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LIFE Recreation ReMEDIES Behaviour Change Project:

Understanding the behavioural context

Appendices

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Action C1: Changing Stakeholder Behaviour Project

LIFE Recreation ReMEDIES Behaviour Change Project

Understanding the behavioural context – Appendices to the Evidence report

Collingwood Environmental Planning (CEP) in partnership with the University of Plymouth and Plymouth Marine Laboratory

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LIFE 18 NAT/UK/000039 Reducing and Mitigating Erosion and Disturbance Impacts affecting the Seabed (ReMEDIES) project

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List of abbreviations

AMS	Advanced Mooring Systems
ANOVA	Analysis of variance
COM-B system	Framework for behaviour change. Three essential conditions for behaviour change: capability, opportunity, motivation
EMS	European Marine Site
ESA	Ecologically Sensitive Area
ESA	Environmentally Sensitive Area
IFCA	Inshore Fisheries and Conservation Authorities
JWEG	Joint Water Evidence Group
MCS	Marine Conservation Society
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Marine Protected Area
NE	Natural England
NRW	Natural Resources Wales
OCT	Ocean Conservation Trust
PCC	Plymouth City Council
PICO	Population, Intervention, Comparators, Outcomes
QHM	Queen's Harbour Master
ReMEDIES	Reducing and mitigating erosion and disturbance impacts affecting the seabed
RYA	Royal Yachting Association
RQ	Research question
SAC	Special Area of Conservation
SIP	Site Improvement Plan
SPA	Special Protected Area
TPB	Theory of Planned Behaviour
UK	United Kingdom
US/USA	United States of America
VNAZ	Voluntary No Anchor Zone
WTP	Willingness to Pay

Appendix 1: Literature review

Introduction

This note summarises the findings of the literature review on understanding the behavioural context, of recreational boating behaviours in relation to anchoring and mooring in seagrass, drawing on existing studies and literature. The review seeks to inform the following research questions:

1. What are the behaviours of recreational boaters in relation to anchoring and mooring that cause seagrass damage generally and specifically at each of the two test sites? What is the frequency and nature of those behaviours?
2. To what extent are these behaviours related to types of recreational boaters (in terms of attitudes, values and a range of other factors), types of boat generally and specifically at each of the two test sites?
3. Approaches to changing anchoring and mooring behaviours of recreational boaters
   3.1 What approaches to changing the anchoring and mooring behaviours of recreational boaters have been effective (or not), generally and specifically at each of the two test sites?
   3.2 What approaches to changing the anchoring and mooring behaviours of recreational boaters have been developed but not yet tested?
4. What are the barriers and facilitators to boaters (in particular, different types of recreational boaters) taking action at each site? To what extent are these related to capability, opportunity and motivation?

This note firstly summarises the method for the literature review, then presents the findings organised by research question, followed by a summary of the key findings and references.

Method

To further clarify the research questions we used the PICO approach (Collins and others, 2015) which details which population is to be studied (recreational boaters), what the intervention is that we are looking at (behaviour change), what comparators we are interested in (e.g. different interventions, different characteristics of boaters), and what outcomes we are investigating (e.g. insights for future behaviour change interventions). The literature review drew on 3 potential source locations:

- Report and studies identified by the Natural England ReMEDIES steering group.
- An advanced Scopus search to identify key academic papers on recreational boating behaviours and seagrass including 2015 onwards, supplemented by citations and references search on key papers of relevance (See Appendix 1a Scopus Search Protocol) Scopus was used as it is an academically respected database with high quality, breadth and reliability of sources and it is internationally recognised.
- Search in Google to identify other relevant sources e.g. grey literature.

The papers were prioritised in terms of relevance to the research questions (and overall quality[1]) and those assessed as most relevant were reviewed in full. Data was extracted into an Excel spreadsheet, and analysed in relation to the four research questions.

Findings

Overview of evidence

Overall, there did not appear to be a lot of available literature on behaviour change of recreational boaters for the protection of seagrass. A total of 32 documents were reviewed, with a total of 26 of these being included in this report[2]. This included literature provided by the ReMEDIES project, academic peer reviewed literature resulting from a search in Scopus, and additional grey literature identified from a further search in Google. Of the final list of literature that was included in the review, 12 documents were peer reviewed papers, eight were grey literature such as policy reports, and six were other grey literature sources such as webpages and information leaflets.

Key themes of the literature reviewed included:

- Understanding damage to seagrass caused by boating activities such as anchoring and mooring (Unsworth and others, 2017; Griffiths and others, 2017; Kelly and others, 2019; La Manna and others, 2015; Sagerman and others, 2020; Ouisse and others, 2020; Glasby and West, 2018).
- Assessing different mitigation and management interventions for the protection of seagrass beds and marine environments (Griffiths and others, 2017; Plymouth City Council, 2019; Lathrop and others, 2017; Barry and others, 2020).
- Understanding links between behaviour change and environmental conservation (Valauri-Orton, 2018; Rare and The Behavioural Insights Team, 2019).
- Understanding the potential for and responses to alternative environmentally friendly mooring systems/eco-moorings, now rebranded as Advanced Mooring Systems (AMS)[3] (Parry-Wilson and others, 2019; Amec Foster Wheeler, 2017; Maclennan, 2020; Diedrich and others, 2013; Luff and others, 2019).
- Measuring recreational use of marine environments to inform marine management (Langmead and others, 2017; Venturini and others, 2018).

[1] Documents were assessed by whether or not they were peer reviewed and the overall quality of paper was based on the expert judgement of team members as to whether or not a paper was of sufficient quality to be part of the review. For example, if the document was produced for government or their agencies it is assumed that the process has been rigorous.

[2] Six documents were reviewed but not included in this summary note as were deemed not relevant to the research questions.

[3] The terms eco-moorings, environmentally friendly moorings, conservation moorings and Advanced Mooring Systems (AMS) describe the same thing and can be used interchangeably. Under the LIFE ReMEDIES project the term Advanced Mooring Systems (AMS) has been chosen to include moorings referred to by these other terms (Maclennan, 2020). Therefore, this report will refer to all as AMS (unless quoting a source that uses a different name).

RQ1: What are the behaviours of recreational boaters in relation to anchoring and mooring that cause seagrass damage generally and specifically at each of the two test sites? What is the frequency and nature of those behaviours?

Recreational boating behaviours including anchoring and use of traditional swing moorings have been found to cause significant physical damage to seagrass[4] and restrict its recovery, which can have a number of deleterious ecological consequences (Parry-Wilson and others, 2019; Luff and others, 2019; Sagerman and others, 2020). These long-lasting impacts are caused by direct regular physical disturbance such as sediment erosion, and partial or total destruction of the seagrass cover (see Jackson and others, 2013 cited by Ouisse and others, 2020). For example, damage to seagrass can be caused at all three stages of an anchor cycle; anchoring of vessels is known to cause damage by the drag of the anchor through the seabed, but damage can also be caused during anchor drop and retrieval (Parry-Wilson and others, 2019; Amec Foster Wheeler, 2017). The amount of damage caused to the bed depends on the type of anchor or weight that is used (Griffiths and others, 2017; Amec Foster Wheeler, 2017).

Mooring is often seen as a way to mitigate damage from individual anchoring, however the most commonly used traditional swing mooring consisting of ground weight, ground chain, riser chain and floating buoy can also damage benthic habitats by causing scouring to the underlying seabed (Griffiths and others, 2017; Amec Foster Wheeler, 2017). This damage can be caused when tide and wind movements cause the chain to swing in a circular motion around the ground weight (Parry-Wilson and others, 2019; Unsworth and others, 2017; Ouisse and others, 2020). This can lead to the creation of "*mooring scars*" (p.1), circular areas of bare ground surrounding the mooring, which can be seen in satellite imagery (Luff and others, 2019). Damage from traditional mooring methods can also occur when the main anchoring blocks and chains are renewed or raised and lowered for inspection (Amec Foster Wheeler, 2017). While impacts from mooring infrastructure has been widely studied, few studies have been carried out in areas of increased tidal fluctuation, like those seen in the UK (Luff and others, 2019).

Anchors thrown from individual boats are considered to be more damaging to habitats than fixed moorings since although they may not have the same length of anchor chain, or duration of scarring, they are potentially thrown repeatedly and frequently from various locations therefore damaging multiple smaller areas of sensitive habitats (such as seagrass beds) with potentially longer lasting effects (Milazzo and others, 2004, in Amec Foster Wheeler, 2017). Anchor chains can cut and uproot seagrass as boats rotate with changing winds and the ebb and flow of tides (Kelly and others, 2019). A US study estimates that between 25%-41% of eelgrass in Richardson Bay (in San Francisco Bay) has been lost because of illegally anchored boats (boats that are anchored in beds throughout the year and serve as homes) (Kelly and others, 2019). These "*anchor-out boats"* (p.24) can cause up to 3 ha of damage to eelgrass (Kelly and others, 2019).

[4] Seagrass is an umbrella term; there are four species of seagrass in the UK, two are eelgrass species and two are tasselweed species. (https://www.wildlifetrusts.org/habitats/marine/seagrass). Tasselweed is found in freshwater. In this report, we are using the term "seagrass" as a general term to cover the range of varieties reported on in the studies reviewed, which include studies from the Florida, Greece as well as the UK. We recognise that there are a number of different species around the world that are referred to generically as "seagrass".

Fixed moorings aim to minimise anchoring impacts to seagrass by anchoring on a single point and limiting any habitat damage to a fixed area (Amec Foster Wheeler, 2017; Diedrich and others, 2013). Trot moorings or "*fore and aft*" moorings can also minimise damage to seabed per boat (Amec Foster Wheeler, 2017). Although fixed moorings are often seen as a way to mitigate the harmful effects of anchoring behaviours, Unsworth and others (2017) demonstrate the significant impact that swinging chain moorings have on the globally important seagrass species *Zostera marina*. Across multiple UK sites, *Z. marina* is damaged by swing chain moorings leading to a loss of at least 6 ha of UK seagrass and the associated fragmentation of at least nine significant meadows (Unsworth and others, 2017). Unsworth and others (2017) conclude that this loss of UK seagrass from boat moorings is small but significant at local scale; fragmenting existing meadows reduces their resilience to other stressors such as eutrophication (Unsworth and others, 2015; Maxwell and others, 2016 cited by Unsworth and others, 2017) and reduces the extensive ecosystem service value of seagrass including carbon storage, invertebrate biodiversity, and fish habitat (Frost and others, 1999; Lilley and Unsworth, 2014; Macreadie and others, 2015 cited by Unsworth and others, 2017). Although the impact of swinging chain moorings is found to be limited to the immediate area and does not translate to meadow scale, an abundance of moorings, as seen at sites containing seagrass throughout the UK, can lead to significant loss of habitat and ultimately ecosystem function (Unsworth and others, 2017). It was reported at a stakeholder workshop that 35 traditional moorings can remove up to the total area of a football pitch of seagrass due to scouring (Maclennan, 2020).

Boating-related damage to seagrass can also be attributed to propellers, the construction of marinas, and the shading from jetties or floating docks (Glasby and West, 2018). Similar to anchoring, propellers can cause physical damage to seagrass that is not spatially restricted (Glasby and West, 2018).

Plymouth

A scoping study of recreational use within the Plymouth Sound and Estuaries European Marine Site (EMS) found that anchoring events related to a number of different activities (Langmead and others, 2017). For example, this included sub-aqua diving, sailing yachts, motor yachts and angling from a vessel. There were clear hotspots of anchoring activity at the Plymouth Breakwater and off Fort Bovisand, with other key areas along the coastline to the north and south of Kingsand, Barnpool, off Cremyl and at West Mud, to the north and east of Drake's Island and off the seafront along the Hoe (Langmead and others, 2017).

Seasonal anchoring activity was concentrated at the same sites within the Plymouth Sound and Estuaries EMS as on the annual map, but the intensity at some sites varied by season (Langmead and others, 2017). For example, the Plymouth Breakwater is used throughout the year, as is the site off Bovisand. In summer, high intensity of anchoring at Kingsand/Cawsand Bay was reported which was much less during autumn, spring and winter (Langmead and others, 2017). Alternatively some sites, such as in the lower Tamar (West Mud and off Cremyll) and at Barnpool and off the Plymouth Waterfront and north of Drake's island, are used more in winter months (Langmead and others, 2017). This is apparently because of the use of these sites as a weather refuge for boat-based anglers (including charter vessels). Asia Shoal, to the southeast of Drake's Island, is a popular anchoring site in all seasons apart from winter, again this is presumed to be driven by anglers (Langmead and others, 2017). Overnight anchoring was reported to take place at Kingsand/Cawsand Bay, Barnpool, in Millbrook Lake, in the Lynher near Sheviock and at St Germans Quay and at Calstock in the upper Tamar (Langmead and others, 2017).

This short literature review did not identify any specific documented evidence on damaging behaviours of recreational boaters in relation to mooring for this location, however this was a short, focused review (see Appendix 1a Search Protocol for search limits) and this does not mean that there is no evidence of damage in this area.

The Solent Maritime – Isle of Wight

This short literature review did not identify any specific documented evidence on damaging behaviours of recreational boaters in relation to anchoring and mooring for this location, however this was a short, focused review (see Appendix 1a Search Protocol for search limits) and this does not mean that there is no evidence of damage in this area.

RQ2: To what extent are these behaviours related to types of recreational boaters (in terms of attitudes, values and a range of other factors) and types of boat, generally and specifically at each of the two test sites?

Understanding the extent to which the behaviours that cause damage to seagrass relate to different types of recreational boater or boat type offers the potential to enable interventions to be better designed and targeted, for example through tailored messaging and/or dissemination channels to reach particular sub-groups. As Barry and others (2020) report "*not all boaters are the same*" (p.2) and taking a social marketing type approach can enable a focus on sub-groups where research shows certain characteristics may present particular opportunities or constraints to adopting a new behaviour. This review has identified no studies which have boater differentiation (or segmentation) as a central focus. There is some limited evidence from four papers to suggest that some attitudes and behaviours of the recreational boating community in relation to seagrass can be related to different types of boater (for example, experience levels, frequency of boating), as well as boat types. The limited evidence draws on studies in the UK, France and US and includes those looking specifically at anchoring and mooring in seagrass, as well as studies examining behaviours related to propeller scarring in seagrass. It is noted that contexts may vary between studies which could affect the transferability of the findings.

Types of boater

In a UK study of recreational boaters in Torbay, those using the anchorages around the Marine Conservation Zone were found to be predominantly "*male local or regional powerboat owners without membership to any local or national boating groups, and that could be reached through local harbours, mooring providers or more widely through local businesses including cafes, retailers or public houses*" (Parry-Wilson and others 2019, p.11).

In a US study to evaluate the effectiveness of different interventions (an education campaign and navigational buoys) focused on reducing seagrass propeller scarring by recreational boaters in Florida, Barry and others (2020) found that the recreational boating audience could be segmented by factors such as experience level to better target educational messages in future seagrass protection efforts (Barry and others, 2020). The study found that boaters with at least 4.5 years of experience tended to rate seagrass scarring as more of an issue than boaters with less experience. More experienced boater groups were also further sub-divided where those that signed an optional pledge (part of the educational campaign evaluated) to protect seagrass were more likely to rate seagrass scarring as more of an issue compared with those that did not sign the pledge. Of the less experienced boaters, those who recalled viewing the education materials (only a small subset) were more likely to rate seagrass scarring as an important issue, however, inexperienced boaters who did

not recall seeing information had the lowest average rating across all the sub-samples. The study also found that more frequent boaters were more likely to have scarred seagrass in the last year regardless of experience level. However, no evidence was found to suggest that activity type (e.g. fishing, scalloping, etc) was a significant segmentation factor, although it has been reported in other studies that primary activity can be influential (Lloret and others, 2008 cited in Barry and others, 2020). The Barry and others (2020) study found that almost all of the boaters surveyed, regardless of experience levels of other factors, rated seagrass as important or extremely important. The main reasons for why seagrass is important included the provision of habitat for fish and wildlife, its natural part of the estuarine ecosystem, and conserving nature is the right thing to do (Barry and others, 2020).

In a US study of illegal "*anchor-out boats*" (p.24) in the San Francisco Bay area the demographics of anchor-outs (ie boats that are anchored in the bed all year and serve as a home) included "*artists, anglers, disabled individuals, and many who are unable to afford Bay-area rental prices*" (Fimrite 2017, in Kelly and others, 2019).

Types of boat

The behaviours of recreational boaters have been found to differ according to type of boat (e.g. sailboat, powerboat, deck/pontoon boat) as well as boat length.

For example, in a study to assess behavioural response to an Advanced Mooring System (AMS) trial in Torbay, UK, Parry-Wilson and others (2019) found that a higher percentage of sailboats compared to powerboats used the trial AMS. This was suggested to be in part due to potential greater awareness among sailors (e.g. through exposure to RYA education courses), and also security reasons related to the deeper water required to accommodate the keels of sailboats given they were on average longer than most of the powerboats recorded at the sites and that the trial AMS was situated 50m from the shoreline (Parry-Wilson and others, 2019).

In a US study to evaluate the effectiveness of different interventions on recreational boaters' behaviours, both larger boats (>21 ft) and deck/pontoon boats were more likely to slow down at greater distances away from navigational seagrass warning buoys (Barry and others, 2020). Additionally, both before and after buoy placement, deck/pontoon boats were more likely to approach at slower overall speeds, and boaters who slowed down at greater distances were more likely to trim up their motors (which avoids propeller damage to the seagrass or stirring up the seabed) (Barry and others, 2020).

The size range of vessels, depth and maintenance of boat mooring can also modify the impact of mooring on seagrass bed (Glasby and West, 2018, in Ouisse and others, 2020). In a study on swinging boat moorings in Dinard (Brittany, France), most of the moorings were found to be used by boats under 8m in length (Ouisse and others, 2020).

RQ3. Approaches to changing anchoring and mooring behaviours of recreational boaters: RQ3.1 What approaches to changing the anchoring and mooring behaviours of recreational boaters have been effective (or not), generally and specifically at each of the two test sites?

Effectiveness of different approaches

Installation of Advanced Mooring Systems (AMS)

AMS avoid or limit the physical pressures on marine habitats, including seagrass, caused by anchors and traditional swing moorings (Amec Foster Wheeler, 2017). AMS designs are being tested in seagrass regions globally, with leading studies currently happening in Australia (see Egerton, 2011; Outerbridge, 2013 both cited by Parry-Wilson and others, 2019). Various designs of AMS (or 'environmentally friendly moorings' or 'eco-moorings') exist but generally all feature either a ground weight or sediment penetrating system and a method to eliminate or reduce chain abrasion on the seabed using bungees, riser buoys, floating rodes and other creative options (Luff and others, 2019; Parry-Wilson and others, 2019). Examples of frequently used AMS include the Ezyrider design and the Seaflex system; according to Luff and others (2019) trials of AMS in the UK typically involve Seaflex moorings, due to Seaflex already being an established UK provider and because of the design's reported ability to endure variable tidal conditions. However according to the RYA website only three Seaflex systems are in use/being trialled in the UK (RYA, n.d.). Other types of AMS currently deployed in the UK include the modified Hazelett system, Stirling Mooring system, and helical mooring system (RYA, n.d.) The UK experience of AMS technology is considered between 'tested' and 'proven' on a rough scale of 'tested', 'proven', 'established', and 'widely used' (Amec Foster Wheeler, 2017). Due to the differences in tidal range between the UK and Australia, as well as limited UK-based testing, uncertainty as to whether AMS could be effective in the UK is reported in the reviewed literature (Parry-Wilson and others, 2019). Trials of Seaflex mooring, for example, have had mixed results at different locations in the UK, emphasising the need for condition-specific AMS specifically designed for use in areas with a high tidal range like the UK (Luff and others, 2019).

Luff and others (2019) reports that advanced mooring trials in Salcombe have shown that removing or floating the chain from a mooring can significantly reduce scouring. Although removing the concrete block was not found to lead to a significant additional reduction in impact.

AMS have also become established in the US (RYA, n.d.). One Massachusetts study concluded that conservation moorings can reduce impacts to seagrass; where AMS failed to reduce impacts this was due to poor design, owners changing back to chain, the build-up of debris/decaying organic matter affecting regrowth of seagrass or fundamental sediment changes due to long term scarring and poor maintenance (fouling and sinking, weathering) (Maclennan, 2020). Apart from owners changing back to chain moorings, the failures described here are not related directly to anchoring and mooring behaviours per se which suggests other more material factors e.g. maintenance of moorings are also needed to be taken into consideration when assessing the success or otherwise of behaviour change approaches to seagrass conservation.

In a review of AMS experience, it was found that they are a possible management measure for MPAs but that evidence is not yet sufficient to assess their suitability for all potential UK marine environments (Amec Foster Wheeler, 2017). The review found that a number of UK site trials have been carried out specifically to protect sensitive marine habitats and species, with AMS deployed as both mooring systems and as markers for Voluntary No Anchoring Zones (VNAZ) (Amec Foster Wheeler, 2017). So far, the focus on trials had been primarily on the effectiveness in achieving

environmental objectives rather than assessment of overall feasibility of a wider AMS deployment strategy (Amec Foster Wheeler, 2017).

Parry-Wilson and others (2019) assessed the social and behavioural responses of recreational boaters to a trial AMS (see Figure A 1) through mapping of boating activity pre- and post- deployment of the AMS, and through structured questionnaires both in-situ and online to local and national audiences respectively. The trial AMS were deployed in Torbay, Devon, UK, in an area where no moorings previously existed (Parry-Wilson and others, 2019). The authors estimate that an additional 20% of anchoring events were alleviated through the deployment of these AMS, subsequently reducing the pressure on the seagrass bed (Parry-Wilson and others, 2019). It was also found that 89.6% of in-situ questionnaire respondents reacted positively to the prospect of further AMS being deployed locally, scoring their confidence in the AMS' reliability significantly higher than the online respondents who did not have a visual or verbal description of its configuration (Parry-Wilson and others, 2019).

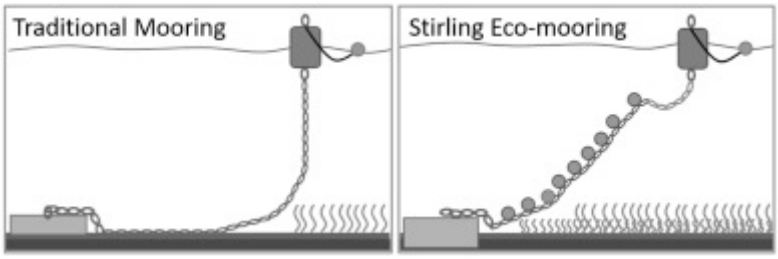

Figure A 1: Diagram showing a traditional swing mooring (left) and the National Marine Aquarium's Stirling Eco-mooring (right). The Eco-mooring has buoys along the riser chain keeping it off the seabed and double the tonnage of a standard ground weight. Image adapted from one provided by the National Marine Aquarium. Source: Parry-Wilson and others, 2019. Crown Copyright © 2019 Published by Elsevier Ltd. All rights reserved. Reproduced with permission.

The successful implementation of seagrass friendly AMS is dependent on their social acceptance and widespread adoption (Egerton, 2011 cited by Parry-Wilson and others, 2019). Despite expressing a general welcome to the prospect of the AMS in the questionnaires, in the face of an opportunity to attach to an AMS upon entering the study site (Fishcombe Cove), over half of the on-site respondents were still recorded anchoring. However, the authors explain that this appears to be connected to a lack of awareness of the free public use of the AMS (Parry-Wilson and others, 2019). Parry-Wilson and others (2019) found that monetary incentives to use AMS were appealing to the boaters who responded to their questionnaire. They also found that the majority of respondents generally preferred mooring (any specification) a vessel to anchoring (74.6% and 82.8% of in situ and online respondents respectively). Therefore, this suggests that providing an AMS option in sensitive seagrass sites around the UK could help alleviate anchor damage. Additionally, over half of respondents indicated an awareness of seagrass presence prior to anchoring their vessel and/or hesitance to cease visiting preferential anchoring sites (sheltered bays) (see VNAZ) (Parry-Wilson and others, 2019). Overall the Parry-Wilson and others study demonstrated that the deployment of this particular type of AMS (Stirling eco-mooring, figure 1) can be socially accepted when trialled in situ, with strong potential for social acceptance within the national recreational boating community as evidenced by the online responses.

Support among recreational boaters for the use of mooring buoys over anchoring has also been shown in other studies. For example, in a survey of recreational boaters in a heavily used bay on the island of Mallorca, Spain, where an endemic seagrass (*Posidonia oceanica*) is found, 75% of the total sample perceived they would be more likely to use buoys if they were available and more were

willing to pay for their use than not (8%) (Diedrich and others, 2013). Monitoring of recreational boating activity in Portofino MPA, Italy, showed good social acceptance of advanced mooring systems by recreational boaters as the San Fruttuoso fee-paying AMS area was one of the most visited sectors in the MPA, despite the option to anchor/moor for free in other sectors (Venturini and others, 2018).

There is uncertainty in the UK around the number of AMS available to recreational boaters; according to an MMO report, recreational users would struggle to find up to date information online about available AMS (MMO, unpublished). An example of information found online about AMS is the RYA website, which as of September 2019 apparently listed six locations as having AMS (referred to as environmentally-friendly moorings) (MMO, unpublished). These included: Fishcombe Cove Torbay, Salcombe Harbour, Cawsand Bay, Helford River, Calstock (River Tamar) and Lundy Island (RYA, 2019 cited by MMO, unpublished). However, according to the MMO, most of these are no longer in the water (MMO, unpublished).

Implementing anchoring restrictions/Voluntary No-anchor Zones (VNAZ)

La Manna and others (2015) evaluate the effectiveness of traditional mooring systems and anchoring park regulations at preserving seagrass and mitigating the mechanical damage caused by boat anchoring. They found that mooring fields (where anchoring is only permitted via buoys which use traditional mooring systems) and anchoring restrictions did not appear to be efficient systems for the protection of seagrass, in fact anchor scars increased after the tourist season (La Manna and others, 2015). This inefficiency is suggested to be due to strong wave action or misuse of moorings that cause the dump weights to become dislodged, affecting the surrounding areas of the meadow (La Manna and others, 2015). It's worth noting that the paper does not explain what it means by "*misuse of moorings*" (p. 164). The study does suggest a number of management actions that include:

- Free anchoring zones where seagrass isn't present.
- Limiting the number of boats permitted to access the park based on capacity of mooring buoys.
- Replacement of traditional moorings with "'*seagrass-friendly' systems*" (p.165).
- Education programmes containing awareness actions about the importance of seagrass habitats.
- Considering the general inobservance of restrictions on anchoring, local surveillance should be implemented in addition to employing video technologies and closer co-operation with law enforcement (La Manna and others, 2015).

Parry-Wilson and others (2019) found that on-site questionnaire respondents gave mixed opinions about the VNAZ in Torbay, Devon. Over half of respondents provided uncertain or negative comments towards them. The author suggests this could be due to boaters' preference to continue visiting particular sites around Torbay without restrictions (Parry-Wilson and others, 2019). It also reflects findings of research conducted in Studland Bay, Dorset, where VNAZ had previously been implemented. Half of the respondents were unwilling to relocate within Studland bay to avoid anchoring in seagrass (see Lloyd and Marsland, 2013 cited by Parry-Wilson and others, 2019). This resistance to behaviour change suggests a need for alternative methods of management to alleviate anchoring and swing mooring damage to seagrass (Parry-Wilson and others, 2019). Further work to understand what other barriers at the individual (e.g. habits), social (e.g. wanting to go to the place considered the prettiest bay) or material (e.g. lack of adequate signage or information on maps) need to be investigated in order to develop those alternative methods. Interestingly, research looking at boat numbers in Studland Bay after the implementing of the VNAZ did show a decrease in boats anchoring in the VNAZ. The authors say that "*These results are believed to be a reflection of an*

increased acceptance and awareness of the VNAZ project among boat users but also as the VNAZ remained intact for most of 2011 making it easier to identify the zone (N.B. the VNAZ marker buoys moved or disappeared on a number of occasions in 2010 but only once (mooring rope believed to have been cut) in 2011)." p. 35 What is clear is the need for more data on both attitudes and values as well as actual behaviours.

Navigational aids

A study to evaluate the effectiveness of interventions for reducing seagrass propeller scarring by recreational boaters in Florida (US), found that the installation of warning buoys to address a potential barrier of a lack of adequate navigational skill/navigational markers was found to elicit *"a clear behavioral improvement across a broad cross-section of boaters*" (p1), with boaters found to slow down at significantly greater distance away after the buoy placement and to trim their motors (Barry and others 2020). The buoys were installed near shallow seagrass beds and showed the message *"CAUTION SEAGRASS AREA"* (p.3), as well as the standard maritime symbol for a hazard warning and were visible above the water (see Figure 2). The area the buoys were installed in remained open to boats and there were no speed restrictions or other regulatory meanings associated with the warning buoys. Observation data on boater behaviour pre- and post- buoy installation showed that following buoy placement, the percentage of boaters slowing down at 200m out increased significantly (15% increase in boaters slowing down far away) and the percentage of boaters who slowed down at less than 100m or who did not slow down until reaching decreased significantly (12% decrease in boaters slowing down close by) (Barry and others 2020). Interestingly, no comment is made on the nature of the relationship between these reductions in speed and improvements in seagrass condition. Further work would be needed to understand the optimum behaviour change needed to prevent seagrass damage from boats.

Figure A 2 Source: Barry and others, 2020. © 2020 Barry and others, reproduced under license CC BY-NC-ND 4.0.

Educational outreach and targeted behaviour change campaigns

Measures to protect seagrass habitats from the negative impacts of anchoring are often generally designed around the installation of AMS but environmental awareness and educational programmes for recreational boaters can also be important for mitigation (Venturini and others, 2018). Management programmes designed to educate the public and prevent physical damage to seagrass beds by propeller scarring have been in effect for more than two decades (see Sargent and others, 1995 cited by Barry and others, 2020). Parry-Wilson and others (2019) highlight that, alongside the installation of AMS, additional measures to improve local knowledge of the presence of and need to use AMS should be considered as an option to alleviate pressures on seagrass from traditional swing mooring scour and anchor damage.

However, some of the reviewed literature highlighted that despite significant investments in boater education programmes, these programmes have had limited success in motivating behaviour change (Valauri-Orton, 2018). Lathrop and others (2017) assess the effectiveness of designated ecologically sensitive areas (ESAs) to protect seagrass damage from boating activities by mapping two indicators of boating usage and impact (concentrations of boating activity (either moored or in transit) and damage caused by boats to submerged aquatic vegetation habitats) using visual interpretation of high-spatial-resolution aerial photography. Their results suggested that although efforts to promote green boating practices to the recreational boating community via public service announcements and an online interactive map of the ESAs have continued, "*messaging alone is insufficient*" (Lathrop and others, 2017, p.285). Notably, the lack of signage along boundaries made it difficult for boaters to judge when they were within the ESA or other special management zones (Lathrop and others, 2017). Barry and others (2020) state that "*environmental education approaches have also been frequently applied with mixed results in attempts to influence boater behaviours in regard to propeller scarring of seagrass beds (Morris, 2004; FDEP, 2004;)*p. 2. They don't elaborate on the types of environmental education approaches but contrast it to approaches that target different groups of boaters and aim to reduce barriers to change.

Barry and others (2020) assessed the effectiveness of two separate interventions, one education-based[5] and the other cue-based (navigational aids), on reducing propeller scarring of seagrass by recreational boaters in Florida, USA. The navigational aids produced clear behavioural improvements across a broad cross-section of boaters (see above section on navigational aids), while the educational intervention appeared to have very minimal effects on boaters' behaviours (Barry and others, 2020). Overall, in the post-intervention survey, boaters who remembered seeing educational information about preventing propeller scarring were more likely to rate scarring as a problem, but the overall number of boaters who recalled seeing this information was low and did not significantly increase after the campaign (only 4% increase) (Barry and others, 2020). Interestingly, of the small percentage of boaters who did recall information in the post-intervention surveys, 41% specifically recalled campaign materials such as boat ramp signs, social media, or stickers as the information source (Barry and others, 2020). Nonetheless research in Chesapeake Bay (US) has shown that educational outreach can sometimes contribute to successful behavioural management (see Orth and others, 2017 cited by Barry and others, 2020). Given critiques of the information deficit model this is not unsurprising but it is important to note that information does still have a role to play as part of behaviour change processes. In this case, aerial monitoring showed general compliance with new management regulations, which suggests that the open discussions between scientists, natural resource managers, and the public had resulted in increased understanding of the impact of commercial boating activities (Orth and others, 2017 cited by Barry and others, 2020). This suggests a role for community-based strategies that involve cooperation with the public (Barry and others, 2020).

Through a review of peer-reviewed literature and interviews with boater outreach experts, Valauri-Orton (2018) identify trends, best practice and pitfalls relating to boater behaviour change

[5] Educational campaign materials included boat ramp signage, social media graphics, a website with YouTube videos, slides for public lectures, online fact sheets, stickers, phone cases, and flyers. The materials were distributed through a variety of methods including direct contact at boat ramps, providing flyers and stickers to hotels and boat rental locations, public presentations, social media and website promotion, and publishing online blogs and magazine articles (Barry and others, 2020).

campaigns. For example, one downfall of educational outreach materials is that they are usually focused on "*filling a perceived knowledge gap*" (p. 4) and therefore often assume that the reason boaters damage seagrass is due to a lack of knowledge about the properties of seagrass and how to properly boat around seagrass (Valauri-Orton, 2018).[6] There is research to suggest, however, that no direct relationship between environmental knowledge and pro-environmental behaviour exists (see Kollmuss & Agyeman, 2002 cited by Valauri-Orton, 2018). Therefore, the assumptions that anti-environment behaviour signifies a knowledge gap, and that filling that knowledge gap will lead to pro-environment behaviour, are not supported (Valauri-Orton, 2018). Along with false assumptions about a knowledge gap, some campaigns have also assumed that anti-environmental boating behaviours are due to boaters lacking the necessary tools to behave in a pro-environmental way (Valauri-Orton, 2018).

According to Valauri-Orton (2018) there is a lack of a comprehensive record of how behaviour change outreach has been conducted, however some studies have identified which sources of information boaters trust to learn about the marine environment and appropriate boating behaviour. For example, newspaper articles, magazines, newsletters and pamphlets were found to be the most effective tools (Valauri-Orton, 2018). Resource intensive educational videos, conferences, and meetings, often employed by environmental groups, were noted to be "*least effective in getting respondents to take action*" (see Jensen, 2010 cited by Valauri-Orton, 2018, p. 5). The review also found evidence that communication materials that promote fear and negative messaging as a tool for changing boater behaviour were least effective (Valauri-Orton, 2018). The importance of achieving a simple design for messaging communications was also recognised. For example, a survey that asked boaters to assess the efficacy of different signs to reduce the transport of invasive aquatic species found that respondents preferred the concise clear message of "*Stop Aquatic Hitchhikers*" and found the message "*Be a Hero – Transport Zero*" and similar messages confusing (Valauri-Orton, 2018, p.7).

Emerging recommendations

This section presents an overview of emerging recommendations (not necessarily tested and evaluated) identified in the literature reviewed, such as, best practice behaviours in anchoring and mooring, the use of multiple interventions, targeted behavioural approaches, and focusing on easy wins.

Best practice behaviours in anchoring and mooring

The Green Blue and RYA have developed best practice guidance for recreational boaters on *"Anchoring With Care"* to help mitigate the impacts on sensitive seabed habitats such as seagrass (see Box 1). As part of the ReMEDIES project, The Green Blue and RYA are working to help promote awareness of the 'anchoring with care' guidance.

[6] This is known as the "information deficit model" and is well recognised in behaviour change literature.

Box 1: The Green Blue Guidance on Anchoring with Care

Anchoring With Care[7]

WHAT CAN YOU DO?

Make sure that anchoring causes as little damage as possible to the seabed by following four simple steps:

1. Choose an anchorage away from the most sensitive areas wherever possible (e.g. away from seagrass, reefs, shellfish beds, etc.).
2. Deploy your anchor correctly to avoid drag:
    - Use the appropriate length of chain and warp to help reduce scouring of the seabed;
    - If your anchor is dragging, raise it and re-anchor; and
    - If it continues to drag, choose a different anchorage.
3. Even if you think the anchor is holding well, check it periodically to make sure it is not dragging.
4. Raise your anchor correctly when leaving:
    - Check to see how the boat is lying;
    - If the boat is pulling back away from the anchor, you may need to slowly motor towards the anchor as the crew pulls in the slack and raises the anchor;
    - Good crew communication is essential to avoid overrunning and fouling the prop; and
    - Bring the anchor and line on-board, and stow it away ready for immediate redeployment.

What else can you do to help?

It is also important to plan your approach with care to avoid damaging your boat, your pride and the seabed!

1. Know your depth and draft – smaller craft can reach shallower areas.
2. Check the tides – if in doubt slow down and use extra caution when boating on a low tide.
3. If you run into a seagrass flat, you will leave a sediment trail behind your boat, making the water murky and probably cutting seagrass fronds or roots. Stop immediately and lift your engine. Paddle away until clear. Never use your engine to force your way through, it will damage the seagrass and your engine!
4. If you run aground on seagrass, wait for the tide to lift you off again. Excessive use of the throttle in an effort to shift the boat will cause significant damage to the seagrass.

At a ReMEDIES project partner meeting held in June 2020, participants (partners of the project) were asked to select the most important behaviours to mitigate impacts of anchoring and mooring on seagrass at the project pilot sites, from a list compiled from RYA sources[8]. The results are presented in Table A 1: the last column indicates the % of vote for each behaviour (participants were able to select more than one) (total submission received = 11). The top scoring 'most important' behaviours were 'Anchor away from sensitive habitats' and 'Use an Advanced Mooring System', followed by 'Avoiding anchoring'. This will be used to input to the focus for the rest of the project.

[7] https://thegreenblue.org.uk/you-your-boat/info-advice/wildlife-habitats/anchoring-with-care/

[8] These behaviours are shared in RYA courses already (however, not all recreational boaters are members of the RYA; of those that are, they will not all have been on one of these courses; and of those that have, we do not know whether they are putting these behaviours into practice (e.g. they may not know where sensitive habitats are and how to avoid them)).

Table A 1 Summary of most important behaviours related to mitigating impacts of anchoring and mooring at ReMEDIES pilot sites as perceived by project partners

Behaviour	% of the vote
Anchor away from sensitive habitats (e.g. seagrass, reefs, shellfish beds)	100
Use an Advanced Mooring System / Environmentally Friendly Mooring / Eco Mooring	100
Avoid anchoring – use sites with existing moorings, marinas, harbours or pontoons	64
Use designated slipways to land and launch your boat to avoid the hull, your feet and trailer wheels coming into direct contact with sensitive habitats	36
Use the appropriate length of chain and warp when deploying your anchor	27
When raising your anchor, pull the chain in slowly and move the bow of the boat towards the anchor until it's over	27
Use extra caution when boating on a low tide to avoid running into / coming aground on seabed vegetation	27
Check your anchor periodically to make sure it isn't dragging	18
If you run into a seagrass flat, stop immediately and lift your engine then paddle away until clear and never use your engine to force your way through	18
If your anchor is dragging, raise it and re-anchor / choose a different anchorage to make sure it holds	9
When raising your anchor, if the boat is pulling back away from the anchor, slowly motor towards the anchor as the crew pulls in the slack and raises the anchor	9
When raising your anchor, use a trip line to help pull the anchor upwards	9
Know your depth and draft	9
Choose the correct anchor for the type of seabed to avoid drag	0
When raising your anchor, avoid overrunning and fouling the prop through good crew communication	0
When raising your anchor, bring the anchor and chain on-board, remove any biofouling and stow it away	0
Check the tides	0
If you run aground on seagrass or maerl beds, wait for the tide to lift you off again and avoid trying to shift the boat through excessive use of the throttle	0

Notes: Project partners were asked in a ReMEDIES partners meeting in June 2020 to select the most important behaviours from a list of anchoring and mooring behaviours compiled from RYA sources (participants could select more than one option). 11 submissions were received.

Complexity and need for multiple interventions

Altering the behaviour of recreational boaters to prevent damage to seagrass is acknowledged to be a complex process that involves "*knowledge, efficacy, concern for natural resources, and boating*

skills in shallow areas" (Barry and others, 2020, p. 6). Many of the papers reviewed recommend the use of multiple interventions to change recreational boater behaviour (see Parry-Wilson and others, 2019; Kelly and others, 2019; La Manna and others, 2015; Venturini and others, 2018; Lathrop and others, 2017; Barry and others, 2020). These variously referred to the need for:

- Education/awareness raising (Parry-Wilson and others, 2019; Kelly and others, 2019; La Manna and others, 2015; Lathrop and others, 2017),
- AMS / eco-moorings (Parry-Wilson and others, 2019; La Manna and others, 2015; Venturini and others, 2018),
- Designated areas for mooring / anchoring (away from seagrass) (Kelly and others, 2019; La Manna and others, 2015; Venturini and others, 2018),
- Need for social acceptance of interventions (Parry-Wilson and others, 2019; Venturini and others, 2018),
- Monitoring, surveillance and enforcement (Kelly and others, 2019; La Manna and others, 2015; Lathrop and others, 2017),
- Use of navigational aids / signage (Kelly and others, 2019; La Manna and others, 2015; Barry and others, 2020),
- Establishing the carrying capacity of sites for sustainable use by recreational boaters[9] and using this in management and communication tools (La Manna and others, 2015; Venturini and others, 2018) and
- Financial incentives (Parry-Wilson and others, 2019).

These are discussed in more detail in the following paragraphs.

Parry-Wilson and others (2019) comment on the efficacy of "*highly visible solutions*" (p.12), such as AMS, coupled with positive messaging around their use, to achieve behaviour change among recreational boaters as well as higher public awareness. Monetary incentives were also found to be appealing to recreational boaters who responded to the questionnaire in their Torbay study area. Parry-Wilson and others (2019) recommend the use of incentives such as complimentary use of public AMS and/or charging fees for anchoring privileges to help encourage / discourage behaviours, and with the added benefit that this may help to generate funds to expand deployment of AMS and monitoring/surveillance. Social acceptance, seen as important to long-term behaviour change, may be increased by wider deployment of AMS at a national scale (Parry-Wilson and others, 2019). Alongside these measures, clear, concise and consistent public messaging is argued to be required to improve community awareness and avoid confusion, to be achieved through improved collaboration between national and local governance (Parry-Wilson and others, 2019). An example of confused messaging was cited, where a local harbour authority previously promoted both anchoring in, and conservation of, seagrass. In particular, the authors point to the need for clear environmental guidance "*aimed towards the wider general public, inclusive of the male powerboat community aged 35 + years that were highlighted in this study as the majority of boaters visiting the study site that were mainly non-boating club members*" (p. 13). Stakeholder engagement at a local community level was seen as important to ensuring understanding of new regulation imposed, and should be tailored to individuals who use particular sites for a variety of activities both commercially and recreationally.

[9] For example, based on the maximum number of eco-friendly moorings, and anchorages available in sandy bottom areas, a site can sustainably accommodate (La Manna and others, 2018).

Recommended options for mitigating the impacts of boat damage in Richardson Bay (San Francisco) include prohibiting boats from anchoring within seagrass (specifically eelgrass) and designating mooring areas outside of eelgrass (Kelly and others, 2019). The authors stress the need for a "*comprehensive solution*" (p. 24) involving education of the public, delineating the extent of the seagrass (eelgrass) bed with channel markers, increasing enforcement of violations and restricted motoring within the sensitive area (Sargent and others, 1995 cited in Kelly and others, 2019).

In a study of the effectiveness of interventions in La Maddalena Archipelago National Park, Sardinia, La Manna and others, (2015) suggest six management, legislative, monitoring and education actions that marine parks should put into practice to effectively protect seagrass:

- Use free zones for anchoring in places where seagrass is not present to reduce the pressure on sensitive areas / no anchor zones and mooring fields;
- Establish the maximum number of boats / carrying capacity of the area;
- Replace traditional mooring systems in seagrass with seagrass-friendly systems, with attention given to the number, concentration and location of buoys;
- Implement local surveillance "*also employing video technologies and closer co-operation with law enforcement*" (p. 166);
- Implement a periodical educational programme to raise awareness and change boaters' attitudes and behaviours regarding anchoring in coastal areas; and, particularly key,
- Design a long-term monitoring plan to measure the effectiveness of new management strategies.

Venturini and others (2018) recommend that the management of the Portofino MPA (Italy) should encourage boaters to have "*a more aware enjoyment*"(p. 7) of the activity, by increasing communication efforts, using the concept of carrying capacity, and applying different tools to manage the different areas of the MPA. The study suggests different strategies for managing boater impacts in different areas of the Portofino MPA, including:

- Increasing seagrass-friendly mooring areas;
- Higher delimitation of sensitive areas / delimitation of anchoring area and use of a forecasting system to inform boaters in advance of areas with possible overcrowding,
- Encouraging the use of seagrass friendly moorings or less crowded areas; and
- Improving the dialogue with boaters, for example, on environmental sustainability and the perception of damage, using information from long-term monitoring of activities to provide a framework.

The study emphasizes the importance of using management options which both protect the seabed but which do not disadvantage recreational boaters in order to maintain good social acceptance towards interventions, promoting dialogue with boaters in advance (Venturini and others, 2018).

To reduce the impact of motorized boating in an ecologically sensitive area of the Barnegat Bay National Estuary in New Jersey (US) where designation alone was found to be insufficient, Lathrop and others (2017) recommend that a three pronged approach is required to reach a broad spectrum of the boating community involving:

- Public education in responsible boating practices;
- Placement of appropriate signage at the boundaries of sensitive areas; and

- Routine enforcement by state marine police and conservation officers.

Barry and others (2020) used a variety of methods are used to raise awareness about scarring of seagrass as well as the provision of visible cue-based aids such as buoys in seagrass scarring hotspots. These include developing educational campaign materials (described in footnote 7). They also advocate some targeting of different audiences e.g. new boaters, more experienced boaters and tailoring the messages and distribution accordingly.

Targeted, behavioural approaches

Community based social marketing approaches[10] have been rarely applied to recreational boating behaviour (Barry and others, 2020). However, given the limited effectiveness and reach of some education and raising awareness interventions, as evidenced by the Barry and others, (2020) study, the authors suggest there is a need to use audience targeting to increase efficiency. Similarly, Valauri-Orton (2018) considers a key component of achieving behaviour changes in relation to seagrass is "*understanding your target audience*" (p. 8) through social marketing type approaches, and to create a social norm and an enabling environment around the desired change. This builds on the toolkit developed by Rare and The Behavioural Insights Team (2019) which outlines 15 strategies for achieving behaviour change in conservation more broadly (not specific to seagrass and anchoring and mooring), centred on tackling the main drivers of behaviour change, through:

- Motivating the change (by harnessing appropriate incentives, emotions, cognitive biases),
- Socializing the change (by leveraging the social nature of behaviour),
- Easing the change (by removing the hassle, helping people to plan, and creating supporting environments).

The authors acknowledge that conventional tools such as legislation, incentives and education are still important, but that these strategies offer "*an alternative and a new lens*" (p. 8) to approach conventional tools, in particular where monitoring and enforcement is not possible (Rare and The Behavioural Insights Team, 2019).

Focus on easy wins

At a stakeholder workshop it was suggested to consider promoting mooring adaptation and focusing on "*easy wins*" (For example, "*management options could include greater focus on use of pontoons rather than moorings in the future. In Salcombe estuary, designated swimming areas over shallow seagrass are being investigated as management tools which would remove impacts from anchoring*" (Maclennan,, 2020, p. 3).

[10] "*Community-based social marketing (CBSM) blends community organization techniques with commercial marketing research principles, including audience analysis, plans to reduce the barriers to change, and targeted communication to promote socially beneficial action*" Barry and others, 2020,p.2.

RQ3.2. What approaches to changing the anchoring and mooring behaviours of recreational boaters have been developed but not yet tested?

This section set outs areas related to recreational boaters anchoring and mooring for which further research and trials are recommended. We also provide an overview of the interventions currently underway and/or planned in the ReMEDIES project sites, focusing on Plymouth and The Solent Maritime SACs.

Further research and trials

This review has identified a number of recommendations in the literature for additional research and trialling of interventions to improve understanding, experience of interventions, and provide evidence which could support behaviour change in relation to anchoring and mooring in sensitive habitats (Amec Foster Wheeler, 2017, Maclennan, 2020). For example:

- Trials of AMS that take into account a holistic set of factors, not just ecological needs, e.g. 'whole life' costs and local circumstances (Amec Foster Wheeler, 2017)[11]
- Assessments of *"'whole life'"* AMS costs for selected MPAs "*to provide a better basis for assessing variation across the UK*", for example, focusing on MPAs which do not currently have mooring provision and on systems with minimum overheads, (Amec Foster Wheeler, 2017, p.47)
- Development of AMS best practice in general terms, as well as standards for UK conditions, coupled with collection of evidence and better information management to avoid misinformation (Amec Foster Wheeler, 2017). Previously, evidence was not always collected in trials which has already led to misinformation (Amec Foster Wheeler, 2017).
- Future AMS workshops to report on trials, provide examples of success and include a wider range of delegates e.g. drawing on the experience of harbour masters using these systems (Maclennan, 2020).

Maclennan (2020) comments on a number of projects which are underway in the UK to address the impact of anchoring and mooring on seagrass, which may provide additional information: the Tevi project[12] to promote private sector growth into industry (funded by a different strand of European funding to ReMEDIES), and a potential swimming buoy trial underway in Plymouth.

ReMEDIES project: interventions planned or underway at the pilot sites

A range of interventions related to changing the behaviour of recreational boaters are underway and/or planned by the wider ReMEDIES project - see Table A 2. These include a variety of activities across the sites that will address anchoring and mooring including:

- Installation of AMS;
- Education and awareness raising events, including RYA training courses, annual AMS workshops, communications via video and social media;
- Development of best practice guidance on anchoring and mooring;

[11] Amec Foster Wheeler (2017) note that at the time of writing Hampshire and Isle of Wight Wildlife Trust are seeking funding to install AMS may provide a good basis for trials.

[12] https://tevi.co.uk/tag/seagrass/

- No anchor zones and voluntary codes of conduct;
- Possible development of a boating app/ or extension of an existing app for example to locate seagrass and how boaters should act.

Table A 2 Summary of ReMEDIES planned interventions linking to behaviour change[13,14]

Intervention	Lead partner	Timing	Intervention applicable to:	
			Plymouth Sound & Estuaries SAC	The Solent Maritime – Isle of Wight (IoW) SAC
Presentations to boaters and instructors on best practice anchoring and mooring	RYA / Green Blue	Pre-COVID: delivery began prior to lockdown with a session delivered to boaters in the Solent on 06/03/2020. Following COVID, presentations will be delivered as webinars with the aim of being able to deliver this face-to-face once restrictions allow, post-COVID. Webinars are recorded and available to view from the RYA website.	Yes	Yes
Green Guide to Anchoring and Mooring	RYA / Green Blue	In draft - publication and dissemination expected in early 2021	Yes	Yes
Installation of Advanced Mooring Systems	NE	**The Solent and Plymouth Autumn 2020.** Other locations 2021	Up to 30 AMS planned to replace existing traditional moorings. Targeting Cawsand Bay. 10 new AMS may be installed as marker buoys for new no anchor zone	Up to 30 AMS planned to replace existing traditional moorings or reduce anchoring and provide markers for no-anchor zones. Targeting 3 locations on Isle of Wight: Cowes, Yarmouth Harbour, & Osborne Bay
No anchor zones and voluntary codes of conduct – leaflets,	NE	Consultation via workshops with local stakeholders in each site starting January	Potential locations for no anchor	Potential location for no

[13] Note, this is subject to change, in particular the timings, due to the project coinciding with the COVID-19 pandemic.

[14] Adapted from: Natural England (2020) Summary of LIFE Recreation ReMEDIES project for CEP 25.6.20. Last 2 columns added for site applicability.

Intervention	Lead partner	Timing	Intervention applicable to:	
			Plymouth Sound & Estuaries SAC	The Solent Maritime – Isle of Wight (IoW) SAC
signage, marker buoys		2021 to decide locations of zones, signage etc and approach, aiming to roll out summer 2021 – TBC **Osborne Bay (The Solent), Cellars Cove (Plymouth**), Helford extension	zones: Cellars Cove, Jennycliff Bay, Yealm. Other TBC	anchor zone: Osborne Bay Other TBC
Annual AMS workshops targeting mooring providers (e.g. harbour authorities) focused on different AMS, technical and practical aspects	RYA	First workshop held in January 2020. Second workshop planned for Autumn 2021. Timing of third workshop to be confirmed.	Yes (UK-wide)	Yes (UK-wide)
Fencing and managing access (The Solent, Essex)	NE	Consultation via workshops with local stakeholders in **The Solent** and Essex starting January 2021. Planning to begin to roll out during summer/autumn 2021	No	Yes. Focus on Langstone Harbour
Interpretation boards	NE	TBC – likely late 2021 at earliest, linked with managing access/codes of conduct interventions and natural capital infographics project within ReMEDIES	Yes	Yes
Roadshows and boat shows – presence at events (stands, presentations)	RYA/MCS	ReMEDIES promoted at Southampton Boat Show in 2019. Events now delayed due to COVID. Envisaging organisers will reschedule events from summer 2021 onwards.	TBC	TBC
Communications – videos, social media (Led by Natural England based comms officer.)	All	Ongoing – communications plan, dedicated project social media account and plans for project website.	Yes	Yes
Boating App – showing locations of seagrass and advising on anchoring and mooring locations	NE	TBC – exploring possibility of linking with existing apps instead of creating standalone app	Yes	Yes
Citizen science workshops to engage local stakeholders in	NE	TBC – 2021 (Essex and IoS)	No	No

Intervention	Lead partner	Timing	Intervention applicable to:	
			Plymouth Sound & Estuaries SAC	The Solent Maritime – Isle of Wight (IoW) SAC
mapping seagrass locations				

Plymouth Sound & Estuaries

A range of interventions linked to behaviour change on anchoring and mooring are planned at the Plymouth Sound & Estuaries pilot site (see Table A 2). These will include among others:

- Installation of advanced mooring systems planned in Spring 2021: 30 AMS to replace existing traditional moorings, plus 10 new AMS as marker buoys for no anchor zones
- No anchor zones and voluntary codes of conduct – leaflet signage and marker buoys, including voluntary code signage, 3 managing access workshops (potentially Cellars Cove)

Alongside the ReMEDIES project, Plymouth City Council (PCC) have a set of wider planned mitigation measures (not all relating to anchoring/mooring and impacts on seagrass) to address recreation impact in Plymouth Sound and Estuaries site (PCC, 2019). Some of which may have already started under Phase 1 of the Recreational Impacts Work. The mitigation measures which seem potentially of most relevance to anchoring and mooring behaviours include (PCC, 2019):

- Development of voluntary codes of conduct in conjunction with user groups including water users, and in cooperation with clubs, to encourage change in behaviour and to be disseminated through local site websites, via social media, and promoted to visitors through signs at locations where activities take place
- Awareness raising for boaters of sensitive habitats including the development of user-scale maps: "*map-based information will also be important and will be further developed to deliver targeted information and signage will be updated and replaced every eight years*" (p. 9)
- Educational workshops targeted at boat clubs and marinas as well as displays at newly expanded holiday parks and activity centres
- Removal of traditional moorings from sensitive sites and installation of Advanced Mooring System or trot moorings[15] where it will discourage increased anchoring impacts on designated features, as part of the implementation and review of the mooring and anchoring strategy to ensure no increased impacts on sensitive features.
- Monitoring of the effectiveness of measures including "*regular monitoring of the scale, distribution and type of boating activities*" (p. 10)
- Ongoing monitoring of the recreational use of the SAC / SPA including anchoring and mooring activities "*to identify any changes in usage and impacts arising from new and increasing levels of activity which may require additional mitigation actions*" (p. 10)
- Liaison activities undertaken by Marine Recreation Officers with key user groups and site monitoring.

[15] A trot mooring involves the boat being more at the bow and stern to keep it in one place.

Additionally, Maclennan (2020) notes that future projects in the Plymouth area include potential swimming buoy trials – while not specified in the document, these may also delimit the areas available to recreational boaters for anchoring and mooring.

The site improvement plan (SIP) for the Plymouth EMSs lists anchoring and/or mooring as one of the issues that requires management actions. The SIP recommends to undertake a study into the recreational use (anchoring) of the site and established level of impact (MMO, 2020).

The Solent Maritime – Isle of Wight

Although there is no strict conservation measure associated with the seagrass beds, it is stated that anchoring behaviour is a threat to the seagrass in the Solent (Solent Forum, 2019 cited by MMO, 2020). A range of interventions linked to behaviour change on anchoring and mooring are planned at the Solent Maritime – Isle of Wight pilot site (see Table A 2). These will include among others:

- Installation of advanced mooring systems planned in Spring 2021: 30 AMS to replace existing traditional moorings or reduce anchoring and/or provide markers for no-anchor zones, in 3 locations on Isle of Wight: potentially Cowes, Yarmouth Harbour, and Osborne Bay to be decided following stakeholder workshops and consultation
- No anchor zones and voluntary codes of conduct – leaflet signage and marker buoys, including managing access workshop
- Roadshows and boat show events for promoting awareness –with Sea Champions (MCS) and Wildlife Trust particularly in the Solent

Additionally, other ReMEDIES project activities to be undertaken at the Solent site, though understood to not directly target anchoring and mooring behaviours, include fencing and managing access which will focus on Langstone Harbour: workshops are planned to start in January 2021.

The Beaulieu River Buckler's Hard Yacht Club (2019) also report that the Beaulieu Estate which has historically put in place restrictions on where anchoring can take place, will no longer allow any anchoring in the river in line with advice, and plans to install signs to inform visitors of the restrictions at the entrance to the river.

The SIPs for the Solent and Isle of Wight Lagoons SAC and the Solent EMSs do not consider recreational vessel anchoring and mooring an issue (ie there is no action mentioned in the SIPs) (MMO, 2020).

Protecting seagrass) in Poole Harbour (near to The Solent Maritime SAC)

According to a guidance leaflet[16] produced by the Poole Harbour Steering Group in association with the Poole Harbour Commissioner and Natural England, the two main eelgrass beds in the Whitley Lake area of Poole Harbour have been identified in the Poole Harbour Aquatic Management Plan as "*anchorage sensitive zones*" and are marked with buoys (Poole Harbour Steering Group, n.d.,

[16] https://www.phc.co.uk/wp-content/uploads/2019/10/env_Eelgrass_-Leaflet_-2009.pdf

p1). Poole Harbour Commissioners Moorings Policy 2008 aims to phase out moorings in these environmentally sensitive areas. The leaflet includes a list of simple guidelines for boaters to help protect the eelgrass beds that includes (Poole Harbour Steering Group, n.d., p1):

- *"Do be aware of where the eelgrass beds are in the harbour.*
- *Don't drop anchor within these areas.*
- *Don't travel at high speeds that create significant amounts of wash in or near these areas.*
- *Don't dredge / bait drag / dig in these areas*
- *Don't trample the seabed in these areas*"

RQ4 What are the barriers and facilitators to boaters (in particular, different types of recreational boaters) taking action at each site? To what extent are these related to capability, opportunity and motivation?

In their proposed framework for a behaviour system, Michie and others, (2011) introduce three essential conditions for behaviour change: capability, opportunity, and motivation (what they term the COM-B system). This forms the centre of a behaviour change wheel surrounded by interventions and policy categories to enable behaviour change (Michie and others, 2011).

- Capability is defined as the individual's "*psychological and physical capacity to engage in the activity concerned*" (p. 4), which includes the necessary knowledge and skills;
- Motivation is defined as "*all those brain processes that energize and direct behaviour, not just goals and conscious decision-making" (p. 4)*, for example habitual processes and emotional response, as well as analytical decision-making;
- Opportunity is defined as "*all the factors that lie outside the individual that make the behaviour possible or prompt it*" (p.4) (Michie and others, 2011).

As well as general barriers and facilitators to boaters carrying out certain behaviours relating to seagrass conservation, we have tried to consider the barriers and facilitators that relate to each of these three factors proposed by Michie and others (2011) to better understand the dynamics involved.

Generally

Outcomes of a discussion on different management measures to mitigate anchoring and mooring impacts at a stakeholder workshop identified potential facilitators and barriers to uptake of certain measures (Griffiths and others, 2017). For example, how simple and straightforward a measure is in turn affects how easy it is to communicate to boaters, and for boaters to comprehend and support it. If a measure is highly complex and difficult to promote and implement or causes confusion amongst boaters, then this will prove a barrier to its adoption (Griffiths and others, 2017).

Public awareness and engagement are crucial to the success of seagrass conservation management (Parry-Wilson and others, 2019). Changing boater behaviour to prevent damage to seagrass can be complex and involves "*knowledge, efficacy, concern for natural resources, and boating skills in shallow areas*" (Barry and others, 2020, p. 6). Using a variety of methods to raise awareness, reinforce existing viewpoints about seagrass importance, and providing facilitating infrastructure is recommended to overcome potential barriers to behaviour change (Barry and others, 2020).

Capability

Knowledge and awareness of seagrass

There has been limited research into the public's perceptions of seagrass beds or how knowledge has influenced behaviour change (Parry-Wilson and others, 2019). According to one UK study of public perceptions of seagrass beds, the general public tend not to consider seagrass as an ecologically important marine plant species in its own right (Jefferson and others, 2014 cited by Parry-Wilson and others, 2019) but charismatic flagship species such as seahorses have been shown to evoke enthusiasm in conservation campaigns calling for the protection of seagrass habitats (Zacharias and Roff, 2001 cited by Parry-Wilson and others, 2019).

Stakeholders at an international conference in 2020 reported a generally low level of awareness of seagrass, including lack of information about where it is located and how easily it grows back. Even people who are more aware of the sensitivity of seagrass to damage from anchoring and mooring tended to think that it is not a problem in their area (Maclennan, 2020). Educational programmes to raise awareness of the importance of marine habitats such as seagrass is recommended for campaigns to change boaters' attitudes and behaviours regarding anchoring in coastal areas (La Manna and others, 2015) although there are few projects that test out the effect of those campaigns. In places where boaters are more aware of the negative impacts of anchoring on seagrass and the role of buoys in minimising these impacts, they are more likely to say they will use buoys and to be willing to pay for buoy use (Diedrich and others, 2013). However, knowledge of seagrass does not always equal behaviour change. For example, almost half of recreational boaters in a study site where AMS were present chose not to use them and to anchor their vessels instead, despite being aware of the presence of seagrass (Parry-Wilson and others, 2019) (see RQ3.1). Barry and others (2020) found a general disconnect between the high importance that boaters assign to seagrass and the low level of concern about seagrass scarring.

Knowledge and awareness of seagrass friendly boating behaviours e.g. AMS

A lack of awareness of the free public use of the AMS at Fishcombe Cove was a reported barrier to its use (Parry-Wilson and others, 2019). Boater perceptions of the AMS working and confidence in its design also had an influence on boaters' willingness to use the AMS (Parry-Wilson and others, 2019). There was a contrast in positivity and uncertainty between the on-site and online survey respondents that suggests having visual proof of the trial AMS in situ was likely responsible for increased confidence among on-site respondents; online respondents may have assumed the trial design was still at a conceptual stage (Parry-Wilson and others, 2019). Parry-Wilson and others (2019) suggest that to improve confidence in AMS among recreational boating communities, further evidence and media attention to existing AMS trials is needed. The authors suggest that media reporting of local success stories would be paramount in changing public perceptions; seagrass currently receives the least media attention globally out of any coastal habitat (e.g. salt marshes, coral reefs, mangroves) (Parry-Wilson and others, 2019). Audience targeting is another way to potentially increase the effectiveness of education and awareness raising campaigns (Barry and others, 2020).

Opportunity

Additional infrastructure may sometimes be required when implementing behaviour change interventions, in which case a lack of adequate infrastructure may be a barrier to boaters changing their behaviour (Valuari-Orton, 2018). For example, to facilitate boaters anchoring in designated sites or to AMS, appropriate infrastructure needs to be available and accessible to use. Not providing boaters with the option to use mooring buoys could constrain seagrass-friendly behaviour and result in a less satisfying recreational experience for those boaters wishing to use them (Diedrich and others, 2013). Alternatively, a lack of proper signage or navigational aids can also be a barrier to boater behaviour change (Barry and others, 2020; Lathrop and others, 2017). For example, without proper signage in place it can be difficult for boaters to know whether they are inside Environmentally Sensitive Areas (ESAs) or other special management zones (Lathrop and others, 2017).

Social marketing practice asserts that behavioural reinforcement cues that are placed close to where the consumer makes the decision are typically more effective than those that occur farther away (Lee and Kotler, 2016 cited by Barry and others, 2020). This was shown to be to case for the navigational buoys used in the study by Barry and others (2020) to tell boaters to slow their boats and trim the motor. However, in one study of the social and behavioural responses to AMS to protect seagrass beds, a high percentage of vessels were reported anchoring despite having the opportunity to attach to an AMS at the site (Parry-Wilson and others, 2019). This suggests that the boaters either did not see the AMS when entering the cove, chose not to investigate it despite large lettering on top of it highlighting its purpose, or chose to ignore the AMS in favour of preferential anchoring habits (Parry-Wilson and others, 2019). This suggests that the opportunity alone was not enough to convey the behaviour change in the recreational boaters.

Financial and practical barriers to providing infrastructure can become a barrier to behaviour change. Amec Foster Wheeler (2017) note that AMS installations require careful design for local circumstances and this creates technical and financial risk which could prevent some management authorities from installing them. Luff and others (2019) note that the challenge to modify swing-moorings also applies to boat owners, which suggests that these insurance and design issues may also be relevant to individual boat owners. AMS, visitor moorings and zoning plans can all have relatively high implementation costs, but lower ongoing costs once established (Griffiths and others, 2017). Free of charge mooring and berthing options were found to be the preferred choices in a national survey of recreational boaters (Parry-Wilson and others, 2019). Anchoring outside of managed harbours is always free (Amec Foster Wheeler, 2017). Therefore, if it costs boaters money to use more seagrass friendly moorings or to anchor in designated sites away from seagrass this could be a barrier to boaters taking up these behaviours. In discussions of anchoring and mooring impact mitigation measures, stakeholders suggest that additional costs to the boater/sea user of management measures such as using AMS are likely to be unpopular, creating a barrier to uptake and decreasing the overall effectiveness of said measure (Griffiths and others, 2017; Maclennan, 2020).

Motivation

Vessel Safety

Prevailing weather is thought to have had an influence on the choice of anchoring location in a study of responses to an AMS trial, as vessel safety is likely to be the prime consideration for recreational boaters (Parry-Wilson and others, 2019). Published RYA advice indicates that the first consideration

when choosing an anchorage is "*Shelter… ensuring good protection from all wind directions*" (Evans, 2011 cited by Parry-Wilson and others, 2019 p.11). Griffiths and others (2017) found that some boaters consider sensitive features such as seagrass to be poorer anchoring grounds due to reduced anchor penetration and increased risk of anchor slippage. Visitor moorings were also identified as possibly contributing to maritime safety, as some boaters prefer the ease of picking up a mooring (and paying a mooring fee) in order to have the peace of mind of not having to set their own anchor, conduct anchor watches and check for slippage. This is not the case for all mariners though; as some have little trust in gear not deployed by themselves (Griffiths and others, 2017).

Stakeholders at a workshop discussed that many boaters may have a potentially mistaken perception that seagrass friendly moorings do not work so well, for example because of the way the boats move when moored, problems when these moorings are used by more than one boat, rumoured problems with insurance, etc. (Maclennan, 2020).

Social Norms

Seagrass-friendly anchoring and mooring behaviours are thought to be reliant on their social acceptance and widespread adoption (Egerton, 2011 cited by Parry-Wilson and others, 2019). Active local groups can play an important role in fostering the success of measures by taking ownership and championing them. This was particularly important for voluntary measures such as voluntary agreements, codes of conduct and VNAZ (Griffiths and others, 2017).

Diedrich and others (2013) take a somewhat different view, based on their analysis of boaters' attitudes and behaviours towards seagrass (*Posidonia oceanica*) in Mallorca. They argue that, in the absence of clear social consequences, integrated personal norms[17] will be more rooted and stronger in the individual, thus making it a more viable predictor of behaviour. In the study in Mallorca, personal norms were found to be related to environmental knowledge about damage to *P. oceanica* (Diedrich and others, 2013).

In a 2014 report, the World Bank identifies thinking socially and thinking with mental models as two of three primary drivers of decision making (Valauri-Orton, 2018). This refers to thinking driven by what others around you are doing, and thinking within common perspectives within societies, respectively (Valauri-Orton, 2018). The third primary driver is thinking automatically (automatic rather than deliberative decision-making). This suggests that social norms can influence a persons' values and preferences which in turn drive decision-making and behaviours (Valauri-Orton, 2018). Therefore, presenting physical cues, messaging, or a value proposition that support particular values and social norms can influence behaviours (Valauri-Orton, 2018).

Attitudes and personal preferences

Prioritising lifestyle choices is a potential barrier to boaters adopting seagrass-friendly behaviours such as using AMS. For example, "*'sail to another location'*" (p12) was reported as the least likely

[17] Integrated personal norms are defined as deeply internalised norms based on conscious reflection on the behaviour and its potential outcomes (Ajzen, 1991; Armitage and Conner, 2001; Bamberg and Möser, 2007, referenced by Diedrich and others, 2013) -

choice by survey respondents asked about their likely response to encountering a site of restricted anchoring due to seagrass in a particular location (Parry-Wilson and others, 2019). This supports previous findings that boaters are likely to prioritise lifestyle choices such as visiting preferential locations, over relocation for an environmental cause (Lloyd and Marsland, 2013 cited by Parry-Wilson and others, 2019; Griffiths and others, 2017). The role of habit in influencing behaviours is important (Kollmuss and Agyeman, 2002; Verplanken and Wood, 2006; both referenced by Diedrich and others, 2013) therefore some authors suggest that it is feasible to assume that support for mooring buoys[18] could increase as boaters become accustomed to using them (Diedrich and others, 2013).

Security of vessels was very important to boaters when asked about their anchoring/mooring behaviours. Boaters indicated a preference for mooring over anchoring, and security was a main reason given for this preference (Parry-Wilson and others, 2019). Diedrich and others (2013) used survey data to model the influence of behavioural and normative beliefs on boaters' perceived likelihood to use buoys and boaters' willingness to pay (WTP) for that use. Positive attitudes towards mooring buoys led to more positive responses for the likelihood to use buoys and also the Willingness to Pay (WTP) for this use (Diedrich and others, 2013). Also, "*attitudes towards buoys*" had a stronger influence on both dependent variables when compared to "*crowding attitude*" and *"belief about the impact of anchoring*" on seagrass (Diedrich and others, 2013, p.116). This suggests that focusing on motivations and personal priorities, other than simply the desire to protect seagrass, could facilitate the use of AMS. When asked about an extension of the AMS trial, "*security of vessels*" (p.13) was a frequently reported benefit (Parry-Wilson and others, 2019). However, Diedrich and others (2013) did find that problem awareness (ie of anchoring in seagrass) also has an indirect influence on perceived likelihood to use buoys and WTP through the perception that buoys are important because they protect seagrass. Therefore, it can be inferred that perceived likelihood to use buoys and WTP for their use is linked to positive attitudes about personal and environmental benefits.

Research suggests that the attitudes that boaters have towards environmental resources, as well as the value they ascribe to them, influences their decisions about environmental behaviours (Jensen, 2010; Morris and others, 2007 cited by Valauri-Orton, 2018). When asked about the extension of an AMS project, the reason given by recreational boaters who supported the extension was the preservation of the seabed (Parry-Wilson and others, 2019). This suggests that some recreational boaters do give value to the conservation of seagrass beds.

Although not looking at boater behaviour change or seagrass conservation specifically, a report by Rare and The Behavioural Insights Team (2019) highlight the prevalence of the "*value-action gap*" (p.18) that often acts as a barrier to conservation campaigns that focus on awareness raising to drive behaviour change which has been subject of much academic debate and research in relation to many behaviours. Some evidence shows that pro-environmental awareness and attitudes can lead to the adoption of easy behaviours such as recycling, but individuals are not often willing to compromising convenience, enjoyment, or profit in the name of conservation or sustainability (Rare

[18] Note that in this paper the intervention was to provide "mooring buoys" in areas where previously people would anchor freely. No information is given about the specific type of mooring buoys hence we have left the term that the author has used rather than assuming it was an AMS.

and The Behavioural Insights Team, 2019). This links to other findings already highlighted in the Opportunity section that financial and practical barriers can be barriers to behaviour change.

Monitoring and enforcement

Direct engagement with boaters by rangers and the visibility of wardens, rangers or regulators has been found to influence boater compliance with anchoring and mooring mitigation measures (Griffiths and others, 2017). For example, at Studland MCZ, volunteer rangers engaged directly with boaters by visiting recreational vessels in kayaks and providing information and advice on the ecology of the bay (Griffiths and others, 2017). Management measures at Skomer have also been found to be successful due to the visibility of the Natural Resources Wales (NRW) staff during regular patrols (Griffiths and others, 2017). Regulatory interventions such as stricter penalties for boaters who cause seagrass damage and enforcement of special boating zones are recommended solutions to seagrass scarring in Florida, although the effectiveness of these is not evaluated in the study (Barry and others, 2020). Monitoring systems of recreational boating in MPAs are also important for evaluating real impact effects and promoting correct and sustainable management (Venturini and others, 2018). Where routine monitoring or enforcement of boating restrictions is lacking, this can be a barrier to boater behaviour change (Lathrop and others, 2017).

Other findings relevant to survey design

Parry-Wilson (2019) provides a useful overview of the questionnaires developed for their study of recreational boaters' behavioural and social responses to AMS trials in Torbay. The online and on-site questionnaires included questions to:

- Define the socio-demographics of the recreational boating community;
- Explore seagrass awareness;
- Understand priorities and anchoring/mooring preferences of boaters in varied circumstances including restricted anchoring sites; and
- Explore social perceptions of the trial AMS.

A variety of question types were used including Likert scale, ranked, closed- and open-ended questions. Simple diagrams were included to demonstrate the AMS design in comparison with a traditional swing mooring design. The online survey was hosted on Survey Monkey and disseminated to recreational boating community via three channels: word of mouth, emails (to senior members of recreational boating groups based in the study area) and social media. Social media was found to be useful for reaching boaters from outside the area, and also non-boating club members (Parry-Wilson, 2019).

The Barry and others (2020) study provides additional supplementary information which contains a list of survey questions used pre- and post-intervention and the observation survey used in a study in the US to explore the attitudes and behaviours of recreational boaters. The survey questions covered some experience questions, purpose for boating, number of times boating in the past 12 months, whether they had "churned up grass and mud" or "run aground" while boating, questions about seagrass, its importance, scarring and the impact of their behaviours on seagrass together with recall of information about prevention of propeller scars in seagrass beds. The surveys were given out to boaters on site. There was also an observational component which noted type of boat and boating behaviours. Both these instruments are included in Appendix 1b.

Summary

A summary of key findings from the literature is provided below, organized by research question:

RQ1: What are the behaviours of recreational boaters in relation to anchoring and mooring that cause seagrass damage?

Recreational boaters can cause damage to seagrass during all three stages of the anchor cycle: anchor drop, while anchored by the drag of the anchor through the seabed, and anchor retrieval (Parry-Wilson and others, 2019; Amec Foster Wheeler, 2017). Traditional mooring systems also cause damage to the seabed through the movement of the ground chain scouring the bed leading to circular mooring scars and when renewing, raising or lowering the main anchoring blocks and chains (Amec Foster Wheeler, 2017, Luff and others, 2019).

- Anchoring from individual boats is generally considered more damaging to seabed habitats than fixed moorings (for example, due to the anchor being thrown repeatedly and frequently from various locations) (Milazzo and others, 2004, in Amec Foster Wheeler, 2017).

There was some acceptance amongst some UK stakeholders at a workshop that anchoring and mooring activities damage seagrass, but this was acknowledged alongside the view that other activities (not boating) are also responsible for seagrass decline for which there is evidence (e.g. eutrophication, fishing, climate change, storm damage) (Maclennan, 2020).

At the Plymouth Sound & Estuaries site, anchoring (though not specifically in seagrass) has been associated with sailing yachts, motor yachts, angling from a vessel and sub-aqua diving. The intensity of anchoring at some locations varied by season: at some sites, higher anchoring intensity is observed in summer, while at other sites it is higher in winter linked to use by vessel-based anglers as a weather refuge. Overnight anchoring has also been observed (Langmead and others 2017).

RQ2: To what extent are these behaviours related to types of recreational boaters (in terms of attitudes, values and a range of other factors) and types of boat?

There is some limited evidence to suggest that the behaviours and attitudes of recreational boaters in relation to seagrass can be related to different types of boater, for example, in terms of their experience levels, frequency of boating, the type of boat (for example, sailboats or powerboats, deck/pontoon boats and boat length):

- Those anchoring are more likely to be male powerboat boaters from the local or regional area without membership to any local or national boating groups, but whom could be reached through local harbours, mooring providers or through local cafes, retailers etc. (Parry-Wilson and others, 2019).
- More experienced boaters (with at least 4.5 years of experience) tend to rate seagrass scarring as more of an issue than boaters with less experience (Barry and others, 2020).
- More frequent boaters more likely to have scarred seagrass in the last year regardless of experience level (Barry and others, 2020).
- A higher percentage of sailboats compared to powerboats used a trial AMS (Parry-Wilson and others, 2019).

- Larger boats (>21 ft) and deck/pontoon boats have been found to be more likely to slow down at greater distances away from navigational seagrass warning buoys (Barry and others, 2020).

RQ3.1: What approaches to changing the anchoring and mooring behaviours of recreational boaters have been effective

So far, the focus on trials had been primarily on the effectiveness in achieving environmental objectives rather than an assessment of the overall feasibility of a wider AMS deployment strategy (Amec Foster Wheeler, 2017).

The successful implementation of seagrass friendly AMS is dependent on their social acceptance and widespread adoption (Egerton, 2011 cited by Parry-Wilson and others, 2019).

Support among recreational boaters for the use of mooring buoys over anchoring has also been shown in several studies (Parry-Wilson and others, 2019; Diedrich and others, 2013; Venturini and others, 2018).

Anchoring restrictions and (VNAZ) appear to be a less popular mitigation measure. For example, over half of respondents surveyed in Torbay, Devon provided uncertain or negative comments towards VNAZ. This resistance to behaviour change suggests a need for alternative methods of management to alleviate anchoring and swing mooring damage to seagrass (Parry-Wilson and others, 2019).

Navigational aids in the form of buoys were shown to have a positive effect on seagrass-friendly boating behaviour in Florida, US (Barry and others, 2020).

Environmental awareness and educational programmes can also be important for mitigation of anchoring and mooring damage to seagrass but are reported with mixed results (Venturini and others, 2018; Parry-Wilson and others, 2019; Valauri-Orton, 2018; Lathrop and others, 2017; Barry and others, 2020).

A cue-based (navigational aids) intervention was found to be much more successful at reducing propeller scarring of seagrass by recreational boaters in Florida than a separate educational-based intervention (Barry and others, 2020).

Newspaper articles, magazines, newsletters and pamphlets were found to be the most effective communication tools for informing boaters about the marine environment and getting them to take action. Resource intensive educational videos, conferences, and meetings were noted to be "*least effective in getting respondents to take action*" (Valauri-Orton, 2018, p.5).

Many of the papers reviewed recommend the use of multiple interventions to change recreational boater behaviour (see Parry-Wilson and others, 2019; Kelly and others, 2019; La Manna and others, 2015; Venturini and others, 2018; Lathrop and others, 2017; Barry and others, 2020).

These variously referred to the need for education/awareness raising, AMS/eco-moorings, designated areas for mooring/anchoring (away from seagrass), a need for the social acceptance of interventions, monitoring, surveillance and enforcement, the use of navigational aids/signage, as well establishing the carrying capacity (maximum number of boats) and using this in management and communication tools.

Incentives such as complimentary use of public AMS and/or charging fees for anchoring privileges are recommended to help encourage the use of AMS and discourage anchoring and have the added benefit that this may help to generate funds to expand the deployment of AMS and monitoring/surveillance (Parry-Wilson and others, 2019).

Audience targeting is suggested as a way to increase the efficiency of education and awareness raising interventions (Barry and others, 2020).

RQ3.2: What approaches are planned but have not yet been tested?

A range of interventions related to changing the behaviour of recreational boaters are underway and/or planned by the wider ReMEDIES project- these include: installation of AMS; education and awareness raising events, including RYA training courses, annual AMS workshops, communications via video and social media; development of best practice guidance on anchoring and mooring; no anchor zones and voluntary codes of conduct; development of a boating app for example to locate seagrass and how boaters should act.

A range of interventions linked to behaviour change on anchoring and mooring are planned at the Plymouth Sound & Estuaries pilot site. For example:

- Installation of advanced mooring systems planned in Autumn 2020: 30 AMS to replace existing traditional moorings, plus 10 new AMS as marker buoys for no anchor zones.
- No anchor zones and voluntary codes of conduct – leaflet signage and marker buoys, including voluntary code signage, 3 managing access workshops (Cellars Cove).

A range of interventions linked to behaviour change on anchoring and mooring are planned at the Solent Maritime – Isle of Wight pilot site. For example:

- Installation of advanced mooring systems planned in Autumn 2020: 30 AMS to replace existing traditional moorings or reduce anchoring and provide markers for no-anchor zones, in 3 locations on Isle of Wight: Cowes, Yarmouth Harbour, and Osborne Bay.
- No anchor zones and voluntary codes of conduct – leaflet signage and marker buoys, including managing access workshop.
- Roadshows and boat show events for promoting awareness – these have been ongoing in the lockdown with Sea Champions (MCS) and Wildlife Trust particularly in the Solent.

RQ4 What are the barriers and facilitators to boaters taking action at each site? To what extent are these related to capability, opportunity and motivation?

Educational programmes and awareness raising are important for the promotion of seagrass-friendly anchoring and mooring behaviours, however there is evidence that knowledge alone does not equal behaviour change (Parry-Wilson and others, 2019; Barry and others, 2020; Rare, 2019).

Additional infrastructure is likely to be required to provide boaters with the opportunity to take action, for example to facilitate anchoring in specific areas or to use AMS (Valuari-Orton, 2018). Not providing appropriate mooring options or proper signage can be a barrier to boater behaviour change (Diedrich and others, 2013; Barry and others, 2020; Lathrop and others, 2017).

Behavioural cues at the site where boaters are supposed to be carrying out a behaviour are shown to be more effective than those further away/at a different site (Barry and others, 2020). However, boaters have been reported anchoring in seagrass areas even when AMS are provided, which suggests that opportunity alone is not enough to change behaviour (Parry-Wilson and others, 2019).

Financial and practical barriers also need to be considered. For example, if it costs boaters money to use more seagrass friendly moorings or to anchor in designated areas away from seagrass this could prevent boaters taking up these behaviours (Amec Foster Wheeler, 2017).

Vessel safety is thought to have the greatest influence on choice of mooring/anchoring location. Mooring is generally preferred over anchoring in regard to security, however some stakeholders at a workshop considered that there may be a mistaken perception among boaters that AMS are less secure than traditional moorings (Maclennan, 2020).
Individual adoption of seagrass-friendly anchoring and mooring behaviours is thought to be reliant on the social acceptance and widespread adoption of these behaviours (Egerton, 2011 cited by Parry-Wilson and others, 2019). Presenting physical cues, messaging, or a value proposition that supports particular values and social norms can facilitate behaviour change (Valauri-Orton, 2018).

Focusing on motivations and personal priorities, other than simply the desire to protect seagrass, could facilitate the use of AMS (Diedrich and others, 2013). There is evidence that suggests that some recreational boaters do give value to the conservation of seagrass beds, however other personal preferences or lifestyle priorities may be a barrier to adopting certain seagrass-friendly behaviours.

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Appendix 1a Search Protocol

Introduction

The search protocol describes how the literature was carried out, focussing on the inclusion/exclusion criteria, search string, sources of evidence and approach to prioritisation of documents. The draft protocol follows the structure laid out in the JWEG guidance (Collins and others, 2015).

Research Question(s)

The Primary Research question for the project was:

What are the behaviours of recreational boaters in relation to anchoring and mooring that cause damage to seagrass and what are the best ways to intervene in these behaviours to reduce disturbance and damage in the two pilot areas?

There were four research questions to be addressed by the desk review:

1. What are the behaviours of recreational boaters in relation to anchoring and mooring that cause seagrass damage generally and specifically at each of the two test sites? What is the frequency and nature of those behaviours?
2. To what extent are these behaviours related to types of recreational boaters (in terms of attitudes, values and a range of other factors), types of boat generally and specifically at each of the two test sites?
3. What approaches to changing the anchoring and mooring behaviours of recreational boaters have been effective, generally and specifically at each of the two test sites? And, what approaches have been developed but not yet tested?
4. What are the barriers and facilitators to boaters (in particular, different types of recreational boaters) taking action at each site? To what extent are these related to capability, opportunity and motivation?

To further clarify the research questions we used the PICO approach which details which population is to be studied, what the intervention is that we looked at, what comparators we were interested in and what outcomes we investigated. The research question is an impact question, related to interventions.

Table A 3. PICO factors for the literature review

Population	**UK recreational boaters**
Intervention	Behaviour change
Comparator	To what extent are these behaviours related to different types of recreational boaters or boats, for example characteristics such as age, gender or socio-economic background? Which approaches to changing anchoring and mooring behaviours of recreational boaters are effective generally and at the two sites?

	How do barriers and facilitators to behaviour change relate to capability motivation and opportunity?
Outcome	Insights for future behaviour change interventions

Scope

The scope establishes the inclusion criteria/exclusion criteria for our search strategy.

Table A 4. Inclusion and exclusion criteria for the literature search

Exclusion criteria	Comment
Exclude studies not in English	
Exclude any research that is not relevant to behaviour change.	
Exclude any research that is not relevant to anchoring and mooring in seagrass	Ie needs to be about seagrass, seagrass beds – maerl may also be relevant? ie if it's about types of habitats discard it
Exclude research that doesn't address recreational boaters.	
Exclude newspaper articles but explore any report references cited in the article.	Key opinion and social media articles that are found will be kept as they could form stimuli for the meetings and focus group
Inclusion criteria	**Comment**
Include UK	If needed could also go wider to include some worldwide countries e.g. US - Florida, Australia Europe See what papers come up
Include literature from past 5 years, so 2015 and onwards.	The focus of the review is recent literature.
Include any method.	Includes review articles as well as empirical studies.
Include peer-reviewed research and grey literature.	Note in the report the quality of research used as evidence (including whether it has been peer reviewed/ published in a journal).
Include literature on all/any behaviour change interventions related to anchoring and mooring of recreational boaters	Includes: • Behaviour change • Behaviour change interventions • Advanced mooring systems (AMS) / eco-mooring systems • No anchor zones • Voluntary codes of conduct • Training • Guidance / guides • Awareness-raising e.g. annual AMS workshops, boatshows and roadshows • Communications – videos, social media • Boating apps • Citizen science workshop • Natural capital infographics and communicating importance • Fencing and managing access • Interpretation boards

Keywords

Table A 5. Key words for literature search

Category	Key words
Keywords related to the population	Recreational boater
Keywords related to the intervention	Behaviour change, anchoring, mooring, no anchor zones Also try terms from the various interventions listed above Try different spellings/terms e.g. eco-moorings, ecological moorings etc
Keywords related to the comparator	Behaviour, habits, attitudes, awareness, values, views, approaches, interventions, trials, barriers, facilitators, segmentation, segments, types, profiles, socio-demographics
Keywords related to the outcome	Seagrass, damage, disturbance, improvement
Other relevant keywords	UK; seagrass; seagrass beds, maerl beds.

Potential source locations

Table A 6 Potential sources of evidence

Locations for peer reviewed evidence (e.g. bibliographical databases)	Scopus
Locations for grey literature (e.g. websites of key organisations)	Google (which scans grey, government and commercial sources) List of documents provided by Natural England
Locations for unpublished data	Steering group; Royal Yachting Association, etc
Will other reviews and secondary reviews be considered?	Yes
Will theoretical or conceptual studies be considered?	Yes if including interventions not yet developed

Scopus search strings

The following search strings were used to retrieve documents from Scopus:

5. TITLE-ABS-KEY ("recreational boat*" AND (anchor* OR moor*) AND "behav* change" AND ("seagrass*" OR "seagrass bed*" OR "maerl bed*"))
6. TITLE-ABS-KEY (("recreational boat*" AND (anchor* OR moor*) AND "behav* change"))
7. TITLE-ABS-KEY ("recreational boat*" AND "behav* change" AND (seagrass OR "seagrass bed*"))
8. TITLE-ABS-KEY (("recreational boat*" OR boat*) AND "behav* change" AND (seagrass OR "seagrass bed*"))
9. TITLE-ABS-KEY ((moor* OR anchor* OR "eco-moor*") AND (behav* OR "behav* change") AND (seagrass OR "seagrass bed*" OR "Zostera marina"))
10. TITLE-ABS-KEY (("recreational boat*" OR boat*) AND (anchor* OR moor*) AND (behav* OR "behav* change") AND ("seagrass*" OR "seagrass bed*" OR "maerl bed*" OR zostera))
11. TITLE-ABS-KEY (("recreational boat*" OR boat*) AND (anchor* OR moor* OR "eco-moor*") AND ("seagrass*" OR "seagrass bed*" OR "maerl bed*" OR zostera))

12. TITLE-ABS-KEY(("recreational boat*" OR boat*) AND (anchor* OR moor*) AND behav* AND ("seagrass*" OR "seagrass bed*" OR "maerl bed*" OR Zostera))
13. TITLE-ABS-KEY (("recreational boat*" OR boat*) AND (behav* OR "behav* change") AND segment*)

Out of the list of search strings, only search string numbers 5, 6, 7, 8, and 9 returned results that were relevant to our study (based on our inclusion and exclusion criteria) and therefore included in this review.

Appendix 1b Example questions

From Barry and others, 2020

Boat Ramp Intercept Survey

1) How many years have you been a boater? _____

2) What is your primary purpose for boating today?
   _____

3) In the past 12 months, how many times have you been out in your boat?
   _____

4) In the past 12 months have you churned up grass and mud while boating? YES NO

5) In the past 12 months have you run aground? YES NO

   If yes, what did you do?

6) On a scale of one to five, with five being a very big problem and one being not at all a problem, how big of a problem is seagrass scarring to you? (Circle the number that fits the best)

I don't know what it is	Not at all a problem		Neutral		A very big problem
0	1	2	3	4	5

7) In the past 12 months, have you accidentally cut a scar in seagrass beds with your propeller? YES NO
   (skip if question #6 = 0)

8) What are some problems you associate with seagrass scarring?

9) If you were talking to an inexperienced boater, what would you recommend they do when boating in a shallow area?

10) On a scale of one to five, with five being extremely important and one being not at all important, How important do you feel healthy seagrass beds are? (Circle the number that fits the best)

Not at all important	Neither Important or Unimportant			Extremely Important
1	2	3	4	5

11) What do you personally think is the most important reason to protect seagrass beds?

12) Can you recall seeing any information recently about preventing propeller scars in seagrass beds? YES NO

If yes, where did you see the information?

Observational checklist

Boat Type	Gender	Time:_____	Ran aground?
○ Flats Boat ○ Deck/Pontoon Boat ○ Open Fisher ○ Cabin Fishing Boat ○ Skiff/Utility Boat ○ Personal Watercraft ○ Other_____	Male Female Operator ○ ○	Trimmed motor up? ○ Yes ○ No ○ Unsure	○ Yes ○ No ○ Unsure
	Direction of Approach	How far out did they slow down?	Additional Notes
	○ North ○ NE ○ West ○ NW ○ East	○ 200+m out ○ 100-200m out ○ <100m out ○ Didn't slow down until sandbar	○ Didn't stop, transiting through ○ Skirted buoys If yes, what did they do? ○ Pushed off
Boat Size	Speed of Approach	Rental Boat	○ Motored off
○ Less than 21 feet ○ 21 feet or more	○ On Plane ○ Idle ○ Fast Idle	○ Yes ○ No ○ Unsure	○ Other_____
Additional Comments			

From Parry-Wilson and others, 2019

The full questionnaire is not in the paper but some of the questions are. Two key ones are:

1. Have you ever anchored in a seagrass bed? Yes/No/Unsure. If Yes – Were you aware seagrass was in the area before you anchored? Yes/No/Unsure.
2. What would you choose do (or have previously chosen to do) in response to encountering a site of restricted anchoring in the UK? Traditional mooring at a cost/Eco mooring free of charge/Eco mooring at a cost/Berthing free of charge/Berthing at a cost/Raft to another vessel/Drop anchor/Sail to another location.

Appendix 2: Interview questions

Mitigating impacts on seagrass through adapting boating behaviours – Interview schedule

Introduction

Thank you for agreeing to take part in this interview. The interview is part of the LIFE Recreation ReMEDIES project. As you know, ReMEDIES is focusing on five key Special Areas of Conservation (SACs) in the UK, one of which is the *Solent Maritime / Plymouth Sound and Estuaries*.

Our project is looking at the behaviours of recreational boaters and their impacts on seagrass. This investigation will help to design and develop ways of addressing any issues identified and help to support changes in behaviour that can lead, in the long term, to the improvement of seagrass.

Thank you for signing the consent form for this interview. Do you have any questions about the interview, or how your data will be used and managed?

General context

1. Could you tell me a bit about your experience of sailing/boating in [*the Solent or Plymouth area*]. And what is your involvement with the boating community in either a professional or voluntary capacity? Are there any parts of the boating community (e.g. yacht or power boat owners or renters) that you are most familiar with?
2. Have you heard of seagrass (also known as eel grass?) *[If 'Yes']* Could you tell me what you have heard about it? *[If the interviewee only refers to seagrass in locations outside the UK]* Are you aware that seagrass is also found in UK waters? *[Then continue to Q3].*

   [*If 'No'*] When I refer to seagrass in this interview, I will be talking about plants that live in shallow sheltered areas along our coast *[including here around the Solent / in the Isle of Wight / Plymouth].* These plants are different from seaweed and have bright green leaves. *[Then continue to Q4]*]

3. Are you aware of any campaigns around seagrass?

Section 1. Beliefs and outcomes

4. If you heard that seagrass in the UK is an important and fragile marine habitat, would that affect anything you do when boating?
5. Do you think that other boaters you know are aware that seagrass is found in UK waters? Is it something you have heard talked about? *[Now skip to Q10]*
6. How important to you is the survival and improvement of seagrass in this area?
7. What benefits, if any, does seagrass provide? *[Prompt if interviewee struggles to answer: To you personally? To others using this area of the sea for all kinds of recreation? To the wider society, economy, environment?]*

8. What problems, if any, does having seagrass in this area create? *[Prompt if the interviewee is struggling to respond: To you personally? To others using this area of the sea for all kinds of recreation? To the wider society, economy, environment?]*
9. How far would you say that others in this area share your views? What do you base this judgement on? *[Prompts: have you discussed this with others? In what context? What comments have you seen in the media? Any other sources?]*

Section 2: Injunctive normative beliefs and motivation to comply

10. To what extent do you think that the authorities (local authorities, harbour authorities or national government and its agencies) are interested in what happens to seagrass? Why do you think that?
11. If the authorities give advice on something like avoiding harm to or protecting seagrass, how important is it for you to follow their advice? How important do you think it is for other boaters?
12. How important is it for you to have the approval of the local community and other boaters for your boating activities? How important do you think it is for other boaters to have the approval of the local community and fellow boaters for their boating activities? When or under which circumstances might this be particularly important?
13. Can you think of any times when you have changed what you do on your boat, e.g. where or how you anchor or moor your boat, because of advice from others? Whose advice did you listen to? What was it about that advice that made you change? Has this experience made you more or less likely to listen to others in the future? Why?

Section 3: Control beliefs and power of control factors

14. How far do you feel that what you and other boaters do could affect the condition of seagrass in this area? Why? Do you think that some activities are more damaging than others? [*If not already mentioned]* How important do you think anchoring and mooring practices might be?
15. How difficult do you think it is for you and other boaters to change behaviours? What sorts of changes would be easiest? And which would be most difficult?
16. What do you think are the factors that could prevent you and other boaters from changing anchoring and mooring practices? Are there any financial or other material constraints (such as equipment) that need to be addressed? What factors would encourage you and other boaters to change practices? Is there anything others - including organisations, businesses and authorities – could do to make it easier for boaters to change their behaviours or practices?

Close

17. That's the end of the interview. Before we finish, did anything that we discussed make you think of other things that you would like to mention?

Many thanks for giving up your time to contribute to this research. Do you have any further questions now? If you have any questions afterwards you can get in touch via the contact details at the bottom of the participant information and consent sheet.

We hope you will continue to be involved in this project. For example, we will be running an online survey look out for a survey next month and please do encourage other recreational boaters you know in the area to complete it, so we can gather as many views as possible.

Appendix 3: Summary of interview results

Introduction

The purpose of the stakeholder interviews was to provide insights into boaters' attitudes and beliefs about the importance of seagrass as well as current practices which might affect seagrass. The stakeholders were all people who have regular contact with different kinds of boaters and were well-placed to talk about wider boater perspectives.

This short analysis summarises the findings from the interviews.

Methodology

Eight virtual interviews were held between August and September 2020 with stakeholders in the two project areas. The stakeholders were selected from contacts provided by Natural England staff in the two areas as well as by other project partners (RYA, MCS) to ensure that a range of perspectives were included.

A total of eight people were interviewed, four from Plymouth Sound and Estuaries and four from the Solent Maritime. The interviewees, cover a range of roles in relation to recreational boating:

- Harbour Master – 1
- Marina manager – 1
- Moorings manager – 2
- Estuary manager – 2
- Sailing Association – 1
- Conservation volunteer - 1

A schedule of interview questions was developed to guide the interviews and ensure consistency. The questions were designed to capture information about the factors that shape individuals' behavioural intentions and behaviours:

- Attitudes, beliefs and outcomes
- Normative beliefs and motivation to comply
- Perceived behavioural control

The interview schedule is included in Appendix 2: Interview questions.

The interviews were carried out using Zoom except in three cases where reception was poor and the interviews were carried out by telephone. All the interviews that were done on Zoom were recorded; detailed notes were taken of the remaining three interviews.

The responses to each of the interview questions were entered in an Excel spreadsheet. Thematic analysis was used to identify and explore the main themes.

Analysis

This section is structured to follow the interview questions, taken in the same order as they appear in the interview schedule. An overview and synthesis of the themes identified is provided at the end.

General context

Q1. Could you tell me a bit about your experience of sailing/boating in [the Solent or Plymouth area]. And what is your involvement with the boating community in either a professional or voluntary capacity? Are there any parts of the boating community (e.g. yacht or power boat owners or renters) that you are most familiar with?

Five of the interviewees had managerial positions which brought them into contact with recreational boaters, both sailing and motor yachters. Three were experienced sail yachters.

Of the Plymouth Sound and Estuaries interviewees, two were from Cawsands and two from the Yealm Estuary. Three of the interviewees from the Solent Maritime were from the Isle of Wight; the fourth was based on the mainland and sailed widely across the south coast.

Q2. Have you heard of seagrass (also known as eel grass?) [If 'Yes'] Could you tell me what you have heard about it? [If the interviewee only refers to seagrass in locations outside the UK] Are you aware that seagrass is also found in UK waters?

All interviewees had heard of seagrass and understood there was concern about its condition; (although one interviewee questioned whether this concern was justified). The interviewees were aware that seagrass is important for carbon sequestration and provision of habitat. One sail yachter mentioned that they had only recently learned about the importance of seagrass through their volunteering work: *"It was all seaweed to me before*."

Although some interviewees were uncertain about why its survival was important, others mentioned its benefits and said that it was important to them on a personal and professional level. All interviewees expressed a need to be environmentally mindful, to "*do their bit*" and ensure species are not "*wiped out*".

All interviewees suggested that awareness of seagrass varies in the boating community, with a 'vague awareness' amongst the majority about seagrass itself and the role seagrass plays environmentally. One felt that popular TV programmes like Countryfile were increasing awareness. Another mentioned the cumulative damaging effect caused by lots of small actions by boaters. One example is anchoring: "*Most yachtsmen would accept that anchoring in a seagrass area must disturb the bottom; after all many anchors are known as "plough" anchors*". There is a lack of awareness of the impact of these small actions, such as motor boaters "*gunning"* the engine (accelerating quickly) rather than lifting out the engine and paddling when they become worried about getting stuck in seagrass) and dragging the anchor.

Information about the extent of seagrass, cover and historical change in the extent and health of seagrass is contested even among people with a professional involvement in marine management. For example, one interviewee mentioned a survey which showed seagrass increases in his area. He reported being told that although the area of had increased, the density of the seagrass is sparser than it was. Contesting this, he commented that he believed that the denser areas had expanded

and the sparser areas were on the edges of the expansion "*the thinner areas are the Pioneer plants on the outside".*

Awareness of campaigns around seagrass

Q3. Are you aware of any campaigns around seagrass?

Interviewees had different levels of awareness of seagrass-focused campaigns. Some were not aware of campaigns, while others were themselves involved in campaigns, some were aware of initiatives to protect seagrass such as the wider ReMEDIES project, the community seagrass initiative[19] and a brochure produced by the RYA and others about anchoring in Studland Bay where there has been controversy about measures to protect seagrass.

Several interviewees were involved in initiatives to raise awareness of the importance of seagrass. Examples were: an annual page in the River Yealm Harbour Guide (and in Harbour Guides for Salcombe and Kingsbridge) dedicated to seagrass information. Two people reported that they were engaged in promoting the importance of seagrass on an ongoing basis: *"We work quite a lot to plug seagrass in the Solent".* The issue had been raised as part of discussions with local boaters and residents about the designation of the Marine Conservation Zone. They noted that several national organisations were promoting the value of seagrass, including Natural England, the Environment Agency and the Inshore Fisheries and Conservation Authorities (IFCA), *"But it's not a constant message*".

Some were also participating in research on seagrass, such as surveys at Cawsands and a survey conducted by the Marine Conservation Society (MCS).

None of the interviewees mentioned campaigns to prevent measures to protect seagrass but one expressed concern that, *"There is a problem with the way that seagrass is portrayed. It's set up as a battle between boaters who want to anchor on a nice sandy beach and environmentalists. That's a dangerous way of looking at the issue*.". This interviewee argued that there was a lack of information about what boaters should be doing: *"Boaters don't know whether they are doing something good or bad.*"

Beliefs and outcomes

Q4. If you heard that seagrass in the UK is an important and fragile marine habitat, would that affect anything you do when boating? /How important to you is the survival and improvement of seagrass in this area?

All three yachters said that awareness of seagrass as an important habitat did affect their behaviours, for example one had made their boat available to support seagrass surveys. The lack of detailed information in both areas about where exactly seagrass is located makes it hard to take measures to protect it. One interviewee said that it was very difficult to avoid the seagrass at Cawsands and at Cellar Bay in the Yealm Estuary. There is also limited information on the health of seagrass habitats

[19] https://www.zooniverse.org/projects/mark-dot-parry/the-community-seagrass-initiative-seagrass-explorer/about/research

and evidence that anchoring is adversely affecting it. "*The 'Plymouth Waterways' brochure produced by Plymouth City Council/QHM does show areas of seagrass but as rather vague blobs on a sketch chart of the area. There is limited information available to yachtsmen on the health of local seagrass meadows, and whether there is firm evidence that anchoring is adversely affecting seagrass*". One interviewee did not think that seagrass habitat was fragile.

The information that seagrass is an important and fragile habitat increased some interviewees' interest in finding out more about it. One interviewee said this would encourage them to go snorkelling to look at the seagrass.

Q5. Do you think that other boaters you know are aware that seagrass is found in UK waters? Is it something you have heard talked about?

The answers to this question were mixed. A few interviews gave examples of how boaters might be aware of seagrass (e.g. in the Isle of Wight boaters were likely to have seen charts showing the location of seagrass or might have heard about seagrass in the context of discussions in the past around the setting up of the Marine Conservation Zone) but also saying that awareness has lapsed in the absence of information: *"I think that there was the Blue Planet effect, and I think it there was a surge of interest there. Unfortunately this year, that's sort of lapsed a bit.*"

Most interviewees felt that awareness was patchy: some boaters would be aware of seagrass but others would not.

Q6. How important to you is the survival and improvement of seagrass in this area?

About half of the interviewees responded that the survival and improvement of seagrass in the area was very important to them. The others were less clear in their responses.

Only one of the interviewees gave reasons why seagrass is important, mentioning its role in carbon capture and its capacity to capture and store nutrients. Others described what they had done to create awareness of seagrass but didn't mention what characteristics of seagrass they thought were most important. *"We had a pier project a couple years ago and we put underwater cameras down there. And the response to that was extraordinary people were just amazed at all the different fish and everything down there. It's as if they've not really ever thought of it.*"

Benefits and disadvantages associated with seagrass

Q7. What benefits, if any, does seagrass provide? [Prompt if interviewee struggles to answer: To you personally? To others using this area of the sea for all kinds of recreation? To the wider society, economy, environment?]

The main reasons given for the importance of seagrass were:

- its carbon capture function
- providing a place where fish and sea creatures lay their eggs and shelter for small creatures ('nursery'/'breeding ground')
- stabilising the seabed.

Many interviewees discussed the benefit of carbon sequestration and the importance of seagrass as a habitat, particularly for charismatic species like seahorses. One interviewee expressed scepticism about the benefits of seagrass, based on the following arguments:

- "no one understands how it [carbon] gets it from the foliage down into the roots"
- "It is maintained or claimed that the presence of the seagrass stabilises the mud and the earth. I am unclear on the depth of the roots in the on in the sea, in the silt. Yeah. And I'm finding difficulty in thinking that the collective root mass is stabilising the seabed given the power of the sea."

Q8. What problems, if any, does having seagrass in this area create?

The only practical problem that was mentioned in association with seagrass was the difficulty of anchoring.

Many of the interviewees noted that the management of seagrass was a problem. One commented that many boaters were wary of initiatives to protect the marine environment (such as Marine Conservation Zones) because of the perception that these would impose changes in boaters' practices. Another interviewee echoed this view, *"if you are told not to anchor because of seagrass, that may cause a negative reaction – people in boating don't like to be moved around. You go out boating because things are free: you can go somewhere remote, there's a pioneering theme.*"

One yachter mentioned conflicts that arise between promoting recreational boating and seagrass preservation. In the Plymouth Sound and Estuaries seagrass is found at the most popular anchorages "*If there were restrictions in Cawsands Bay or in the Yealm or North Drakes island that would then start to impact on leisure sailors. At the moment there isn't really a direct impact, the other grass around the sound I think in areas where yachtsman don't hang and unlikely to be unlikely to be conflict*". Another raised the issue of diversion of resources to help conserve seagrass and the potential for seagrass conservation to adversely affect the local economy at Cawsands: "*if it gets out of balance and the need for preservation of seagrass becomes strident that could have huge economic effects for the community [of] Kingsands and Cawsands and also a huge diversion of resources to police it, which doesn't exist……it's the diversion of resources to try and achieve the impossible*".

Q9. How far would you say that others in this area share your views? What do you base this judgement on?

The interviewees felt that their views were shared by some other boaters (often based on conversations) but acknowledged that there are people with different opinions. One mentioned other boaters may not have the level of (ecological) knowledge that he does. Two mentioned here that there is a reluctance to tighten up management due to concerns about anchoring restrictions.

Two interviewees talked about different responses among boaters to requests for behaviour change: while concepts of freedom to go where you like are important to most boaters, many will accept that problems associated with boating had to be managed: "*The majority see it as a situation to be managed*', ' *there is a divide in attitudes: boaters value their independence and don't like being told what to do but they will listen if they are told something in the right way*." One interviewee brought up the concern that the local community was not really being engaged with about seagrass and the importance that local people should feel ownership of this habitat: *"We probably need to work a bit more with local people. So that people start to learn to love the seagrass that's here and find out more about it*."

Section 2: Injunctive Normative Beliefs and Motivation to Comply

Q10. To what extent do you think that the authorities (local authorities, harbour authorities or national government and its agencies) are interested in what happens to seagrass? Why do you think that?

Some of the interviewees were authorities with a role in protecting seagrass, e.g. Harbourmasters and local authorities. The interviewees also mentioned the police, Natural England and the Marine Management Organisation (MMO) as relevant authorities. Most interviewees said that relevant authorities are interested in what happens to seagrass, although some suggested that they were not effective in motivating compliance.

One harbourmaster expressed concern about reductions in the staff of national agencies (e.g. NE, EA) which were felt to have reduced their presence at a local level. This interviewee said this meant that messages about the importance of seagrass were not communicated strongly: "[Staff] *are so thinly spread now that they're just not around for people to sort of hear from and notice. So I think they tend to think that the organizations as a whole are remote and sort of top down.*"

Another interviewee suggested that national authorities took a different approach from local organisations and that their actions could lead to issues becoming politicised. This was not seen as being intentional, but more a result of national authorities not being in touch with local realities.

Q11. If the authorities give advice on something like seagrass, how important is it for you to follow their advice? How important do you think it is for other boaters?

One interviewee referred to a British institutional culture of a laissez faire attitude to boaters. Boaters expect to be able to go where they like, within reason, and authorities like harbourmasters try to avoid being seen as telling them what to do or enforcing rules. One harbourmaster described how he would approach a boat anchored in seagrass: "*we wouldn't necessarily go to the education side of it, I would just say, you do not want to anchor in seagrass because it's a poor anchorage, you know?*". Boaters are more likely to respond well to information and advice than to direct enforcement via regulations, markers, etc.

The same point was made by the other interviewees and the harbour master who also referred to the lack of powers to enforce: *"there's limits to what you can do. You can't sort of do enforcement side of stuff unless it's specifically noted in the harbour general directions.*"

There was a willingness on the part of all interviewees to follow any advice that came from authorities on protecting seagrass as far as they could but it would depend on how the advice was presented and the message source. For example, if it was sensible and practical *"If it's sensible and practical? If it's not practical, you'll get totally ignored*", if boaters could take ownership rather than be dictated to from the top down ("*It really comes down to the content and how it's presented and, you know, am I allowed myself to take ownership or is it a kind of top down dictation or whatever*.") and if the message was from a source that represented boaters themselves e.g. RYA, Plymouth Sailing Association, and if an assessment of the seagrass locations had been conducted. "*I think it is important which conduits transmit that information to the boat owners if something comes from a city or a corporation or Natural England… oh! If it comes from the RYA, there's more listening because they know the RYA and places like that, they will protect people on the water*." One interview acknowledged that this may be different for motor boaters who are less likely to belong to a group or association.

Q12. How important is it for you to have the approval of the local community and other boaters for your boating activities? How important do you think it is for other boaters to have the approval of the local community and fellow boaters for their boating activities?

The interviewees suggested that there are fairly strong peer relations within at least some parts of the boating community, such as sail yachters. One said that boaters saw advice from other boaters as important and that boaters "*are quite ready to tell others where they are going wrong – and are quite responsive to being told*." Another commented that boaters are aware of and care about how they are seen by other boaters: "*There's a lot of embarrassment comes with owning a boat. If* [anchoring away from seagrass] *were part of training and part of a captain's qualification, I think then people would be worried about what other people think of them because they would assume they also have that qualification*." Several interviewees noted that it is difficult to generalise as not all boaters behave in the same way.

Interviewees who have management roles were most likely to comment on the need to have community approval for their work "*As a company it is very important to have the local community approval and support for commercial activities*". One mentioned the fact that he has a responsibility not to be seen to '[do] something wrong' "*I'm, I think quite mindful because I'm very conscious that particularly me if I was going to be doing something wrong, how that how that would get around*". One mentioned comradery at sea and the importance of helping out other boaters, while another thought that although the majority of boaters behave responsibly, not all do and this can spoil the enjoyment of other boaters.

While the two interviewees who responded directly to this question emphasised that being on good terms with local communities is important, they provided little detail of how those relationships work and the extent to which the views of local people might influence their behaviours.

Q13. Can you think of any times when you have changed what you do on your boat, e.g. where or how you anchor or moor your boat, because of advice from others? Whose advice did you listen to? What was it about that advice that made you change? Has this experience made you more or less likely to listen to others in the future? Why?

Most of the interviewees found it difficult to think of specific advice that had caused them to change their behaviour, but one recognised that an increase in his environmental awareness over a few years had caused him to change his behaviour. For example, he used to throw all rubbish overboard but is now ashamed of doing that. This change was part of a general culture change and was prompted by the Blue Green Campaign on waste disposal.

Another interviewee made the point that he would listen to locals when sailing into unfamiliar ports. *"I would listen to locals…..Any good sailor going into a new area, [would] ask someone. Is that okay?."*

Section 3: Control Beliefs and Power of Control Factors

Q14. How far do you feel that what you and other boaters do could affect the condition of seagrass in this area? Why? Do you think that some activities are more damaging than others?

The views on this question were different between the Solent Maritime area and Plymouth Sound and Estuaries SAC. The interviewees in the Solent Maritime area were more likely to think that changing individual boaters' behaviour could reduce damage to seagrass because of the number of people who boat in this area and the poor anchoring practice of many boaters: *"They're just grabbing with an anchor and ripping out a line."*

The Plymouth Sound and Estuaries interviewees considered that anchoring and mooring practices of boaters were only part of the explanation of damage to seagrass. One suggested that 'winter weather' was one of the causes of damage to seagrass, while another mentioned boat maintenance activities and products such as anti-foul paint and lubricants. Some impacts were attributed to local communities: "*In some of the projects I'm involved in, it's not just people in the boats but it's the local communities what people are doing in their homes, what they're pushing down the kitchen sink, what they're putting on the garden, it all has an impact."*

Q15. How difficult do you think it is for you and other boaters to change behaviours? What sorts of changes would be easiest? And which would be most difficult?

As stakeholders, the interviewees tended to look at this question from the point of view of how easy it would be to change other people's behaviours (rather than their own). A yachter said that changing anchoring behaviour would not be difficult, but it involved learning and adopting a technique. He felt that convincing people to make the effort was potentially difficult with the risk that those encouraging behaviour change could *'cross a delicate line'* between appealing to boaters' appreciation for the natural environment and requiring them to change their behaviours in ways that could seem alien to the boater culture. Another interviewee acknowledged that the message needed to be clear and sustained over time. It is more about convincing people that behaving in a way that protects seagrass is important to them, rather than telling them they have to change: *"Instead of a 'you will do this because we say so', you've got to take people with you, get them to understand why they're doing it and try and engender this sense of ownership – "this is your local area and its beautiful. You need to keep it that way"."* Another suggested that seagrass is not recognised as important in Britain as, say, coral reefs in the Caribbean (which are very important to the economy because of tourism).

Q16. What do you think are the factors that could prevent you and other boaters from changing anchoring and mooring practices? What factors would encourage you and other boaters to change practices?

Several factors were seen as having the potential to stop boaters from changing their behaviours. Some have been described earlier, e.g. the association between boating and the freedom to go where one wants making many boaters wary of restrictions on where they can anchor and less willing to use established moorings; reporting of initiatives in the media which emphasises the restrictions (e.g. Studland Bay). The discussion about mooring fees raised interesting points about the perceived advantages and disadvantages of using moorings (the advantages of convenience versus the disadvantages of being in a more controlled environment) and how these could play out in the context of increased mooring fees to pay for the introduction of AMS. Another interviewee addressed the question of safety: as AMS become more familiar, there is expected to be less concern about

safety: if insurance providers are willing to provide cover for their use and there is little evidence of their failure, boaters will become more ready to use them.

Appendix 4: Meeting questions

Mitigating impacts on seagrass through altering boating behaviours - meetings with boating community - programme

Three meetings were held with boaters as part of Task 1: one for each of the case study sites (Plymouth and the Solent estuaries) and a joint meeting with boaters from both sites and focussed on motorboaters as they had been in the minority at the other meetings.

The purpose of the meetings was to discuss:

- the impacts of anchoring and mooring on seagrass – participants' awareness of, attitudes towards, and experience of those impacts
- the types of behaviours that could be/are encouraged to reduce the impacts – participants' awareness of, attitudes towards, and experience of those behaviours generally, and specifically within their area
- barriers and facilitators to encouraging behaviour change in boat users in that area
- what practical interventions might work in that area in addition to what is already there – this will draw on proposed interventions from other part of ReMEDIES project.

The meetings were held online using Zoom and were interactive to ensure interest. The sessions lasted 2 hours with two breaks. The sessions were designed for up to 9 participants in each meeting to work in a mixture of small group sessions (meeting size permitting) and also together in whole group / plenary sessions to share their discussions. There were two facilitators (one for each small group) and two note takers who captured the points raised and the dynamic of the conversation. Participants were invited to fill in consent forms beforehand.

The programme and questions used in the meetings, as well as images presented to participants, are presented in Table A 7 and Figure A 3 below.

Table A 7. Boater meeting programme

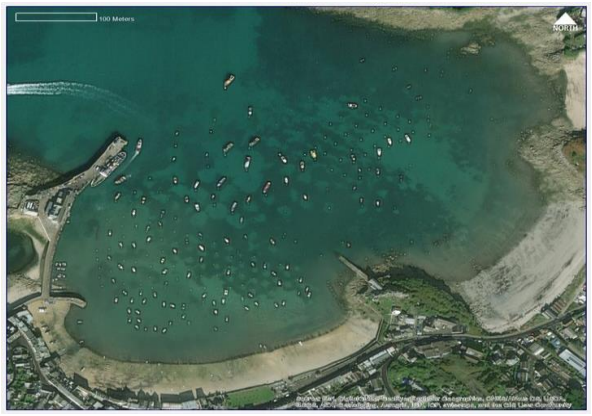
Time	Session /question	Activity	Materials
6.30pm **(10 mins)**	Introduction (Plenary)	**Context of meeting:** ReMEDIES project, three meetings like this [one each in in the Solent /Isle of Wight and Plymouth Sound and Estuaries, and one combined], current survey; then evaluation of behavioural interventions of project. **ReMEDIES partners** – lots! Led by Natural England – for others, see slide **Introduce team on call.** Mention PML and University of Plymouth **Data protection / Brief GDPR**: We are recording this session.	Slide set Including (5) -Slide with overview programme (to show the breaks!) -Slide with ground rules

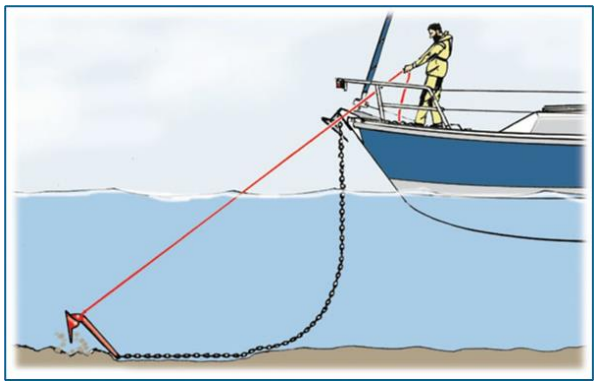
Time	Session /question	Activity	Materials
		Your contributions will be used in reporting etc but will be anonymous. You can withdraw permission to use your contributions for up to 2 weeks after this event. **Ground rules for the meeting:** How the meeting will work (show slide with Programme) We will work together for part of the time and in two small groups for other parts of the meeting. We will have two breaks during the sessions. Any questions? Is everyone comfortable with Zoom?	
6.40 **(10 mins)**	Icebreaker (Plenary)	Please say your name and, very briefly, one memorable sight you've seen when sailing in the Plymouth Sound and Estuaries and Isle of Wight	None
6.50-6.55	Session 1 Under the sea (Plenary session)	How aware are you of what is under you in the sea when you are boating? (slides from participants, if provided) (ReMEDIES photos) Do you know what these plants (seagrass) are? What do you know about them? Where are they found? Do you think they are important? Why / Why not? Now we will break into our small groups to carry on the discussion	(a) Participants slides if available (b) Slides with photos of seagrass habitats
6.55 – 7.00	Session 2 Impacts of anchoring and mooring on seagrass (small group)	**Impacts** What do you know about the ways that anchoring and mooring can affect the seabed and their impacts on seagrass? Can you describe any of these ways? Have you seen these impacts? Here are some photos of impacts of anchoring and mooring on the South Coast of England. [Images 4, 5, 6] Is this what you have seen or would have imagined it looked like? . Do you think impacts of anchoring and mooring behaviours are significant enough to warrant changing how people anchor and moor in seagrass beds? If yes, who do you think should change?	(b) Slides of damage

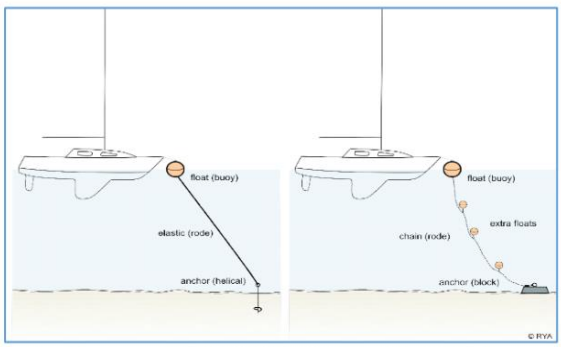
Time	Session /question	Activity	Materials
7.00-7.20	Session 3 Awareness of alternatives for mooring and anchoring with less impact (small group)	**Alternative behaviours** Here are some pictures of moorings designed to avoid impact on seagrass, known as **Advanced Mooring Systems:** To what extent are you aware of changes that could be made to reduce impact on seagrass in this area or elsewhere using Advanced Mooring Systems? Do you know anyone who has installed an AMS and/or do you or does anyone you know try only to use Advanced Mooring Systems to reduce seabed damage? If yes, please share this experience. If no, is this something you have thought about doing? How different from your usual approaches to mooring is this behaviour? What changes did or would you have to make? Would you need to learn new skills? **Anchoring:** Here is a diagram of one anchoring technique to reduce impact on seagrass. To what extent are you aware of changes that could be made to anchoring practices to reduce impact on seagrass in this area or elsewhere? Do you or does anyone you know use anchoring techniques to avoid damage to the seabed or seagrass habitats? If yes, please share this experience. If no, is this something you have thought about doing? How different from your usual approaches to anchoring are these practices? What changes did you or would you have to make? Would you need to learn new skills? Now we are going to have a 5-minute break from our screens. Please be back at 7.25	Slides of moorings designed to avoid impacts on seagrass: Advanced Mooring Systems Slides of techniques for avoiding damage caused by anchoring
7.20-7.25	BREAK 1		
7.25 – 7.35	Session 4 Attitudes towards anchoring and mooring behaviours to	A lot of interesting ideas came out of the small group discussion, now we would like to explore another approach to	Slides – use of buoys / signage to restrict access to areas of seagrass

Time	Session /question	Activity	Materials
	reduce impact on seagrass (Plenary session)	reducing impact on seagrass, by restricting access to certain areas Have you been in areas which use this kind of restriction? Can you tell us briefly what the restrictions involved? What opinions do you have about the introduction of these types of restrictions? [If not already mentioned] How effective do you think restrictions on access are/would be in protecting fragile habitats like seagrass? Now we are going to break into our small groups again.	
7.35– 8.00	Session 4 cont: Attitudes towards anchoring and mooring behaviours to reduce impact on seagrass [continues] (Small group session)	Thinking about the changes in practices and behaviours we have discussed (ie changing anchoring practices, using Advanced Mooring Systems, prohibit anchoring in certain areas), how effective do you think these might be in improving the condition of seagrass in this local area? What factors do you think affect boaters' willingness or ability to change their behaviours in these ways? To help us think through how far you and other boaters would be prepared to change your behaviours and practices to protect seagrass, let's look at decisions you make during a 'normal' boat trip and the factors that affect your decisions regarding anchoring and mooring. [Decision map exercise] Can you suggest any types of boaters who would be more or less willing to change their behaviours and say why? To what extent do you feel confident in changing your behaviour in the ways we have discussed: • use AMS? • using no-anchor zones? • changing ways of anchoring?	(e) Using a 'decision map' (diagram) showing the points at which boaters take decisions which affect their potential impact on seagrass, identify the factors they take into account in making those decisions. - Are these the main decision points? (add or take away points)

Time	Session /question	Activity	Materials
		We are going to have another 5-minute break now. Please be back at 8.05pm	
8.00-8.05	BREAK 2		SLIDE
8.05-8.15	Session 5: Changing practices and behaviours (Small group session)	We are going to consider what recreational boaters need to enable them to change their practices and behaviours in the ways we have discussed. Are there any things that would encourage you or other boat users to adopt the practices and the behaviours we have been discussing? (Prompts: regulations; if key people I know do it; training; information about the benefits of seagrass habitats; maps of seagrass, posters to remind) Now we will return to the full group	
8.15-8.25	Session 5 cont: Changing practices and behaviours (Plenary session)	There have already been some initiatives to encourage behaviour change: Examples from ReMEDIES Other examples e.g. Cawsand AMS What types of interventions do you think would be most likely to help encourage behaviours that protect seagrass in your local area? Why or why not? Would any types of boaters be more or less likely to respond to these interventions?	
8.25 - 8.30	Close (Plenary session)	Any last points that anyone wanted to raise? (allow 2 mins). Thank you very much for your participation Reiterate GDPR Ask people to publicise survey, and if they are happy to be contacted for us to send them the survey? Remind about consent forms	Slide with information on how to access the survey







AMS with elastic rode & helical anchor and AMS with chain floats

Figure A 3 Images shown to participants in the boater meetings

(*From left to right*: Zostera marina moorings damage Salcombe © Keith Hiscock; anchor chain on the seagrass bed © Dan Bolt; Aerial shot of mooring scars within the seagrass, St. Mary's © Phil Horton; diagram of anchoring with care using a trip line © RYA presentation; Diagram illustrating a elastic rode and helical anchor AMS © ReMEDIES project information note 3). All images have been reproduced with permission.

Appendix 5: Summary of meeting results

This appendix presents a summary of the findings from the meetings held with recreational boaters.

The purpose of the meetings was to explore boating practices, their knowledge and views of seagrass, their knowledge and views on approaches to mitigating damage to seagrass (ie Advance Mooring Systems, Voluntary No Anchor Zones, Anchoring with Care).

3 meetings were held with members of the local boating communities: 1 with boaters from Plymouth, 1 with boaters from the Solent and 1 with boaters from both sites and focussed on motorboaters as they had been in the minority at the other meetings (joint meeting). The boater meetings were carried out between September – November 2020 via Zoom. Notes were taken of the discussion.

Thematic analysis was used to identify and explore the main themes. The findings were then clustered around the overarching research questions.

A summary of findings by the research questions is presented below:

RQ1: What are the behaviours of recreational boaters in relation to anchoring and mooring that cause seagrass damage generally and specifically at each of the two test sites? What is the frequency and nature of those behaviours? What are recreational boaters' perceptions of these behaviours?

General themes

There were mixed levels of awareness among the meeting participants of the damage caused to seagrass by recreational boating behaviours. Those that were aware of damage to seagrass or had witnessed damage to seagrass themselves, generally understood this to be linked to anchoring and mooring behaviours. However, some participants questioned how much damage could be caused by recreational boaters compared to other causes. For example, a few participants suggested that fishing boats and trawlers would more likely be responsible for damage to seagrass, or that water quality and other environmental factors are responsible.

- *"I have done snorkelling, on clear day have seen the damage it can cause, bare un-vegetated surfaces." (the Solent meeting participant)*
- *"Haven't personally seen damage. […] Other than swimming through it (I think) I haven't been under the water and seen it or seen any damage." (the Solent meeting participant)*
- *"See lots of fishing boats in my area – trawl for scallops etc – would question how much damage can be caused by individuals anchoring compared to other things like trawling. Nature has a good way of recovering very rapidly to lots of things. Not sure how much damage can be being caused [by boaters]." (Joint meeting participant)*

A few participants from both locations had not witnessed damage to seagrass or were unaware of damage that can be caused by anchoring and mooring behaviours. When shown pictures of

seagrass damage caused by anchoring and mooring, a few of the participants spoke about their own anchoring behaviours and how they can see now how that might cause damage.

- *"I usually put more chain down than more than 3 times the chain you are supposed to, so with tide turn you can imagine the damage it does. I don't know if there is a really large area of seagrass – don't know if I should be going somewhere else, When people say please don't anchor here, I say fine. Don't really know how widespread the seagrass is or how much damage the anchor does." (Plymouth meeting participant)*

Boater perceptions of damage caused by anchoring

Several participants were aware of damage to seagrass caused by anchoring and explained this to be due to poor anchoring techniques of recreational boaters. For example, several participants across all the groups spoke about scarring caused by anchors and chains dragging across the seabed, and many of these participants explained it to be caused by certain anchoring techniques such as putting down more chain than is necessary or not bedding in the anchor properly so that it moves around/drags across the floor. One participant said that damage is caused by boaters dropping anchor but "*not reversing on the anchor*", so it drags across the floor. However, there was some dispute among participants about whether this would cause more, or less damage to seagrass. Generally, more participants spoke about seagrass damage from anchoring behaviours than by mooring behaviours.

- *"I'm very aware that anchors and chains do dramatically affect the seabed – if turning on tide or wind changes, you drag your chain across a big circle. Sure you do a lot of damage." (Joint meeting participant)*

Boater perceptions of damage caused by mooring

Some meeting participants were aware of damage caused by traditional mooring blocks with chains swinging around. A few participants spoke about moorings that had been installed in certain areas to reduce the amount of anchoring, aiming to protect the seagrass (e.g. at Cawsand Bay and near Poole). However, a few participants perceived mooring blocks to be more damaging than anchoring because the large chains make a bigger, long-term impact to seagrass. One participant in the Solent group said that they had seen illegally placed moorings that had caused scarring in seagrass beds.

- *"I'm aware of a project near Poole where mooring buoys have been put down to stop people anchoring, I understand fairly recently there is seagrass over there – so one of my interested is this, as there are always a huge number of yachts there so there must be a huge amount of damage -we go to the left where there is less damage" (Plymouth meeting participant)*
- *"Even the mooring blocks are churning around and make a big impact, I swim and snorkel and it's probably worse than we are shown here." (Joint meeting participant)*

Similarities or differences between locations: Plymouth, the Solent, Other

Some of the participants were aware of seagrass damage by anchoring and mooring in certain areas, for example Studland Bay, but were unaware that it was an issue in their local area. One participant from the Solent meeting said that they regularly anchor in Osbourne Bay, a popular area, and did not think that there was seagrass there. However, another participant in the same group said that Osbourne Bay is a "fantastic seagrass bed" and that they were aware of a big hole in the seagrass bed and wondered if this represents a hotspot of daytime anchoring activity. Another participant in

the Plymouth meeting said although they acknowledge the pictures of damage in Salcombe, they were yet to be convinced that anchoring in Cellars is doing significant damage to seagrass and that maybe there were other reasons for the damage at Salcombe. A few other participants from both Plymouth and the Solent also questioned the amount of damage that could be caused by recreational boaters and wanted to find out more. Another participant, also in the Plymouth group, wanted to know what they would be asked to do to protect seagrass, and whether it is particularly in the Cellars area, because they do not want to be told that they can no longer anchor there.

- *"My taking on seagrass is largely derived from the yacht club bar where there are a lot of experts which say the seagrass – especially Cellars – some will say the seagrass is gravely endangered and anchoring in Cellars is very anti-social thing to do. Others say seagrass is actually quite healthy there. I've been told its actually increasing. Proponents say its not problem there is nice healthy seagrass there. I don't know which part is true. I want to learn more to put some facts into the bar room chatter!"*

RQ2: To what extent are these behaviours related to types of recreational boaters (in terms of attitudes, values and a range of other factors) and types of boat generally and specifically at each of the two test sites? To what extent do recreational boaters themselves perceive these behaviours to be related to types of boaters / types of boat?

Type of boaters: motorboaters vs yachters

Although one or two participants commented that most recreational boaters are environmentally conscious, there was a consensus across all of the groups that there are different types of boaters who behave in different ways and therefore there are some who are more or less likely to cause harm to seagrass.

- *"I think most of us don't want to harm the environment. The minority would abuse it. Other people could police it by saying you shouldn't be there. I would."*
- *"There is a huge variety of people using the water so trying to get penetration of these different people is a hard nut to crack."*

There were some participants from each meeting that voiced the perception that sailors/yachters are more aware of the environment that motorboaters, and therefore motorboaters are more likely to be responsible for damage to seagrass/less willing to protect it. This was generally met with agreement from other meeting participants in all three groups.

- *"Anyone can be a boater – some might prefer speed boats that rip up weeds etc, others more careful about the environment." (the Solent meeting participant)*
- *"Certain people are more keen to make sure environment is as good as it can be. Other people like to ride around on Rottweilers on water and make a lot of noise. We are totally different people and have different perspectives on the environment." (Plymouth meeting participant)*
- *"Choosing where to anchor is very dependent on wind direction. Motorboats are very much more susceptible to swell – want to find somewhere where no swell e.g. sheltered bay or anchorage. Will effect decisions about where to stop." (joint meeting participant)*

Although mentioned in each of the meetings, the view that motorboaters are more damaging was a more substantial part of the discussions in the joint location meeting where most of the participants owned motorboats themselves. Although, most of them were also sailors and generally seemed to consider themselves sailors first and foremost. The explanation given by several participants for why motorboaters were perceived to be more damaging to the environment/less likely to want to protect seagrass was related to the perception that motorboaters are less experienced boaters and/or less engaged with the boating community ie do not belong to boat clubs. Note: all meeting participants were experienced boaters.

- *"Most of us have been sailing people all our lives and have degenerated into motorboats. We do belong to clubs because we've always belonged to clubs. Not the case for all motor boaters." (Joint meeting participant)*
- *"People that belong to yacht clubs are more aware. Some people just launch boat from slip ways and speed – never seen anyone prosecuted for speeding. I think this is way down the list." (the Solent meeting participant)*
- *"I suspect majority do not think about seagrass, and perhaps sailors are more aware, but there is a new breed e.g. plastic fantastic, often buy a boat with little experience and are not really interested in that sort of thing so I think education is very important." (Joint meeting participant)*
- *"My friend with a power boat still can't tie a boat line and doesn't know anything about weather or tides, drives it like a car, and parks it wherever." (Joint meeting participant)*

On the other hand, there were a few participants that felt because of these differences between motorboaters and yachters, motorboats might actually be less responsible for damage to seagrass. For instance, participants felt that most anchoring is done by yachts/sail boats and that it is also mostly yachts/sail boats that visit areas that are more likely to be at risk. Motorboaters are perceived to more likely keep their boat in a marina or on land, and mostly use their boats to travel between onshore locations (i.e. don't stop off and anchor on the way).

- *"My view would be that it's more a problem for the yachts as more anchoring is done by yachts than motor boaters." (Joint meeting participant)*
- *"About 80% of anchoring done by yachters, not motor boaters" (Joint meeting participant)*
- *"I suspect most of us here are environmentally aware, responsible boaters and also that most of us anchor in environmentally delightful/delicate places – and the other lot we are talking about go back to the nearest marinas and slipways. i.e. maybe doing less damage than the thoughtful people [as don't go to the delicate environments]." (Plymouth meeting participant)*
- *"I run a motorboat, diesel engine, have specific destinations in mind, don't find myself looking for little bays somewhere. Don't tend to stop between destinations." (Joint meeting participant)*
- *"I think there is specific difference between motor boaters and yacht boaters – motor boaters have much better idea of how far you can get – sailing more dependent on weather, more likely to change plans and anchor somewhere didn't plan to." (Joint meeting participant)*

Types of boat trip

Some of the meeting participants pointed out that only some types of boat trip would involve anchoring at all. For example, participants who used their boats for racing or travelling between different locations/marinas said that they would never/rarely drop anchor. Some meeting participants felt that 'day boaters' and those that visit places and stop for a short time were more responsible for damage caused to seagrass by anchoring. For example, one participant said that if they were stopping for a short time they might go in closer to the shore because they would be less concerned

about the changing tides. Therefore, this might mean they are more likely to be anchoring in seagrass beds because seagrass is found in shallower water.

- *"This is a particular type of trip isn't it, because there are plenty of trips that wouldn't involve anchoring e.g. racing. Don't know how typical a day out this is. Lots of boat journeys where wouldn't weigh anchor." (the Solent meeting participant)*
- *"The vast majority of people anchoring on seagrass is 'during the day people', not a lot of night-time anchoring going on, it's a short period middle of the day thing." (Joint meeting participant)*
- *"Short stop you may go further in depending on the tide, if only stopping short time then don't need enough water to ride over the change of the tide, can go further in if tide going in if short stay." (Plymouth meeting participant)*

Generally, out of the meeting participants, it seemed to be motorboaters who were less likely to stop and anchor between destinations, although one participant suggested this was dependent on size of boat as well. Another participant who owned a motorboat said that they would be more likely to anchor in sheltered locations (i.e. locations that might be more likely to have seagrass) because motor boats are more susceptible to swell.

- *"I don't do much day boating – tend to go to places for a few days – in the Solent quite a few places to go. I think unless individual who anchors rather than go to marinas e.g. to keep costs down – I don't think the average person thinks about anchoring before they leave, not a planned process. I tend to use my boat to go to and from marinas […] People who anchor tend to be day boaters – maybe smaller boats, ribs etc that want to spend time in and off the boat. Anchoring in motorboats is aimed at smaller day boats I think." (Joint meeting participant)*
- *"run a motorboat, diesel engine, have specific destinations in mind, don't find myself looking for little bays somewhere. Don't tend to stop between destinations." (Joint meeting participant)*
- *"Motorboats are very much more susceptible to swell – want to find somewhere where no swell e.g. sheltered bay or anchorage. Will effect decisions about where to stop." (Joint meeting participant)*

The length of time that an individual was planning to stop would also influence anchoring and mooring behaviours, and potentially the risk of damage to seagrass. Some participants felt that boats that stop for longer / overnight could be more damaging to seagrass because boaters' concerns about safety of the vessel might mean carrying out behaviours that are more damaging to seagrass, e.g. letting down more anchor chain than is needed. Although a few participants felt that concerns about safety would always trump concerns about seagrass when deciding to anchor overnight, one participant said that if they knew they would be causing damage to seagrass in a particular location then that would influence their decision about stopping overnight and they would go elsewhere e.g. to a marina.

- *"Concerns about weather and how long staying (safety) will always trump decisions over seagrass." (Plymouth meeting participant)*
- *"I stayed at Cellars twice in summer, if I knew by putting a lot of chain out, I was causing lots of damage I would change my decision, e.g. find a mooring or marina or go somewhere else. Stopping for the night means a totally different attitude, safety, might mean Cellars beach became somewhere I avoided if I knew was doing damage." (Plymouth meeting participant) – overlap with RQ4*
- *"A lot will depend on whether a day trip or weeks holiday, so what are we planning for will affect where you might anchor or stay e.g. if you want to go into a marina for a shower, etc so whole lot of things to do with duration." (Joint meeting participant)*

Plymouth

- *"Cawsand is a mixture, mostly during day but on weekends a large number of people who stay Friday night to Sunday." (Joint meeting participant)*
- *"I stayed at Cellars twice in summer, if I knew by putting a lot of chain out, I was causing lots of damage I would change my decision, e.g. find a mooring or marina or go somewhere else. Stopping for the night means a totally different attitude, safety, might mean Cellars beach became somewhere I avoided if I knew was doing damage." (Plymouth meeting participant)*

Types of boat: size

A few participants spoke about how the amount of damage to seagrass might depend on the size of the boat. For example, one Plymouth participant felt that it is mostly smaller boats that are looking to anchor within seagrass areas and may be less likely to observe buoys and no-anchor zones. However, another Plymouth participant felt that smaller boats would cause less damage to seagrass because they have smaller anchors and smaller chains.

- *"Smaller boats that have smaller anchors and smaller chains would guess do less damage." (Plymouth meeting participant)*
- *"Smaller boats looking to go inside seagrass areas, swimming areas, see smaller boats dropping anchors there, at this stage would say less likely to observe buoys and no-anchor zones etc. But possibly also less damage." (Plymouth meeting participant)*
- *"Tripline – can only really use it on a small boat, an extra thing you need to store properly – can easily get tangled up e.g. with chain or anchor. Can be hazard if not managed well." (the Solent meeting participant)*
- *"Small boats won't have [enough rope to use as a tripline] e.g. small yachts, less that 20ft, small power boats, ribs, Cawsand sees a lot of those, unlikely to carry trip lines" (Plymouth meeting participant)*

(Last two points overlap with RQ4, can be cross-referenced)

RQ3. What approaches to changing the anchoring and mooring behaviours of recreational boaters have been effective (or not), generally and specifically at each of the two test sites? What approaches to changing anchoring and mooring behaviours of recreational boaters do recreational boaters themselves perceive to be potentially effective generally and at each of the two test sites?

AMS

Overall, some participants voiced concerns about the effectiveness of AMS. The main issues related to capacity i.e. the number of boats that could attach to one AMS, the impact of crowding in busy locations, and tidal range and whether this would affect effectiveness. Because the UK coast is tidal, there are some concerns among participants that the AMS models would still scrape the seabed at low tide therefore be ineffective at protecting seagrass. Generally, participants wanted more evidence on effectiveness of AMS. Barriers to changing boater behaviours (i.e. to use AMS) that would subsequently reduce effectiveness of the intervention are discussed in RQ4.

- *"I know there is a big debate about AMS – e.g. 80-100 boats over the area, if you want to stop that with AMS how many are you going to put in? And at the moment there is talk of no charge, but I find that difficult to accept given the costs involved in providing eco-mooring for a substantial part of that number." (Plymouth meeting participant)*
- *"my understand of the ones in Cawsand – they have their place - in Cawsand is quite wider, the first few people may moor up at a buoy rather than drop their anchor, but I'd be really worried about Sellars beach on bank holiday days [because there would be many more boats there e.g. 40?] there would be people dropping an anchor near it and tripping over it and could cause problems, so it all depends on where you are talking about and how tight an area it is - You might have 3 boats using it in Cellar on a quiet day and that would be fine but if there are 30 boats it may not work." (Plymouth participant)*
- *"If you put a few down then you still have other anchoring, and you still have problems with anchor dragging." (Plymouth meeting participant)*
- *"Various issues with advanced mooring systems – tidal range – need small tidal range to make them effective" (Joint meeting participant)*
- *"have seen the versions before. I'm looking at the floating one and guessing at low tide that that would scrape the floor as well." (Joint meeting participant)*

A few meeting participants had perceptions that some forms of AMS better/more effective than others.

- *"have seen footage of them in action – followed development of them for some time – have slightly different characteristics – different capacities to deal with tidal rand and things like that. Another type – uses buoyant rope, high-tech rope – similar idea – any traditional mooring relies of same idea – big weight on seabed. Lifting anything that is moving to prevent it abrading the seabed. Static lump is then only thing on seabed." (the Solent meeting participant)*
- *"yes, just as efficient. If anything helical screw has advantages over anchor block. AMS have got bogged down with helical screw but it's the elastic rode that actually prevents scouring." (Joint meeting participant)*

A few participants had positive perceptions about the effectiveness of AMS, particularly in some circumstances e.g. to avoid restricting access to popular locations.

- *"yes, just as efficient. If anything helical screw has advantages over anchor block. AMS have got bogged down with helical screw but it's the elastic rode that actually prevents scouring." (Joint meeting participant)*
- *"Other areas where combination of popularity and a seagrass bed – could we use some of these other solutions e.g. the AMS. I think most people I've talked to, there are anchoring nerds out there that love anchoring, but most people would prefer to pick up a mooring for a couple of hours." (the Solent meeting participant)*

A few participants did not feel able to comment on the effectiveness of AMS because they were unfamiliar with the intervention/technology.

There did not appear to be any strong differences in perceptions of effectiveness of AMS between the two locations.

Alternative anchoring techniques (tripline)

Overall, there were mostly concerns about effectiveness of using a trip line to retrieve anchor among meeting participants in the joint meeting group. There was generally consensus among participants in the joint meeting group that they could not see the difference this would make in terms of amount of damage to seagrass.

- *"no, never seen anyone do that. I haven't ever done that. I honestly can't see what that's going to achieve." (Joint meeting participant)*
- *"not someone who does a lot of anchoring – but can't see much benefit that would have – doesn't seem to be saving much damage." (Joint meeting participant)*
- *"I don't think the difference of disturbance down below if going to be much changed by this, most of us go slowly to pick up anchor, the notion of dragging one forward and eventually picking up the anchor is not what happens, people pick up the anchor from a vertical position." (Joint meeting participant)*

Restricted anchoring / VNAZ

There were some positive perceptions to the effectiveness of voluntary no anchor zones (VNAZ), however a keen interest among many participants not to have enforced restrictions on anchoring. Generally participants felt that effectiveness of VNAZ would depend on factors specific to the location on which it was rolled out, for example it would depend on amount of space, popularity of site, level of public awareness/support.

- *"awareness – from what we've seen, signs in Helford and fell – if make people aware where seagrass is, I think they will respect that. Haven't seen anyone in anchor where they have been told there is seagrass." (Plymouth meeting participant)*
- *"I think it depends on the location – so I think somewhere where there is more space and can accommodate more boats perhaps people will pay more attention to it. But on a really hot summers day in Sellars it will be ignored." (Plymouth meeting participant)*
- *"the problem in Sellars is if the wind is in east it's a lovely place to be and everyone wants to be there and that's where the seagrass is. [but if wind changes] We would not want just to protect a bit of seagrass to have the boats drive onto the cliffs! I don't know where seagrass is in Cawsand don't even know where the eelgrass is but it's a big area, it's a different situation and there is space to cordon off [the seagrass area]" (Plymouth meeting participant)*
- *"the Solent is an extremely tricky place to put together what everyone wants to do. May be a case for no anchoring areas in some of the more pristine seagrass beds. […]. Other areas where combination of popularity and a seagrass bed – could we use some of these other solutions e.g. the AMS." (the Solent meeting participant)*

Perception that it could work in e.g. Studland (the Solent), Cawsand (Plymouth)

- *"The Studland bay one makes total sense to me – believe there is a colony of seahorses there and wouldn't want to cause damage to them." (the Solent meeting participant)*
- Perception that it couldn't work in e.g. Sellars (Plymouth)
- Depends on public support / level of education.

Some participants felt the VNAZ should have navigational aids that have clear and direct instruction to be most effective.

- *"The only thing that has changed my behaviour in seagrass is buoys in Helford [??] area – I think it just said 'seagrass area no anchoring' and we anchored outside the area with no*

problem and that changed my behaviour. There may have been a map if I went on shore but I wouldn't have picked it up. To me signs on yellow buoy are effective." (Plymouth meeting participant)

- *"Straightforward sign – people would do it, like swimming zone." (Plymouth meeting participant)*
- *"Rather than saying can't anchor, perhaps signs could be put up to inform people that there is seagrass in that area – more people would take more note of that than just a blatant 'you can't anchor here'. Salcombe is tidal area, telling tourist not to anchor won't work, but telling them why – might get more compliance." (Joint meeting participant)*
- *"if I go to Cawsand I may damage the seagrass, and if I saw some signage, I would avoid or change go e.g. hundred yards in a different direction. So maybe on the 2nd or 3rd visit people could change behaviour on that increased awareness [i.e. I think this was in relation to that they may only see the information after they have anchored the first time and gone ashore? So that it takes 2 or 3 times for them to change]." (Joint meeting participant)*
- Needs enforcement.
- Some clear resistance/opposition from some boaters to anchoring restrictions.

Other approaches

Generally, very positive perceptions of education/awareness raising approach.

- *"awareness – from what we've seen, signs in Helford and fell – if make people aware where seagrass is, I think they will respect that. Haven't seen anyone in anchor where they have been told there is seagrass." (Joint meeting participant)*
- *"Like [participant name], I'm totally ignorant, I look for sand banks, wrecks and divers but don't have much other concern about what is beneath me." (Joint meeting participant)*
- Some preference for visual/navigational aids to inform boaters where seagrass is over restricted anchoring. Although also some doubts about this approach.
- Some mention of a need for a mixed approach – multiple interventions together

RQ4: What are the barriers and facilitators to boaters (in particular, different types of recreational boaters) taking action at each site? To what extent are these related to capability, opportunity and motivation?

Capability

Knowledge and awareness of seagrass

All Plymouth meeting participants were able to identify the photos of seagrass. Some of the Solent meeting participants identified the photos of seagrass, a few participants said that they recognised it but didn't know it was seagrass. Most of the joint meeting participants also identified the photos of seagrass but a couple had not seen it before nor knew what it was called.

When it came to knowledge and awareness of the importance of seagrass and a need to protect it, many of the participants felt that it was important. In the Plymouth group, the majority of participants felt that seagrass was important. One participant felt that there has been more communication about the importance of seagrass in the last few years. Another Plymouth participant said that they suspect

everyone that has chosen to attend the meeting must think seagrass is important, or at least want to find out more about it, otherwise they wouldn't have joined the meeting.

Some of the Solent meeting participants felt that seagrass was important because it "*encourages wildlife*" and a few were aware of the link with seahorses in Studland Bay. A few of the participants said that they had not previously had discussions about the importance of seagrass, although one of these participants was aware of the seahorse habitat at Studland Bay. One participant in the Solent group worked as a marine biology and had in-depth knowledge of seagrass and their importance for many species of wildlife, and for climate change mitigation.

The importance of seagrass was not discussed in the joint meeting group; however, a few participants mentioned the link with seahorses.

- *"If have boat hold in anchorage I would have a good idea of if it's a sandy bottom or better holding where have rocks and seagrass – Cawsand has very good holding with mixture of sand and seaweed – but when you come to grasses I now know a little about seagrass but didn't know much a while ago." (Plymouth meeting participant)*
- *"is eelgrass and seagrass the same thing or am I showing my ignorance there?" (Plymouth meeting participant)*
- *"I understand it's a flowering plant that grows in clean waters around the coast and is home to fry and seahorses and other than and a vulnerable environmental that needs to be cared for – vulnerable." (Plymouth meeting participant)*
- *"Similar, seen it, would hate to have been put on the spot to name it. Know that seagrass is very good and encourages wildlife." (the Solent meeting participant)*
- *"I'm a marine biologist working in the Solent, I have too much knowledge! […] those are common seagrass – Zostera marina – grows primarily from low-down, covered parts of sea. Particularly in Isle of Wight. Some of those leaves have black on them, a disease that knocked out 30-40% of seagrass in the 1920s, no longer as serious as it used to be." (the Solent meeting participant)*

A few participants wanted to know more about *why* seagrass needs protecting. This suggests that a lack of understanding of why seagrass is important and needs protecting could be a barrier to boaters adopting alternative seagrass-friendly behaviours. This relates to the argument from meeting participants that more education is needed to inform boaters about seagrass and the alternative approaches to protect it (see section on education as a facilitator).

- *"I wouldn't have a problem but yet to see any good science to tell me that is the case [ie that seagrass need protection in this way?]" (Plymouth meeting participant)*
- *"I would like to know more about seagrass? We are talking about protecting seagrass, but I'm not clear on why we are protecting." (Joint meeting participant)*
- *"Yes maybe [the damage warrants changing behaviours] but I have yet to be convinced that anchoring in Cellars is doing any material damage to the seagrass bed there, the seagrass appears to be healthy – I acknowledge the horrible picture of the damage in Salcombe but that doesn't look like anchor damage, [more like a boat being there for a long time], for me the jury is out." (Plymouth meeting participant)*

Knowledge of seagrass locations in Plymouth and the Solent

Many participants across all the groups said that they were interested in finding out more about where seagrass is located around the South Coast. Several participants did not feel they were able to effectively change their behaviours to protect seagrass because they did not know where it is

located (ie which areas to avoid or where alternative boating behaviours are needed to reduce damage). Some participants were able to name some locations that they were familiar with that they understood to have seagrass beds, but many participants were unsure whether the locations they visit regularly have seagrass or not.

- *"I'm aware of some seagrass in Salcombe Estuary but apart from Studland Bay, I'm not aware of any other areas." (Joint meeting participant)*
- *"There is lots in the Yealm River." … "And a lot in Torbay, Fal and Helford, Scillies and there are areas where it's not been found yet, you just find the seagrass washed up on the storm" (joint meeting participants]*
- *"Salcombe also have dwarf seagrass for which the main damage is not anchoring but small boats being pulled up the beach with propeller damage so the Salcombe harbour guide probably doesn't make it clear that there is a difference between the two types of seagrass." (Joint meeting participant)*

Knowledge and awareness of alternative seagrass-friendly behaviours

Alternative anchoring techniques

Most meeting participants were aware of the technique of using a tripline to retrieve anchor despite many not using it themselves. Only a few were familiar with it as a technique to protect seagrass/the seabed. A few participants were not familiar with the technique at all. Generally, participants knew of the technique in the context of dealing with hazardous terrain or to avoid debris on the seabed that could get caught on the anchor. Most meeting participants appeared to have the knowledge and skills required for using a tripline, however several participants felt that education would be needed to encourage boaters to use this technique to protect seagrass as this is not the usual purpose. Overall, capability did not seem to be the main barrier to using a tripline as an alternative anchoring behaviour, however other barriers were apparent (see Opportunity and Motivation).

- *"If anchor in Plymouth sound, have to use a tripping line because so much rubbish on seabed so will get anchor [caught]." (Joint meeting participant)*
- *"I know it's a way of getting an anchor out when stuck under underwater obstruction, not thought of it as environmental protection." (Joint meeting participant)*
- *"Most boaters that anchor know that using a trip line is something you have to use in certain circumstances e.g. when bottom is going to be particularly tricky – not something I would use normally." (Plymouth meeting participant)*
- *"Familiar with them from getting stuck and also because they damage the seabed less." (Joint meeting participant)*
- *"Yes familiar with this – we would do this type of release. We would use this approach, particularly if anchoring over rocks – to avoid it getting caught. Most people would need to be taught this." (the Solent meeting participant)*
- *"On my particular boat I haven't used that, haul anchor in by the chain. Need to be educated by that. Not been in rocky situations." (the Solent meeting participant)*
- *"Familiar with approach but can't say I've used it a lot in the Solent." (the Solent meeting participant)*

Advanced Mooring Systems (AMS)

Knowledge and awareness of AMS varied among meeting participants. Many participants were aware of some of the types of AMS and their purpose to protect seagrass, others had not heard of them and were only aware of traditional mooring blocks. A few participants were aware of AMS being

trialled in certain locations in the UK, including on the south coast. One or two participants knew of other boaters who used or planned to install AMS, however most participants had not used an AMS themselves. This suggests that some form of education about the different types of AMS may be needed to facilitate the use of these alternative systems by recreational boaters. However, overall, awareness of AMS did not seem to be the main barrier to their use, other barriers (see Opportunity and Motivation) seemed to be more significant.

- *"Yes, I was aware of them and I understand there has been some experimenting on them in Cawsand Bay." (Plymouth meeting participant)*
- *"Not aware of these. Never seen in boat shows in South Hampton." (the Solent meeting participant)*
- *"Aware of them, have seen one of two of them out of the water. Don't personally use them. Not aware if currently any in the Solent. Aware of the elastomer model. New to us but not to the rest of the planet. They require – helical system – different installation. Have been installed elsewhere in the UK. Helical piling is not a new method." (the Solent meeting participant)*
- *"Apart from traditional mooring, not aware of alternatives." (joint meeting participant)*
- *"My boat moored on traditional mooring. Know someone nearby who is keen for laying down those helical anchors." (Joint meeting participant)*

In terms of possessing the necessary skills to be able to use AMS as an alternative mooring behaviour, meeting participants generally felt this would not be a barrier as it would require the same exact skills as using a traditional mooring, a behaviour that many felt is a basic skill for a boater.

- *"Picking up mooring buoy in Salcombe should be the same as using AMS mooring buoy, no difference" (Plymouth meeting participant)*
- *"[Behaviour is the] same as picking up ring on top of mooring buoy – basic skill for a boater." (Plymouth meeting participant)*
- *"Technique would be the same." (Joint meeting participant)*
- *"I don't think it would make any difference [to behaviour/technique used]." (Joint meeting participant)*

Restricted access / VNAZ

Other than awareness of seagrass and the need to protect it, which applies to all interventions, there did not appear to be any barriers related to boaters' capability that were specific to restricted access or VNAZ.

Education as a facilitator of behaviour change

There was consensus among participants in all groups that more education is needed to raise awareness of seagrass to facilitate seagrass-friendly boating behaviours. Most participants felt that if recreational boaters were provided information on *why* they need to avoid/protect seagrass then they would be more likely to follow advice on the alternative behaviours. A few participants themselves voiced that they wanted more evidence to support the need to change behaviours.

- *"We need to educate people at the start about what the seagrass is! That sort of information would be really useful." (Joint meeting participant)*
- *"I think need to educate more, probably first step. There's lots of people that don't really know about this and might change habits if they did. There needs to be a balance, recreational boating is very popular and wouldn't want it to be detrimental to that but maybe ways to encourage people to be more sensitive. There must be ways around it." (the Solent meeting participant)*

- *"I don't think you will get some emotion unless you do the education bit first, and I think that is a really important part of this." (Plymouth meeting participant)*
- *"I would need convincing to know this is what we need to do to save the seabed, I think we could do it, but we need education." (Joint meeting participant)*

Many meeting participants also called for more information and education about *where* seagrass is located to facilitate the adoption of seagrass-friendly boating behaviours.

- *"if going to anchor, you're going to cause damage – don't see any way of avoiding if dropping anchor. Need to know where seagrass is. Then can decide whether to anchor there." (Joint meeting participant)*
- *"There are no yellow buoys saying don't anchor here – on planning a trip – if I was told do you know that going to Yealm you are going to damage the seagrass, I may go elsewhere because I knew I was going to protect the environment, but of course up until now that is not a factor because there is nothing telling me I could be causing a problem." (Plymouth meeting participant)*
- *"if I knew I was going to damage something delicate I just wouldn't do it – goes back to education and also some simple tips." (Plymouth meeting participant)*
- *"No personal handle on how much seagrass there is. Has someone done calculations of damage by mooring/anchoring vs seabeds that are important for seeding point of view. More knowledge needed about the actual problem and where it is." (the Solent meeting participant)*

Some participants also wanted more information and education on why they should enrol in seagrass-friendly behaviours, including evidence of why the proposed alternative behaviours are better for seagrass, and also of their effectiveness in terms of safety. A lack of understanding as to why behaviour change is needed was seen by some participants to be a barrier to changing habits of other recreational boaters.

- *"Need to have education. At moment too traditional and need more information to have the confidence to implement this [AMS] is my own mooring!" (Joint meeting participant)*
- *"electronic charts don't show seagrass bed, if they did, people would be more aware. Have details about shingle bed etc but not seagrass." (Plymouth meeting participant)*
- *"[On using a tripline] techniques that most boaters are aware of – need education of when and where to use them. If people were more aware of seabed they would do it." (Plymouth meeting participant)*
- *"Limiting where people can go will have negative impacts e.g. crowding. If people are educated and on board with it then maybe support but generally restricting anchoring might not be supported." (the Solent meeting participant)*
- *"I want evidence I am doing damage by mooring and I want evidence a trip line is any better than my current practise" (Plymouth meeting participant)*
- *"need education on why I would want to anchor in deeper water, with a longer line and longer row to get to shore – we need to understand what the benefits would be for anchoring further out, so if you want to change my behaviour you need to make a good argument for why." (Joint meeting participant)*

Information about seagrass needs to be readily accessible to recreational boaters, ie, clear messaging that reaches all types of boaters. A few participants felt that clear and simple instructions that are readily accessible to all boaters will increase the likelihood of boaters abiding. For example, one participant felt that most boaters do not want to spend time looking for information about seagrass because they are not particularly interested, they just want to 'get on' with boating. A few

participants felt that some simple tips on avoiding seagrass, such as anchoring outside of the 5m contour, would be more effective than implementing restrictions or signage that not everyone understands. Education through sailing clubs was also suggested by a few participants as a good way to raise awareness among recreational boaters. However, it was also noted that not all types of boaters generally belong to clubs, particularly that motorboaters often do not, so these boaters would need to be reached some other way. Some suggestions included through marinas / berth-holders or insurance policy renewals (see Opportunity section).

- *"The information is not immediately obvious, if you look for it they may find it but recreational boaters just want to get on i.e. a lot of people not interested at all, so you need to educate much more people." (Plymouth meeting participant)*
- *"Cawsand my advice would be if you anchor out of 5m contour, that more or less mean you are outside of the seagrass beds so if you have a simple message like that then they are more likely to abide by it than a complicated chart or a no anchor zone e.g. Studland, it wasn't clear whether buoys marked area to anchor in or not to anchor in." (Joint meeting participant)*
- *"Visiting clubs when they have programme of talks on environment issues – that's another way to get the information out, but there are so many people in the boating community who have no link to sailing clubs. I asked my marina if they would post info out to all the berth-holders but they refused to do so – so how do you get the info out to people not included e.g. people who have small high-power boats – they are not members of clubs - how do you educate those people?" (Plymouth meeting participant)*
- *"Yes educational process for yachts people and sailors so they know what happening – there are notices in Yealm about specific oysters but not about the grass, so while there are various entry and exist areas, there are other pinch points where you could have education." (Joint meeting participant)*
- *"Also when you renew your mooring – Harbour authorities could send out information in their renewals as that goes to everyone that uses the estuary." (Joint meeting participant)*
- *"in terms of info, how would we receive info? I wouldn't get it from social media, but if I go elsewhere, the Harbour Master will give us their info. I don't think in Yealm there is any info about seagrass, so could improve the information communication, e.g. through harbour masters." (Joint meeting participant)*
- *"Using apps to know things is becoming more common e.g. if I want to check tide times the first place I look is online – I have apps I can use. Most people rely more on electronic devices – nothing to stop apps to include environmental information e.g. alerting you that where you are going is of environmental importance – wouldn't be able to avoid thinking about it because it would be presented to me. Would change my decision making." (the Solent meeting participant)*
- *"All seagrass is coastal so probably in mobile phone signal range so apps could be good way to get info across." (the Solent meeting participant)*
- *"If integrating an app – integrate it into an app that people already use, don't make a new one or people won't use it." (the Solent meeting participant)*

A few participants felt it was important to make sure any information about seagrass and changing behaviours was communicated in a way that makes boaters feel like it is on their side. For example, one participant said it would be important to make sure it does not seem like it is "*bashing yachties again*". A few participants were in favour of providing boaters with information and allowing them to make their own decisions based on that, rather than enforcing restrictions because people "*go sailing to enjoy the freedom*".

- *"I think you go sailing to enjoy the freedom so to be told you can't do this or that [ie is not good]… You can gradually encourage people to change their behaviours so people understand why they need to change their behaviour. Let me know about the seagrass, so if you can encourage me to do the right thing, I can probably change what needs to be done." (Joint meeting participant)*
- *"If you are going to write in motor magazine, please try to be even-handed, so if it's just seen as another prohibition that boat users are going to bear, they need to know the whole story, otherwise just seen as bashing yachties again." (Joint meeting participant)*
- *"I would resist strongly any banning of anchoring in Yealm, it's been used for years as an anchorage and it's not doing any harm, the seagrass is getting better every year. [What if it was voluntary?] It could be issued as an advice and I would not be against that. But humans need to have something in this race, don't want to cower to an underground[water?] lawn!" (Joint meeting participant)*
- *"you will change people's behaviours if they want to change because they know more, but don't try to change us in the Yealm!" (Joint meeting participant)*

Opportunity

Access to necessary infrastructure

A lack of necessary infrastructure is arguably the most obvious barrier to use for some of the alternative boating behaviours put forward in the boater meetings, particularly for advanced mooring systems (AMS). Although a few participants were aware of AMS being trialled at Cawsand near Plymouth, the majority of participants were unaware of these types of mooring systems existing along the South Coast. Furthermore, those that were aware of the trial AMS at Cawsand had not used them themselves. One participant said that they had applied to replace some traditional moorings at Cawsand with AMS. Others said they had not heard any feedback about the Cawsand AMS trial.

- *"I don't know where they are – last year, a trial one disappeared in Cawsand." (Plymouth meeting participant)*
- *"I know they have been installed outside Cawsand, also maybe further east along the coast. Haven't heard any feedback on using them." (Joint meeting participant)*
- *"Not been available where I anchor." (Plymouth meeting participant)*
- *"Not aware if currently any in the Solent… Have been installed elsewhere in the UK" (the meeting participant)*
- *"we have some of these in Cawsand as part of trial, believe there has been good progress around the 5 trial buoys, I've signed up to replace 20 moorings out of perhaps [150??] boats on a summer day and we are identified on charts as anchorage, and we will continue to suffer unless we have more moorings which can be used by visitors we will continue to have problems." (Joint meeting participant)*
- *"If ever tried to moor your boat as a stranger outside Cawsand you'd know about it – they are very protective! Would have to drop anchor." (Joint meeting participant)*
- *"If mooring, Salcombe is predominantly mooring there is no marina, the HBA own all the mooring buoys, there are probably 500 moorings and I can see the two on the right hand side are, but the ones there are exclusively the traditional moorings." (Joint meeting participant)*

Some participants agreed that they would use an AMS if it were available where they wanted to moor/anchor. A few participants raised concerns about the cost of using an AMS; it was felt generally that participants would not want to use AMS if it cost more than traditional mooring systems.

Therefore providing AMS systems that were free to use, or cost no more than traditional moorings, could be a potential facilitator of changing mooring behaviours.

- *"If there was an AMS there that I could pick up I would use it." (Plymouth meeting participant)*
- *"I know there is a big debate about AMS – e.g. 80-100 boats over the area, if you want to stop that with AMS how many are you going to put in? And at the moment there is talk of no charge, but I find that difficult to accept given the costs involved in providing eco-mooring for a substantial part of that number." (Plymouth meeting participant)*
- *"As a recreational boater my question is how robust is it and how much does it cost? Mooring my boat is quite expensive with a chunk of concrete, but I expect it costs more if we use one of these novel systems." (Plymouth participant)*

Access to information about seagrass location / navigational aids

As previously mentioned under capability barriers/facilitators, many meeting participants felt the need for better information about the location of seagrass so that recreational boaters can make behavioural decisions to avoid/prevent damage to the seagrass. This is particularly relevant for anchoring away and alternative anchoring techniques (i.e. using a tripline) as boaters need to know where the seagrass is. Many participants felt that providing information that maps out seagrass beds, either in the form of signage/navigational buoys, electronic navigational systems, or on paper charts and maps that provide the information about seagrass location *at the site* of seagrass would be most effective at changing boater behaviour.

- *"Helford have buoys where seagrass beds begin and ask you to anchor on the other side, drop anchor outside of seagrass area." (Plymouth meeting participant)*
- *"I think the one [photo] that says no anchoring [is in Falmouth?], I was down there when that was on, and no problem, I could go about a quarter of a mile away and anchor so it seemed like the eelgrass was in a particular area and there was room to anchor somewhere else " (Plymouth meeting participant)*
- *"If included seagrass markings in navigational charts – navigational units in the boat – if going to deploy anchor and guide says there is seagrass be careful I think all boaters would comply." (Joint meeting participant)*
- *"If I go to Cawsand I may damage the seagrass, and if I saw some signage, I would avoid or change go e.g. hundred yards in a different direction." (Joint meeting participant)*

However, there was some concern among participants that without boaters already possessing the knowledge and awareness of seagrass and alternative seagrass-friendly behaviours such as anchoring away or alternative anchoring techniques (see capability section) that simply sign-posting where seagrass is / providing navigational aids (ie providing the opportunity to carry out certain behaviours) may not be enough to change behaviours. It was felt by several participants that boaters need to understand why they are being asked to do certain behaviours (see capability section). Some participants suggested providing this information not only at the site, but at multiple points of contact with boaters, for example signage where boaters get onto their boat/at piers/marinas, or incorporating information into training. As previously mentioned in the capability barriers section, not all boaters will actively look for information on seagrass, so it needs to be presented to them so that they have the opportunity to learn and change behaviours. A few participants felt that a combination of both information away from site *and* buoys/navigational aids at the site would be best to facilitate boater behaviour change.

- *"If you put an info buoy – if I just saw 'seagrass area' on a buoy I wonder how many people would read that. I can't see how many people would do much. You can't put that much info on*

the buoy. You need to provide the info to people before they get on their boat – and part of that is a time thing, the more places you drip that info the better it will come." (Plymouth meeting participant)

- *"If you put notices on main areas where people get onto their boats that can only help." (Joint meeting participant)*
- *"There are signages across piers about seagrass but don't know how consistent that is across the Solent. Designated areas where highly sensitive seagrass is it is quite important to know." (the Solent meeting participant)*
- *"do the RYA incorporate these things in any of their courses e.g. day skipper, competent crew etc? I've never seen anything like this." (Joint meeting participant)*
- *"In Cawsand there are maps of the bay which highlight seagrass but it doesn't say 'don't anchor in this area'! So not sure it's helpful to inform behaviour in advance of people arriving! Having buoys would help, so when people are approaching the area, they can take note of the signs. The buoys could serve 2 purposes [I think by this he meant signage and somewhere to moor?]" (joint meeting participant)*

Overall, participants seemed to believe that navigational buoys / signage could be an effective facilitator of boater behaviour change, as long as the messaging/instructions are clear and direct. If boaters are unclear about what the navigational buoys represent, then this will be a barrier to behaviour change. Unclear signage of VNAZ was reported in some locations, including Studland, and participants felt that this was a barrier to boaters adhering to the requests for no anchoring.

- *"The only thing that has changed my behaviour in seagrass is buoys in Helford [??] area – I think it just said 'seagrass area no anchoring' and we anchored outside the area with no problem and that changed my behaviour. There may have been a map if I went on shore but I wouldn't have picked it up. To me signs on yellow buoy are effective." (Plymouth meeting participant)*
- *"straightforward sign – people would do it, like swimming zone" AGREEMENT (Plymouth meeting participant)*
- *"Studland, it wasn't clear whether buoys marked area to anchor in or not to anchor in." (Joint meeting participant)*
- *"Do we encourage publishers of tide tables and Yealm Harbour Authority and visitor guides etc and encourage advice and diagrams? Also do you follow Helford route and have yellow signs. I don't particular want to see them but in terms of communication with boat owners clearly floating yellow buoys when they arrive somewhere is most straightforward." (Plymouth meeting participant)*
- *"Would it work if there were signs indicating that it was a seagrass area rather than prohibiting boaters." (Plymouth participant)*

Access to personal equipment

Using a tripline to retrieve anchor not only requires knowledge and skills to be able to use the technique (see capability barriers), but also possessing the necessary personal equipment. A few participants highlighted this as a potential barrier for some boaters, particularly smaller boats that might not have room to store additional rope. However, one participant said that using a tripline could only work for small boats. Another participant said that most boaters would have enough rope but wouldn't think to use this, suggesting that this may not be an opportunity barrier but a motivation barrier.

- *"Tripline – can only really use it on a small boat, an extra thing you need to store properly, can easily get tangled up e.g. with chain or anchor. Can be hazard if not managed well." (the Solent meeting participant)*
- *"Small boats won't have [enough rope to use as a tripline] e.g. small yachts, less that 20ft, small power boats, ribs, Cawsand sees a lot of those, unlikely to carry trip lines" (Plymouth meeting participant)*
- *"Most people have enough rope on their boats but wouldn't think to use it." (Plymouth participant)*

Motivation

General attitudes and personal preferences

Many of the meeting participants considered themselves somewhat environmentally aware / that they care about protecting the environment, hence why they had chosen to attend the meeting, and suggested that this would make them personally more inclined to change their behaviour to protect seagrass. A few meeting participants said that they already take behavioural action to protect the seagrass by anchoring away from seagrass beds or by using anchoring techniques.

- *"Yes I do [consider damage to seagrass significant enough to warrant behaviour change] which is why I came alone to find out more and to find out how other yachtswomen and boaters might be education not to anchor over there especially somewhere where it's very popular." (Plymouth meeting participant)*
- *"I anchor outside of the seagrass beds – make sure of it." (Plymouth meeting participant)*
- *"I use 2m line with float from tripping point of anchor – fishing net float – several advantages – when want to retrieve anchor, can go out in dingy and pick anchor up. I do that regularly to avoid damage." (Joint meeting participant)*
- *"seagrass only grows in water under 5m deep, so I go somewhere over 5m to avoid seagrass." (Plymouth participant)*

On the other hand, a few participants felt that most boaters do not care about the condition of the seabed when they are anchoring/mooring. Therefore, a lack of interest in protecting the environment could be a motivational barrier for some recreational boaters to adopt any seagrass-friendly behaviour. Also as previously mentioned in RQ2, many participants perceived motorboaters to be less environmentally aware so this could be a particular barrier for this type of boater.

- *"Personally I think most people do not think at all about the condition of the seabed when they lifts their anchor." (Plymouth meeting participant)*
- *"Certain people more keen to make sure the environment is as good as it can be and others like to ride around on rottweilers on water, we are totally different people and have different perspectives on the environment. AGREEMENT" (Plymouth meeting participant)*
- *"I suspect majority do not think about seagrass, and perhaps sailing are more aware, but there is a new breed e.g. plastic fantastic, often buy a boat with little experience and are not really interested in that sort of thing." (Joint meeting participant)*

A few participants expressed a personal preference for either anchoring and mooring, suggesting that individual boaters have individual preferences that could encourage or prevent some behaviours. A few participants also expressed personal preferences for certain anchoring techniques such as preferring to anchor away from seagrass, or a dislike for using a tripline. A personal preference to anchor instead of using a mooring would be a motivational barrier to using AMS;

likewise a personal preference for using a mooring buoy might be a motivational facilitator to use an AMS but a barrier to anchoring away or using alternative anchoring techniques.

- *"I usually anchor – depends where I am going – fewer places to anchor these days – anchor at Helford and at the Fal – also at Cawsand. Prefer to anchor." (Plymouth meeting participant)*
- *"If on odd occasion I have anchored, it looks more stressful to mess around with an additional line, but maybe if you did it all the time. My interest is to maintain access to areas for boaters, so whatever we need to do to maintain that happen I am happy to do." (Joint meeting participant)*
- *"I'm not someone who does a lot of anchoring – but can't see much benefit that would have – doesn't seem to be saving much damage." (Joint meeting participant)*
- *"I always reverse down on the anchor to a certain extent definitely." (Plymouth meeting participant)*
- *"when we sail – tend to pick up mooring buoy rather than anchor – but always have plan b along the way – pull in somewhere else – but usually go for mooring buoys or pontoon – anchoring would always be last resort." (Joint meeting participant)*

Some participants had a clear preference or personal attachment to certain locations, which could be a barrier to certain interventions at such locations. For example, some participants voiced how they would be disappointed if they were told they could not anchor in certain locations and this might mean they would be less likely to abide by VNAZ. A personal attachment to visiting certain areas may be a motivational facilitator for adopting alternative anchoring techniques or using an AMS if it meant that visits to said location could continue. One Plymouth participant said that if it meant protecting an area that they cared about, i.e. Cellars, then they may be willing to avoid that particular area at certain times of year.

- *"I love coming to Cellar […] a good place for me to go and I see friends there. I want to understand what I would be asked to do, is it that the eelgrass is particular in this area or if you go over there by the sandbar it's okay, but if I was told I couldn't anchor there at all that would be a big disappoint as it would be a real shame if I couldn't anchor there." (Plymouth meeting participant)*
- *"Have become aware of swimming areas – normally tend to be close in, like seagrass – wouldn't ever anchor in a swimming area, anchor outside it. Cellars – means you can't go there at all if it is restricted. Where I used to go, no longer being able to go there becomes an emotive issue for people." (Plymouth meeting participant)*
- *"I would be disappointed if we had no anchoring zone around the Plymouth area I think it would impact severely on what people do. I'm aware of anchoring survey in Kingsand [??] area, given the unusual nature of this season. I think there are other ways (i.e. not around it." (Plymouth meeting participant)*
- *"I don't think anyone thinks I won't go to Cellars in the spring because the seagrass is particularly vulnerable…But if someone told me in May its particularly harmful to the seagrass then I would avoid it." (Plymouth participant)*

Attitudes and personal preferences relating to specific interventions

General attitudes towards specific interventions – e.g. negative attitudes towards AMS/VNAZ/restricted access because want to feel free; effectiveness - negative attitudes towards using a tripline as don't think it will be effective at protecting seagrass; don't want hassle e.g. of using trip line. Link to RQ3 – effectiveness of interventions.

- *"in summer, when 100s of boats in the bay, to have trip lines, its chaotic anyway, so it will be unmanageable!" (Joint meeting participant)*

Restricted access/VNAZ

- *"I'm okay with it generally but depends where it is. Cause it's like I want to go there sort of thing. How will it be policed? Will it be an ever expanding area? What's the balance really." (the Solent meeting participant)*
- *"The Studland bay one makes total sense to me – believe there is a colony of seahorses there and wouldn't want to cause damage to them. If was told couldn't anchor elsewhere then that would be disappointing – if no seahorses there . the Solent is like the M25 at the best of times. Limiting where people can go will have negative impacts e.g. crowding." (the Solent meeting participant)*
- *"I haven't been anywhere where there is a restriction but I would be more than happy with the restriction if there was one and I would think most boaters would feel the same." (Plymouth meeting participant)*
- *"I agree – wouldn't have any issue going somewhere else" (Plymouth participant)*

Social norms

It was clear from the boater meeting discussions that there are certain areas around the Plymouth and the Solent areas that are particularly popular among recreational boaters. It was suggested by a few participants that popularity of certain areas, particularly Cellars (Plymouth) and Cawsand (Plymouth) could present motivational barriers to some interventions. For example a few participants felt that VNAZ would not be adhered to at popular locations because it would be too crowded. One participant suggested that popularity of an area could be a facilitator of using AMS over other interventions because it would allow boaters to continue to visit that area. It was recognised by this participant that a "flexible suite of approaches" would likely be used depending on the location.

- *"Other areas where combination of popularity and a seagrass bed – could we use some of these other solutions e.g. the AMS. I think most people I've talked to, there are anchoring nerds out there that love anchoring, but most people would prefer to pick up a mooring for a couple of hours. Couldn't reasonably argue that if someone dropped an anchor in a seagrass bed once a year that it cause significant damage. Needs a flexible suite of approaches." (the Solent meeting participant)*
- *"I don't see this [restricted access/VNAZ] as a problem but in somewhere like Cellars where there are 30 boats it may cause an issue." (Plymouth meeting participant)*
- *"Agree Cellars would be an issue. Wonder about Cawsand – despite trying to get message out, feel that some people would anchor anyway." (Plymouth participant)*

It was clear from some of the discussions in the boater meetings that social groups had an influence on boaters' perceptions of certain things, including the state of the environment and seagrass. In particular, it was clear that many participants had formed views based on information they have received from sailing clubs, whether through formal training and talks, or through informal means such as "bar room chatter". It was also felt by some participants that endorsement by the RYA would be a motivational facilitator for many recreational boaters to respond to interventions. However, as previously noted in RQ2, not all boaters belong to clubs, and in particular, motorboaters are less likely to belong to clubs than yachters.

- *"My taking on seagrass is largely derived from the yacht club bar where there are a lot of experts which say the seagrass – especially Cellars – some will say the seagrass is gravely*

endangered and anchoring in Cellar [how do you spell this?] is very anti-social thing to do. Others say seagrass is actually quite healthy there. I've been told its actually increasing. Proponents say it's not problem there is nice healthy seagrass there. I don't know which part is true. I want to learn more to put some facts into the bar room chatter!" (Plymouth meeting participant)

- *"RYA supposedly probably sponsor these leaflets, these need to be better targeted to clubs etc that are near these areas. Using things like RYA leaflets – I give env talks at my sailing clubs – will now be giving talk about seagrass." (the Solent meeting participant)*
- *"visiting clubs when they have programme of talks on environment issues – that's another way to get the information out, but there are so many people in the boating community who have no link to sailing clubs." (Plymouth participant)*

There was a general perception among some meeting participants that anchoring is an inherent part of "being a boater" and that this would be a barrier to recreational boaters stopping anchoring. The affiliation for anchoring was linked to a desire to feel free and not be restricted to only stopping where there are designated moorings.

- *"never will be the case for moorings everywhere you would want to take a boat. Not only do people enjoy anchoring but it's important to stay trained in it. Would be a shame if anchoring diminished – important part of the boating hobby. But I prefer to pick up a buoy if available – less hassle." (the Solent meeting participant)*
- *"Picking up buoy is easier. But part of the enjoyment of owning a boat is to be able to go somewhere, drop anchor and have a swim. To be herded where everyone else is, that takes away from it." (the Solent meeting participant)*
- *"When growing up near new forest, everyone used to drive and park cars all over the place and then that was restricted and now people wouldn't imagine ever doing it. Make the environment more valued." (the Solent meeting participant)*

Vessel Safety

From discussions in the boater meetings, it is clear that safety is often the most important factor in boaters' choice of anchoring or mooring behaviour. Other things that participants consider in their decision-making process about where to anchor/moor included weather, wind direction, and tides (which all relate to safety). Several participants said that protecting seagrass would come way down their list of priorities when making such a decision.

- *"When I look at a decision about what we are going to go when going out on the boat. 2 main things – the weather is the main one. Where we need to go e.g. do we need to go to a marina if the weather is bad. No planning around seagrass or environmental factors are coming into the decision process." (the Solent meeting participant)*
- *"The first thing that look at is weather forecast." (Joint meeting participant)*
- *"Choosing where to anchor is very dependent on wind direction. Motorboats are very much more susceptible to swell – want to find somewhere where no swell e.g. sheltered bay or anchorage. Will effect decisions about where to stop." (Joint meeting participant)*
- *"environmental constraints are low down on my priorities list. I think RYA does cover some env issues. But in forefront of my mind, issues like seagrass have not been weighed in the balance." (the Solent meeting participant)*
- *"anyone that has spent any time at sea will tell you at the end of the day you have to treat it with respect. You want to have a nice day but there is always an element of danger associated with it. Priority order of decision map – is boat equipped for what you are doing, plan for weather and tides to get to certain places. All things that if not planned accordingly can lead to*

dangerous situations. Should make a proper plan and go through it with everyone – that is the RYA guidance – not everyone does that." (the Solent meeting participant)

- *"the overwhelming thought is 'where is the shelter?' – that is a fundamental thing." (Plymouth meeting participant)*
- *"These concerns [safety, wind, tides] trump decisions over seagrass and I think will always trump things to do with seagrass." (Plymouth meeting participant)*

Another theme that came out of the boater meetings, also relating to vessel safety, is familiarity and trust in technology, particularly for AMS. Many participants voiced concerns about the effectiveness and safety of using an advanced mooring system (AMS) over a traditional mooring system. This was somewhat to do with familiarity and personal experience of using traditional mooring buoys compared with using AMS, this could be overcome as more boaters use AMS and become familiar with them.

- *"I'm only familiar with the traditional mooring. Wondering, looking at the other two, how good they would be in a storm." (the Solent meeting participant)*
- *"I would only pick up a mooring if I know it's safe. When you put own anchor down and dig it in you know it is going to be safe. I have had more trouble with broken moorings that haven't been serviced properly that I have with anchoring. Trust my anchor over mooring." (Joint meeting participant)*
- *"I think the new ways are okay for picnic areas or light use, but my boat weighs nearly 10 tonnes and so I'm happy to have two lines [/traditional moorings], I don't think I'm going to sit on a piece of elastic or something that allows itself to float!" (Joint meeting participant)*
- *"I understand the physics of having a lot of heavy chain to hold my boat in place and a bit of elastic doesn't give the same comfort – so it would be good to have the evidence on e.g. helical moorings., we have had a talk in yacht club on helical and I think it was well received" (Joint meeting participant)*
- *"my understand of the ones in Cawsand – they have their place - in Cawsand is quite wider, the first few people may moor up at a buoy rather than drop their anchor, but I'd be really worried about Cellars beach on bank holiday days [because there would be many more boats there e.g. 40?] there would be people dropping an anchor near it and tripping over it and could cause problems, so it all depends on where you are talking about and how tight an area it is - You might have 3 boats using it in Cellar on a quiet day and that would be fine but if there are 30 boats it may not work." (Plymouth meeting participant)*

A few participants suggested that a potential facilitator to changing boater behaviours towards using AMS, would be if people knew insurance brokers would cover it.

- *"How long did it take in Cawsand for people to make the change? People are nervous, people will be assured if the insurance broker would cover it – I think we need to put pressure on insurers." [joint meeting participant)*

A few participants also raised concerns about safety of using trip lines in busy places as the additional rope could cause a hazard for boats getting tangled up in one another.

- *"My concern would be on Cellar beach on sunny afternoon, you have extra boats anchoring and trip lines, would make it more complicated e.g. have a trip line around my propeller!" (Joint meeting participant)*
- *"rarely use tripline but depends on nature of bottom and how busy it is going to be. Not unknow for trip line to be used and then someone else think it is a mooring and pick it up – if throw it back then your anchor is dislodged, and boat can float away." (Plymouth meeting participant)*

- *"in summer, when 100s of boats in the bay, to have trip lines, its chaotic anyway, so it will be unmanageable!" [joint meeting participant)*

Monitoring and enforcement

There were generally negative attitudes among meeting participants about enforcing restrictions on recreational boaters, particularly among the joint meeting participants. There was also feeling among some participants that enforcement would be ineffective as enforcement of existing restrictions e.g. speed restrictions is already difficult. Many participants felt that informing recreational boaters through education/awareness raising, rather than enforcing behaviours on them would be the better approach. However, a few participants felt that without proper enforcement, some interventions would be ineffective e.g. VNAZ/restricted access.

- *"Enforcing anything like that [restricted access] at sea is difficult. Think that education and engaging people with that habitat is really important so that people choose to – rather than only reason for obeying regulations being to avoid prosecution." (the Solent meeting participant)*
- *"how do you enforce it [restricted access]? You would need to police it so it become effective, otherwise how would it work?" (Joint meeting participant)*
- *"I would resist strongly any banning of anchoring in Yealm, it's been used for years as an anchorage and it's not doing any harm, the seagrass is getting better every year. [What if it was voluntary?] It could be issued as an advice and I would not be against that. But humans need to have something in this race, don't want to cowe to an underwater lawn!" (Joint meeting participant)*
- *"think you go sailing to enjoy the freedom so to be told you can't do this or that [i.e. is not good]." (Joint meeting participant)*
- *"inform don't try to enforce." (Joint meeting participant)*
- *"No, don't think enforcement will work – they have enough trouble trying to enforce speed limits in estuaries – 'don't anchor here' not a cat in hells chance!" (Joint meeting participant)*
- *"you must not enforce, take people along with you by consent, I think as years go by the eelgrass will do quite well." (Joint meeting participant)*
- *"Years ago there was a man in Helford that would ask you to move out which I thought was really good" (Plymouth meeting participant)*

Appendix 6: Survey questions

LIFE Recreation ReMEDIES (Reducing and Mitigating Erosion and Disturbance Impacts affecting the Seabed): Behaviour Change Project

Participant Information and Consent form: Survey

What is this project about?

Our project is looking at the behaviours of recreational boaters with regards specifically to anchoring and mooring in seagrass. We are focusing on two special areas of conservation Plymouth Sound & Estuaries and the Solent Maritime – Isle of Wight and would like to hear from people who go boating for recreation in these areas. This project is part of a larger project run by Natural England, called LIFE Recreation ReMEDIES (Reducing and Mitigating Erosion and Disturbance Impacts affecting the Seabed). The focus of this project is on recreational boating however we acknowledge there are other threats to seagrass habitats.

In this survey, when we say 'recreational boating' we are interested in those times that you go out on some kind of vessel – for example, you might go sailing or power boating – for leisure, but not for any commercial purpose.

What is the purpose?

This project will help to improve understanding on recreational boaters' awareness, attitudes and behaviours towards anchoring and mooring in seagrass, and will help to design and develop ways of addressing any issues identified and help to support changes in behaviour that can lead, in the long term, to the improvement of seagrass.

Who is conducting the project?

Collingwood Environmental Planning, in partnership with Plymouth Marine Laboratory and the University of Plymouth, has been commissioned by Natural England to conduct this project.

How can you get involved, and what will you need to do?

We would like to invite you to take part in a survey to share your views and experiences in relation to mooring and anchoring in seagrass. The survey will take approximately 15-20 minutes to complete, and there are no right or wrong answers. Before you start we will ask you to read the following information and then to confirm that you are happy to take part.

Things to know:

- The survey is completely voluntary, you can stop at any point you wish. You can withdraw your data up to 2 weeks after taking part by contacting us on the below

details and providing us with your unique participant code that you will be invited to create at the end of the survey.

- The survey questions will not ask you to provide information that will identify you personally. Should you reveal any personally identifiable data in the free text responses it will be deleted.
- Any information you provide will be stored securely and all participant input will be treated as anonymous. This means any information you share will be anonymised in any reports or other project outputs. Further information on how your data will be handled is provided in the accompanying Privacy Notice which covers the overall ReMEDIES project, see in particular sections related to 'Surveys and Interviews'.
- The results of this research will be used to inform project activities aimed at understanding and changing behaviours in order to reduce impacts on seabeds, and will contribute to a report and guidance document which is expected to be published in Natural England's Evidence Catalogue, as well as related workshops, presentations and papers which may be available on the ReMEDIES project website on gov.uk.
- The anonymised survey data will be deposited in the UK Data Archive so it can be used for future research and learning.
- This survey is being hosted by SurveyMonkey; please click here to view their privacy policy.

Any questions? If you have any questions about this project either before or afterwards, please get in touch with Dr Clare Twigger-Ross, CEP: c.twigger-ross@cep.co.uk | 020 7407 8700. If you have any questions about the wider ReMEDIES project, please contact Dr Emma Hinton, NE: Emma.Hinton@naturalengland.org.uk | 0208 026 6606. If you have a complaint about the conduct of the research, please contact Maurice Bottomley, Faculty Research Ethics and Integrity Committee Research Administrator, Faculty of Health, University of Plymouth, 4th Flr Rolle Building, Drake Circus, Plymouth, PL4 8AA | FOHsethics@plymouth.ac.uk .

1. ***Thank you for taking the time to read the information sheet, if you are happy to take part in this survey, please click to give your consent in the box below and then go to the first question*:***

☐

Your boating experience

2. What type of vessel do you mainly use when you go boating for recreation?

- Yacht
- Motor boat / power boat
- Smaller vessels, e.g. RIB, trailer sailer
- Dinghy
- Personal watercraft (e.g. jet ski)
- None of the above. Please specify: (Text box)

3. What size is the boat you mainly use?

- Less than 12 ft

- 13 – 24 ft
- Over 24 ft

4. Do you use other boats that you use to go boating for recreation? Y/N

5. If YES, please tick all that apply:

    - Yacht
    - Motor boat / power boat
    - Smaller vessels, e.g. RIB, trailer sailer
    - Dinghy
    - Personal watercraft (e.g. jet ski)
    - None of the above. Please specify: (Text box)

6. Where do you mainly go boating for recreation? (please tick all that apply)

    - The Solent / Isle of Wight area
    - Plymouth Sound and Estuaries area
    - All of the South Coast
    - Other areas of the UK
    - Internationally, including the UK South Coast
    - None of the above

7. When boating for recreation do you mainly use

    - your own boat,
    - a hired boat,
    - the boat of someone you know (crew or skipper)
    - None of the above

8. If you own your boat where do you usually keep it??

    - The Solent / Isle of Wight area
    - Plymouth Sound and Estuaries area
    - Other areas of the UK
    - Internationally, including the UK South Coast
    - Not applicable

9. When you go out boating for recreation what types of activities do you mainly do? (please select all that apply)

    - sailing/cruising on the water
    - going to a nice spot to have lunch/dinner
    - going out to a nice spot and meeting up with friends with other boats
    - going out to fish
    - going out to dive
    - going to have a swim/snorkel
    - Other – please specify

10. How long have you been recreational boating?

- 0-3 years,
- 4 -10 years,
- 11 plus years

11. In a **typical 12 months** how many times would you go out boating for recreation? (please add number to the box)

    - [free text]

Your memberships and training

12. Are you a member of any boating organisations? (please select all that apply)

- Royal Yachting Association
- Berth Holder Association
- Mooring holder association
- A local sailing club
- No, I don't belong to any boating organisations
- Other (please specify) [free text]

13. Are you aware of the Green Blue campaign?

- Yes, I am familiar with it,
- Yes I have heard about it but am not familiar with it,
- No, I haven't heard of it,
- Not sure

14. Have you ever undertaken any training on how to anchor?

    - Yes [GO TO Q15]
    - No [GO TO Q17]

15. If answered yes to anchor training, did that training cover preventing damage to the seabed?

    - Yes
    - No

16. Where/ from whom did you receive this training?

    - RYA
    - Local sailing club
    - Green Blue campaign
    - Other [please specify]

Your views and knowledge of seagrass

We will now ask you some questions about seagrass, which is also known as eelgrass or tasselweed

17. Have you heard of seagrass before this survey?

    - Yes

- No
- Don't know

18. Using the following scale please select to what extent you agree or disagree with each of the following statements: (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree, and a "don't know")

    - I know a lot about seagrass
    - Seagrass improves water quality
    - Seagrass is an important habitat for marine wildlife
    - Seagrass plays an important role in removing carbon from the air

NEXT PAGE: INFO ON SEAGRASS

Seagrass (Zostera species) Is a flowering marine plant that is scarce in the UK. Seagrass beds are one of the most rapidly declining habitats on earth (11th International Seagrass Biology Workshop 2014). Provides important nursery grounds for fish including commercially important species. Seagrass helps stabilise sediment and reduces coastal erosion. Healthy seagrass beds store significant amounts of carbon from the atmosphere, helping mitigate climate change impacts. Beds of seagrass are like the rainforest of the marine world!

Your experience of boating and seagrass

19. Do you plan where you are going when you go out boating?

    - Always – even if I have been there before
    - Most of the time especially if I have not been there before
    - Only if I have not been there before
    - Never
    - No, I generally go with a chartered boat and they plan the journey

20. Do you know if there is seagrass where you usually go boating for recreation?

    - Yes
    - No
    - Unsure

21. Would you try to avoid seagrass if you knew where it was located?

    - Yes
    - No

22. Where would you prefer to get information on the location of seagrass from? (please select all that apply)

    - Paper charts
    - pilot guides
    - electronic charts/apps
    - online searches
    - local knowledge - other boaters

- my sailing club/marina

Your Experience of anchoring and seagrass

23. Where do you get your information on potential anchoring locations?

- Paper charts
- pilot guides
- electronic charts/apps
- online searches
- local knowledge - other boaters
- my sailing club/marina
- follow everyone else
- not applicable

24. Have you have looked to see if there is seagrass where you plan to anchor?

- Yes [GO TO Q25]
- No [GO TO Q26]
- Unsure [GO TO Q26]
- Not applicable [GO TO Q26]

25. If yes, where did you get the information from:

- From a leaflet
- From online searches
- From other boaters e.g. via social media
- Other – please specify

26. Have you ever anchored in seagrass?

- Yes [GO TO Q27]
- No [GO TO Q30]
- Unsure [GO TO Q30]
- Not applicable [GO TO Q30]

27. If Yes – why did you anchor there? (tick all that apply)

- It was a safe place to anchor
- I always anchor there
- I thought it was ok to anchor in seagrass
- I did not have a tender so needed to be close to the shore for access
- Other

28. Were you aware seagrass was in the area before you anchored?

- Yes [GO TO Q29]
- No [GO TO Q30]
- Unsure [GO TO Q30]

29. If yes, where did you get the information from?

- From a leaflet
- From online searches
- From other boaters e.g. via social media
- Other – please specify

Your knowledge & experience of Advanced Mooring Systems

30. Do you…..

- Own your own mooring
- Rent/lease your mooring
- I don't own my own boat
- I don't keep my boat at a mooring (e.g. it is on a trailer and kept on land)

31. What type of mooring/berth do you own/rent?

- Swing mooring (traditional)
- Fore and Aft mooring
- Pontoon mooring
- Don't know

32. Have you heard of Advanced Mooring Systems (aka eco-moorings, environmentally friendly moorings) or AMS?

- Yes
- No
- Unsure

NEXT PAGE:

Advanced Mooring Systems (AMS), or eco moorings, are mooring systems designed to have less impact on the seabed than conventional swing moorings. They aim to minimise interaction with the seabed to prevent abrasion and therefore the potential to damage sensitive habitats. The term Advanced Mooring System has been adopted to emphasise the improved measurability of mooring load potential offered by these systems. (RYA website)

33. Have you used an Advanced Mooring System?

- Yes
- No
- Unsure
- Not applicable

34. If you had the choice would you choose an AMS over a traditional mooring?

- Yes
- No
- Unsure

Please say why or why not… [free text box]

Your knowledge and experience of voluntary no anchor zones

35. Have you heard of restricted anchoring or voluntary no anchor zones?

- Yes
- No
- Unsure

A voluntary no anchor zone is an area where boaters are requested not to anchor. This can be put in place for a number of reasons including to protect seagrass from the impacts of boaters.

36. Have you been anywhere that there was a voluntary no anchor zone?

- Yes [GO TO Q37]
- No [GO TO Q38]
- Unsure [GO TO Q38]

37. If YES, did you observe the voluntary no anchor zone

- Yes
- No

38. If you came across a voluntary no anchor zone while out boating for recreation, what course of action are you most likely to take?

- use a mooring
- raft to another vessel
- drop anchor
- sail to another location
- other [free text]

Your views on anchoring away from seagrass

We will now ask you some questions about anchoring away from seagrass, by anchoring away we mean choosing an anchorage away from protected seabed habitats wherever possible in this case away from seagrass.

39. To what extent do you agree or disagree with each of the following statements?

- Anchoring away from seagrass is a good thing to do
- Anchoring away from seagrass would be inconvenient
- People who are important to me value anchoring away from seagrass
- People like me anchor away from seagrass
- Other boaters tend to anchor away from seagrass
- The RYA would prefer me to anchor away from seagrass
- When it comes to matters of recreational boating I tend to do what the RYA/local harbour authority thinks I should do.
- When it comes to matters of recreational boating, I tend to do what others close to me think is best

BREAK POINT NEW QUESTION

40. Here are some more statements relating to anchoring away from seagrass. To what extent do you agree or disagree with each of the following statements?

- I am confident that I can almost always anchor away from seagrass
- It's up to me whether or not I anchor away from seagrass
- I intend to anchor away from seagrass when boating
- In a typical 12 months, I will have anchored away from seagrass.
- I intend help protect seagrass by anchoring away from it
- I expect that I will be able to anchor away from seagrass
- It will be easy for me to anchor away from seagrass

Your views on using AMS

We **will** now **ask you some questions about using Advanced Mooring Systems**

41. To what extent do you agree or disagree with each of the following statements?

- Using an Advanced Mooring System is a good thing to do
- Using an Advanced Mooring System would be inconvenient
- People who are important to me would use Advanced Mooring Systems if they were available
- People like me would use an Advanced Mooring System if they were available
- Other boaters would tend to use an Advanced Mooring System if they were available
- The RYA thinks that I should use an Advanced Mooring System thinks I should use an AMS where they are available.

42. To what extent do you agree or disagree with each of the following statements?

- I am confident that I would be able to use an Advanced Mooring System
- It's up to me whether or not I would use an Advanced Mooring System
- If an Advanced Mooring System were available in the future I would use it
- I intend to help protect seagrass by using an Advanced Mooring System if it were available
- It would be easy to maintain an Advanced Mooring System

Your views on the opportunities to use AMS and anchor away

43. To what extent do you agree or disagree with each of the following statements?

(All items on 5-point Likert scale - (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree and don't know)

- There is often an Advanced Mooring System available for me to use when I go out boating
- Thinking about the places I stop (when I go out boating), there are often plenty of places for me to anchor away from seagrass
- Thinking about where I moor my boat, there are plenty of places for me to moor that are not in seagrass

44. To what extent do you agree or disagree with each of the following statements?

(All items on 5-point Likert scale - (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree and don't know)

- Thinking about when I go out boating I can clearly imagine how I would use AMS
- Thinking about when I go out boating I can clearly imagine how I would avoid anchoring near seagrass
- I want to protect seagrass
- I can clearly imagine how good it would feel to be protecting seagrass.

Ocean connectedness

45. To what extent do you agree or disagree with each of the following statements?

- I feel very close to the marine environment.
- I have a clear understanding of how my actions affect the ocean.
- I often feel a sense of oneness with the ocean around me.

Your values

46. You will now see some statements about values. Please select how important each value is for you as a guiding principle in your life.

	It is important for you…	Not at all Important	Slightly Important	Reasonably Important	Very Important	Extremely Important
A	That everyone is given equal opportunities.	1	2	3	4	5
B	To respect the earth and live in harmony with other species.	1	2	3	4	5
E	To have social power e.g. control or dominance over others.	1	2	3	4	5
A	That there is social justice and that we care for the weak.	1	2	3	4	5
H	To enjoy life by enjoying food, sex, leisure activities etc.	1	2	3	4	5
B	To protect the environment and preserve nature.	1	2	3	4	5
E	To be influential and have an impact on people and events.	1	2	3	4	5

H	To be self-indulgent and do pleasant things.	1	2	3	4	5

Environmental concern

47. How concerned are you about protecting the environment? [Not at all – extremely 5-point scale]

Demographics

Now we would like to know a bit about you.

48. What is your age?

- Under 18
- 18 – 24
- 25 - 34
- 35 – 44
- 45 – 54
- 55 – 64
- 65 and over

49. What is your gender?

- Male
- Female
- Non-Binary
- Prefer not to say

50. Have you participated in any other activities for the ReMEDIES project?

- ❑ Interview
- ❑ Meeting
- ❑ Webinar
- ❑ Seagrass surveys
- ❑ Boating surveys in your area
- ❑ Other
- ❑ None

Thank you for your time. The information you have shared with us will inform the work of the LIFE Recreation ReMEDIES project.

If you wish to you can withdraw your data up to 2 weeks after taking part by contacting us on the below details and providing us with your unique participant code which we invite you to create below. We recommend you use your mother's initials with the date and month of her birth. For example, if your mother's name was Mary Anne Thompson and her birthday was on the 6th of September your code would be MAT06/09.

Please insert your unique participant code here: FREE TEXT

Please make a note of the code and keep it safe.

Contact details: Dr Clare Twigger-Ross, CEP: c.twigger-ross@cep.co.uk | 020 7407 8700

To stay up to date with the latest project news including more opportunities to get involved, email LifeRemedies@naturalengland.org.uk to sign up to our mailing list, or follow @EULIFERemedies and #SaveOurSeabed on Twitter.

Appendix 7: Summary of survey results

This appendix presents the results of the online survey.

Question 1 Thank you for taking the time to read the information sheet, if you are happy to take part in this survey, please click to give your consent in the box below and then go to the first question.

Answer Choices	Responses	
I consent	100%	184
	Total Respondents	**184**
	Skipped	**0**

Question 2 What type of vessel do you mainly use when you go boating for recreation?

Answer Choices	Responses	
Yacht	50%	87
Motor boat / power boat	23%	40
Smaller vessels, e.g. RIB, trailer sailer	12%	21
Dinghy	10%	18
Personal watercraft (e.g. jet ski)	2%	3
None of the above. Please specify	2%	4
	Total	**173**
	Skipped	**11**

Question 3 What size is the boat you mainly use?

Answer Choices	Responses	
Less than 12 ft	10%	16
13 – 24 ft	33%	56
Over 24 ft	57%	96
	Total	**168**
	Skipped	**16**

Question 4 Do you use any other kinds of boats when you go boating for recreation?

Answer Choices	Responses	
Yes	70%	117
No	30%	49
	Total	**166**
	Skipped	**18**

Question 5 If yes, please select all that apply

Answer Choices	Responses	
Yacht	38%	42
Motor boat/power boat	35%	38
Smaller vessels e.g. RIB, trailer sailer	36%	40
Dinghy	65%	72
Personal watercraft (e.g. jet ski)	6%	7
None of the above (please specify)		15
	Total respondents	**110**
	Skipped	**74**

Question 6 Where do you mainly go boating for recreation?

Answer Choices	Responses	
The Solent / Isle of Wight area	25%	42
Plymouth Sound and Estuaries area	38%	63
All of the South Coast	17%	29
Other areas of the UK	1%	2
Internationally, including the UK South Coast	17%	29
None of the above	1%	2
	Total	**167**
	Skipped	**17**

Question 7 When boating for recreation do you mainly use

Answer Choices	Responses	
your own boat,	87%	141
a hired boat,	2%	4
the boat of someone you know (crew or skipper)	8%	13
None of the above	2%	4
	Total	**162**
	Skipped	**22**

Question 8 If you own your boat where do you usually keep it?

Answer Choices	Responses	
The Solent / Isle of Wight area	28%	45
Plymouth Sound and Estuaries area	56%	90
Other areas of the UK	4%	6
Internationally, including the UK South Coast	1%	2
Not applicable	11%	18
	Total	**161**
	Skipped	**23**

Question 9 When you go out boating for recreation what types of activities do you mainly do? (please select all that apply)

Answer Choices	Responses	
Sailing/cruising on the water	84%	132
Going to a nice spot to have lunch/dinner	49%	77
Going out to a nice spot and meeting up with friends with other boats	25%	40
Going out to fish	22%	34
Going out to dive	4%	7
Going to have swim/snorkel	18%	28
Other (please specify)		15
	Total respondents	**158**
	Skipped	**26**

Question 10 How long have you been boating for recreation?

Answer Choices	Responses	
0-3 years	4%	6
4 -10 years	14%	22
11 plus years	83%	133
	Total	**161**
	Skipped	**23**

Question 11 In a typical 12 months how many times would you go out boating for recreation? (please add number to the box)

Answered	**154**
Skipped	30

Question 12 Are you a member of any boating organisations? (Please select all that apply)

Answer Choices	Responses	
Royal Yachting Association (RYA)	52%	82
Berth Holder Association	6%	10
Mooring holder association	9%	15
A local sailing club	62%	99
No, I don't belong to any boating organisations	13%	21
Other (please specify)	15%	24
	Total respondents	**159**
	Skipped	**25**

Question 13 Are you aware of the Green Blue campaign?

Answer Choices	Responses	
Yes, I am familiar with it,	42%	67
Yes I have heard about it, but I am not familiar with it,	24%	39
No, I haven't heard of it,	31%	50
Not sure	3%	4
	Total	**160**
	Skipped	**24**

Question 14 Have you ever undertaken any training on how to anchor?

Answer Choices	Responses	
Yes	61%	98
No	39%	62
	Total	**160**
	Skipped	**24**

Question 15 Did that training cover preventing damage to the seabed?

Answer Choices	Responses	
Yes	25%	25
No	75%	75
	Total	**100**
	Skipped	**84**

Question 16 Where/from whom did you receive this training?

Answer Choices	Responses	
Royal Yachting Association (RYA) Recognised Training Centre	68%	66
Local sailing club	6%	6
Green Blue campaign	1%	1
Other (please specify)	25%	24
	Total	**97**
	Skipped	**87**

Question 17 Have you heard of seagrass before this survey?

Answer Choices	Responses	
Yes	96%	149
No	4%	6
Don't know	1%	1
	Total	**156**
	Skipped	**28**

Question 18 Using the following scale, please select to what extent you agree or disagree with each of the following statements.

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		Don't know		Total	Weighted Average
I know a lot about seagrass	8%	12	21%	33	36%	56	25%	39	9%	14	1%	1	155	2.63
Seagrass improves water quality	0%	0	1%	1	12%	18	45%	69	28%	44	15%	23	155	2.99
Seagrass is an important habitat for marine wildlife	2%	3	0%	0	7%	11	33%	51	53%	82	6%	9	156	2.96
Seagrass plays an important role in removing carbon from the air	1%	1	2%	3	17%	27	30%	47	32%	50	17%	27	155	2.96
											Total			**156**
											Skipped			**28**

Question 19 Do you plan where you are going when you go out boating?

Answer Choices	Responses	
Always – even if I have been there before	49%	76
Most of the time especially if I have not been there before	39%	60
Only if I have not been there before	10%	15
Never	3%	4
No, I generally go with a chartered boat and they plan the journey	0%	0
	Total	**155**
	Skipped	**29**

Question 20 Do you know if there is seagrass where you usually go boating for recreation?

Answer Choices	Responses	
Yes	54%	84
No	22%	34
Unsure	24%	37
	Total	**155**
	Skipped	**29**

Question 21 Would you try to avoid seagrass if you knew where it was located?

Answer Choices	Responses	
Yes	88%	136
No	12%	18
	Total	**154**
	Skipped	**30**

Question 22 Where would you prefer to get information on the location of seagrass from? (please select all that apply)

Answer Choices	Responses	
Paper charts	57%	78
pilot guides	46%	63
electronic charts/apps	74%	101
online searches	40%	54
local knowledge - other boaters	43%	59
my sailing club/marina	43%	58
	Total respondents	**136**
	Skipped	**48**

Question 23 Where do you get your information on potential anchoring locations? (please select all that apply)

Answer Choices	Responses	
Paper charts	68%	103
pilot guides	56%	85
electronic charts/apps	59%	89
online searches	17%	26
local knowledge - other boaters	71%	108
my sailing club/marina	18%	28
follow everyone else	5%	8
not applicable	4%	6
	Total Respondents	**152**
	Skipped	**32**

Question 24 Have you have ever looked to see if there is seagrass where you plan to anchor?

Answer Choices	Responses	
Yes	54%	80
No	38%	56
Unsure	7%	11
	Total	**147**
	Skipped	**37**

Question 25 Where did you get the information from (please select all that apply)

Answer Choices	Responses	
From a leaflet	24%	19
From online searches	23%	18
From other boaters e.g. via social media	30%	24
Other (please specify)	51%	40
	Total respondents	**79**
	Skipped	**105**

Question 26 Have you ever anchored in seagrass?

Answer Choices	Responses	
Yes	42%	61
No	17%	25
Unsure	41%	60
	Total	**146**
	Skipped	**38**

Question 27 Why did you anchor there? (please select all that apply)

Answer Choices	Responses	
It was a safe place to anchor	74%	45
I always anchor there	20%	12
I thought it was okay to anchor in seagrass	20%	12
I did not have a tender so needed to be close to the shore for access	3%	2
Other	26%	16
	Total respondents	**61**
	Skipped	**123**

Question 28 Were you aware seagrass was in the area before you anchored?

Answer Choices	Responses	
Yes	62%	38
No	31%	19
Unsure	7%	4
	Total	**61**
	Skipped	**123**

Question 29 Where did you get the information from? (please select all that apply)

Answer Choices	Responses	
From a leaflet	11%	4
From online searches	14%	5
From other boaters e.g. via social media	32%	12
Other (please specify)	59%	22
	Total respondents	**37**
	Skipped	**147**

Question 30 Do you…..

Answer Choices	Responses	
Own your own mooring	30%	45
Rent/lease your mooring	47%	71
I don't own my own boat	9%	13
I don't keep my boat at a mooring (e.g. it is on a trailer and kept on land)My boat is on a trailer and stored on land	0%	0
I don't keep my boat at a mooring (e.g. it is on a trailer and kept on land)	15%	23
	Total	**152**
	Skipped	**32**

Question 31 What type of mooring/berth do you own/rent?

Answer Choices	Responses	
Swing mooring (traditional)	58%	67
Fore and Aft mooring	14%	16
Pontoon mooring	28%	33
Don't know	0%	0
Not applicable	0%	0
	Total	**116**
	Skipped	**68**

Question 32 Have you heard of Advanced Mooring Systems (aka eco-moorings, environmentally friendly moorings) or AMS?

Answer Choices	Responses	
Yes	46%	70
No	49%	75
Unsure	5%	7
	Total	**152**
	Skipped	**32**

Question 33 Have you used an Advanced Mooring System?

Answer Choices	Responses	
Yes	5%	8
No	79%	119
Unsure	11%	17
Not applicable	5%	7
	Total	**151**
	Skipped	**33**

Question 34 If you had the choice would you choose an AMS over a traditional mooring?

Answer Choices	Responses	
Yes	53%	75
No	14%	20
Unsure	33%	46
Please say why or why not?		48
	Total	**141**
	Skipped	**43**

Question 35 Have you heard of restricted anchoring or voluntary no anchor zones?

Answer Choices	Responses	
Yes	84%	120
No	13%	18
Unsure	4%	5
	Total	**143**
	Skipped	**41**

Question 36 Have you been anywhere there was a voluntary no anchor zone?

Answer Choices	Responses	
Yes	38%	54
No	43%	61
Unsure	20%	28
	Total	**143**
	Skipped	**41**

Question 37 Did you observe the voluntary no anchor zone?

Answer Choices	Responses	
Yes	98%	52
No	2%	1
	Total	**53**
	Skipped	**131**

Question 38 If you came across a voluntary no anchoring area while out boating for recreation what course of action are you most likely to take?

Answer Choices	Responses	
use a mooring	41%	59
raft to another vessel	2%	3
drop anchor	3%	4
sail to another location	41%	58
Other (please specify)	13%	19
	Total	**143**
	Skipped	**41**

Question 39 To what extent do you agree or disagree with each of the following statements?

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		don't know		Total	Weighted Average
Anchoring away from seagrass is a good thing to do	1%	2	3%	4	18%	25	31%	43	45%	62	2%	3	139	4.17
Anchoring away from seagrass would be inconvenient	4%	6	21%	30	36%	50	23%	32	9%	13	6%	9	140	3.12
People who are important to me value anchoring away from seagrass	2%	3	10%	14	33%	46	27%	38	12%	17	16%	23	141	3.44
People like me anchor away from seagrass	1%	1	7%	10	31%	43	33%	46	19%	27	10%	14	141	3.69
Other boaters tend to anchor away from seagrass	6%	9	27%	38	38%	54	10%	14	2%	3	16%	23	141	2.69
The Royal Yachting Association (RYA) would prefer me to anchor away from seagrass	0%	0	1%	1	23%	33	35%	50	24%	34	16%	23	141	3.99
When it comes to matters of recreational boating I tend to do what the Royal Yachting Association (RYA)/local harbour authority thinks I should do.	2%	3	4%	5	24%	34	45%	64	23%	33	1%	2	141	3.86
When it comes to matters of recreational boating, I tend to do what others close to me think is best	8%	11	20%	28	44%	61	23%	32	3%	4	3%	4	140	2.93
										Total				**141**
										Skipped				**43**

Question 40 Here are some more statements relating to anchoring away from seagrass. To what extent do you agree or disagree with each of the following statements?

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		don't know		Total	Weighted Average
I am confident that I can almost always anchor away from seagrass	2%	3	22%	31	22%	31	29%	41	16%	22	9%	13	141	3.38
It's up to me whether or not I anchor away from seagrass	9%	12	9%	13	19%	26	41%	57	18%	25	5%	7	140	3.53
I intend to anchor away from seagrass when boating	1%	1	4%	6	19%	27	41%	58	33%	46	2%	3	141	4.03
I want to do my best to protect seagrass	1%	1	2%	3	11%	15	44%	62	40%	57	2%	3	141	4.24
In a typical 12 months, I will have anchored away from seagrass.	1%	1	5%	7	25%	35	34%	48	23%	32	13%	18	141	3.84
I intend help protect seagrass by anchoring away from it	1%	1	6%	9	18%	26	35%	49	38%	53	2%	3	141	4.04
I expect that I will be able to anchor away from seagrass	1%	2	9%	13	29%	40	30%	42	24%	33	7%	10	140	3.7
It will be easy for me to anchor away from seagrass	6%	9	20%	28	26%	37	19%	27	14%	20	14%	20	141	3.17
											Total			**141**
											Skipped			**43**

Question 41 To what extent do you agree or disagree with each of the following statements?

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		don't know		Total	Weighted Average
Using an Advanced Mooring System is a good thing to do	1%	1	4%	5	22%	31	41%	58	26%	37	0	9	141	3.95
Using an Advanced Mooring System would be inconvenient	6%	9	23%	32	38%	54	9%	12	4%	6	0	28	141	2.77
People who are important to me would use Advanced Mooring Systems if they were available	1%	2	4%	5	35%	50	21%	30	14%	20	0	34	141	3.57
People like me would use an Advanced Mooring System if they were available	2%	3	3%	4	25%	35	38%	54	19%	27	0	18	141	3.8
Other boaters would tend to use an Advanced Mooring System if they were available	3%	4	5%	7	36%	51	33%	46	6%	8	0	24	140	3.41
The Royal Yachting Association (RAY) thinks that I should use an Advanced Mooring System where they are available	0%	0	1%	2	28%	40	29%	41	15%	21	0	37	141	3.78
													Total	**141**
													Skipped	**43**

Question 42 Here are some additional statements relating to AMS. To what extent do you agree or disagree with each of the following statements?

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		Don't know	Total	Weighted Average
I am confident that I would be able to use an Advanced Mooring System	2%	3	7%	10	17%	24	35%	49	24%	34	21	141	3.84
It's up to me whether or not I would use an Advanced Mooring System	4%	6	11%	15	19%	27	43%	61	16%	23	9	141	3.61
If an Advanced Mooring System were available in the future I would use it	1%	2	3%	4	22%	31	38%	54	30%	42	8	141	3.98
I intend to help protect seagrass by using an Advanced Mooring System if it were available	2%	3	3%	4	20%	28	38%	54	31%	43	9	141	3.98
It would be easy to maintain an Advanced Mooring System	4%	6	11%	15	36%	51	11%	16	2%	3	49	140	2.95
											Total		**141**
											Skipped		**43**

Question 43 To what extent do you agree or disagree with each of the following statements?

	strongly disagree		disagree		neither agree nor disagree		agree		strongly agree		don't know		Total	Weighted Average
There is often an Advanced Mooring System available for me to use when I go out boating	35%	48	32%	43	13%	17	0%	0	0%	0	21%	28	136	1.71
Thinking about the places I stop (when I go out boating) there are often plenty of places for me to anchor away from seagrass	6%	8	14%	19	21%	28	27%	37	13%	17	20%	27	136	3.33
Thinking about where I moor my boat, there are plenty of places for me to moor that are not in seagrass	5%	7	8%	11	16%	22	36%	49	19%	26	15%	20	135	3.66
												Total		**136**
												Skipped		**48**

Question 44 To what extent do you agree or disagree with each of the following statements?

	Strongly disagree		disagree		neither agree nor disagree		agree		Strongly agree		Don't know		Total	Weighted Average
Thinking about when I go out boating I can clearly imagine how I would use AMS	4%	6	11%	15	31%	42	28%	38	8%	11	17%	23	135	3.29
Thinking about when I go out boating I can clearly imagine how I would avoid anchoring near seagrass	3%	4	18%	24	19%	25	33%	45	16%	22	11%	15	135	3.48
I want to protect seagrass	0%	0	1%	1	7%	9	49%	65	42%	56	2%	2	133	4.34
I can clearly imagine how good it would feel to be protecting seagrass	1%	2	4%	5	24%	32	37%	50	30%	41	4%	6	136	3.95
												Total		**137**
												Skipped		**47**

Question 45 The following statements relate to ocean connectedness. To what extent do you agree or disagree with each of the following statements?

	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree		Don't know		Total	Weighted Average
I feel very close to the marine environment.	1%	1	1%	2	7%	9	48%	66	43%	59	<1%	1	138	4.31
I have a clear understanding of how my actions affect the ocean.	1%	1	3%	4	10%	14	45%	63	39%	55	2%	3	140	4.22
I often feel a sense of oneness with the ocean around me.	1%	1	1%	2	21%	29	41%	56	36%	49	<1%	1	138	4.09
												Total		**140**
												Skipped		**44**

Question 46 You will now see some standard statements about what you value. Please select how important each value is for you as a guiding principle in your life.

	Not at all		slightly		reasonably		very		extremely		Total	Weighted Average
That everyone is given equal opportunities.	4%	5	1%	2	26%	36	36%	50	33%	45	138	3.93
To respect the earth and live in harmony with other species.	1%	1	1%	2	20%	27	40%	55	38%	53	138	4.14
To have social power e.g. control or dominance over others.	64%	87	20%	27	13%	17	3%	4	1%	1	136	1.57
That there is social justice and that we care for the weak.	4%	6	11%	15	32%	44	31%	43	21%	29	137	3.54
To enjoy life by enjoying food, sex, leisure activities etc.	1%	1	6%	8	30%	40	46%	62	17%	23	134	3.73
To protect the environment and preserve nature.	1%	1	2%	3	23%	31	38%	52	36%	49	136	4.07
To be influential and have an impact on people and events.	11%	15	22%	30	43%	57	19%	25	5%	7	134	2.84
To be self-indulgent and do pleasant things.	20%	27	36%	48	36%	48	6%	8	2%	2	133	2.32
										Total		**138**
										Skipped		**46**

Question 47 How concerned are you about protecting the environment?

	Not at all		slightly		reasonably		very		extremely		Total	Weighted Average
How concerned are you about protecting the environment?	0%	0	1%	1	22%	30	43%	58	35%	47	136	4.11
											Total	**136**
											Skipped	**48**

Question 48 What is your age?

Answer Choices	Responses	
Under 18	1%	1
18 – 24	4%	5
25 - 34	5%	7
35 – 44	4%	6
45 – 54	16%	22
55 – 64	25%	35
65 and over	46%	64
	Total	**140**
	Skipped	**44**

Question 49 What is your gender?

Answer Choices	Responses	
Male	78%	109
Female	21%	29
Non-Binary	0%	0
Prefer not to say	1%	1
	Total	**139**
	Skipped	**45**

Question 50 Have you participated in any other activities for the ReMEDIES project? (please select all that apply)

Answer Choices	Responses	
Interview	0%	0
Meeting	7%	10
Webinar	7%	9
Seagrass surveys	6%	8
Boating surveys in your area	8%	11
Other	2%	3
None	83%	114
	Total respondents	**138**
	Skipped	**46**

Question 51 Please insert your unique participant code here

Answered	**87**
Skipped	97

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

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