



Understanding audiences: Making public perceptions research matter to marine conservation



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ABSTRACT

There is increasing awareness of the need to meaningfully engage society in efforts to tackle marine conservation challenges. Public perceptions research (PPR) in a marine conservation context provides tools to see the sea through the multiple lenses with which society interprets both the marine environment and marine conservation efforts. Traditionally, PPR is predominantly a social science which has considerable interdisciplinarity, owing to the variety of disciplines which contribute to its delivery and benefit from its outputs. Similarly, the subjects of a marine application of PPR are diverse, and relate to public perceptions of any marine component or activity. Evidence shows this is a growing area of science, and the paper presents a qualitative approach to addressing key questions to inform the continuing development of this field through a workshop held at the Third International Marine Conservation Congress 2014. Key findings are discussed under the themes of 1) the benefits of PPR to marine conservation; 2) priorities for PPR to support marine conservation; 3) making PPR accessible to marine practitioners and policy makers; and 4) interdisciplinary research collaboration to deliver PPR. The workshop supported the development of a framework which illustrates: the key conditions which can support PPR to take place; the types of research which PPR can be used to address; the applications of PPR findings for marine conservation; and the types of marine conservation benefits which can be delivered. As PPR gains an increasing presence in marine conservation, it is hoped that this discussion and framework will support researchers and practitioners to identify opportunities for PPR to deliver benefits, and to work together to achieve these.

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1. Introduction

Increasingly, there is a recognised awareness of the need to meaningfully engage society in efforts to tackle marine conservation challenges (e.g. Lotze et al., 2011), with at least three main reasons underpinning this. Firstly, societal behaviour change has the potential to significantly reduce certain pressures on marine

systems (e.g. through exercising consumer choice, to reduce demands on fisheries or lowering energy consumption to reduce carbon emissions) (Vincent, 2011). Secondly, participatory governance of coastal and marine environments is increasingly common, providing opportunities for society to be a force to support management which protects and restores marine ecosystems (McKinley and Fletcher, 2012). Thirdly, the increasing designation of Marine Protected Areas (MPAs), which are a key tool for marine conservation, require public engagement and acceptability to achieve success (Voyer et al., 2015). This context of increasing recognition and infrastructure to mobilise societal engagement with marine conservation is an opportunity to develop a hitherto under-

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exploited policy channel to deliver marine conservation benefits.

1.1. Public perceptions research for marine conservation

Public perceptions research (PPR) in a marine conservation context provides tools to view the sea through the multiple lenses with which audiences interpret both the marine environment and marine conservation efforts (Thomas et al., 2015; Jefferson, 2010). "Perceptions" is an umbrella term which includes components such as knowledge, interest, social values, attitudes or behaviours. The types of research being conducted are extensive and can include qualitative and quantitative approaches such as questionnaires, interviews and focus groups. Public perceptions are rarely homogenous, with influencing variables including age, gender, social values, or proximity to the coast (Jefferson et al., 2014; Rose et al., 2008; Ocean Project, 1999). It is essential to recognise the heterogeneity in society's connection with the sea and to incorporate this into conservation engagement efforts (Jefferson et al., 2014). By understanding public perceptions of the sea, particularly the ways in which people value and connect with the marine environment and the issues which affect it, engagement can be developed to resonate with the target audience and generate the greatest marine conservation outcome.

At an international scale, perceptions may differ or even diverge between countries, possibly as a result of the complex interplay of environmental or cultural factors. For instance, in a survey carried out in 2008 ($n = 1,579$, aged 5–13 years), children and teenagers from Italy were more likely to associate seas with positive feelings (e.g. "the sea is funny", "the sea gives me dreams") while children and teenagers from the UK were more likely to associate them with negative ones (e.g. "the sea has dangerous animals in it", "the sea is dark", "the sea scares me"), whilst respondents from Poland and Ukraine held intermediate positions (Milanese et al., 2014; 4SEAS, 2010). This study reveals the need to understand how age influences perceptions, with children and teenagers tending to associate seas with positive feelings more than adults. Awareness of such differences can be used to help design tailored marine engagement campaigns.

PPR is predominantly a social science incorporating insights from psychology, sociology and human geography disciplines. However, it often includes expertise from natural sciences to inform the development of research questions and approaches; this interdisciplinarity is a considerable strength of PPR for marine conservation (Jefferson, 2010). In this vein, PPR has in many cases adopted a 'risk perception' framework, so as to examine the factors affecting people's judgements about natural or human-caused hazards. In particular, the differing influences of emotional and cognitive processes on risk perception have been stressed by researchers such as Slovic et al. (2004) when assessing public attitudes towards subjects such as nanotechnology (Lee et al., 2005) and climate change (Sundblad et al., 2007). Identifying the ways in which the public and experts diverge in their knowledge and attitudes has also been a focus of risk perception research (e.g. Savadori et al., 2004; Reynolds et al., 2010). For example, Thomas et al. (2015) have observed that public perceptions of sea-level rise due to climate change vary in subtle but important ways from expert assessments. These researchers found that in many cases there was alignment between the public and experts in their perspectives, for example concerning the risks of erosion, flooding and ecological change resulting from sea-level rise. However, whereas experts stressed thermal expansion of water and land-based ice melt as factors critical to sea-level rise, there was relatively limited awareness or recognition of these causes among the public. This manner of pinpointing differences in understanding between the public and experts has been argued to be a critical step in the

design of effective communication and science education programs (de Bruin and Bostrom, 2013). Pidgeon and Fischhoff (2011) have likewise stressed that careful attention to the information needs and pre-existing understanding of an audience can form part of a process of 'strategic listening' able to bring about improved science communication.

The subjects of marine PPR are diverse, and relate to public perceptions of any marine component or activity. PPR can focus on the negative elements of marine conservation (such as what issues people are concerned about, how fear of the sea manifests itself) or identify feelings of hopelessness (such as problems being 'too big to fix') (e.g. Trenouth et al., 2012; Morgan et al., 2010; Pendleton et al., 2001). Equally, however, these tools can be used to delve into the optimistic elements of marine conservation, such as the positive connections people have with the sea, memories of coasts and marine spaces, the marine elements which people are interested in, and the issues which people are passionate about supporting (Jefferson et al., 2014; WWF, 2012; Nordstrom and Mitteager, 2001).

In other fields, there have been examples of PPR being used to investigate public engagement with a particular issue. This can be in relation to issues which are salient to people in a local or practical context (e.g. Morgan et al., 2010) or topics which are more global or less visible in nature. One such topic is ocean acidification arising from anthropogenic carbon emissions (Doney et al., 2009). Research in the natural sciences examining ocean acidification has proliferated in recent years (Gattuso and Hansson, 2011) and has been increasingly considered in the work of the Intergovernmental Panel on Climate Change (Pörtner et al., 2014). Authors such as Turley and Boot (2011) have drawn attention to the relevance of ocean acidification for individuals and societies, including economic impacts on fisheries and consequences for recreation and well-being. Others have stressed that it is critical that awareness of the problem of ocean acidification be raised among the public and measures required to address it (Zeebe et al., 2008). However, there has, to date, been very little research which has examined public perceptions in this area (though see Gelcich et al., 2014). Recent research has started to fill this gap, examining public perceptions of ocean acidification across a representative sample of the British public during 2013 and 2014 ($n = 2,500$) (Capstick et al., 2014; see also Corner et al., 2014). Although less than 20% of survey participants stated that they had heard of ocean acidification, the research found that the subject tended to be associated with negative emotional imagery suggestive of deleterious effects on the marine environment: examples in research participants' own words include 'poisoned fish', 'the sea being destroyed' and 'destruction of marine habitat'. A conclusion drawn from the study was that those seeking to generate accurate understanding of ocean acidification should seek to counter the plausible but misleading notion of localised pollution as having an important causal role. In addition, the research noted something of a mismatch between expert and public perceptions in this area. Whereas it is not generally controversial among experts that carbon emissions are a principal driver of acidification, there is less certainty about the effects upon organisms and ecosystems (cf. Gattuso et al., 2013). By contrast, among public research participants, there was perceived to be a greater degree of controversy concerning the underlying cause of ocean acidification. Again, these findings and this example of the use of PPR in a marine context help to point the way towards areas for emphasis in science communication, so as to effectively raise awareness of the current state of knowledge in this area.

As previously mentioned, public audiences are not homogenous in their perceptions and this can lead to multiple public audiences within society. For this paper we interpret 'public' broadly to include audiences which are not represented within sector-specific studies, such as studies of communities or the general public. This is

not to say that more focused studies, e.g. those which investigate fishers' perceptions, are not relevant, but it highlights that there is currently a gap in our efforts to investigate the broader, societal-scale picture and a need to focus on the research which informs it.

1.2. A growing future for public perceptions research in marine conservation

There is a growing call for PPR to contribute to marine conservation. Vincent (2011) describes the need to understand how people connect to the sea in order to successfully engage audiences with marine conservation, a call echoed by Fletcher et al. (2012). This importance of inspiring people to care about the seas is further emphasised by Laffoley (2014), describing the seas as a place of adventure and enjoyment. However, in order for this ideology to be promoted effectively across society, more needs to be understood about this public element of marine conservation. Given the number of threats to marine ecosystem health from human activities (Halpern et al., 2008) and the multitude of human behaviours which drive those threats, the potential scope of PPR for marine conservation is vast. Relatively little effort has been made to assess public perceptions of the marine environment (Rose et al., 2008; Williams 2008). However, as the benefits of PPR become more widely recognised there is growing demand. This demand comes from the need to support marine management processes which require societal engagement such as marine renewable energy developments (Kerr et al., 2014) and marine protected area management (Petrosillo et al., 2007). PPR which has been conducted illustrates the wide number of drivers for this research, as it is sourced from academic research (e.g. Guest et al., 2015), government agencies (e.g. Colmar Brunton, 2014 for the New Zealand Ministry of Primary Industries), statutory nature conservation bodies (e.g. Rose et al., 2008 for Natural England) and environmental non-governmental organisations (WWF, 2012) demonstrating that outputs of PPR are valuable to the conservation missions of a variety of entities. To meet the growing demand for PPR, we propose that there is considerable value to marine conservation of investigating how this developing tool can best be applied to deliver positive outcomes for marine conservation.

Further to this, a recent review has assessed the current status of marine PPR, identifying how much of this research has been conducted, in which countries, the topics of study, study size and the approaches which have been adopted (Jefferson et al., in prep). The review identified 43 peer reviewed articles and 15 grey literature studies published between 1988 and 2013 with the majority conducted in the USA, UK and Australia. These studies investigated a range of marine conservation components such as coastal erosion, MPAs, marine resource use, marine species and environmental awareness. Fig. 1 shows the growth in volume of marine PPR publications, with a hypothetical projection of how this research may increase, i.e. addressing the key question of how to make PPR science matter or, in other words, what research should be pursued to deliver the maximum benefit to marine conservation outcomes. Given the context of increasing opportunities for societal engagement with marine conservation, PPR could provide results which ensure these processes are most effective.

It is evident that there are numerous directions in which marine PPR could develop, but key questions remain: what should be the focus, how should research be conducted and how can the results be applied in order to contribute to overcoming the challenges of marine conservation? These questions framed the structure of a workshop at the Third International Marine Conservation Congress 2014 (IMCC). The outputs of this workshop are presented here with recommendations as to how to best shape PPR in the future as a tool to support marine conservation.

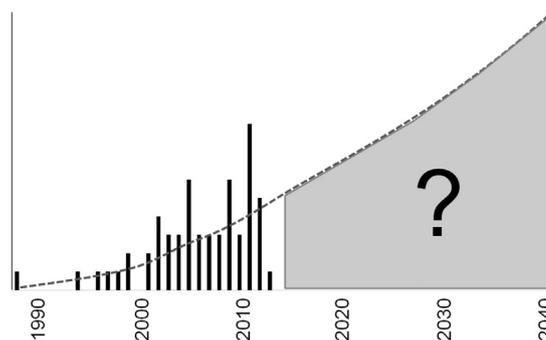


Fig. 1. Publication of peer reviewed and grey literature articles on public perceptions of the marine environment over time (taken from Jefferson et al., in prep). The dashed line represents a hypothetical projection of how this field may continue as the demand for this research continues to grow. The grey area represents the question of how to make PPR matter to marine conservation.

2. Methods

In order to explore the role of PPR in marine conservation, a two-hour workshop was held during the Third International Marine Conservation Congress held in Glasgow, August 2014. The workshop followed a symposium which presented six perspectives of PPR for marine conservation. The workshop began with an introductory presentation, which outlined PPR for marine conservation and presented Fig. 1 and the need to identify the future development of PPR for marine conservation. Delegates were then split into four facilitated groups, discussing each of the following questions:

- How might you use public perceptions research to support marine conservation outcomes? Do you have examples of when and how this has been done?
- What are the priorities for future research on public perceptions of the sea?
- How can connections be fostered between researchers to support cohesion in the research, and practitioners to encourage application of this research to marine conservation?
- How can public perceptions research be made most accessible to practitioners and policymakers?

These four questions were chosen to prompt discussions of different elements of the future development of PPR for marine conservation. The first question reviews how PPR can support marine conservation by investigating real or potential examples of the application of PPR. The second question asked participants to consider the most pressing issues for future PPR to focus on, and aimed to reduce down the potentially overwhelming demand for PPR to cover many aspects of marine conservation. Knowing that the conference would attract researchers and practitioners, the last two questions consider the full life cycle of PPR from research development to marine conservation action. The third question responded to the currently disparate efforts in the field of PPR to identify opportunities for greater cohesion between researchers, to deliver a stronger identity and output from the field. The fourth question investigated the links between research activities and how these could be accessed by policymakers and practitioners.

As part of the workshop introduction, the purpose of the workshop was described to the participants and they were informed that the information recorded would be used to produce a paper output. Attendance at the workshop was voluntary, and participation in the workshop was taken as an indication of informed consent. Participants were given the option to contribute

to the group discussions but request their comments were not recorded if they wished.

Facilitators led a carousel discussion giving each group an opportunity to comment on each question. All groups had the opportunity to review the comments made by previous groups, and successive groups had reduced time to contribute to each question. The comments of each group participant were captured on flip-charts, with participants asked to check for accuracy as these were scribed. The comments of all groups were visible throughout the workshop. These notes were then transcribed by each facilitator shortly after the workshop. All transcribed results were then analysed by the lead authors who conducted text analysis for emergent themes, both as responses to each question and between the questions. These themes were then discussed by all authors to elucidate the key observations and recommendations from the workshop.

Through analysis of the data, four key themes emerged: 1) the benefits of PPR to marine conservation; 2) priorities for future PPR to support marine conservation; 3) interdisciplinary research collaboration to deliver PPR; and 4) making PPR accessible to marine practitioners and policymakers. Anonymised quotes from the workshop transcripts are included below, indicated by italicised text. The results are discussed and from the findings, a series of recommendations are made on how PPR science can matter to marine conservation.

3. Results and discussion

This section presents and discusses the findings of the workshop, based on the discussions of the workshop participants. A total of 37 delegates attended the workshop. Formal assessment of age, country of residence and sector or discipline was not conducted; however the group was approximately 60% female, 40% male. Discussions with facilitators revealed that participants were from a range of countries across Europe, North America and Australia and a range of backgrounds including academic and practitioner. This variety of cultural and technical background not only provides a valuable coverage of the different angles of PPR, but also testifies that PPR is increasingly of interest across disciplines and sectors.

3.1. The benefits of public perceptions research for marine conservation

This pivotal discussion allowed participants to identify the ways in which PPR could be applied to support marine conservation outcomes. Without identifying such benefits, PPR is interesting but will provide little added-value to the marine conservation challenge. A number of applications emerged, beginning with assessing public knowledge of the seas: what do people know about marine environments, species and problems? Are they aware of conservation issues relevant to marine environments? Are they informed about the drivers of these issues or about the impacts of their own behaviours? These questions overlap with elements of Ocean Literacy and examples of such research include investigations of children (e.g. Cummins and Snively, 2000), teenagers (e.g. Nordstrom and Mitteager, 2001; Plankis and Marrero, 2010) and adults (e.g. Steel et al., 2005).

Yet, there was agreement among participants that PPR should go beyond simply understanding an audience's level of Ocean Literacy, illustrating a move away from the "knowledge deficit" approach which states that providing knowledge to an otherwise ignorant audience will achieve a conservation behaviour change (and illustrated as flawed in many circumstances (e.g. Bauer et al., 2007; Kollmuss and Aygeman, 2002)). Such agreement also highlights the importance of acknowledging the heterogeneity of perceptions

within a population as, for example, a group could have a similar knowledge of a marine conservation issue but respond to different engagement approaches. The participants' interest in considering multiple variables of human behaviour aligns with the increasing incorporation of social science disciplines into conservation. In other words, PPR offers opportunities to explore the values, emotions and cultural connections that exist between society and the sea, because "*understanding cultural context is critical to understanding how people engage with the sea*". This was considered to enable a deeper appreciation of how the sea influences or is part of an audience's identity or sense of place.

The emotional components of a person's connection with the sea are recognised as being part of the resonance of marine conservation engagement (Fletcher et al., 2012; Koss and Kingsley, 2010; Orams, 1995). By understanding emotions, engagement can be more than a knowledge transfer exercise, and can inform approaches by talking to the heart, not to the mind. Participants stated that PPR which investigates these deeper variables provides opportunities for connection and greater involvement through "*building on uniqueness of an area, feelings of pride and identity*" and "*reviving cultural and historical feelings towards the marine environment*", and can inform more effective conservation strategies (e.g. Jobstvogt et al., 2014; Koss and Kingsley, 2010). An example of the potential role of cultural connection in marine conservation was provided by one participant who highlighted work at Bien Unido Reef Marine Park in the Philippines, which is threatened by blast- and cyanide-fishing. Through understanding the cultural connections between society and the sea, religious statues were placed underwater resulting in dramatic declines of illegal activities (pers comms, Nino Rey Boniel), thereby supporting the marine conservation objectives of the Park through the alignment of such priorities with cultural values (in line with Hitzhusen and Tucker, 2013). The use of PPR can support the understanding of these cultural links, and identify where such opportunities could be incorporated into future marine conservation actions.

Participants suggested that PPR could be used as a foundation to build shared languages which could bridge boundaries between stakeholders. PPR into associations of different audiences with the sea enables shared languages to be found and language commonalities across sectors to be identified, rather than only applying the language of one sector (Voyer et al., 2015). An area where such processes are studied and applied is where Traditional Ecological Knowledge is involved. As "Traditional Ecological Knowledge is a complex of cultural beliefs, understanding, and practices, and is adapted to its specific social-ecological environment" (Lam, 2014), there is clear scope for PPR. Further examples of cross-sectoral collaboration in marine conservation come from the citizen science literature, whereby non-specialist volunteers support science and management by collecting data (for instance in the water – e.g. on the distribution of species (Cerrano et al., submitted) or along the shore – e.g. mapping debris distribution, (Bravo et al., 2009)) or co-creating participatory activities (Cerrano et al., submitted). PPR can benefit the design of effective citizen science programmes identifying shared grounds and languages – for example building upon the attachment to common attributes of the same marine habitat. This leads to increased mutual trust and understanding, and ultimately supports the implementation of both the programme and of the derived management decisions (Hammerton et al., 2012). Furthermore, besides being scientifically sound and practically implementable, successful citizen science programmes need to keep volunteers engaged so that activities can be carried out over large spatial and temporal scales. Here, participants considered that PPR can help tailor often disregarded – yet crucial – aspects of the overall experience, such as the alignment of sampling designs and promotional campaigns with motivations for

volunteering, or the provision of rewarding feedback that resonates with these (Koss and Kingsley, 2010; Campbell and Smith, 2006).

Workshop participants recognised that traditional conservation messages may “preach to the choir”, whilst issues of doom and gloom disengage audiences. Beyond the marine conservation world, there is a drive to find new ways to engage audiences with environmental behaviour changes, nature and issues of sustainability, e.g. Common Cause (Crompton et al., 2010). Participants believed this should be investigated for the oceans too. Within marine conservation, the growing presence of the Ocean Optimism message (e.g. www.oceanoptimism.com) is becoming a philosophy to build positivity in the face of the many negative conservation stories about the seas. Ocean Optimism and approaches such as Common Cause tap into the emotions and values of an audience in order to engage audiences with conservation. PPR was seen to provide support to these approaches by investigating the emotions and values of the target audiences and how people respond to these approaches, thereby identifying the resonance points where engagement can be most effective.

Concerning effectiveness, participants considered a key role of PPR to be in assessing the outcomes of public engagement activities to identify successful interventions. This could relate to obtaining the greatest impact on audiences, changing knowledge, behaviours or values, and consequently assessing how this influences policy makers or delivers wider conservation benefits. Participants also recognised that, although considerable effort is put into the engagement of audiences for marine conservation, there is limited research into the benefits this delivers (but see, for instance, Koss and Kingsley, 2010; Hammerton et al., 2012; Cerrano et al., submitted). This results in limited feedback to managers and policy makers to inform improved public engagement in the future. Examples come from research on recreational SCUBA diving. There is a growing body of literature about the human dimension components involved in divers' underwater behaviour (Milanese et al., 2013). This type of research, which includes aspects of PPR, has led to the development of structured programmes aimed at increasing divers' environmental awareness and reducing their negative impacts (e.g. NOAA's Blue Star, <http://floridakeys.noaa.gov/onthewater/bluestar.html> or UNEP's Green Fins, www.greenfins.net). There is evidence supporting the effectiveness of such programmes in terms of improved underwater behaviour (Hunt et al., 2013; Krieger and Chatwick, 2012). Less is known about the potential long-term changes in knowledge, attitudes, beliefs and values of divers or others engaged in marine activities, whether professional, conservation-oriented or recreational. More generally, however, a significant body of psychological research does suggest that the adoption of one type of environmentally-friendly behaviour (such as recycling) can lead to the adoption of other, similar behaviours under some circumstances (Truelove et al., 2014; Thøgersen and Ölander, 2003). Longitudinal research with volunteers on environmental stewardship programmes has also found that maintaining an active involvement in these activities over time can lead to changes in personal outlook and behaviour, for example spurring greater participation in environmental activism and conservation behaviours at home (Ryan et al., 2001). By investigating these aspects in more detail in the area of marine conservation, PPR could give strength to existing programmes and support conservation well beyond context-specific effects (e.g. from SCUBA diving to everyday life).

Workshop participants identified a range of approaches in using PPR for marine conservation. These started with questions around audience knowledge and understanding of issues, which can be addressed using questionnaire surveys and interviews. The investigation of emotions and cultures require more in depth methods, including application of frameworks such as Kellert's typology of

values (Kellert, 1996) and more specialist understanding of environmental psychology methods and literature (e.g. Kollmuss and Agyeman, 2002). The assessment of the impacts of engagement efforts requires PPR to be integrated within a project from the earliest stages, potentially allowing pre and post intervention comparisons of key variables such as behaviour. All these approaches entail the availability of suitable methods, expertise and resourcing. Further components of effective PPR pipelines (from design to delivery of results and uptake by policy and society) are considered in the following sections.

Finally, participants noted that PPR which does not directly investigate marine-related aspects can still be used to support marine conservation. An example of this is Rare (www.rare.org) which conducted demographic research into who was littering beaches in New Jersey. The results identified key polluters as men aged 18–25 years and mothers aged 30–40 years. PPR was then conducted to understand what was important to these groups (i.e. cars, as a status symbol for young men and a practical necessity for mothers), how these interests linked to the issue of littering and finally how to develop targeted direct marketing which resonated with these audiences - and led to reduced beach littering.

This section has described numerous ways through which PPR can positively contribute to achieving marine conservation objectives. PPR can be used at different stages of marine conservation action, from establishing understanding of new issues through to evaluating the efficacy of public engagement campaigns.

3.2. Priorities for future research on public perceptions of the sea

The marine environment is diverse in its flora and fauna, habitats and issues. As a consequence, the list of potential subjects on which to understand public perceptions could become long and unwieldy. Recognising this, the workshop participants discussed a number of immediate priorities for this field as it moves forward. One particular issue which emerged was the subject of deep sea mining. This is a rapidly developing industry, with exploration and extraction licensed in several areas (Mengerink et al., 2014). The newness of this issue prompted the initial need for PPR to assess baseline public perceptions of the deep sea, focused around audience knowledge. Participants stated that this would assess public knowledge of the deep sea – the seascapes, species, habitats, awareness of oil and gas extraction, or that there are these other extractive uses of the sea, besides fishing. However, these questions are based on measuring public knowledge – essential as a foundation but with limited benefits for conservation efforts. Workshop participants felt that PPR must go beyond knowledge assessment to include values and emotions to deliver the maximum marine conservation benefit: “*what about values – what do people feel about the sea and the deep sea?*” Participants discussed how to understand “*what makes most people tick when it comes to the sea?*” in order to better appreciate how people relate to and are affected by the marine environment. Emotions and values mapping of sectors and coastal communities were proposed as methods which could address these questions, supporting a more real understanding of the impacts of the sea on people's lives.

A number of priority research questions were recorded from participant discussions. These represent a range of types of PPR, from knowledge assessment (as with deep sea mining), specific connections with behaviours or issues, to broader questions about marine conservation and the impact of engagement:

- Climate change: how do people connect the sea to the abstract notion of climate change, e.g. through sea level rise, ocean acidification, changes in species present?

- Pollution/plastic: do people make the link between the rubbish that can be seen, some of which are recognisable household items, and their own behaviour?
- Do people think that fish from the sea is clean and healthy?
- How do people perceive food security of seafood species?
- Do people perceive a link, or could they, between the sea and our health e.g. food from aquaculture?
- What are the ecosystem benefits to people from the sea, and how do people perceive these benefits?
- What about the sea as the 'last frontier'? Does the idea of exploration of the unknown engage people?
- Where do people access information?
- If people knew more about the sea, would they take action?
- Do aquaria change the perceptions of the sea of people who do not visit marine environments?
- Can we assess the impact of marine conservation campaigns on people's perceptions?

These questions cover a range of scales of issues, concepts and connections, and represent the considerable opportunity for PPR to contribute to societal engagement with marine conservation. Through understanding questions such as these, participants considered that there would be great potential to inform marine conservation action to engage public audiences through effective application of PPR.

Participants also felt that there is a need to understand different audiences, within and beyond the public. A single "public" audience may have a variety of perceptions, and workshop participants agreed that PPR can be used to identify how perceptions vary within a single audience. Issues of sector representation were also discussed, for example, where representatives in policy consultations "*espouse different views or values to those of their members*". Therefore, PPR can ground-truth and add further input to policy processes. Additionally, investigating policy makers as an audience was of interest as "*policy makers are people too: what do they know and feel about the sea? What influences them?*"

Reflecting further on the different types of PPR which can be conducted, and the discussions from Sections 3.1 and 3.2, Table 1 provides an overview of these types, and describes how they can be applied in marine conservation settings. A number of these types may be combined within one study, or used in isolation,

depending on the particular research need. Not all PPR types are suited to all subjects, however there is some element of development, with knowledge assessments being particularly relevant for newly emerging issues, and more in-depth studies, such as emotional connections to the sea, being more relevant as a greater understanding of the target audience is needed. The variables of education and information and marine experience are not specifically PPR types, but are included here as these two variables are recognised as contributing a considerable amount to understanding society's connections with the sea (e.g. Jefferson et al., 2014).

This list of priorities and the many types of PPR which are available (Table 1) illustrate the potential for PPR to fill the grey area indicated in Fig. 1. It is evident that there is considerable interest in pursuing PPR to better understand many elements of the connection between society and the sea. There is scope to learn about some of these issues from existing research, some of which may not be exclusively marine. For example, links between human health and seafood could be informed by research on perceptions of farming and human health (e.g. Weatherell et al., 2003). It is likely, however, that focused marine PPR will be highly valuable and will add new dimensions to marine conservation action.

There are many subjects which could be explored using PPR, and the scope for growth of this field is considerable. The priorities proposed here include particular issues as well as investigating components of the relationships between society and the sea to inform more effective engagement approaches.

3.3. Connecting disciplines and facilitating public perceptions research

Although marine PPR is a growing research area, it is relatively disparate and includes researchers working in both natural and social science disciplines (Jefferson et al., in prep). PPR is interdisciplinary at both the research and application phases and can benefit from input from many disciplines, such as environmental psychology, conservation marketing, arts and graphic design. These disciplines need to work alongside marine experts in order to fully connect the PPR with the marine conservation issue being addressed. As the field of PPR grows, it is useful to consider the ways in which it could be made more efficient and effective through cross-discipline collaboration. Here we discuss the question of

Table 1
Overview of types of public perceptions research.

Type of research	Description
Knowledge	Assessing how much an audience knows about a given marine subject, issue or species. Particularly used for newly emerging issues e.g. ocean acidification, deep sea/deep sea mining or situations where relatively little is known about the public perceptions
Heterogeneity of audience perceptions	Relevant in almost any study, as it assesses whether variables such as age, gender, social values are influencing perceptions.
Cultural	Identifying particular elements of religious relevance, identity of a coastal town or city, folklore which is important to the population being studied.
Emotions	Identifying what emotions the sea creates in people e.g. fear, happiness, hope, whether positive or negative, and investigating the drivers of these emotions.
Human – ecosystem interactions	Investigating how the audience connect their actions, and those of others, with impacts on the sea, and also how they think the sea influences them e.g. positive and negative impacts of behaviour choices such as seafood consumption; links between seafood and human health; role of the sea in supporting their lifestyle through shipping or recreation.
Behaviours	Monitoring the types of behaviours which have positive or negative impacts on marine environments, and may be targeted to change through a particular engagement.
Concern	Assessing what the audience are concerned about in terms of marine conservation, and, potentially, how this relates to other concerns about non-marine and non-conservation issues.
Positive connections	With a growing departure from gloom and doom focused conservation engagement, there is an increasing need to identify the good things people associate with the sea.
Monitoring interventions	Monitoring what effects an intervention is having on the knowledge, attitudes, values or behaviours of a target population.
Education and information	Assessing the communication channels through which audiences gather information from. Identifying what knowledge an audience wants about a particular marine conservation issue.
Marine experiences	Understanding the types of engagement people choose with the sea, whether this is direct e.g. visiting the coast, manufactured e.g. aquaria, or indirect e.g. seeing marine documentaries.

bringing together researchers from a wide range of disciplines, considering some of the barriers to such interdisciplinary approaches and how to overcome these.

PPR is clearly interdisciplinary and is conducted by both academic and non-academic researchers. This leads to a group of active researchers who approach the subject from different angles, applying different paradigms to the work. Participants considered that as this group coalesces into a discipline focused around PPR for marine conservation, it will be a strength to draw on this diversity; however, drawing together these researchers could be complex. Participants felt that it would be important to be aware of these differences as efforts are made to bring together those interested in the field. As a way of addressing these differences, a recommendation was made by workshop participants that PPR could be considered as a useful tool to engage science, society and policymakers.

Participants recognised a number of barriers to PPR researcher connection within the academic infrastructure. The interdisciplinary nature of PPR can be a considerable obstacle to research funding, as much funding is focused within single disciplines. Additionally, there were concerns around the prevalence of issues around confidentiality and competition within academia which can lead to people not sharing ideas, a concern which is particularly relevant later in this paper where shared working at every stage of a research project is discussed (Section 3.4). Therefore, promoting trust across disciplines and between researchers is clearly essential to enabling collaborative PPR. The challenges of publishing PPR, again often due to its interdisciplinary nature, was also raised as an obstacle for researchers working in this field within an academic infrastructure, and one which is very difficult to overcome. The need for researchers to deliver activity which is of academic 'value' was not felt to foster increased PPR, as there was a feeling that this type of research may not be rated as having the greatest importance within universities and research institutions. Therefore there may be an opportunity for increasing focus of PPR in practitioner organisations, rather than within the academic sector. The potential for diverse communications outputs, such as blogs, was identified as important for PPR results but may also be a challenge as these may not be valued within the academic system, which could prohibit the interdisciplinary collaboration required for successful PPR.

A number of solutions were proposed by participants as mechanisms to engage researchers. In particular, the establishment of collaborative networks which bring together groups of researchers and practitioners to discuss methods, findings and new opportunities was highlighted. Similarly, a coordinating platform such as a collaborative web portal, through which PPR could be facilitated, and also enable those new to the field or interested in incorporating PPR into their research or conservation action to identify best practice, access support and network across the field. The importance of face-to-face meetings was highlighted as being very valuable to enable the development of research links and to pursue collaborative agendas. It should be noted that conferences provide a key opportunity for this, as seen within the International Marine Conservation Congress itself which had sessions on a number of themes relevant to PPR, including communicating marine conservation and application of marketing expertise to conservation. Collaboration can support the development of interdisciplinary teams and could enable PPR researchers to work with partners to catalyse the transition of research findings into marine conservation practice.

The diversity of disciplines and sectors involved with PPR presents an opportunity to create outputs which are of particular value to marine conservation, but it is also a challenge to delivering these outputs. Increasing efforts to work in interdisciplinary teams and involve multiple sectors with marine conservation can be adopted

by those in PPR to support the success of this field.

3.4. Making public perceptions research accessible to practitioners and policymakers

Interventions which deliver successful marine conservation outputs usually require multiple actors and institutions, including researchers, practitioners and policy makers (Ferse et al., 2010). In order for PPR to inform interventions, participants recognised that the relevant institutions must be willing to engage with research development, receptive to the findings and willing to allow the findings to influence their public engagement processes. Therefore, consideration of how PPR can be made accessible to practitioners and policymakers is essential to ensure that PPR generates marine conservation benefit. The workshop participants discussed how this process would take place during the development of research projects, in the dissemination of research findings, and how to develop wider buy-in of PPR as a component of marine conservation.

3.4.1. Research development

Workshop participants asserted that PPR should be driven by a need from a policymaker or practitioner, therefore partnerships between researchers and research users are required at the beginning of a project's development. This will involve a process of understanding who the practitioners or policymakers for PPR are, identifying the relevant actors who will apply the findings and ensuring that the research will deliver outputs which improve their marine conservation efforts. As the research is further developed, there should be transparency in the methods and aims of the research in order to build confidence in the quality of the research. A conversation around the understanding of representativeness of research was had, with a question about the need to understand how to communicate the reliability and confidence of the research. This is important given the range of studies which exist and could exist, and the care with which research findings should be applied. It was proposed that a series of criteria could be developed which would be applied to PPR research in order to support a quality assured approach.

3.4.2. Results dissemination

Disseminating research to diverse audiences is a subject which has received much attention (e.g. Bickford et al., 2012; Funkhouser and Maccoby, 1971), and many similar issues were raised in the workshop regarding the dissemination of marine PPR. Participants were emphatic that researchers should look beyond peer-reviewed articles as their only communications channel and explore additional communication opportunities. It was considered that the communications should be concise and highlight key messages. The spatial coverage of the results should be described, and verbatim quotes used to give the research a human perspective. There were discussions of how to personalise the communications to the target audience, such as breaking down sample sizes to enable decision makers to identify the people most important to them and sending relevant information personalised to each policymaker. Participants also felt that researchers should be pro-active about sharing their findings, even prior to peer review. This reflects the wider discussions of this workshop question around inclusivity of actors throughout the research process, rather than only when the research is complete – the process and findings throughout are valuable, as well as the polished end product. A number of mechanisms for communications were proposed by participants as ways to deliver the ideas suggested above. Improving accessibility of peer reviewed articles and ensuring articles have key messages which can be converted into action was also a key recommendation from

the group. Using infographics and innovative images as a way to pique interest was thought to be an efficient communication tool to support these messages. Again, it should be noted that these types of outputs, which are highly valuable for PPR in marine conservation, may create a tension for researchers owing to the different criteria by which research outputs are measured.

Many of the suggestions above reflect discussions around the challenges of science communication (Royal Society, 2006) and its role as a contributor to conservation science (Lindenfeld et al., 2012; Nisbet and Scheufele, 2009). Similar communications challenges are faced by many science disciplines. Organisations such as the British Science Association provide guidance for science communication, which could provide a foundation for developing good practice in PPR communications (e.g. <http://www.britishtscienceassociation.org/science-society/public-engagement-resources-0>).

3.4.3. Broader buy-in of PPR

Beyond the specific actions of communicating particular research projects, participants felt that there was also a wider need to 'sell' PPR. This would involve increasing the profile of PPR as being beneficial to marine conservation, and as a source of credible research. Participants considered that a number of success stories to illustrate the impact of PPR were needed to begin to catalyse interest. It may be necessary to develop a greater understanding of how this research can support practitioners and policy makers through understanding the processes they are involved in, their needs and how PPR can contribute. There is also a need to emphasise the credibility of PPR, particularly as it is dominated by social science methods which may be unfamiliar in traditional conservation fields, and often requires working with disciplines and actors which may be more familiar with natural science processes and outputs.

To ensure PPR delivers outputs which can positively impact marine conservation, involvement of practitioners and policy-makers is essential during research development and dissemination. Increasing the profile of PPR will help to create a receptive audience for such research, and the application of its findings.

3.5. Informing the development of future PPR

The paper began by recognising the potential for PPR to become an important discipline within marine conservation. There is increasing research activity in this field and growing interest in the results that these studies provide. A number of questions were proposed in Section 1 which need to be addressed in order to shape the development of this field. The outputs of this study provide expert opinion on the answers to these questions and the future of PPR within marine conservation. In terms of what the focus of future PPR should be, the participants in this study considered PPR relating to new and emerging issues such as deep sea mining as well as established issues such as climate change and fisheries to be equally important. Research should consider all aspects of perceptions including knowledge, emotions, and the cultural associations between society and the sea. There is a clear message that PPR should be both interdisciplinary and cross sectoral, ensuring policy makers and practitioners are engaged at each stage of research development to keep research relevant to conservation need. The following sections propose a framework, based on the findings of this workshop, which supports application of PPR to overcoming the challenges of marine conservation.

3.6. Reflections on the study

This study provides a first step to discussing what is needed to

deliver maximum benefits of PPR to marine conservation. The findings illustrate a number of routes for potential benefits, and propose mechanisms for achieving these. The results and recommendations are limited by the number of participants involved in the workshop; however, the paper presents useful findings which will be of value to those working in research, policy or practice. The outputs do not constitute a formal review of the field, as a more substantial, structured and resource intensive process would be required to deliver such outputs. At this stage of the development of PPR in a marine context, the authors believe the paper makes a worthwhile contribution to this growing area.

4. Marine PPR: a working agenda

The paper reviews the discussions and contributions of the workshop participants. An overview of the findings is presented in Fig. 2, which proposes a framework for shaping PPR for marine conservation. The first column of the figure outlines the key conditions which can support the delivery of PPR and provide a positive context in which to maximise its benefits. This includes broad scale challenges, such as a positive policymaking environment which is receptive to PPR, and project specific factors such as working with practitioners or policymakers to identify PPR needs. The second column outlines the types of research which PPR can be used to address (see also Table 1); these are the different types of research questions which could be addressed using PPR. At this stage of the framework, a project must select and apply the most suitable research method to deliver the project aims. Column three outlines the application of PPR findings into marine conservation processes: it is this stage which particularly benefits from the achievement of the context developed in column one. It could be assumed that column two could lead directly to column four, marine conservation benefits. However, the application of PPR to marine conservation is more nuanced, as the outputs of PPR are usually most powerful when integrated into other larger marine conservation processes, such as management mechanisms or community engagement. PPR presents a considerable opportunity which can complement the many other marine conservation actions already in use, but to do this, the translation of the research findings into the processes is required. As a final connection, achieving marine conservation benefits will have a positive effect for adoption of future PPR projects, as this illustrates the potential for making PPR science matter to marine conservation.

The framework provides guidance on the elements to be considered for applying PPR to marine conservation. Due to the diversity of potential applications of PPR, these are not precise step-by-step instructions which will suit all studies, rather an overview of the elements to be considered at each stage. It is likely that many issues or situations may revisit particular columns, perhaps returning to select new methods from column two as expertise grows (see discussion about Table 1 in Section 3.2). As PPR gains an increasing presence in marine conservation, it is hoped that this framework will support researchers and practitioners to identify opportunities for PPR to deliver benefits, and to work together to achieve these.

Returning to the two themes of IMCC and this special issue, consideration is given to "making marine science matter" and progressing the philosophy of Ocean Optimism. There are many calls for increased application of the social sciences in conservation (Sandbrook et al., 2013; Vincent, 2011; Mascia et al., 2003): a call echoed by the authors here. Equally, there is recognition that this is not an easy task owing to the considerable differences between natural and social sciences (Fox et al., 2006). PPR is an example of how social sciences can be integrated into existing efforts of natural science research, policy and practice to strengthen the conservation

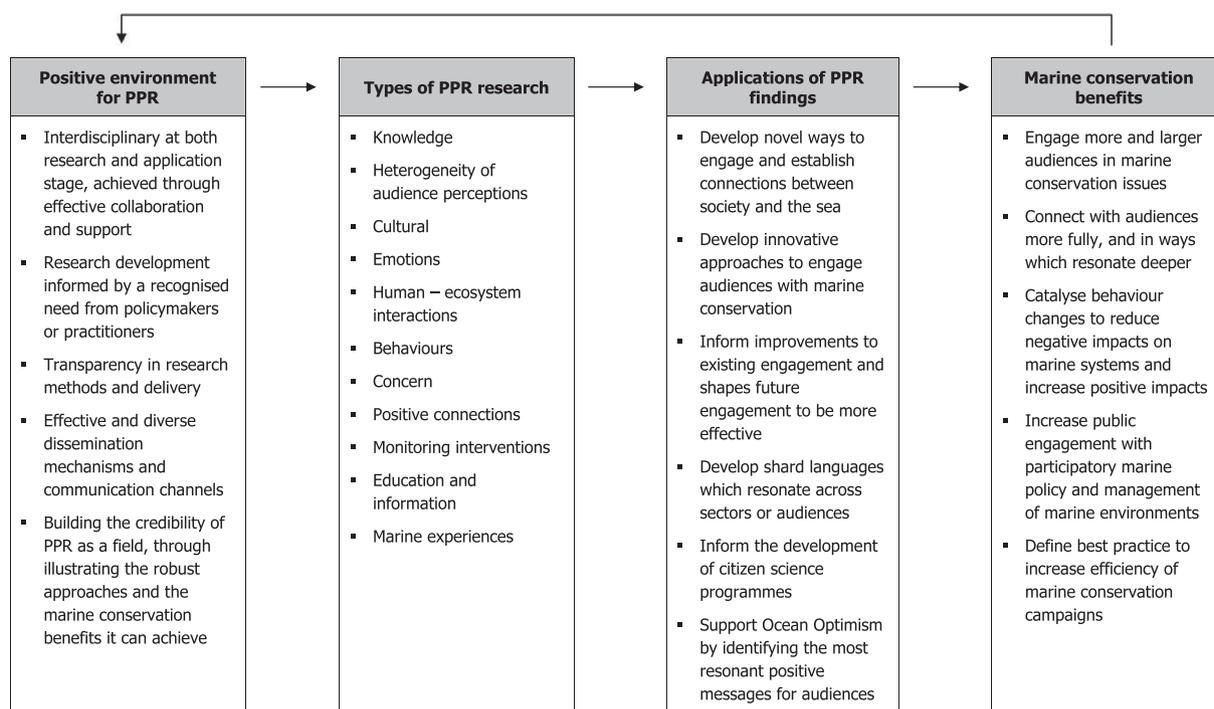


Fig. 2. Framework to guide the application of public perceptions research into marine conservation action.

benefits of their outputs.

The workshop participants were in strong agreement that PPR is a powerful tool, and in the right settings (interdisciplinary working, meeting an identified need, research being communicated to action), it could deliver science which has great impact on marine conservation. This is particularly through the power of PPR to support more effective engagement between society and the sea and targeted outcomes such as behaviour changes. This feeling of having a tool with great capacity for change in itself led to considerable optimism. The enormity of the challenges facing marine conservation (e.g. Halpern et al., 2008) and the urgent need to catalyse stronger societal engagement with marine conservation in response to this (Fletcher et al., 2012; Vincent, 2011) is not lost on any of those who work in this field, regardless of their background discipline. The discussions within this workshop were filled with enthusiasm for the capacity of PPR to deliver science which shows how other people see the sea. This is the real power of PPR, as it gives the opportunity to be led by the people whose engagement is so crucial.

This paper reviews a breadth of opportunities of how PPR could contribute to marine conservation engagement and outcomes. PPR can be seen as the societal version of investigating the ecology and population of a species or habitat to inform management interventions to increase population of a target species. If society is to be an integrated part of marine conservation, we require societal baselines to be defined and interventions tailored to the audiences: this can be delivered by PPR.

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