In line with the Benyon review[22] recommendations (in particular recommendation 12), pilot HPMAs should be selected based on ecological, social, and economic criteria, to provide the maximum biodiversity benefits while seeking to also maximise associated benefits and minimise impacts to sea users. Our proposed approach (option 4) is in line with these recommendations. After considering third-party proposals, alongside areas they identified, JNCC and NE (Natural England) developed an initial list of 30 potential areas of ecological importance, using the ecological criteria, which was submitted to Defra for further social and economic consideration. Defra, with analysis from Cefas, MMO and IFCAs applied social and economic criteria to narrow down the list. This included, but was not limited to, understanding what economic activity occurs in potential site. The

[18] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

[19] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[20] Government response to the Highly Protected Marine Areas (HPMAs) review - GOV.UK (www.gov.uk)

[21] Safeguard the seas (publishing.service.gov.uk)

[22] Ibid.

results of this work have been used to recommend a shortlist of five candidate HPMAs to the Defra Secretary of State. Defra will publish detail on how the candidate HPMAs meet the criteria and why they have been shortlisted, drawing on best available evidence. A short appraisal of these sites has been included in this IA, but a fuller appraisal will be included in the post-consultation IA. The sites proposed as being most suitable for designation are:

- Allonby Bay
- Dolphin Head
- Inner Silver Pit South
- Lindisfarne
- North-east of Farnes Deep

1.7. At present, we are unable to conduct a full appraisal of the sites due to a number of evidence gaps. Through the consultation on candidate HPMAs and additional evidence gathering throughout 2022, we will look to fill these gaps, where possible, to ensure that we use the best available evidence. Existing gaps and how they will be addressed is explained in more detail in section 3. Work to fill the evidence gaps will include site-specific engagement with local stakeholders to collect further evidence on the social and economic criteria. Consultation responses and any additional evidence will be analysed to provide an up-to-date assessment for each candidate HPMA before Ministers decide which sites to designate as pilot HPMAs. Due to incomplete evidence to assess environmental and economic benefits, it was not possible to select sites purely on a quantified cost-benefit basis. Instead, a qualitative approach has been adopted, in which ecological criteria are prioritised and then balanced with economic risk. An exclusion filter is also used to reduce the economic costs of implementation to some sectors that are fixed to specific locations (e.g., ports). Any site which includes features/activities included in the filter, outlined in section 5, are removed from consideration for designation as these features/activities would not be permitted under HPMA designation.

1.8. Nonetheless, this choice is underpinned by the best available evidence and focuses on prioritising designation where the risk of habitat loss/damage is higher, as well as sites habitats with unique features that would benefit from preservation. As a sense check, section 9 discusses the literature on economic benefits, which has been assessed to give a broad picture of the magnitude of benefits and indicative qualitative estimates to ensure that proposed approaches are proportionate.

1.9. Currently 40% of our seas are covered by MPAs[23], which if effectively managed, play a large role in conserving species and habitats at a wide scale. Higher biomass, density, diversity, and individual organism size have been reported in MPAs with high levels of protection compared to partially protected MPAs in the same area, with commercially and non-commercially important species demonstrating a significant increase in biomass, abundance, and species diversity[24,25,26,27,28]. HPMAs will take a whole site approach, unlike MPAs which aim to protect individual features within a site, which allows them to achieve a higher level of protection.

1.10. We are developing criteria to complete a post-implementation evaluation of the pilot HPMAs from an ecological, social, and economic perspective. Some changes, especially ecological ones, could take a long time to manifest. Evaluation will inform decisions about future HPMA designation and management. Any designation of HPMAs referred to in this IA is for the pilot sites only.

1.11. The implementation of pilot HPMAs can also be valuable in understanding the effectiveness of other management measures, such as MPAs. Pilot HPMAs aim to return the sites to as close to a pristine state as possible. The gap in outcomes between unregulated sites to sites with current

[23] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

[24] Lester, S. and Halpern, B. (2008). Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series 367, 49–56.

[25] Sala, E. and Giakoumi, S. (2018). No-take marine reserves are the most effective protected areas in the ocean. ICES Journal of Marine Science, 75(3), 1166–1168.

[26] Lester, S., Halpern, B., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B., Gaines, S., and Warner, R. (2009). Biological effects within no-take marine reserves: a global synthesis. Marine Ecology Progress Series 384 33–46.

[27] Sciberras, M., Jenkins, S. R., Mant, R., Kaiser, M. J., Hawkins, S. J., and Pullin, A. S. (2015). Evaluating the relative conservation value of fully and partially protected marine areas. Fish and Fisheries 16 58–77.

[28] Stewart, G. B., Kaiser, M. J., Côté, I. M., Halpern, B. S., Lester, S. E., Bayliss, H. R., & Pullin, A. S. (2009). Temperate marine reserves: global ecological effects and guidelines for future networks. Conservation Letters 2 243–253.

levels of regulation to sites with pilot HPMA regulation in place will add to the evidence base on the effectiveness of both HPMAs and other regulations.

1.12. All information and data used in this IA is referenced in footnotes throughout.

2. Problem under consideration

2.1. A biologically diverse and thriving marine environment is of high value to society, contributing to a variety of areas such as sustainability, tourism and recreation, education, research, human health, aesthetic, cultural and religious significance, and non-use values, where people experience positive feelings from knowing that the marine environment is being protected and maintained for future generations to enjoy/use[29]. Although recent evidence showed progress has been made towards achieving Good Environmental Status (GES), it also highlighted that further action is needed to continue to move our seas towards GES including for benthic (seafloor) habitats. The updated Marine Strategy assessments have clearly flagged up that the predominant human pressures preventing GES being achieved include commercial fishing and the introduction of marine litter. Other factors that are affecting the achievement of GES include natural phenomena such as species competition and predation and the impact of changes to the marine environment due to climate change. The risk from Non-Indigenous Species (NIS) also remains high[30].

2.2. There are market failures which occur in the marine environment. Market failures are when the market is not operating in a way that maximises welfare[31]. In the context of the environment, these are evidenced in the Dasgupta review on the Economics of Biodiversity[32] (published in February 2021) which makes it clear that demand for the goods and services that nature produces far exceed its capacity to supply them, at present. Between 1992 and 2014, it is estimated that the stock of natural capital per person has decreased by nearly 40%. This is not sustainable, and biodiversity is declining faster now than during any other period of human history. Decline in biodiversity leads to increased extinction of species (with current rates around 100 to 1000 times higher than the baseline rate and increasing[33]), which leads to increased economic and wellbeing risk and uncertainty. The review also makes clear that we are nearing or passing 'tipping points' for a number of ecosystems, beyond which point, they cannot be repaired and cannot contribute to economies or wellbeing in the future.

2.3. The market failures in the context of the marine environment can be described as:

- Public goods – A number of goods and services provided by the marine environment such as climate regulation and biological diversity are 'public goods'. The defining features of a public good are that no-one can be excluded from benefiting from these goods/services and that consumption of the service does not diminish the good/service being available to others. These characteristics mean that individuals do not necessarily have an economic incentive to voluntarily contribute effort or money to ensure the continued existence of these goods, they can "free ride". This can lead to undersupply or, in this case, under-protection and consequent degradation. Unlike much of the terrestrial environment, the marine environment is mostly not privately owned (Vaughan et al, 2021[34]), meaning that individuals are not personally incentivised to protect it and, by extension, the goods and services it produces, and so the government must intervene to ensure adequate levels of protection so that supply of these goods and services is able to meet the market demand continually and sustainably.

- Common pool resources- A number of goods and services provided by the marine environment such as wild fish and shellfish are 'common pool resources'. The defining features of a common pool resource are that no-one can be excluded from benefiting from these goods/services, but consumption of the good/service does diminish the good/service being available to others, i.e., it is a scarce resource which has a finite supply. These characteristics mean that if individuals act in pursuit of self-interest, these resources are susceptible to overexploitation and reduced availability.

[29] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

30 Defra Marine Strategy Part One. 2019. https://www.gov.uk/government/publications/marine-strategy-part-one-uk-updated-assessment-and-good-environmental-status

31 HMT Green Book. 2022. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent/the-green-book-2020

[32] The Economics of Biodiversity: The Dasgupta Review (publishing.service.gov.uk)

[33] Ibid.

[34] Vaughan et al. 2021. https://www.researchgate.net/publication/354865783_Marinising_a_terrestrial_concept_Public_money_for_public_goods

- Negative externalities – Negative externalities (costs to a third party incurred through the production or consumption of goods or services) occur when damage to the marine environment is not fully accounted for by users and no compensation payment is foreseen. In many cases no monetary price is attached to marine goods and services therefore the cost of damage is not directly priced by the market. Even for those goods that are traded (such as wild fish, a common pool resource), market prices often do not reflect the full economic cost, as prices exclude costs borne by other individuals and by society. Government intervention, through regulation, would increase the supply of goods (i.e., the number of wild fish) and services from the marine environment and reduce the demand for goods and services from the marine environment (in this case, demand will be reduced to almost nothing as most fishing activity will be restricted) until demand is equal to supply and there are no negative externalities. Another example, in the context on pilot HPMA's is marine litter, as the consumption of goods (fishing for wild fish) will be reduced (or in this case almost completely restricted), as fishers will no longer be allowed to use the site and therefore, they will no longer potentially be leaving behind waste, and therefore costs to third parties, i.e., other users of the site, will be reduced.

2.4. As indicated above, human activities are having a detrimental effect on the extent and condition of many diverse marine habitats and their ecosystems. Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic's (OSPAR) 2010 Quality Status Report[35] noted that a reduction in the decline in biodiversity is still a long way off, and that combined pressures from human activities are not fully understood and need to be carefully managed to avoid undesirable impacts. Although OSPAR's 2017 Intermediate Assessment[36] identified some positive indications of change, such as reduced contaminant pollution and signs of recovery of fish communities in some areas, significant areas of concern remain.

[35] OSPAR 2010. Quality Status Report: https://qsr2010.ospar.org/en/index.html
[36] OSPAR 2017. Intermediate Assessment Report: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

3. Summary of evidence gaps and how they can be filled through formal public consultation and additional evidence gathering

3.1. The majority of work on pilot HPMA policy development to date has focused on identifying a shortlist of sites for designation that best meet the ecological and social and economic criteria. During this process a significant amount of data was collected and analysed but it was not possible to do an in-depth assessment of each site that met the ecological criteria due to the large number of possible locations. A shortlisting process has reduced the number of sites in consideration from 30 to five. Data collection and analysis, as described in section 6, prior to consultation has allowed us to identify those locations that are best suited for possible designation as pilot HPMAs. More in-depth and site-specific analysis will be undertaken during and post-consultation. More detailed information on the five shortlisted sites is included in section 8.

3.2. There are some remaining evidence gaps for the shortlisted sites, that need to be filled before a complete site level analysis can take place. In the post-consultation IA, we will look to fully quantify costs and benefits, in line with Green Book Guidance[37]. To enable us to do so, we have already commissioned some of the work to fill these gaps and will look to undertake further analysis and data collection during and after the consultation period. We also welcome any site-specific evidence provided to us on the costs and benefits of pilot HPMA designation at each of the candidate sites from the public consultation.

Angling Activity

3.3. At present, we are using habitat mapping to estimate the potential for angling activity in the five candidate HPMA sites. While this method provides us with some idea of potential angling activity, a more robust and reliable approach on the shorter list of sites is needed for the final IA. Cefas have been commissioned to provide Defra with an assessment of angling activity within the sites using all the existing data on sea angling – including angling diaries, internet, and social media scrapings as well as modelled data sets. Cefas will also provide an assessment of the potential for local displacement of recreational anglers.

3.4. Responses to the consultation from local site users would be valuable in increasing our understanding of this activity and local impacts it has, particularly regarding where charter and private boats are operating/fishing and what is particularly special or unique about the area for the angling community.

Displacement of commercial fishing activity

3.5. We recognise the importance and level of interest in the potential displacement impacts of pilot HPMAs on fisheries and the implications that this will have on business viability but also health and safety. During pre-consultation phases we have undertaken a qualitative assessment of displacement based on an assessment of the local area impacts. Further analysis is required to fully understand the potential for and impacts of displacement.

3.6. A more complete assessment of the displacement of activity will be complete for the five sites which are being consulted on. This will go beyond the impact on revenues of UK fishers in a site to assess the impacts once a fisher is displaced from the area. To do this existing displacement models, e.g., FIDGIT (AVS) or based on location choice models described in Dépalle et al., Hutniczak and Münch, Tidd et al. are to be updated with most recent available data on fishing activity and fishing regulations that may restrict spatial effort reallocation.

3.7. Secondary displacement, where those in the area which activity is displaced to are then displaced due to increased activity displaced from the original site will also be assessed once this work is complete.

[37] HMT Green Book. 2022. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent/the-green-book-2020

3.8. We would welcome submissions to the consultation on the ability or inability of the fishing fleet to be displaced and the impacts of the pilot HPMA-induced displacement of the fleet.

Anchoring

3.9. Data on anchoring collected so far includes licensed anchorages and legal mooring locations from local observations. The MMO will be undertaking further analysis of data held in the Royal Yachting Association (RYA) database to understand where informal and irregular mooring may also be occurring and if these might be impacted by the candidate HPMA locations.

Non-UK vessels

3.10. We have identified the presence and effort of non-UK vessels across the candidate HPMA locations. Due to data deficiencies and timelines, we have not yet been able to assess the implication of designating these locations on the revenues of the non-UK fishing fleets. The MMO have been commissioned to assess this for the five shortlisted sites.

Ecosystem service valuation

3.11. There is good evidence on the ecological benefits of highly protected areas (see section 9) and economic literature has enabled analysts to place a value on the environment and flow of ecosystems services from the stock of environmental assets. It is however technical and time-consuming work to ensure the right ecosystem services values are applied and the ecological impacts at site level are appropriately considered. We will explore these further considering evidence provided during the consultation.

3.12. JNCC and NE have provided information on which habitats are present in each site, as well as the extent, condition, and recovery potential of these habitats. We will use the Ecosystem Services Valuation Database (ESVD) to obtain values for each marine habitat. The ESVD provides specific values, converted on a consistent basis, and referenced in the literature, that relate to a range of ecosystem services provided by each marine habitat type. ESVD also presents valuations in a consistent and comparable manner (Int. USD per hectare).

3.13. The rate of recovery of each of the individual habitats within the five sites will be crucial to identifying the flow of ecosystem services from those habitats and therefore determining the value of these. This is a technical and time-consuming process. Statutory Nature Conservation Bodies (SNCBs) are providing Defra with site and habitat specific estimates of the rate of recovery of the ecosystems within the sites. Defra economists will then identify an appropriate value for these services to be included in the final IA.

3.14. Any information on habitats within the sites or site-relevant recoverability evidence would be welcomed during in response to the consultation.

Site users

3.15. We will look to gain a better understanding of those who use the site, both those who use it for leisure and those who use it for employment. We want to better understand those who live around the site and how implementing pilot HPMAs may affect their lives. We also want to get a fuller understanding of how pilot HPMAs are perceived, both by local and the national stakeholders. Not only does this data help us to have a more detailed understanding of the positive and negative effects on stakeholders, but it also helps us to better comply with legislation on measuring impacts on protected groups. The responses from stakeholder meetings and the public consultation will form a crucial part of this evidence base and we welcome evidence in this regard.

3.16. Internally, we will use the Indices of Multiple Deprivation (IMD), published by DLUHC, to assess the deprivation levels for those local to the site and those who use the site either for commercial or recreational uses. We will do this by looking at the Lower Super Output Areas (LSOAs) around each potential site as well as those which contain ports linked to the site through landings or vessel registration. The IMD is less reliable in rural areas as LSOAs are population-based and so

rural LSOAs include a wider spread of people. Where practicable, we will look to use benefits data, or other appropriate data, to support the IMD analysis in understanding these areas.

3.17. We will assess available research studies to gain a better understanding of users of the site. These might include the Ocean literacy survey and the People in Nature Survey, amongst others.

Local businesses

3.18. During the consultation period, we will look to collect information on the size of businesses affected by the implementation of pilot HPMAs as well as their annual revenue. This information will feed into more robust assessments of the cost to business assessment and the Small and Micro Business Assessment.

COVID-19

3.19. The analysis we have conducted is static meaning that it does not account the effects of COVID-19. We recognise the global pandemic has impacted all economic activity, including fishing activity and that as the UK recovers from the pandemic industry patterns may change, however we are not yet in a position to be able to assess how permanent the changes observed during the pandemic will be. A further, limited analysis will investigate how the commercial fishing fleet adapted to recent shifts caused by COVID-19.

3.20. We welcome insight from all sectors and respondents on how activities have changed as a result of the pandemic and any long-lasting impacts and implications for our analysis of pilot HPMAs.

Cost analysis

3.21. The ability to manage and enforce the pilot HPMA areas will be important to ensure the success of the areas in reaching the objectives. The cost of these activities will help us to have a more accurate understanding of the costs of implementing and maintaining pilot HPMAs. During the next phase we will collect additional data on enforcement costs, and these will be included in the post-consultation IA.

3.22. Previous data gathered on candidate HPMA locations – not those included here, prior to the latest process, suggested the cost of managing and enforcing the sites could range between £200,000 and £1.4m per year. These figures however are highly site specific, dependent on the current asset availability and the management and enforcement regime determined as appropriate by regulators. Further, these costs did not consider how the pilot HPMAs could be monitored within the existing mechanisms. Hence, they are considered insufficiently reliable for inclusion at this stage. Therefore, during the consultation period, we will work with parties responsible for monitoring and enforcement to provide more accurate estimates of monitoring and enforcement costs additional to the current baseline.

3.23. We welcome responses from stakeholders and the public during the consultation as to innovative monitoring and enforcement mechanisms that may ensure costs are minimised and effectiveness of the areas maximised.

Other Information

3.24. As outlined above we recognise that this impact assessment does not contain all the final information needed for a full and detailed assessment of the sites. In addition to the information requested above, we welcome any further information on each of the sites that respondents to the consultation might be able to provide to inform the next version of this impact assessment.

4. Rationale for government intervention

4.1. A diverse marine environment is of high value to society through the services that it provides and as a basis for human health and livelihoods[38]. Marine life has a clear market value, but the marine environment also provides non-traded services including carbon storage, natural hazard protection, recreation, research, and education. Aside from its economic value to society, the natural environment also has intrinsic or 'non-use' value[39]. Work by the National Ecosystem Assessment Follow-On project[40] (NEAFO) supports this and in particular highlights the significant importance of ecosystem services, including less tangible cultural benefits, derived from a good quality marine environment.

4.2. The Dasgupta review on the Economics of Biodiversity[41] (published in February 2021) supports the idea that a number of economic and non-economic goods and services are reliant on a healthy marine environment and that improved biodiversity increases productivity, resilience, and adaptability in nature.

4.3. Currently 40% of our seas are covered by MPAs[42], which if effectively managed, play a large role in conserving species and habitats at a wide scale. However, some areas require a higher level of protection in order to restore them to a better condition or to prevent their deterioration beyond a high-quality state, which indicates the need for pilot HPMAs to provide adequately strict regulation to enable this higher level of protection. HPMAs will take a whole site approach, unlike MPAs which aim to protect individual features within a site, which allows them to achieve a higher level of protection.

4.4. The Benyon review into Highly Protected Marine Areas[43] agrees that "HPMAs allow marine ecosystems to recover to a mature state. By taking a 'whole site approach' to designation, thereby protecting all habitats and species in their boundaries, HPMAs give nature the best chance to thrive."

4.5. The Benyon review[44] also highlights that there are a number of long-term social and economic benefits which could be achieved for both users and non-users from the implementation of HPMAs. The review suggests that these include "tourism and recreational activities, opportunities for scientific research and education, and positive impacts on human health". The review also suggests that HPMAs could "enhance the aesthetic, cultural and religious significance" of the area around a designated HPMA, as well as providing several other "non-use and intrinsic values", such as a feeling of helping to "fulfil a duty to protect the marine environment".

4.6.

4.7. The UK is legally required to take measures to achieve or maintain Good Environmental Status (GES) for our seas, and to do this through development and implementation of a UK Marine Strategy (UKMS) as set out in the Marine Strategy Regulations 2010[45]. At present, the UKMS consists of a 3-part cycle, which renews every 6 years. Part One assesses the status of UK seas

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[38] OSPAR 2010. Quality Status Report: https://qsr2010.ospar.org/en/index.html

[39] There are two forms of intrinsic value: anthropocentric and non-anthropocentric. Anthropocentric value is the intrinsic value assigned by humans to nature, which has practical implications for policy. Non-anthropocentric value is the value that nature has 'in itself'. As explained in Defra (2007), "While it is recognised that the natural environment has intrinsic value i.e., is valuable in its own right, such non-anthropocentric value is, by definition, beyond any human knowledge".

[40] NEAFO 2014. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=2&ProjectID=18081

[41] The Economics of Biodiversity: The Dasgupta Review (publishing.service.gov.uk)

[42] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

[43] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[44] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[45] The Marine Strategy Regulations. 2010. https://www.legislation.gov.uk/uksi/2010/1627/contents/made

and sets the criteria, targets, and indicators to be used for the following 6 years and was last updated in 2019. This most recent cycle of indicator assessments[46] showed that; we have largely achieved GES for eutrophication, hydrographical conditions, contaminants and contaminants in seafood; there is a mixed picture for marine mammals, fish populations, food webs, and marine habitats; more is needed to understand and protect bird populations; measures to tackle non-indigenous species and marine litter need longer to take effect; we remain uncertain about whether GES has been achieved for underwater noise; and overall we have a better understanding of the main pressures preventing the achievement of GES and we aim to take action in the UK and press for action internationally to tackle these pressures.

4.8. Government intervention is able to address the sources of market failure in the marine environment and supply alternative adequate solutions. The designation of pilot HPMAs and adoption of management measures to protect features of conservation importance will ensure negative externalities are reduced or suitably mitigated by restricting activities and pressures that prevent features recovering to a favourable condition or risk existing features. Designation will also support the continued provision of public goods in the marine environment, for example the features protected will ensure the range of marine biodiversity in our seas is conserved.

[46] Defra Marine Strategy Part One. 2019. https://www.gov.uk/government/publications/marine-strategy-part-one-uk-updated-assessment-and-good-environmental-status

5. Policy objective and intended effects

5.1. This IA concerns the designation of pilot HPMAs in English waters for which Defra's Secretary of State is responsible. HPMAs were defined in the Benyon review and government response as "*Areas of the sea that allow the protection and recovery of marine ecosystems by prohibiting extractive, destructive and depositional uses and allowing only non-damaging levels of other activities to the extent permitted by international law*[47]". They can act as a nature-based solution to improve the state of our seas, address biodiversity loss, and ensure a more climate resilient marine ecosystem which will deliver benefits for society. They are distinct from previous methods of regulation as they are more restrictive, prohibiting all extractive, destructive, and depositional uses, allowing only non-damaging levels of other activities to the extent permitted by international law, making them the areas of the sea with the highest level of protection.

5.2. Government intervention to designate pilot HPMA sites will protect and recover ecologically valuable habitats and species for the long-term benefits to both users and non-users, will support the government in meeting its commitment to identify and designate pilot HPMAs in English waters by the end of 2022 and will allow nature to recover to a more natural state, allowing ecosystems to thrive. Protection and recovery of marine ecosystems can also increase resilience to climate change.

5.3. HPMAs will have their conservation objectives set to maximise potential for recovery and applied to all habitats and species and the supporting processes within the HPMA.

5.4. HPMAs will also support the government to reach its wider objectives of:

- Leaving nature in a better state than we found it as set out in the 25 Year Environment Plan
- Reaching 'Good Environmental Status' as set out in the UK Marine Strategy
- Sustainably managing, protecting, and preserving the ocean through a co-ordinated approach as set out The Commonwealth Blue Charter
- Conserving at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information as set out the United Nations Sustainable Development Goals (SDGs) (this objective has already been reached but pilot HPMAs will build on the existing 40% coverage[48] by providing high levels of site wide protection to some areas which will benefit from it)
- Being consistent with government's Blue Belt policies for the ocean under its control

5.5. The Government has considered introducing HPMAs over the last decade. In 2012, as part of identifying the first tranche of MCZs the Statutory Nature Conservation Bodies[49] recommended a number of highly protected 'reference areas' to Defra. These were not progressed. In 2018 Cefas published a review of Highly Protected Marine Areas[50]. In June 2019, the Secretary of State announced a review, led by former Environment and Fisheries Minister Richard Benyon, to examine whether and how HPMAs could be introduced. The review, published in June 2020[51], concluded that HPMAs are an essential component of the UK's Marine Protected Areas network, and government should introduce them into waters for which the Secretary of State has responsibility (the English inshore and offshore and Northern Ireland offshore zones). It provides 25 recommendations covering what HPMAs are and how they should be identified and managed.

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[47] Government response to the Highly Protected Marine Areas (HPMAs) review - GOV.UK (www.gov.uk)

[48] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

[49] Natural England 2012. JNCC and Natural England's Advice on recommended Marine Conservation Zones - MCZ022

[50] Cefas 2018. Defra, UK - Science Search

[51] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

5.6. The government responded to this review[52], largely agreeing with its recommendations, including that pilot sites should be implemented in English inshore and offshore waters. Government agreed that the purpose of HPMAs is for the protection and recovery of marine ecosystems using a 'whole site approach', that they should work with existing regulation, and must aim to maximise potential recovery. They agree that HPMAs should be used to increase engagement with the marine environment, that they should also provide social and economic benefits, and that their designation should consider the effects of displacement. Other recommendations were accepted including those on marine planning and management, transparency and engagement, the use of the 'best available evidence', implementation, monitoring, management, and enforcement.

5.7. The pilot phase of HPMAs aims to improve understanding of:

- how the marine ecosystem will recover in the absence of direct human pressures;
- how to best monitor and manage HPMAs;
- the suitability of the Marine and Coastal Access Act for the designation of HPMAs; and
- the effects of HPMAs on sea users and coastal communities. This will include understanding any displacement of fishing effort at a site level and how we can best improve our understanding of this in the future.

[52] Government response to the Highly Protected Marine Areas (HPMAs) review - GOV.UK (www.gov.uk)

6. Pilot HPMA selection approach and rationale

6.1. Pilot HPMAs are being selected based on ecological, social, and economic criteria (detailed below), to provide the maximum biodiversity benefits while seeking to also maximise associated benefits and minimise impacts to sea users. HPMAs may be inside or outside of the existing MPA network, in inshore and offshore areas, recognising that HPMAs must be in the locations best able to deliver protection and recovery. Defra asked JNCC and NE, working with Cefas, the Marine Management Organisation (MMO), the Association of Inshore Fisheries and Conservation Authorities, to identify potential locations for pilot HPMAs.

6.2. The first step in pilot HPMA selection entailed JNCC and NE, with inputs from Cefas, developing ecological criteria to identify locations. The criteria are based on and fall within the principles outlined in the Benyon review[53] and are:

- Ecological Importance
    a) The location has, or has had, relatively higher levels of biological diversity.
    b) The location is known to contain multiple species and/or habitats of national, regional, or global importance, or of regional distinctiveness.
    c) The location is of importance to the key life cycle stages and/or behaviours of marine species.
- Naturalness, sensitivity, and potential to recover
    a) The location represents a relatively natural ecosystem.
    b) The location represents a relatively degraded ecosystem.
- Ecosystem Services
    a) The location includes habitats considered to be of importance to the long-term storage of carbon.
    b) The location is of importance to the key life cycle stages of commercially important marine species.
    c) The location includes, or supports, habitats that are important in the provision of flood/erosion protection.

6.3. In July 2021, JNCC and NE invited stakeholders to propose locations that met the ecological criteria. The submission process closed on 31 August 2021. Third parties were asked to avoid proposing locations with industrial physical structures or consented activities that are unable to adapt to the location of a pilot HPMA.

6.4. After considering third-party proposals, alongside areas they identified themselves, JNCC and NE developed an initial list of potential areas which was submitted to Defra for further social and economic consideration.

6.5. In order to meet the objectives of the policy, it is anticipated that, in line with the conservation objectives of an HPMA, management measures would usually be required to prohibit extractive, destructive, and depositional uses within their boundaries. Therefore, any site that could not adjust itself to adhere to this rule, either because it included a permanent structure or was committed or due to be committed to an activity that could not be adapted or relocated, was removed from consideration when the sites were passed through an exclusion filter. This meant that shortlisted sites did not include any of the following activities and/or features:

- Ports and harbours
- Existing licensed aggregate extraction
- Existing licensed dredging and dredging disposal

[53] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

- Existing licensed oil and gas
- Active and proposed pipelines[54]
- Carbon capture and storage (CCS)
- Existing offshore wind farms, Leasing Round 4 sites and pre-commercial floating offshore wind sites
- Active and proposed cables
- Existing licensed aquaculture
- Existing licensed anchorages, moorings, and berths
- Routine defence exercises

6.6. Defra then applied social and economic criteria to narrow down the list. This included, but was not limited to, understanding what economic activity occurs in potential sites that will not be permitted if it were to become a pilot HPMA, and the scale and importance of that activity and site to local communities. Sites were removed from consideration if their cumulative risk from the below was considered very high or critical. The indicators we used are:

- Levels of potential recreational angling
- Levels of recreational anchoring
- Level of UK commercial fishing
- Level of non-UK commercial fishing

6.7. All four indicators of levels of activity were given equal weighting in our analysis to avoid bias toward one industry or another.

6.8. The level of non-UK commercial fishing operations was assessed using three metrics; the coverage of the candidate HPMA location by fishing activity hotspot[55], number of VMS (Vessel Monitoring System) pings within the candidate HPMA location 2016-2020 and the number of unique vessels identified as fishing the location between 2016 and 2020.

6.9. The level of UK commercial fishing operations was assessed using a wider range of indicators than non-UK operations due to a greater level of data availability. VMS-mandated vessels and smaller vessels were both analysed using the best available data sources. The first three metrics (hotspot, VMS pings and unique vessels) were the same as the non-UK analysis, for >12m vessels. Due to pings, hotspot and unique vessels being only available for >12m vessels for the smaller under 10m fleet we also included the estimated number of vessels under 10m which were fishing the area.

6.10. The additional metrics used to understand the dependency of the UK fleet on an area were:

- Average revenue dependency for UK vessels
- Percentage of UK vessels generating over 50% of the revenue
- Average effort dependency

6.11. Certain metrics were removed or not used due to correlation issues.

6.12. Whilst we did not have quantitative data on displacement for this IA, which we will look to have for the post-consultation IA as described in section 3, we did have qualitative information provided by local IFCAs. This local knowledge fed into assessment of the sites and was used to cross-check sites at the point of final selection to ensure we were not suggesting sites where potential displacement would interact with other sites' potential displacement.

6.13. Defra policy teams reviewed the outputs of this work and used additional intelligence from ALBs to finalise the shortlist. The results of this work were used to recommend a shortlist of candidate

[54] Decommissioned pipelines may be compatible with the aims of pilot HPMAs, pending further work to understand the structures and activities involved, at a site-specific level. We will not be excluding these areas as candidate HPMA locations.
[55] These are areas where there is intense fishing activity compared to the rest of the marine plan area.

HPMAs to the Defra Secretary of State. Defra are publishing detail on how the candidate HPMAs meet the criteria and why they have been shortlisted, drawing on best available evidence.

6.14. Within this IA, there are a number of evidence gaps. Through the consultation on candidate HPMAs and additional evidence gathering throughout 2022, we will look to fill these gaps, where possible, to ensure that we use the best available evidence. This will include site-specific engagement with local stakeholders to collect further evidence on the social and economic criteria. Consultation responses and any additional evidence will be analysed to provide an up-to-date assessment for each candidate HPMA before Ministers decide which sites to designate as pilot HPMAs.

7. Descriptions of options considered

Overview of Do-Nothing (Baseline) Option

7.1. At present, there aren't any HPMAs, in English waters. Therefore, if they were implemented, they would be new regulation in English water. There are, however, other forms of regulation in UK waters which aren't as comprehensive, e.g., MPAs. HPMA do exist in other countries at present, providing some evidence that we can draw on to support their implementation.

7.2. Under the do-nothing option, no pilot HPMAs would be designated, all current protection and legislation would remain as it currently stands, including protection for features already recognised within national lists[56] and management measures for MPAs which will continue to go ahead as planned. Under this option, we assume that degradation of ecosystems in candidate HPMAs will continue in line with the baseline assumptions for each individual site, i.e., those which are deteriorating will continue to deteriorate at the same rate and those which are stable will continue to be so. In the consultation IA we assume that the current trend of ecosystem degradation at the pilot locations is likely to continue on historic trends. Where there is overlap between a current MPA and a candidate HPMA, we assume that recovery will continue in line with current trends under the MPA restrictions, which is likely a slower trajectory than if the area became a pilot HPMA. We recognise that ecosystems are dynamic, especially in the marine environment. Therefore, during the consultation we welcome additional information to inform these baseline assumptions and we look to refine the estimated future rates of degradation at a site level for the final IA.

7.3. This option presents a high level of risk. It would not allow the government to meet their public commitment of designating a number of pilot HPMAs in 2022 in English waters using powers under the Marine and Coastal Access Act[57]. It would potentially be damaging to our role as a global leader on marine protection, for example as leader of the Global Ocean Alliance and Ocean Co-Chair of the High Ambition Coalition for Nature & People. which we should instead be aiming to solidify and enhance by championing ambitious action for the ocean. It is the government's intention to build upon the opportunities presented by leaving the EU to build an independent trading policy in which animal welfare and conservation will play an integral part and which will complement our strong domestic standards. This option would also risk impacts of climate change and would not provide refuges for marine life.

7.4. Baseline assumptions will vary by site but are based on the current state of the site. Each site's baseline assumptions for extent, condition, quality, size, etc, will be based on the data provided by SNCBs.

7.5. The baseline option provides a comparison point against which the costs and benefits of pilot HPMAs can be calculated (in line with IA guidance and the HMT Green Book 2022[58]).

Options

7.6. It is expected that in all of the options except the do-nothing option (option 0) that up to 5 pilot HPMAs will be designated and that they will receive ongoing funding to ensure they are managed and enforced correctly and for us to evaluate their effect. A high-level monitoring and

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[56] Features may be subject to one or more of the following national and multi-lateral agreements: (1) OSPAR List of Threatened and/or Declining Species - features that are considered to be under threat or in decline, and may be rare or particularly sensitive; (2) UK BAP Priority Habitats and Species - features of international importance, at high risk or in rapid decline, as well as habitats that are important for key species (UK BAP priority habitats and species are now referred to as Habitats or Species of Principle Importance under the UK Post-2010 Biodiversity Framework); and (3) Wildlife and Countryside Act, Schedule 5 - species likely to become extinct from the UK unless conservation measures are taken, and species subject to an international obligation for protection.

[57] Marine and Coastal Access Act. 2009. https://www.legislation.gov.uk/ukpga/2009/23/contents

[58] HMT Green Book. 2022. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent/the-green-book-2020

evaluation plan is included in section 11.

Option 1: Prioritisation of ecological criteria with no use of the exclusion filter

- This option entails selecting pilot sites that score most highly against the ecological criteria, outlined in section 6. No other criteria are applied during site selection in this option.
- This option entails excessive costs as it requires removal of a large number of current usages, such as cables and active pipelines (outlined in more detail in section 5) from the site.
- This option does not align with the Benyon review[59] recommendations.

Option 2: Prioritisation of ecological criteria with use of the exclusion filter

- This option entails selecting pilot sites that most closely met the ecological criteria, outlined in section 6. As explained in section 5, we have excluded locations with existing and/or consented physical structures and activities that would not be allowed in an HPMA (i.e., they are extractive, depositional, or destructive).
- Whilst, this option considers both ecological and social and economic criteria, it fails to capture economic metrics related to key sectors, such as fishing and recreation, which are important to consider during site selection for successful designation.
- This option does align with the Benyon review[60] recommendations.

Option 3: Prioritisation of ecological criteria with use of the exclusion filter and minimisation of economic costs

- This option entails the same process as option 2. Sites are then scored against economic risk criteria, outlined in section 6, and those with the lowest level of risk are selected
- Taking the approach of minimising economic costs could lead to some sites with the highest potential for ecological benefit being removed, reducing the likelihood of the policy meeting its objectives.
- This option aligns with the Benyon review[61] recommendations.

Option 4: Prioritisation of ecological criteria with use of the exclusion filter and balancing of economic costs with ecological and economic benefits

- This option entails the same process as option 2. Sites are then scored against economic risk criteria, outlined in section 6, and those with the highest level of risk are removed. Final proposed sites are based on the balance between ecological and economic factors.
- Taking the approach of balancing economic costs and benefits with ecological costs and benefits should mean that the sites that are selected represent the best chance of the policy meeting its objectives, whilst also ensuring value for money.
- This option aligns with the Benyon review[62] recommendations.
- **This is the preferred option.**

Option 5: Prioritising minimising economic costs with use of the exclusion filter and then selecting sites which score highly based on the ecological criteria

- This option entails the same process as option 2. If further filtering is required, remaining sites that score most highly against the ecological criteria, outlined in section 6, are selected.

[59] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[61] Ibid.
[62] Ibid.

- This option does not align with the Benyon review[63] recommendations.

Option 6: Sites with no or extremely low activity with use of the exclusion filter

- This option entails selecting pilot sites that with no or extremely low site activity. As explained in section 5, we have excluded locations with existing and/or consented physical structures and activities that would not be allowed in an HPMA (i.e., they are extractive, depositional, or destructive). This option would not allow the policy to meet its objectives.

7.7. A non-regulation option was not considered at the shortlisting of options stage of appraisal as it would not be viable. However, a non-regulation option was considered earlier in the process, at the longlisting stage. It was discounted from further consideration as it would involve multiple stakeholders having to unanimously agree on a site. This would be unlikely to happen as any viable site would reduce the economic productivity of at least one of these stakeholders meaning that they would veto this option and it could not be selected. The market failure in this case is that the marine environment is a public good and so is open for anyone to access and therefore there are no private incentives to provide protection. This means that stakeholders are not focused on ecosystem services valuation but rather their own private costs. The best outcome under a non-regulatory option would be the selection of a voluntary area that is not currently used by any of the stakeholders.

7.8. It is reasonable to assume that if the chosen area is not used by any stakeholders, then there are no existing examples of extractive, destructive, and depositional activity taking place within the area. Therefore, any implementation of agreement to remove these activities from within the chosen area will not result in any changes as stakeholders will continue to use other areas for extractive, destructive, and depositional purposes and continue not to use the chosen area for these purposes.

7.9. For this reason, there is no scope to protect and recover ecosystems as the areas with damaged ecosystems will not be in scope, and the areas in scope will likely not be subject to damaging activities, will not require protection at present and will not provide opportunities for recovery. As such, this approach and the associated best outcome do not allow the policy to meet its objectives.

7.10. In terms of ecological objectives it particularly cannot meet those set out by Benyon to allow "marine ecosystems to recover to a mature state"[64], the government's objective for HPMA's to protect and recover ecologically valuable habitats and species for the long-term benefits to both users and non-users, conservation objectives which aim to maximise potential for recovery of all habitats and species and the supporting processes within the HPMA.

7.11. In terms of wider government objectives it particularly cannot contribute meaningfully to the following:

- Leaving nature in a better state than we found it as set out in the 25 Year Environment Plan
- Reaching 'Good Environmental Status' as set out in the UK Marine Strategy
- Sustainably managing, protecting, and preserving the ocean through a co-ordinated approach as set out The Commonwealth Blue Charter
- Conserving at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information as set out the United Nations Sustainable Development Goals (SDGs) (this objective has already been reached but pilot HPMAs will build on the existing 40% coverage[65] by providing high levels of site wide protection to some areas which will benefit from it)

[63] Ibid.

[64] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary

[65] JNCC's UK Marine Protected Area network statistics. UK Marine Protected Area network statistics | JNCC - Adviser to Government on Nature Conservation

- Being consistent with government's Blue Belt policies for the ocean under its control

7.12. It will also not allow for learning to be gained through the implementation of HPMAs, in particular in the understanding of the following:

- how the marine ecosystem will recover in the absence of direct human pressures;
- how to best monitor and manage HPMAs;
- the suitability of the Marine and Coastal Access Act for the designation of HPMAs; and

the effects of HPMAs on sea users and coastal communities. This will include understanding any displacement of fishing effort at a site level and how we can best improve our understanding of this in the future.

Overview of sites

7.13. As a combination of the shortlisted sites will be designated, but it is not clear yet which combination, it is difficult to formulate options which include suggestions of sites. Therefore, an overview of key data and information for each shortlisted site can be seen below. There are two different types of tables for the sites. One is for inshore sites and the other is for offshore sites. The data in the tables are provided by SNCBs. We will look to test the assumptions in the below tables through additional analysis completed by the SNCBs during the consultation period, as well to supplement the available data during the consultation period.

Overview of Site 1 – Allonby Bay, inshore Irish Sea

Size: 38.5km^2

Baseline assumptions:

Table 1: % site with habitats that have moderate or high sensitivity to key pressures (note these pressures are not necessarily occurring):

Habitat structure changes - removal of substratum (extraction)	99.70
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	83.28
Changes in suspended solids (water clarity)	4.57
Smothering and siltation rate changes (Heavy)	83.49
Abrasion/disturbance of the substrate on the surface of the seabed	48.02
Removal of target species	81.75
Removal of non-target species	49.59

Level of likely degradation in site: Low

Site specific info

- This site is within a marine plan policy area of strategic sustainable aquaculture production (SW-AQ-1).
- Recovery timeframes were not assessed for this site.
- Ecological Importance
    - Allonby Bay consists of a complex mix of habitats characteristic of an environment that is subject to dramatic currents and tides. The nutrient-rich sediments, dense mussel beds and intertidal rocky habitats that characterise this area attract large densities of shore birds including species such as curlew and oystercatchers.
    - Within the candidate HPMA is part of one of the best examples of honeycomb worm reefs in the UK. Honeycomb worms create a complex sediment network of tubes, which provides vital habitat for a range of species including sheltering crabs and molluscs. These reefs also provide water purification and erosion protection.
    - The biodiverse habitats in this area provide a food source for flat fish and nursery areas for commercially important juvenile fish species such as bass, cod, and herring. In turn, these

fish species attract diving, foraging seabirds including guillemots, gannets, and razorbills. The area also contains 17.5km^2 (45%) of 'blue carbon' habitats including intertidal sand, muddy sand and subtidal sand.
    - With limited disturbance in this area, Allonby Bay represents a relatively natural ecosystem and a pilot HPMA designation provides an important opportunity to safeguard its habitat and species biodiversity.
- Commercial fishing
    - The following gear are known to be used in this area:
        - Bottom trawl
        - Dredges
        - Pots
    - A very small number of vessels[66], greater than 12m in length, landing at Maryport and Silloth may fish this area, thought to be harvesting mainly brown shrimp or king scallop using dredge or bottom trawls.
    - Sighting data indicates a small of number of vessels, less than 12-metres in length, may also fish this area, specifically potting for lobster, crab, and whelk, thought to be landing in; Fleetwood; Workington; Milford Haven and Whitehaven.
- Recreational fishing
    - Shore based recreational angling is likely to be popular along this coastline, however limited data on extent of this activity is available.

Benefits

<u>Environmental</u>

- This site will build our scientific understanding of how HPMAs will benefit a range of marine habitats, including intertidal biogenic reef, such as mussel beds and honeycomb worm reefs (Sabellaria alveolata) as well as habitats for a large number of coastal waders and diving birds.
- Introducing a pilot HPMA here will further protect one of the best honeycomb worm (Sabellaria alveolata) reefs in the UK, as well as some of the largest densities of shore birds in the Solway Firth Special Protection Area (SPA).

- <u>Socio</u>economic There are no major fisheries in this site meaning that the number of vessels affected by implementing a pilot HPMA is lower than for other sites.
- This site is categorised as a low economic risk for designation.
- The site is currently well monitored as it overlaps with an MPA designation and a SPA designation, which would reduce monitoring costs.

Cost considerations

- Displacement
    - It can be assumed that the fishing activity of vessels over 12m in length and using demersal trawl and dredge will be impacted, as they will not permitted if the site is designated as a HPMA. Existing Northumberland Inshore Fisheries and Conservation Authority (NIFCA) byelaws may restrict demersal trawl activity from moving to nearby areas, however, no indication can be detected that dredge activity cannot be displaced into the adjacent area except the potential lack of profitability.

Risks

- Despite a low number of vessels operating in the site, dependency on this site is high meaning that for those who are displaced, the impact will be greater than for other sites.
- The site is a holiday destination with angling opportunities. Designation of a pilot HPMA on this site could be disruptive to this.
- There is a very small Pacific oyster farm adjacent to site and Pacific oyster spat can travel and settle outside the farm, potentially leading to localised changes in the structure of marine ecosystems. At some point an assessment may be required on potential impacts of the farm to the SPA.

[66] Data provided by Cefas. >5 vessels but generalised due to data protection.

- Impact on local communities could be significant, as despite the low number of vessels operating on the site, there is a heavy dependence on fishing and farming for livelihoods, in particular on angling, across the region.

Overview of Site 2 – Dolphin Head, offshore Eastern Channel

Size: 506km^2

Baseline assumptions:

Table 2:

Overlapping MPA Condition (only applicable for potential sites that overlap with designated MPA sites only)	Unfavourable
List of activities within site	Demersal towed gears, static gears
Estimated timeframes for recovery for habitats	2-25+ years
Estimated timeframes for recovery for Threatened and/or declining habitats	Worm species - 2-10yrs
Estimated timeframes for recovery for Threatened and/or declining species	N/A

Site specific info

- If the site were a more regular shape, this could make enforcement easier.
- The site is within a marine plan policy area for potential future offshore wind developments.
- The eastern edge of the site overlaps with an MCZ (approximately 50% of the candidate HPMA is overlapped by the MCZ), for which consultation and management is expected by end of 2022.
- The site is considered to be monitorable from an ecological perspective.
- Ecological importance
    - This site is hugely diverse by comparison to other areas in the Eastern Channel, attracting numerous seabirds (such as northern fulmar and black-legged kittiwake), marine mammals (such as Risso's dolphin and harbour porpoise), and regionally threatened fish species such as undulate ray.
    - Areas of ross worm reef, occur on mixed sediment within this area. These small tube-building worms consolidate to build reefs which help to stabilise cobble, pebble, and gravel habitats, providing habitat for a range of benthic species that would not otherwise be present in the area. These reefs are particularly affected by dredging or trawling and in heavily dredged or disturbed areas an impoverished community may be left.
    - This area is thought to be in a relatively degraded state following the impacts of human activity. Subject to the removal of pressures however, the habitats in this area have the potential to recover. Designation of a pilot HPMA therefore presents a good opportunity to recover this location, as well as enhance the condition of the protected features of existing MPAs within the network because the area overlaps with the Offshore Brighton MCZ.
- Commercial fishing
    - The following gears are known to be used within the site:
        - Pots
        - Scottish seine
        - Midwater trawls
        - Dredges

Mostly whelk, horse mackerel, mullet, king scallop, herring or squid are thought to be harvested here, plus possible lobster and sole. On average 7 UK vessels, greater than 12m in length, have been recorded using this area between 2017 and 2019 and are thought to be harvesting whelk, horse mackerel, mullet, king scallop, herring, or squid. The main UK landing ports for these vessels are Portsmouth and Shoreham-by-sea. Based on sightings data we have no evidence of vessels under 12m in length using this area[67].

[67] Data provided by Cefas.

- Just over twice the number non-UK vessels (113), greater than 12m in length, compared to UK vessels used this area between 2016 and 2020. Based on our available data this effort is mostly from French vessels and to a lesser degree from Dutch, Irish, Belgian, and German vessels.

- Recreational angling
  - The offshore nature of the site means that only boat-based angling is possible here. There is no data on the sea angling activity within the site, although some charter boat fishing has been recorded within 20 km of the site and there is anecdotal evidence of charter fishing targeting shark take place in the area.
  - Given the distance from the shore, it is very unlikely that there is a lot of activity by either private or charter boats.

Benefits

Environmental

- The site has higher levels of disturbance; however, it also has higher overall ecological scoring than other identified offshore areas in the region. With parts of the candidate HPMA currently in recovery, further designation can help improve our understanding of the impact of restrictions on the quality and scale of marine habitats.
- As this location includes Annex I reefs/Sabelleria spinulosa reefs, an OSPAR threatened and declining habitat, which are particularly vulnerable to damage by human activity, designation of a pilot HPMA will help to protect these vulnerable habitats.
- The area is of importance for the nursery and spawning behaviour of at least six commercially important species of fish, as well an important foraging area for many species of seabirds.

Socioeconomic

- OPVs patrol to inspect scallopers for correct gear and Belgian beam trawlers so monitoring and enforcement is already taking place in this area, which will reduce monitoring costs.

Cost considerations

- Displacement
  - It can be assumed that predominately vessels over 12m in length using pots and mobile gear (trawl and dredge) will be impacted, as they will not permitted if the site is designated as a HPMA. Dredging for king scallop is already restricted by current regulation, as such the implementation of the candidate HPMA site would add more restrictions to this fleet segment. Due to existing MPA and cables, the displacement of the mobile fishing fleet in the adjacent area is limited. Potting could be displaced to the adjacent area if density of the fishing activity allows for it.

Risks

- This site is categorised as a high economic risk for designation. This is driven primarily by a high level of non-UK fishing in the site and high levels of potential angling activity.
- The site has ten times more French fishing than UK fishing[68].
- The area's irregular wedge-shaped boundary could cause compliance issues particularly where the candidate HPMA boundary becomes narrow and shares a boundary between English and French waters.
- The introduction of a pilot HPMA could push fishers into the channel shipping lanes.
- This site is a key area for shark angling and charter fishing**.**

Overview of Site 3 – Inner Silver Pit South, offshore Southern North Sea

Size: 62.5km^2

[68] Data from VMS pings provided by MMO.

Baseline assumptions:

Table 3:

Overlapping MPA Condition (only applicable for potential sites that overlap with designated MPA sites only)	Unfavourable
List of activities within site	Demersal towed gears, including seines
Estimated timeframes for recovery for habitats	2-25 years
Estimated timeframes for recovery for Threatened and/or declining habitats	Sandbanks - 10-25yrs Worm species - 2-10yrs
Estimated timeframes for recovery for Threatened and/or declining species	N/A

Site specific info

- There is potential offshore wind development in the wider region around this site.
- There is partial overlap (approximately 10% of the candidate HPMA is overlapped by the SAC) between this site and the Inner Dowsing, Race Bank and North Ridge SAC. In 2021 MMO consulted on prohibiting bottom towed fishing over the sandbank and biogenic reef features of the SAC and prohibiting static gear fishing over the biogenic reef features of the SAC. If the MMO byelaw is made and confirmed, increased restrictions will be in place in the site before designation. This would likely reduce the cost of implementation as some level of monitoring and enforcement would already be in place.
- Blue carbon habitats are not present in site.
- Ecological importance
    - The Inner Silver Pit South area has relatively high levels of biodiversity by comparison to other areas considered in the Southern North Sea region, playing host to a wide range of marine mammal, seabird, and fish species.
    - A mosaic of different habitats characterises the seabed ranging from rocky areas through to sediment-dominant habitats and biogenic reefs including blue mussel beds and the regionally distinctive ross worm reefs. These reefs support a diverse community structure and enhance the levels of primary and secondary productivity through the provision of feeding and nursery grounds. This in turn provides foraging areas for seals, cetaceans, and seabirds, with this candidate HPMA being identified as an important foraging area for northern gannet and razorbill.
    - The area is thought to be relatively degraded following the impacts of human activity, however the sandbanks and reef habitats have a strong potential for recovery subject to the removal of pressures. Designation of a pilot HPMA therefore presents a good opportunity to recover this area.
- Commercial fishing
    - The following gears are known to be used within the site:
        - Pots
        - Dredges
    - This area is predominantly targeted by UK vessels thought to be harvesting mainly edible crab, lobster, king scallop, velvet crab, brown shrimps, cockles, or whelk and using mainly pots or dredge. VMS data suggests only a small number of vessels greater than 12m in length use this area, with sightings data indicating vessels less than 12m in length make up the majority of the UK fleet operating in this area, with an average of 53 vessels recorded here. The main landing ports are Bridlington, Grimsby, Hornsea and Fraserburgh.
    - A relatively small number of non-UK vessels, greater than 12m in length, utilise this candidate HPMA (8 vessels), making up less than half of unique vessels present in this area between 2016 and 2020. The non-UK effort in this area is mostly from French vessels with limited use from Dutch vessels.

Benefits

Environmental

- This area has several important habitats present including Sabellaria spinulosa reefs, which is an OSPAR threatened and/or declining habitat.
- The area supports prey items for the foraging of several species of fish, seabirds, and marine mammals.
- The area is of importance for the nursery and spawning behaviour of at least 23 fish and shellfish species, with at least six being commercially important species.

Socioeconomic

- N/A

Cost considerations

- Displacement
    - It can be assumed that predominately the fishing activity of the vessels over 12m in length using pots or dredges would be impacted, as they will not permitted if the site is designated as a HPMA. Displacing the dredging and potting activity into the adjacent area may be challenging due the concentration of existing human activities and MMO marine conservation byelaw to protect designated feature of biogenic reefs built by ross worms (Sabellaria spinulosa).

Risks

- This site is categorised as a high economic risk for designation. This is driven primarily by a high level of UK fishing in the site.

Overview of Site 4 – Lindisfarne, inshore Northern North Sea

Size: 129km^2

Baseline assumptions:

Table 4: % site with habitats that have moderate or high sensitivity to key pressures (note these pressures are not necessarily occurring):

Habitat structure changes - removal of substratum (extraction)	68.21
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	58.68
Changes in suspended solids (water clarity)	25.25
Smothering and siltation rate changes (Heavy)	68.41
Abrasion/disturbance of the substrate on the surface of the seabed	92.51
Removal of target species	53.38
Removal of non-target species	92.53

Level of likely degradation in site: High

Site specific info

- The site boundary has been revised to exclude the causeway and aquaculture operation occurring in Lindisfarne Bay.
- Eider ducks in unfavourable recovering condition in the area, likely linked to recreational disturbance and predation. Eiders breed on the Farne Islands and forage in the surrounding waters of the Farnes and Lindisfarne. The Farne Islands SSSI/SPA only fall in part of the area, with Inner Farne, the island most heavily visited area (recreational wildlife watchers), located outside of the area.
- This is area is thought to be important area to the local economy in terms of tourists visiting Lindisfarne and the Farne Islands. Wildlife boat tours visiting the Farne Islands operate from Seahouses harbour, which is south of the area boundary, however one of the most heavily visited

islands is outside the candidate HPMA boundary.

- Ecological importance
    - Lindisfarne includes some of the most diverse habitats in the North Sea, both in a UK and European context and is home to 40 threatened or important species. It is one of the most varied coastlines in the UK, with a complex mix of marine habitats and associated species, which are unusually diverse for the North Sea.
    - Several 'blue carbon' habitats and habitats important for coastal protection can be found in Lindisfarne, including seagrass, saltmarsh, coastal sand dunes, kelp forest and rich muddy habitats. These rich muddy sediments, full of worms and sand shrimp provide a key food source for thousands of wintering birds such as geese. This bird haven also supports breeding Arctic and little tern as well as other breeding seabirds such as puffins and guillemots on the Farne Islands.
    - Deeper sediment habitats, while appearing more barren than intertidal areas, provide habitat and food sources for important commercial fish species such as herring and cod, living in the water column.
    - The area also contributes to the British population of grey seals, with the Northumberland colony providing 3% of the British annual pup production.
    - The area is considered to represent a relatively degraded ecosystem and assessments show it has a strong potential for recovery subject to the removal of pressures, making it a good candidate as a pilot HPMA.
- Commercial fishing
    - The following gear are known to be used in this area:
        - Bottom trawl
        - Dredges
        - Longlines
        - Pots
    - The VMS data suggests that a small number of over 12m vessels use this area, harvesting mainly Norway lobster, squid, or turbot and using mainly dredge or bottom trawl. Sightings data, used to better understand the under 12m fleet without VMS, indicates on average around 40 vessels using this area, harvesting mainly lobster, edible crab, or velvet crab and using mainly pots, longlines, or bottom trawls.
    - Potting is the predominant under 12m fishery along this coastline, mostly targeting lobster with larger vessels exploiting brown crab stocks further offshore. For the lobster fishery the summer season is the most economically important season with higher landings per unit effort. During the summer season pots are set close inshore where fishing is most effective and loss of fishing days due to adverse weather conditions is at its least.
    - Trawling for Norway lobster in the northern section of the candidate HPMA is thought to take place, outside of the existing MPA. Most of this activity is thought to be from fishing vessels operating from the Scottish port of Eyemouth.
    - Limited scallop dredging occurs within the wider Northumberland Inshore Fisheries and Conservation Authority (NIFCA) district. Fishers must have a permit to scallop dredge in the district with a limited number issued in 2021. A small number of beach trout netting stations are thought to be in place off Goswick. Seasonal hand lining also takes place for mackerel, which is thought to contribute to the pot bait supply for commercial vessels in the area[69].
    - Commercial hand gathering for periwinkles occurs on the rocky shore on the northern and eastern intertidal areas of Holy Island, however the boundary of this candidate HPMA excludes the Lindisfarne voluntary bait digging zone.
- Recreational angling
    - Our evidence suggests both shore and boat-based angling is a popular activity is this area. A small number of charter angling vessels operate from Berwick and Seahouses, some of which are also commercial shellfish vessels. It's estimated approximately 20 private fishing vessels operate from Berwick, Holy Island and Seahouses with additional trailer launched vessels in the summer months and additional activity from local campsites.
    - Shore angling occurs within the site over the beaches targeting flatfish, as well as any rocky shore for cod, pollock, saithe, wrasse, and occasional bass.

[69] Information provided by IFCA.

    - Recreational fishers also have recreational shellfish permits allowing them to set a maximum of five pots targeting mainly lobster. The number of recreational permit holders is unknown.
    - Significant recreational SCUBA diving activity also takes place within the site during the summer months which may result in the removal of crab and lobster from the site.
- Anchoring
    - There are no known anchoring areas within the candidate HPMA, however there is some overlap with an area used for general boating, which may mean some recreational anchoring takes place here. The Lindisfarne area is also a popular SCUBA diving location, so there is a possibility of anchoring from diving and other vessels taking place, however this is unconfirmed.

Benefits

<u>Environmental</u>

- This candidate HPMA is important for key behaviours, or life cycles stages, for a high number of species (44), which will be more protected as a result of pilot designation.
- This site would improve our understanding of the benefits of HPMAs for the recovery of biodiversity by stopping hand gathering collection, and the removal of fishing pressure.
- This area would improve our understanding of the benefits of HPMAs to a wide variety of migrating birds and seabirds and their recovery from disturbance and pressures associated with breeding and foraging. As Inner Farne is excluded from the area boundary this could provide a unique opportunity to monitor spill over effects of a pilot HPMA protecting the other Farne Islands and the associated benefits to Inner Farne and the surrounding area.
- This area is part of NE sentinel monitoring programme, meaning there is an existing monitoring programme in place and baseline information available for this area
- This site includes several habitats that are important for long-term 'blue carbon' storage and coastal protection and therefore protecting this habitat will protect vital carbon stores and coastal areas.

<u>Socioeconomic</u>

- This site could be a good showcase for pilot HPMAs to increase public awareness and improve scientific understanding.
- This site boundary has been revised to reduce negative socio-economic impacts (primarily through the restriction of bait digging, fishing, angling).
- This site has strong links with Newcastle Uni and the North East local team. Several research projects have focussed on this area. The site is currently well monitored as it overlaps with several designations, which would reduce monitoring costs.

Cost considerations

- Displacement
    - It can be assumed that predominately the fishing activity of vessels under 12m in length using pots will be impacted, as they will not permitted if the site is designated as a HPMA. This activity could be in theory added to the already existing potting activity south of the candidate HPMA site, however, would lead to significant increase in fishing pressure in a OSPAR MPA site and potentially also to conflict between fishers in this fleet segment due to lack of space to place additional pots.

Risks

- This site is categorised as a medium economic risk for designation. This is driven primarily by a high number of UK vessels and a high proportion of UK vessels generating over 50% of their revenue in the site.
- Potting, a static gear fishery, is the only fishery in operation in the vast majority of the site. Therefore, most of the fishing effort removed will be low impact activity.
- This site has significant levels of mapped angling potential (shore and boat).
- This is a very important area to the local economy in terms of tourism with thousands of tourists visiting Lindisfarne and the Farne Islands annually. Wildlife boat tours visiting the Farne Islands operate from Seahouses harbour, which is south of the area boundary. This is a very lucrative

business in the region supporting the local community which may raise concern but the most heavily visited island is outside the site boundary.
- This area is heavily used for dog walking.
- The large Pacific oyster operation to south of site may influence acceptability due to its proximity to the boundary. Wildfowling is permitted under permit.
- Areas of underwater metal wreckage are present in the area, which may act as artificial reef or may degrade over time.
- Risks associated with displacement include small under 10m open boats; exposed coastline; working deeper waters; short seasonal fishing period; tidal harbours as well as time constraints for safe causeway crossing on Holy Island; gear entanglement/conflict with neighbouring fishers; and vessels operating beyond their safe working limits.
- There is a fishing community at Holy Island rooted in history which part of the island's heritage, as well as the other coastal fishing harbours of Seahouses and the historic town of Berwick. This change could impact the local communities who have fished these grounds for generations as well as supporting businesses (hotels, restaurants, maintenance, and engineering support).
- An invasive sea squirt (Corella eumyota) has been recorded in the intertidal rocky reef on the north side of Holy Island. Currently very localised and in small numbers but monitoring consideration.
- Main pressures in the inshore waters affecting biodiversity are currently water quality and recreational disturbance activities (e.g., dog walking).
- Water quality issues would need to be considered (River Tweed) as intertidal seagrass is thought to be impacted by poor water quality.

Overview of Site 5 – North-east of Farnes Deep, offshore Northern North Sea

Size: 500.17km^2

Baseline assumptions:

Table 5:

MPA Condition (only applicable for potential sites that overlap with designated MPA sites only)	Favourable
List of activities within site	Demersal towed gears, static gears
Estimated timeframes for recovery for habitats	2-25 years
Estimated timeframes for recovery for Threatened and/or declining habitats	N/A
Estimated timeframes for recovery for Threatened and/or declining species	Clam species - 25yrs+

Site specific info

- This site has a 100% overlap with an MCZ. The measures in place revolve around gear selectivity and recording of catch, requiring inspections by ship or on landing.
- This site is a relatively natural ecosystem.
- Ecological importance
    - This is the only offshore example of a site in natural state in Northern North Sea and wider English waters where all current protected features are considered to be in favourable condition, which provides the opportunity to safeguard the biodiversity of this area with a pilot HPMA, whilst helping to build our understanding of what recovery looks like.
    - The seabed consists of a mix of habitats ranging from coarse sediments such as sand, where several species of filter feeding sponges have been identified, through to muddier areas. These muddy areas which cover 5.6 % of the seabed in the site are thought to be important habitats for the absorption and storage of atmospheric carbon.
    - The wide-ranging habitats in this area support a broad range of benthic species including the long-lived ocean quahog, a type of mollusc which is considered to be under threat in the Northeast Atlantic. In addition, several mobile species call this area home, including the rare

and regionally distinctive European smelt, which is an important prey source for larger fish, seabirds, and marine mammals.

- Commercial fishing
    - The following gears are known to be used within the site:
        - Bottom trawls
        - Dredges
    - Pelagic vessels targeting haddock, plaice or whiting, as well as some scallop dredging activity in the area.
    - Of the all the vessels which have been identified utilising this candidate HPMA between 2016 and 2020, just over 40% are non-UK vessels (33). Of these non-UK vessels, effort is predominantly from Dutch, German, French, Swedish and Danish vessels, with very small numbers of Lithuanian and Norwegian vessels.

Benefits

<u>Environmental</u>

- The North-east of Farnes Deep MCZ entirely overlaps with this site was surveyed in 2016 which. This will help to provide a baseline to monitor change against a candidate HPMA.
- Protecting this site protects the subtidal mud in the site which is vital for carbon storage.
- The area is of importance for the nursery and spawning behaviour of at least ten commercially important species of fish.

<u>Socioeconomic</u>

- Monitoring and enforcement of this site can also be done by seagoing assets when on location.

Cost considerations

- This site can be monitored through VMS as predominantly fished by >12m and patrols could be used to monitor recreational activity.
- Displacement
    - It can be assumed that the fishing activity of vessels over 12m in length using demersal trawl or dredges would be impacted, as they will not permitted if the site is designated as a HPMA. No restrictions except the potential decrease of profitability for the fishing fleet can be identified with respect to displacing this activity into the adjacent area.

Risks

- The area is highly utilised throughout the year, which may cause a risk of displacement of site users.

8. Costs under each option

Stakeholder engagement process

8.1. Throughout the selection of shortlisted areas of ecological interest, JNCC and NE were involved by identifying and considering sites as well as providing analysis to support Defra's consideration of sites against social and economic criteria which included as explained in section 1.

8.2. Stakeholders were invited to provide comment on the draft criteria over summer 2021 which informed their development. These criteria are published in annex B of the pilot HPMA consultation.

8.3. In Spring 2022, a stakeholder consultation will take place. This is discussed in more detail in section 3.

Costs under the baseline scenario

8.4. As described in section 5, in order to meet the objectives of the policy, it is anticipated that, in line with the conservation objectives of an HPMA, management measures would usually be required to prohibit extractive, destructive, and depositional uses within their boundaries. Therefore, any site that could not adjust itself to adhere to this rule, and could not be relocated nearby, was removed from consideration when the sites were passed through an exclusion filter. Sites that were unable to adjust themselves to adhere to the rule either included a permanent structure or was committed or due to be committed to an activity that could not be adapted or relocated. The removal of these sites meant that those shortlisted did not include any of the following activities and/or features:

- Ports and harbours
- Existing licensed aggregate extraction
- Existing licensed dredging and dredging disposal
- Existing licensed oil and gas
- Active and proposed pipelines[70]
- Carbon capture and storage (CCS)
- Existing offshore wind farms, Leasing Round 4 sites and pre-commercial floating offshore wind sites
- Active and proposed cables
- Existing licensed aquaculture
- Existing licensed anchorages, moorings, and berths
- Routine defence exercises

8.5. Exclusion of areas based on the above criteria means that the baseline scenario includes no costs related to the continuation of the above.

Small and Micro Business Impact Assessment (SAMBA) (applicable to the preferred option only – option 4)

8.6. According to Statista[71], all businesses in the UK in the fishing and aquaculture industries are small or micro as they have under 49 employees.

8.7. As the final set of sites that will be designated have not been selected, we can only estimate the costs to small and micro businesses, at present. Costs have been estimated by aggregating the average annual UK fishing revenue for sites. Average annual UK fishing revenue has been

[70] Decommissioned pipelines may be compatible with the aims of pilot HPMAs, pending further work to understand the structures and activities involved, at a site-specific level. We will not be excluding these areas as candidate HPMA locations.
[71] Statista 2020. https://www.statista.com/statistics/319981/number-of-local-units-in-the-fishing-and-aquaculture-industry-by-employment-size-band-in-the-uk/

calculated by Cefas using VMS and logbook data for vessels over 12m in size and using sightings and landings data for vessels under 12m.

8.8. The costs to business are dependent on the sites chosen, both which sites and the number. We anticipate a number of the candidate sites will be designated as pilot HPMAs. If only the site with the highest average annual UK fishing revenues was selected, the total cost to business would be £5.3m, which would affect an estimated 57 vessels. If only the site with the lowest average annual UK fishing revenues were selected, the total cost to business would be £5,500, which would affect an estimated 2 vessels. If all five shortlisted sites were designated, the likely cost to business is £9m, with an average of £1.8m per site. This would affect an estimated 113 vessels.

8.9. These lost UK revenue figures do not account for costs of doing business (e.g., fuel or labour) and assume that there is no opportunity to recover the lost UK revenues through displacement of fishing activity[72]. Further, these are direct fishing vessel costs and do not consider the localised land-based multiplier effects and supply chain impacts. We will look to include multiplier effects in the post-consultation IA calculation of costs to business. We have not included them at present as they are dependant a number of factors, including the type of fish caught, where it's landed and the impact on processing, which will vary based on the final sites which are selected. These figures do not include familiarisation costs which are addressed below.

8.10. For some sites, there is only data available for vessels over 12m (e.g., far offshore locations). For the sites where there is a data available for vessels under 12m, precautionary assumptions have been made due to limited data, and therefore this is likely to be an overestimation. We cannot distinguish the size of the businesses receiving this revenue, at present, and so while this data includes all sizes of businesses, the majority, if not all, of these, especially those with vessels under 12m are likely to be small or micro, as supported by the Statista findings referred to above. This data is for UK registered vessels only and is estimated from data covering a larger area than the sites. The average is taken over the three years from 2017 to 2019. We will test these assumptions during the consultation period.

8.11. We do not expect small businesses to be reimbursed for costs incurred.

8.12. In the case of pilot HPMAs, small and micro businesses will not be exempt from the requirements of new regulations as this would not allow the policy to meet its objectives. The majority of businesses affected will be small or micro and therefore exempting them would significantly reduce the impact of the policy.

8.13. We expect some of the cost to businesses to be mitigated through adaption and displacement. We have done a preliminary assessment of potential displacement. During the consultation, we will collect information on the possibility for businesses to change gear type to continue to operate. We will look at how the Fisheries and Seafood Scheme, or similar funds, could be used to support adaptation. We will also collect information and Arm's Length Bodies (ALBs) will do additional analysis on the potential for displacement of activity outside of the candidate HPMA sites. This is described in more detail in section 3.

8.14. Familiarisation Costs:

- MMO VMS pings record the number of over 12m vessels detected in a site (those most likely to be participating in commercial activity). If all the five sites were to be designated this would affect 113 unique UK vessels.
- According to the Economic Research Institute[73], average wage of ship captain is estimated at £54,000pa or £25/hr, whilst fishing vessel skipper salary is significantly lower than a ship captain, we use this as an upper bound estimate for familiarisation costs. We therefore estimate a cost of £25/hr, plus 22% uplift, for familiarisation cost calculations.

[72] During the MCZ assessment process it was assumed that the fishing industry would be able to recover 75% of their lost revenue by fishing elsewhere.

[73] Ship Captain Salary in United Kingdom. https://www.erieri.com/salary/job/ship-captain/united-kingdom

- BEIS[74] guidance suggests that reading of technical documents is 50 to 100 words per minute, normal documents upwards of 250 words per minute. We estimate regulations and communications will be no more than 20 pages in total (max 500 words per page), with half being read at the technical speed and half at 'normal' speed. We therefore estimate a reading time of 50 mins for technical content and 20 for non-technical content, equating to a total familiarisation time per person of 70 minutes.
- It is also assumed that it will take eight hours for fishers to research alternative sites for fishing, to which they can move their fishing effort after the policy is implemented. This is based on the assumption that they would each consider on average four other sites which are a two hour round trip from their current site.
- Familiarisation costs therefore are calculated as follows:

    - Time X average hourly wage + uplift (22%) X number of businesses impacts
    - Time = 8 hours + 70 minutes = 9.167 hours
    - Fishing industry: 9.167 X (£26.00 + £5.70) X 113 vessels = £32,837
    - **Total familiarisation cost = £32,837**

8.15. During the next phase we will collect additional data on enforcement costs, and these will be included in the post-consultation IA.

8.16. Costs to Business (Equivalent Annual Net Direct Costs to Business) will be calculated in full in line with the Better Regulation Framework in the post-consultation iteration of the IA, as full economic costs. Information of current site usage for business is included in the site sheets in section 7. At present this is equal to the SAMBA assessment above but will be refined in the post-consultation iteration of the IA.

8.17. The costs of inspection have not been included as they will not fall on industry and will be funded by public sector, specifically to IFCAs and the MMO. Compliance will be monitored through existing routes, with inspections already taking place in some of the candidate HPMA sites due to existing regulations, VMS data (on over 12m vessels) already being collected in all candidate sites, and existing checks by IFCAs and the MMO already taking place. As HPMAs prevent the occurrence of all types of fishing, regardless of gear type, it is unlikely that inspections or any other form of more HPMA-specific monitoring will be required as any boat in the area would be easily identifiable using current provisions as non-compliant. These costs are not expected to be recouped from industry.

Risks, sensitivities, and limitations of costs methodology

8.18. As these figures are indicative and the methodology is not yet robust, they should be treated with high levels of caution as they are very likely to change and are subject to a number of caveats.

8.19. First, costs will depend on the final five chosen sites. In the post-consultation IA, we will have a better understanding of these costs and can complete a more robust assessment.

8.20. Costs are calculated using modelled approaches meaning that they are heavily dependent on the quality of data used in the models and the assumptions made in using the models. In the post-consultation IA, we will have access to more robust data meaning that less assumptions can be made in the modelling process and the resulting estimates will be more robust.

8.21. There is a lack of data on small and micros businesses including the on the extent of their business, on their catches, and on the proportion in the industry which they occupy. Work is being done to ascertain if this data is available.

8.22. This iteration of the IA lacks data on non-financial costs, which include social costs. We will look to ensure that these are considered in the post-consultation IA.

[74] BEIS 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/609201/business-impact-target-guidance-appraisal.pdf

8.23. Section 3 of this document described the evidence gaps and our approach to filling these gaps wherever possible.

9. Benefits under each option

9.1. The marine environment provides us with many benefits, such as food, in terms of wild and farmed fish and shellfish, and gives millions of people the chance to enjoy sailing, angling, watching birds and other wildlife and provides environmental resilience. These can be described as 'Ecosystem Service' benefits. Ecosystem services are defined functions of the natural environment, that directly or indirectly provide benefits for people (Enabling a Natural Capital Approach guidance, 2021[75]), several of which can be considered public goods as discussed in Section 4.3. The UK National Ecosystem Assessment Follow-on (NEAFO) study[76] has underlined the value of the marine environment and benefits derived from its ecosystem services. The NEAFO recognised both the need to take proper account of the benefits of marine conservation measures in decision making but also the challenges and lack of economic evidence currently available for doing so.

9.2. In this iteration of the Impact Assessment (consultation), this section contains illustrative benefits from the designation of pilot HPMAs based on literature. In the next iteration (post-consultation), we will look to provide a more quantitative analysis, where possible, using data and information provided by SNCBs. How we intend to go about this is explained in the section 3.

Benefits under baseline

9.3. Under the baseline option, we assume that the ecosystems and biodiversity in candidate HPMAs will continue in line with the baseline assumptions for each individual site, i.e., those which are deteriorating will continue to deteriorate at the same rate and those which are stable will continue to be so. In the consultation IA we assume that the current trend of ecosystem degradation at the pilot locations is likely to continue on historic trends. This means that any benefits currently being created by the site will continue to decrease or remain stable, depending on the baseline assumptions of each individual site. Therefore, during the consultation we welcome additional information to inform these baseline assumptions and we look to refine the estimated future rates of degradation at a site level for the final IA.

Benefits of the preferred option (option 4)

9.4. HPMAs are intended to be a tool used for the protection of biodiversity and recovery of marine ecosystems. HPMAs are likely to provide many benefits for both nature and humans, primarily ecological benefits. Other benefits may include carbon storage and sequestration, future benefits for fisheries and benefits for tourism. However, these benefits will vary per site which makes it difficult to predict the extent of effects that can be expected. While the exact links between biodiversity and the ecosystem services are not well understood, it is generally agreed that biodiversity contributes to the generation of ecosystem services.

Ecological Benefits

9.5. Studies[77,78] conducted on MPAs support the idea that protecting marine areas improves the size and abundance of species within protected areas compared to the areas around them, in particular for fished species[79]. HPMAs are more restrictive than MPAs, which based on evidence from existing MPAs with differing levels of protection, will likely lead to higher biomass, density,

[75] Enabling a Natural Capital Approach guidance. 2021. https://www.gov.uk/government/publications/enabling-a-natural-capital-approach-enca-guidance/enabling-a-natural-capital-approach-guidance
[76] Ibid
[77] Moland, E., E. M. Olsen, H. Knutsen, P. Garrigou, S. H. Espeland, A. R. Kleiven, C. André, and J. A. Knutsen. 2013. Lobster and cod benefit from small-scale northern marine protected areas: Inference from an empirical before-after control-impact study. Proceedings of the Royal Society B: Biological Sciences 280:1–9.
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diversity, and individual organism size[80,81,82,83,84]. PISCO[85] states that a 2006 global review of studies into biological changes inside marine reserves found that fishes, invertebrates, and seaweeds have increased in weight, density (number of animals) per area, size, and diversity (number of species per area). Fenberg et al.[86] found that in in marine reserves fishes, invertebrates, and seaweeds increased in weight by on average 251%, increased in density by on average 121%, increased in size by on average 13%, and increased in diversity by on average 19% in the area that was sampled. At the upper end of these averages is more heavily fished species, who often showed the most dramatic increases. Some fished species had their weight or density increase ten-fold inside the marine reserves. Species which are not fished can also increase if the habitat they live in is protected. While increases in species diversity and size are likely to be smaller, even these small changes can be important.

9.6. These benefits hold true within the UK with Atrill et al. finding significant positive changes in biodiversity, abundance, and size in benthos and mobile species after establishing areas of protection in Lyme Bay. The global scientific review referred to in PISCO[87] also supports the idea that increases in weight, density, size, and diversity are similar across tropical and temperate waters and therefore findings from tropical regions are likely to hold in the UK.

9.7. Increases in abundancy and size can then add to resilience of marine ecosystems (Micheli et al. 2012)[88]. Size can also improve the reproductive potential of a species[89,90,91], allowing for a larger and more diverse population, further increasing adaptability and resilience[92].

9.8. While the effects of marine protection regulations generally have more effect on targeted than non-targeted species[93], this can in turn affect the rest of the ecosystem.

Economic Benefits

9.9. Villa et al.[94] says that one of the key functions of MPAs in modern conservation of to contribute to economic and social welfare.

9.10. The Dasgupta review[95] states that conserving and restoring natural assets will sustain and enhance their supply and that it is less costly to conserve nature than to restore it once damaged or degraded, all else being equal. Dasgupta[96] says that expanding and improving the management of Protected Areas has an essential role to play and that multi-functional

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[94]
[95] The Economics of Biodiversity: The Dasgupta Review (publishing.service.gov.uk)
[96] Ibid.

seascapes that provide ecosystem goods and services, and protect and enhance biodiversity, are also important.

Other benefits

Carbon storage and sequestration

9.11. Currently carbon emissions are increasing as a result of economic development while natural ecosystems are degrading, reducing their capacity to absorb CO2[97].

9.12. Marine ecosystems are vital for carbon uptake, which can be distinguished into carbon storage and carbon sequestration. Carbon storage is the storage of carbon in marine plants or organisms during its lifetime. Carbon sequestration means that carbon is sequestrated for millennia far underneath the seabed where it can be decomposed[98].

9.13. There are large knowledge gaps on marine ecosystems and their capacity to mitigate emission effects. However, it is clear is that these ecosystems play an important part in the global carbon cycle as well as provide many other ecosystem services[99]. When areas of the marine environment are protected, this could partly mitigate emission effects as well as protecting against many activities which cause disturbance[100].

Future benefits for fisheries

9.14. International evidence suggests that implementation of protection in areas of the marine environment can lead to a level of increase in the size and abundance of organisms in the area around the protected area, which can lead to benefits for fisheries[101,102,103]. These changes to areas around a protected area are dependent on a number of factors, which are not guaranteed[104,105,106] and will also differ by species[107].

9.15. Evidence from the UK's first marine reserve in Lundy also supports the theory that implementing marine protection leads to increased size and abundance of species. Hoskin et al.[108] found that four years after the marine reserve in Lundy opened in 2003, legal-sized lobsters were five times more abundant within the reserve than within fished areas and that lobsters inside the reserve were 9% larger than those in fished areas. Changes in size and abundance started to be detected as early as 18 months after the measures were first implemented. Lobsters of legal-size next to the reserve did not increase in size or abundance in the first four years but abundance of sub-legal lobsters did. As Lundy is a small reserve, changes seen in larger reserves could be on a larger scale. Over time, further increases in the size and weight of lobsters could lead to

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[108] Hoskin et al. (2009). https://www.dassh.ac.uk/dataDelivery/filestore/1/5/8_d90a9e1b4ded278/158_690e71cd16ecdea.pdf

migration out of the reserve benefitting the nearby lobster fishery. However, this paper also notes that other species did not experience the same levels of improvement, which may in part be due to increased competition between species within the area.

9.16. Although increases to weight, size, diversity, and density can be beneficial, they are not necessarily economic compensation for fishers, as they, for example, may have to go to fishing grounds further away because of displacement. Additionally, any beneficial changes to areas outside of the protected area take time to occur[109].

9.17. Whilst evidence from a UK context found that the majority of the stakeholders supported the MPA which was introduced in Lyme Bay and thought that the social and economic benefits outweighed the costs, some based outside the protected area reported negative effects, such as increased costs and more conflicts due to displacement. However, they did say it would be fairer to close the area for all kinds of fishing[110,111] so this issue may not occur in pilot HPMAs where regulations will be stricter.

9.18. Perceptions of fishers of MPAs can vary between different locations[112]. Additionally, it may take fishers several years before they can benefit from marine protection and so they are not always initially supportive. If restriction cause losses in income, then fishers may not support the regulation, even though they would like to benefit from it in the future[113].

Tourism and recreation

9.19. Tourism and recreation can lead to economic benefits through increased visitor numbers and changes in visitor behaviour which then leads to increased revenues, more jobs, and other livelihood opportunities.

9.20. This is evidenced through international evidence which shows that the introduction of protection of marine environments has led to increased visitor numbers and increased revenue. For example:

- Ballantine[114] found that the first MPA (equivalent in regulation strength to the candidate English HPMAs) established in New Zealand attracted around 5000 visitors per year and that similar affects occur in other MPAs depending on accessibility.
- McCook et al. (2010)[115] found that the Great Barrier Reef MPA (which includes areas that are equivalent in regulation strength to the candidate English HPMAs) generates approximately €3.2bn annually, with most of the revenue coming from tourism, and sustains around 53,800 full time jobs, most of which are based in tourism. Tourism revenue has been increasing steadily over time.
- Roncin et al.[116] found that MPAs in Southern Europe can generate an estimated €88,000 per year for recreational fishing tourism and €551,000 per year for scuba diving tourism, which when aggregated, outweighs the management costs of €588,000.

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- Dixon, J.A., and Sherman, P.B.[117] found that in Canada ocean recreation contributes approximately 32% of the GDP in the region around an MPA. The implementation of an MPA led to an increase in nature-based tourism and recreation opportunities. There have even been known cases where the increased market benefits from activities as tourism have been enough to warrant the creation of an MPA.

9.21. In the UK context, Chae et al. (2012)[118] estimated that visitors were willing to pay (using a travel-cost method study) between £359 and £574 to visit the MPA around the island of Lundy.

9.22. However, research in Scotland[119] highlights that benefits can take a period of time to occur and Petrosillo et al.[120] found that tourist's willingness to visit and stay in an MPA site was very dependent on features beyond the marine environment such as natural attractiveness and the natural value of the environment.

9.23. International evidence from MPAs showed that implementing protective restrictions leads to a shift away from jobs in the fishing industry towards jobs that are more involved with and fall under the scope of tourism instead. Despite the introduction of MPAs leading to a shift in the types of employment opportunities and jobs available, research indicates that the shift towards being more accommodating for tourism helps to generate employment, improve the living standards of residents, and increase the incomes[121]. It does however also tend to increase the cost of living for locals due to increased local demand. Despite this, stakeholders very rarely report negative impacts of MPAs on recreation and tourism[122] and it is recognised that by extension, benefits generated by protected areas can provide benefits for coastal communities, local to the protected area.

9.24. Following the implementation of marine protection in an area, the maintenance and enhancement of ecosystem services increases the appeal of sites to tourists over time as the condition of ecosystems and cultural ecosystems improve.

9.25. The benefits for recreation and tourism will be greater for inshore areas of protected marine ecosystems as they are more easily accessible and so visited more often than offshore areas. However, it takes time before these benefits occur[123].

9.26. If types of recreational activity are permitted within a pilot HPMA, the improvements in the area due to the higher level of protection would result with higher recreational benefits compared to other types of MPA. However, Cefas[124] found that "HPMAs that preclude all recreational activities are unlikely to provide recreational or aesthetic benefits". Additionally, Ruiz Frau et al. suggested that there would be a decrease in utility (or well-being) if HPMAs permitting no recreation were introduced.

9.27. Tourism benefits are also effectively capped as there is a point where tourism if too great in scale can have adverse effects on the environment and therefore visitor numbers need to be controlled.

Risks, uncertainties, and sensitivities

[117] Dixon, J.A., and Sherman, P.B. 1990. *Economics of protected areas: a new look at benefits and costs.* Island Press, Washington.
[118] Chae, D. R., P. Wattage, and S. Pascoe. 2012. Recreational benefits from a marine protected area: A travel cost analysis of Lundy. Tourism Management 33:971– 977.
[119] Marine Scotland Science. 2016. Scottish Marine Protected Areas Socioeconomic Monitoring 2016 Report. Retrieved from: https://www.gov.scot/publications/scottish-marine-protected-areassocioeconomic-monitoring/.
[120] Petrosillo, I., Zurlini, G., Corlianò, M., Zaccarelli, N. and Dadamo, M., 2007. *Tourist perception of recreational environment and management in a marine protected area*.
[121] Bennett, N. and Dearden, P., 2014. *Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand*.
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[123] GOV.UK., 2020. *Benyon review Into Highly Protected Marine Areas: Final report - executive summary*. [online] Available at: https://www.gov.uk/government/publications/highly-protected-marine-areas-hpmas-review-2019/benyon-review-into-highly-protected-marine-areas-final-report-executive-summary
[124] Cefas 2015. Review of Highly Protected Marine Areas Appendix 5

9.28. There are examples where marine protection has failed, with 59% of MPAs studied globally being found to be ecologically like fished areas, indicating that there were no effects of conservation. However, Edgar et al. found that the success of protected areas depended on the level of restrictions as well as the management, age, size, and presence of continuous habitat allowing for movement across boundaries, meaning that good design and management are key factors for success. Higher biomass, density, diversity, and individual organism size have been reported in MPAs with high levels of protection compared to partially protected MPAs in the same area, with commercially and non-commercially important species demonstrating a significant increase in biomass, abundance, and species diversity[125,126,127,128,129]. This indicates that HPMAs are more likely to be successful at providing increased biodiversity due to higher levels of regulation.

9.29. Sequeria note that there can be trade-offs to be made when selecting sites based on their characteristics as the increase in some species can increase some ecosystem services and reduce others.

[125] Lester, S. and Halpern, B. (2008). Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series 367, 49–56.
[126] Sala, E. and Giakoumi, S. (2018). No-take marine reserves are the most effective protected areas in the ocean. ICES Journal of Marine Science, 75(3), 1166–1168.
[127] Lester, S., Halpern, B., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B., Gaines, S., and Warner, R. (2009). Biological effects within no-take marine reserves: a global synthesis. Marine Ecology Progress Series 384 33–46.
[128] Sciberras, M., Jenkins, S. R., Mant, R., Kaiser, M. J., Hawkins, S. J., and Pullin, A. S. (2015). Evaluating the relative conservation value of fully and partially protected marine areas. Fish and Fisheries 16 58–77.
[129] Stewart, G. B., Kaiser, M. J., Côté, I. M., Halpern, B. S., Lester, S. E., Bayliss, H. R., & Pullin, A. S. (2009). Temperate marine reserves: global ecological effects and guidelines for future networks. Conservation Letters 2 243–253.

10. Potential trade implications

10.1. In line with guidance from the Better Regulation Unit, we have only considered direct trade implications. There may be some indirect trade implications which are out of scope for consideration.

10.2. The marine economy contains a number of activities relating directly and indirectly to trade, which are subject to significant investment. This includes commercial fisheries, ports and harbours, renewable energy, oil and gas, and recreation.

10.3. The designation of pilot HPMAs is unlikely to impact on trade and investment for the following reasons:

- Candidate HPMAs have been assessed to be of low economic risk, which takes into account the level of use and dependency in sites;
- Use of the exclusion filter, which means any sites with extractive, depositional or destructive uses were not considered, means that a number of key marine industries upon which trade is reliant, such as ports and harbours and oil and gas, are not present in candidate HPMA sites and are therefore not affected by the policy;
- Whilst there is significant uncertainty as to the effect of environmental regulation on patterns of trade and investment, empirical evidence suggests these impacts are likely to be small[130].

10.4. There is potential for direct trade impacts in the commercial fishing industry. However, the consultation will be used to gain a better understanding of how much of this activity can be displaced, which will mitigate some of the effects on trade if catch for exportation can be fished for at an alternative location. During the consultation period, we will also look to better understand what trade occurs for the commercial fishers working in each site and how impacts can be mitigated.

10.5. Relevant industries will be consulted prior to designation, during the consultation period, permitting significant time for any mitigation required.

10.6. Furthermore, the measure does not include different requirements for domestic and foreign businesses.

[130] Dechezleprêtre and Sato (2014)

11. Potential implications on competition

11.1. There are no direct effects on competition from implementing HPMAs as all businesses related to the restricted activities will be excluded from the site. If there are any indirect effects on competition due to displacement, these will be explored in the post-consultation IA, once more information on displacement effects is known.

12. Potential implications on innovation

12.1. There are no potential impacts on innovation as while people may change to another existing type of gear, they are not incentivised to use new gear/to change techniques in an innovative manner. This assumption will be tested during the consultation period.

13. Post-implementation review plan

13.1. Following the designation of a pilot HPMA, regulatory authorities will put management measures in place to meet the conservation objectives of the site. Any management measures required for non-damaging levels of activities which are not extractive, depositional, or destructive will be worked out in consultation with stakeholders, and social and economic impacts will be taken into account.

13.2. The post-implementation review date is yet to be confirmed with ministers, but it will likely be five years after implementation of the pilots.

13.3. Prior to designation of pilot HPMAs, monitoring and evaluation of biological, social, and economic processes and effects of pilot HPMAs will be commissioned according to HMT Magenta Book guidelines. In 22/23 an external supplier will be appointed to undertake the evaluation of pilot HPMA sites. The commissioned partner will scope and develop an evaluation framework for pilot HPMA sites, which will identify appropriate methods for undertaking process and impact evaluation. To support the development of the evaluation framework, the commissioned partner will develop a programme theory of change, identifying pathways to anticipated biological, social, and economic impacts as well as develop an understanding of the pilot HPMA system and its complexity characteristics. They will also scope and review options for identifying counterfactuals to pilot HPMA sites and undertaking collection of baseline data in 22/23 and 23/24 before and shortly after, pilot HPMA designation.

14. Conclusion

14.1. HPMAs are intended to be a tool used for the protection of biodiversity and full recovery of marine ecosystems. HPMAs are likely to provide many benefits for both nature and humans, primarily ecological benefits. Other benefits may include carbon storage and sequestration, future benefits for fisheries and benefits for tourism. However, these benefits will vary per site which makes it difficult to predict the extent of effects that can be expected. While the exact links between biodiversity and the ecosystem services are not well understood, it is generally agreed that biodiversity contributes to the generation of ecosystem services.

14.2. In this IA, we have provided a qualitative assessment of the benefits of pilot HPMAs. In the post-consultation IA, we will look to fully quantify costs and benefits. SNCBs have provided information on which habitats are present in each site, as well as the extent and condition of these habitats. We will use the Ecosystem Services Valuation Directory (ESVD) to obtain values for each habitat, which can be converted to a per hectare per annum value. SNCBs have provided potential recovery rates for the habitats in the sites. The quality of ecosystems services can be measured using changes to recoverability (measured using the recoverability rate) and extent (measured using the size of the habitat). An improvement in the quality of ecosystems indicates an increase in benefits as a result of the implementation of a pilot HPMA.

14.3. In this IA, we have provided an indicative assessment of what it will cost to implement pilot HPMAs. We are in the process of calculating the cost more robust estimates, which we will present in the post-consultation IA in line with Green Book guidance[131] and securing the required funding. Boundaries for sites could still be refined to enable easier monitoring and enforcement and therefore the economic assessment may change. In the post-consultation IA, we will also look to include any non-financial costs.

14.4. The data and information in this IA indicate that there are many benefits of significant scale to be obtained from the implementation of pilot HPMAs, at a reasonable level of cost. We will look to refine the benefit and cost estimates to provide more robust evidence of this in the post-consultation IA.

[131] HMT Green Book. 2022. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent/the-green-book-2020

Annex A

Allonby Bay

Overall economic risk rating	
Levels of angling	Low
Levels of anchoring	Low
Levels of hotspots for UK only	Low
Levels of unique vessels for UK only	Medium
Number of pings for UK only	Medium
Levels of hotspots for non-UK only	Low
Levels of unique vessels for non-UK only	Low
Number of pings for non-UK only	Low
Average revenue dependency for all UK vessels	High
Percentage of UK vessels generating over 50% of the revenue	Medium
Average effort dependency	High
Number of UK vessels under 10m	Medium
Average dependency for UK vessels under 10m	N/A
Average effort dependency for UK vessels under 10m	N/A

Southwest offshore Brighton including Dolphin Head (now renamed as Dolphin Head)

Overall economic risk rating	
Levels of angling	Medium
Levels of anchoring	Low
Levels of hotspots for UK only	Low
Levels of unique vessels for UK only	Concerning
Number of pings for UK only	Concerning
Levels of hotspots for non-UK only	Low
Levels of unique vessels for non-UK only	High
Number of pings for non-UK only	High
Average revenue dependency for all UK vessels	Medium
Percentage of UK vessels generating over 50% of the revenue	Low
Average effort dependency	N/A
Number of UK vessels under 10m	Medium
Average dependency for UK vessels under 10m	N/A
Average effort dependency for UK vessels under 10m	N/A

Inner Silver Pit South

Overall economic risk rating	
Levels of angling	Low
Levels of anchoring	Low
Levels of hotspots for UK only	Concerning
Levels of unique vessels for UK only	Concerning
Number of pings for UK only	Concerning
Levels of hotspots for non-UK only	Medium
Levels of unique vessels for non-UK only	Medium
Number of pings for non-UK only	Medium
Average revenue dependency for all UK vessels	Medium
Percentage of UK vessels generating over 50% of the revenue	High
Average effort dependency	High
Number of UK vessels under 10m	Concerning
Average dependency for UK vessels under 10m	High
Average effort dependency for UK vessels under 10m	High

Lindisfarne

Overall economic risk rating	**Medium**
Levels of angling	Concerning
Levels of anchoring	Low
Levels of hotspots for UK only	Medium
Levels of unique vessels for UK only	High
Number of pings for UK only	Medium
Levels of hotspots for non-UK only	Medium
Levels of unique vessels for non-UK only	Medium
Number of pings for non-UK only	Medium
Average revenue dependency for all UK vessels	Low
Percentage of UK vessels generating over 50% of the revenue	High
Average effort dependency	Medium
Number of UK vessels under 10m	Concerning
Average dependency for UK vessels under 10m	Concerning
Average effort dependency for UK vessels under 10m	Medium

North-east of Farnes Deep

Overall economic risk rating	
Levels of angling	Low
Levels of anchoring	Low
Levels of hotspots for UK only	Low
Levels of unique vessels for UK only	Concerning
Number of pings for UK only	Medium
Levels of hotspots for non-UK only	Medium
Levels of unique vessels for non-UK only	Concerning
Number of pings for non-UK only	Concerning
Average revenue dependency for all UK vessels	Low
Percentage of UK vessels generating over 50% of the revenue	Low
Average effort dependency	N/A
Number of UK vessels under 10m	Medium
Average dependency for UK vessels under 10m	N/A
Average effort dependency for UK vessels under 10m	N/A

Annex B - List of acronyms

25 Year Environment Plan. https://www.gov.uk/government/publications/25-year-environment-plan
ALBs – Arms-Length Bodies
AVS – Acoustic Visual Systems (Development)
BAP – Biodiversity Action Plan
CCS – Carbon Capture and Storage
CDEL – Capital Departmental Expenditure Limit
Cefas – Centre for Environment, Fisheries and Aquaculture Science
COVID – 19 – Coronavirus Disease 2019
Defra– Department for the Environment, Food and Rural Affairs
DLUHC – Department for Level Up, Housing and Communities
EA – Environment Agency
EIA – Environmental Impact Assessment
ESVD - Ecosystem Services Valuation Database
EU – European Union
FIDGIT - Fishing Impact Decision, Guidance, and Information tool
GES – Good Environmental Status
HMT – Her Majesty's Treasury
HPMA – Highly Protected Marine Area
IA – Impact Assessment
IFCA - Inshore Fisheries and Conservation Authority
IMD – Indices of Multiple Deprivation
JNCC - Joint Nature Conservation Committee
LSOA – Local Super Output Area
LA – Local Authority
MCAA – Marine and Coastal Access Act 2009
MCZ – Marine Conservation Zone
MMO – Marine Management Organisation
MPA – Marine Protected Area
NE – Natural England
NEAFO - National Ecosystem Assessment Follow-on
NIS – Non-Indigenous Species
OPV – Offshore Patrol Vessel
OSPAR – Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
PV – Present Value
R&D – Research and Development
RDEL – Resource Departmental Expenditure Limit
RPC – Regulatory Policy Committee
RYA – Royal Yachting Association
SAC – Special Area of Conservation
SAMBA - Small and Micro Business Impact Assessment
SDG – Sustainable Development Goals
SNCB – Statutory Nature Conservation Body (collective term for Natural England and the Joint Nature Conservation Committee)
SPA - Special Protection Area
SSSI – Site of Special Scientific Interest
UK – United Kingdom
UKMS – UK Marine Strategy
USD – United States Dollar
VMS – Vessel Monitoring System, used to track the location of vessels