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## Public awareness and attitudes towards marine protection in the United Kingdom

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## ABSTRACT

Public perception research evaluating awareness and attitudes towards marine protection is limited in the United Kingdom (UK) and worldwide. Given public opinion can help drive policy and affect its successful delivery we conducted nationwide surveys in 2005, 2010 and 2015 to assess public knowledge of UK (England, Scotland and Wales) sea 'health' and management. Respondents from all three surveys were relatively pessimistic about sea 'health', perceiving this as poor-fair and largely in decline. Enthusiasm for marine conservation was high with almost two-thirds of respondents in each survey wanting >40% of UK seas highly protected from fishing and damaging activities. In 2015 there was considerable dissatisfaction with the rate of progress in Marine Conservation Zone designation and over three-quarters of respondents considered dredging and trawling to be inappropriate in protected areas, contrary to management. The UK government and devolved administrations need to better align future conservation and management with public expectations.

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## 1. Introduction

UK seas cover more than three-and-a-half times the country's land area (JNCC, 2014) and support a wealth of habitats and species, many of which are important both nationally and internationally for a variety of environmental, societal and economic reasons. The UK government estimates that the marine economy generates around £49 billion annually (DEFRA, 2014) through diverse industries that include oil and gas, offshore wind farms, fishing, tourism and recreation (Pugh, 2008; Morrissey, 2014). As all these compete for space among themselves and with nature (Smith et al., 2012) there is a need to ensure that UK waters are managed fairly and sustainably.

The marine environment around the UK is managed under a plethora of national and international legislation (Boyes and Elliott, 2014). Implementation of the 2009 Marine and Coastal Access Act (the Marine Act) in England and Wales, the 2010 Marine (Scotland) Act, and the 2013 Marine Act (Northern Ireland) provided a fundamental change in framework for the management of marine activities and the sustainable use and protection of marine resources (DEFRA, 2011; Potts et al., 2012; Rodwell et al., 2014). In particular, these Acts established an opportunity to develop a network of marine protected areas (MPAs), referred to as Marine Conservation Zones (MCZs) in England, Wales and Northern Ireland and Nature Conservation MPAs in Scotland. The devolved administrations have therefore each initiated a process for

establishing a protected area network within their respective waters (DEFRA, 2011).

MCZs are intended to complement existing UK MPAs, namely Special Areas of Conservation, Special Protection Areas, Sites of Special Scientific Interest, and Ramsar sites. In England, candidate MCZs were identified through a process of extensive stakeholder engagement and expert knowledge (Lieberknecht and Jones, in press). In 2011, 127 MCZs were recommended for establishment of which 27 were designated in November 2013 and 23 in January 2016. A third tranche will proceed to consultation in 2017 for designation in 2018.<sup>1</sup> To date only one MCZ in Wales has been designated (the long standing Marine Nature Reserve at Skomer) following the withdrawal of 10 proposed MCZs after extensive comments from the public consultation were received.<sup>2</sup> The Welsh Government is currently assessing the existing MPA network to determine whether additional protection in the form of MCZs will be given. In 2014, the Scottish Government designated 30 Nature Conservation MPAs following public consultations<sup>3</sup> and is currently considering an additional four sites.<sup>4</sup> Northern Ireland also only has one existing MCZ (again a former Marine Nature Reserve)

<sup>1</sup> JNCC. Marine Conservation Zones and subsequent pages. Available at: <http://jncc.defra.gov.uk/page-4525> [accessed 18/02/2016].

<sup>2</sup> JNCC. MCZ Project Wales. Available at: <http://jncc.defra.gov.uk/page-4164> [accessed 18/02/2016].

<sup>3</sup> JNCC. Nature Conservation Marine Protected Areas (MPAs). Available at: <http://jncc.defra.gov.uk/page-5269> [accessed 18/02/2016].

<sup>4</sup> The Scottish Government (2014). New protection for Scotland's seas. Available at: <http://news.scotland.gov.uk/News/New-protection-for-Scotland-s-seas-fl-e.aspx> [accessed 18/02/2016].

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and has recently closed public consultations on the designation of four additional sites.<sup>5</sup> Collectively, as of February 2016, approximately 17% of UK seas were designated under some form of conservation designation.<sup>6</sup> In Scotland management plans have been implemented in several inshore Nature Conservation MCZs. By contrast no additional management in England's MCZs has yet been applied.

Surveys of public awareness and attitudes allow an appreciation of wider social knowledge and interests which can positively contribute to achieving conservation objectives (Jefferson et al., 2015). However, research to examine public awareness of coastal and marine protection in the UK is very limited. Interviews conducted in 2009 at the National Maritime Museum, Greenwich (N = 138) found their visitors to have a 'general interest' in the marine environment, but with knowledge gaps of marine environmental issues (Fletcher et al., 2009); although these results likely over-represent general awareness due to the location of the interviews. Jefferson et al. (2014) found the UK public to have poor knowledge of subtidal species and marine health. While respondents showed considerable interest in charismatic species such as puffins and seahorses, many were unaware that these lived in UK waters. Respondents also perceived "less colourful" or "less impressive-species" as more likely to exist in UK seas and had a largely pessimistic view about the UK marine environment, corroborating previous public surveys by Natural England (2008) and Rose et al. (2008). Elsewhere in the world, other studies have identified gaps in public knowledge about ocean issues and marine protection (e.g. Steel et al., 2005; Eddy, 2014; Guest et al., 2015), with this ascribed to an 'out-of-sight, out-of-mind' mentality (Rose et al., 2008; Jefferson et al., 2014).

To date, public perception research findings suggest a lack of positive connections between UK society and the sea. As public awareness of environmental issues is important for marine conservation strategies to succeed (Horwich and Lyon, 2007), a good appreciation of the former within the UK is required. Using data collected from three surveys across ten years this study aims to explore changes in public awareness and attitudes to marine protection in the UK over a period of substantial change in marine management and protection.

## 2. Methods

Survey packs consisting of a cover letter, a questionnaire (Table 1 and Table S1), and a stamped return envelope were mailed to 2000 UK citizens in 2005 and 2015, and 2500 in 2010. In each case, participants were randomly selected by Data HQ Ltd. ([www.datahq.co.uk](http://www.datahq.co.uk)) to represent in proportion all social and economic segments of UK society as defined by the Cameo UK Classification™ profiling system (<http://cameo.bvdep.com/help/classifications1.htm>) with samples independent of previous years.

Survey questions varied slightly among years to reflect changes in marine legislation and progress in marine conservation initiatives, but key questions were common to examine trends over time. Each survey consisted of between 13 and 17 closed questions although many invited further elaboration on reasoning. Socio-demographic questions were optional in all surveys. Respondents were asked to complete and return the questionnaire within four weeks with surveys accepted 11 days after this deadline to allow for postal delays and to minimise response bias from those most motivated to respond (Berg, 2005). This meant that survey responses were obtained in December 2005 and January 2006 for the first, December 2009 and January 2010 for the second, and in March and April 2016 for the last.

Descriptive statistics were used to summarise results from each survey and make comparisons among surveys. Chi squared tests examined

<sup>5</sup> Department of the Environment. Marine conservation zones consultation. Available at: <https://www.doeni.gov.uk/consultations/marine-conservation-zones-consultation> [accessed 18/02/2016].

<sup>6</sup> JNCC. Contributing to a Marine Protected Area Network. Available at: <http://jncc.defra.gov.uk/page-4549> [accessed 18/02/2016].

relations between respondents' awareness of MPAs and the Marine Act and (1) the distance they lived from the coast, (2) whether they took part in sea related activities, and (3) whether they were a member of an environmental organisation.

While every effort was made to obtain a representative sample of the UK public, respondents to our questionnaires are nonetheless self-selecting. Respondents to postal questionnaires inevitably deviate from representativity for a number of reasons, notably: people who tend to hold strong views on an issue may be more likely to respond to a questionnaire which addresses these than people who don't; or the questionnaire may be completed by someone other than the addressee (Blair et al., 2013). All findings from our study assume that respondents answered their questionnaire honestly.

## 3. Results

### 3.1. Number of responses and respondent characteristics

Response rates of 24.9% (N = 498) in 2005, 23.9% (N = 598) in 2010, and 11.7% (N = 234) in 2015 were obtained. These sample sizes produce error margins of approximately  $\pm 3$ –6% on responses to questions (95% confidence intervals). Despite a low response rate in 2015, respondent demographics remained representative of the UK population in terms of gender and age<sup>7</sup> (Table S2), although other factors that could bias it such as economic or employment status couldn't be explored.

Survey respondent demographics were similar across all survey years; gender was relatively equally represented and the modal group of respondents' ages was 51–70 in each survey (Fig. S1a, b). Across all surveys the 18–30 and 71+ age group were the least represented. A high proportion of respondents (40.8% in 2010 and 41.9% in 2015, question not asked in 2005) reported living within 20 miles of the sea or >40 miles from it (39.5% in 2010 and 34.6% in 2015) (Fig. S1c). The proportion of respondents who said they belonged to at least one environmental organisation increased from 22.1% in 2005 to 26.5% in 2010 to 30.8% in 2015. However, the proportion who said they used the seas for an activity (e.g. swimming, sea kayaking, fishing, etc.) remained consistent at 45.6% in 2005, 44.0% in 2010, and 44.4% in 2015 (Fig. S1d, e).

### 3.2. Public perception of marine environmental health

The majority of respondents perceived the UK marine environment to be in 'fair' or 'poor' health (Table 1 Q1, Fig. 1a), although the proportion who considered this to be in 'good' health increased over the survey period from 4.4% in 2005 to 7.7% in 2015. When asked to rate how the health of the sea had changed in the preceding 10 years, the 2005 and 2015 surveys showed similar results, with respondents almost equally divided between those that considered this to have 'improved', 'stayed the same' or 'deteriorated' (Table 1 Q2, Fig. 1b). In 2010 fewer respondents considered the health of the sea to have 'improved' over the previous ten years, with the figure being 9.4% as opposed to 29.7% in 2005 and 34.2% in 2015. In all surveys, more than a third of respondents perceived that health of the sea in the UK had declined (36.1% in 2005, 43.8% in 2010, and 38.0% in 2015; Fig. 1b).

### 3.3. Public awareness of UK marine legislation and protection

A steady increase in awareness of MPAs was seen across the period of study with the percentage of respondents affirming they were familiar with the concept being 47.6% in 2005, 61.7% in 2010, and 72.2% in 2015 (Table 1 Q3). However no similar improvement in knowledge about the Marine Act occurred with similar results obtained between

<sup>7</sup> Data extrapolated from the UK Office for National Statistics, 2014 UK demographics, available from: <http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/february2016> [accessed 7th June 2016].

**Table 1**

Summary of questions asked across surveys for which results are reported. These are presented in full in Table S1. Given that the wording of some questions varied slightly among years the text has been paraphrased in places. “Q” identifies question numbers used for reporting in the manuscript. “Years asked” details years when a question was asked, with the number in brackets after this showing the original question number. Questions about demographic information are shown in Table S1. If additional information was provided prior to a question then this is indicated below in italics.

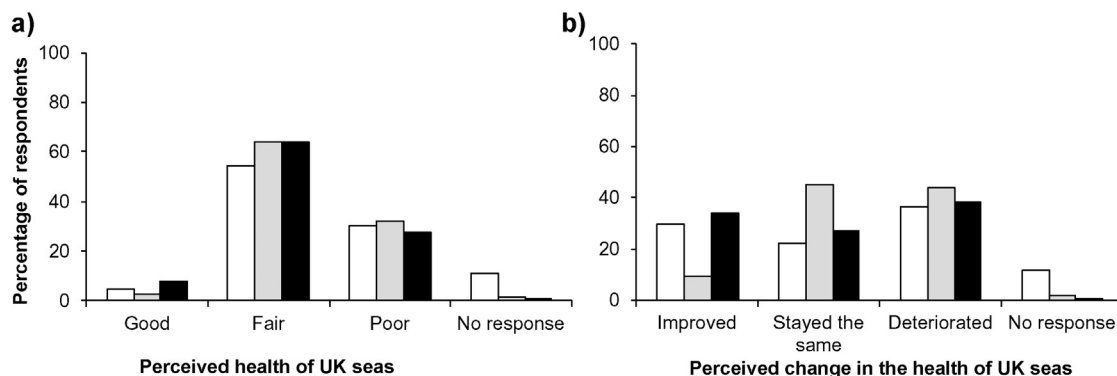
Q	Question	Answer options	Years asked
1	Do you think that the seas around Britain are currently in:	Good, fair or poor health	2005 (3) 2010 (2) 2015 (1)
2	In the past ten years, do you think that the health of Britain’s seas has:	Improved, stayed the same, deteriorated	2005 (4) 2010 (3) 2015 (2)
3	Are you familiar with the concept of declaring parts of the sea as marine protected areas?	Yes or no	2005 (5) 2010 (4) 2015 (3)
4	Have you heard of the Marine and Coastal Access Act?	Yes or no	2010 (7) 2015 (5)
5	What percentage of the total area of UK coastal waters would you estimate is currently declared as marine protected areas?	Open answer	2005 (6) 2010 (5)
6	What percentage of the total area of UK coastal waters around Britain do you think should be protected in marine reserves?	Open answer	2005 (10) 2010 (6) 2015 (4)
7	Below are provisions which are currently contained within the Marine Bill. Please indicate how important each one is to you.	Very, quite or not important	2010 (8a, d)
	a) Designation of Marine Conservation Zones to protect wildlife and habitats		
	b) Enforcement of penalties and fines for breaching Marine Licensing and damaging Marine Conservation Zones		
	<i>NB: Question referred to the Marine Bill as the questionnaire was issued prior to the adoption of the Marine Act.</i>		
8	a) How satisfied are you with the designation of 27 marine conservation zones out of 127 recommended sites? b) Please give a reason for your answer.	a) Extremely or slightly satisfied, neither satisfied nor unsatisfied, slightly or extremely dissatisfied. b) Open answer	2015 (6)
	<i>NB: Question asked after information provided on the process.</i>		
9	a) How satisfied are you with this level of expansion? b) Please give a reason for your answer.	a) Extremely or slightly satisfied, neither satisfied nor unsatisfied, slightly or extremely dissatisfied. b) Open answer	2015 (7)
	<i>NB: Question asked after information that consultation was being undertaken on a further 23 sites.</i>		
10	a) How satisfied would you be if trawling and dredging were permitted in marine protected areas in Scotland. b) Please give a reason for your answer.	a) Extremely or slightly satisfied, neither satisfied nor unsatisfied, slightly or extremely dissatisfied. b) Open answer	2015 (8)
	<i>NB: Question asked after information provided on proposed management strategies by the Scottish Government.</i>		
11	Do you think more of Scotland’s seas should be fully protected from trawling and dredging?	Yes, no or don’t know	2015 (9)
	<i>NB: Question asked after information provided on proposals for trawling and dredging restrictions.</i>		
12	a) How satisfied are you that the Welsh Assembly Government withdrew proposals for protecting 10 small highly protected marine conservation zones following consultation? b) Please give a reason for your answer.	a) Extremely or slightly satisfied, neither satisfied nor unsatisfied, slightly or extremely dissatisfied. b) Open answer	2015 (10)
	<i>NB: Question asked after information detailed responses to the Welsh consultation on 10 MCZs and the response by the Welsh Assembly Government’s to withdraw the sites.</i>		

the 2010 and 2015 surveys when 21.9% and 20.1% of respondents respectively stated they had heard of the Marine Act (Table 1 Q4). This question was not asked in 2005 as this survey pre-dated the Marine Act.

In 2015, respondents who practised one or more sea related activities were found to have greater familiarity with the concept of MPAs than those that didn’t ( $\chi^2 = 5.33$ , 1 d.f.,  $p = 0.02$ ,  $N = 227$ ), but the same did not apply to knowledge about the Marine Act ( $\chi^2 = 1.69$ , 1 d.f.,  $p > 0.05$ ,  $N = 227$ ). No significant relationships were found between

respondents’ proximity to the coast or membership of an environmental organisation and their awareness of MPAs ( $\chi^2 = 2.03$ , 3 d.f.,  $p > 0.05$ ,  $N = 226$ ;  $\chi^2 = 1.99$ , 1 d.f.,  $p > 0.05$ ,  $N = 154$  respectively) or the Marine Act ( $\chi^2 = 1.13$ , 3 d.f.,  $p > 0.05$ ,  $N = 226$ ;  $\chi^2 = 1.96$ , 1 d.f.,  $p > 0.05$ ,  $N = 154$  respectively).

In 2005 and 2010, nearly half of respondents or just over (41.2% and 52.7% respectively) thought that highly protected MPAs i.e. areas where any form of extraction is prohibited, covered between 1% and 10% of the



**Fig. 1.** Perceived health of UK seas (a) at the time of asking in 2005 (white), 2010 (grey), and 2015 (black); and (b) change in status across the preceding 10 years from the survey date (i.e. in 2005 this question referred to the period from 1995 to 2005, etc.)

UK's seas, with average figures of 19% in 2005 and 11% in 2010. In reality <1% of the UK's sea was protected to this level in the year of each survey (Table 1 Q5). The question was not asked in 2015.

### 3.4. Public support for UK marine conservation

Overall almost two-thirds of respondents in all surveys (60.0% in 2005, 61.9% in 2010, 59.4% in 2015) said they would like to see >40% of UK waters become highly protected marine reserves (mean 54.2%, 52.0%, and 57.2% in 2005, 2010, 2015 respectively; Table 1 Q6, Fig. 2). No significant relationships were identified between the percent coverages proposed by respondents in 2015 and either their proximity to the coast ( $\chi^2 = 35.23$ , 27 d.f.,  $p > 0.05$ ,  $N = 208$ ), membership of an environmental organisation ( $\chi^2 = 10.60$ , 9 d.f.,  $p > 0.05$ ,  $N = 145$ ) or their participation in coastal/marine activities ( $\chi^2 = 3.82$ , 9 d.f.,  $p > 0.05$ ,  $N = 209$ ).

### 3.5. Public satisfaction in the achievements of the Marine Act

In 2010 more than three-quarters (77.1%) of respondents felt that the designation of MCZs was a 'very important' provision of the Marine Act with 82.8% considering it to be important to levy fines for damage to these protected areas or for other breaches of licensing conditions (Table 1 Q7). In 2015, 49.6% of respondents were 'extremely dissatisfied' that only 27 MCZs had been designated in England out of the 127 originally recommended, and that none would receive any new management until 2016 (Table 1 Q8a). In particular, respondents considered that insufficient sites had been established (19% of comments,  $N = 43$ ), expressed frustration that the government had failed to follow expert advice (16.8%,  $N = 38$ ) and disappointment/concern at the slow progress of designation (13.7%,  $N = 31$ , Table 1 Q8b). A number of reasons were cited to support viewpoints including a perception that low priority is placed on environmental/conservation issues by the government (11.1%,  $N = 25$ ). Other responses were more moderate, with 12.8% ( $N = 29$ ) stating that while they weren't completely satisfied with progress with protection, the initial 27 MCZs were a step in the right direction (Table 1 Q8b).

In 2015, when respondents were informed that a second tranche of MCZs was under consideration (these 23 sites were designated in 2016), 43.2% ( $N = 101$ ) then said they felt slightly or extremely satisfied (Table 1 Q9a). For this topic as a whole, higher levels of satisfaction were reported by more than half of respondents (54.3%,  $N = 127$ ) in response to the new information, although 42.3% ( $N = 99$ ) reported the same level of satisfaction in the process irrespective of the second tranche of sites (comparison between responses to Table 1 Q8a and Q9a) with 28.0% ( $N = 60$ , Table 1 Q9b) of comments stating that this expansion was a further step in the right direction but that it was still insufficient

( $N = 52$ , 24.3%). Only 1.9% ( $N = 5$ ) of comments expressed concern about the cost of MCZs, displacement of fishing and impacts on local businesses, or stated that there were already enough MPAs.

### 3.6. Public opinion on activities to be permitted in Scottish Nature Conservation MPAs

In 2015, four fifths of respondents (79.9%,  $N = 187$ ) stated they would be dissatisfied if trawling and dredging were to be permitted in Scotland's Nature Conservation MPAs, with 59.4% ( $N = 139$ ) specifying extreme dissatisfaction (Table 1 Q10a). The main reason respondents gave for this was the damage these fishing techniques caused (35.1% of comments,  $N = 72$ , Table 1 Q10b), with 25.4% ( $N = 52$ ) feeling that to allow trawling or dredging within MPAs would undermine their conservation purpose. While a small number of respondents (3.4%,  $N = 7$ ), perceived that financial gain was being prioritised over conservation almost the same number (2.9%,  $N = 6$ ) noted the need to take fishers' livelihoods into account and suggested that where fisheries were vital to the economy then these should be allowed (2.4%,  $N = 5$ , Table 1 Q10b). 73.5% of respondents thought the current plan to only protect approximately 1% of Scotland's seas from trawling and dredging was insufficient and that greater restriction was needed (Table 1 Q11). Only 4.3% of respondents thought otherwise with the rest unsure or not responding (31.2%,  $N = 64$ ).

### 3.7. Public satisfaction with the Welsh MCZ process

Half of all respondents in 2015 (50.9%,  $N = 119$ ) said they were dissatisfied with the Welsh Assembly Government's decision to reject plans for 10 highly protected MCZs following public consultation (Table 1 Q12a). Comments to explain respondent's opinions on this included dissatisfaction that the Welsh government had failed to follow public opinion (22.1%,  $N = 40$ ) and that vested interests (6.6%,  $N = 12$ ) and financial gain (8.8%,  $N = 16$ ) were being prioritised over conservation (Table 1 Q12b). However, 27.8% ( $N = 65$ ) of respondents expressed satisfaction in this outcome; of which half (51.7%) were slightly satisfied with the remainder extremely so (Table 1 Q12a). 29 of these respondents chose to provide their rationale (Table 1 Q12b) whereby: 10.3% ( $N = 3$ ) described economic considerations; 6.9% ( $N = 2$ ) were pleased the MCZs hadn't been established; and one person considered that fishing should be limited but not banned. However, a number of respondents who stated they were satisfied with the outcome appeared to misunderstand either the question or the scoring system given that several expressed either pleasure that consultation was undertaken (17.2%,  $N = 5$ ) and that most people supported the MCZs (24.1%,  $N = 7$ ), or frustration that the government had failed to follow public opinion (10.3%,  $N = 3$ ), stating that conservation needs to be taken more seriously (10.3%,  $N = 3$ ). The remaining three respondents definitely misinterpreted the question, indicating it was good that the 10 MCZs were being protected.

## 4. Discussion

The success of biodiversity protection relies on social, cultural, economic and political influences (Fiske, 1992; Brooks et al., 2012; Katsanevakis et al., 2015; McCracken et al., 2015). For example, MPA effectiveness is consistently associated with the level of community engagement, socio-economic characteristics, governance, and enforcement (Pietri et al., 2009; Rossiter and Levine, 2014). Understanding public opinion can therefore help focus the prioritisation of policy and management initiatives to ensure their successful delivery.

Overall, we found most respondents to our surveys were relatively pessimistic about the health of the UK's seas, corroborating previous research (Natural England, 2008; Rose et al., 2008; Jefferson et al., 2014). Across all surveys, between 84.5% and 95.8% of respondents considered the marine environment to be in fair-poor health at the time of asking

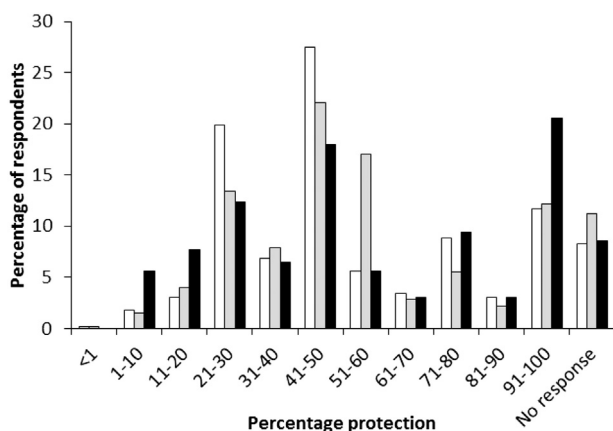


Fig. 2. Percentage of UK seas respondents considered should be highly protected by marine reserves in 2005 (white), 2010 (grey), and 2015 (black).

(Fig. 1a). However, while the greatest proportion of respondents in each survey considered the health of UK seas to be in decline, mixed responses were obtained (Fig. 1b) indicating a general lack of clarity about change over time and the effectiveness, or not, of different policy and management initiatives.

The majority of respondents were unaware of the existence of the Marine Act in both 2010 and 2015 suggesting that mechanisms underpinning marine conservation measures are either of little interest to most people or are not well publicised. By contrast familiarity with the concept of MPAs increased steadily between surveys. This may have been driven by a greater media focus on the sea stimulated by debate around the Marine Act, as well as recent high profile media campaigns, involving well-known celebrities, which had championed global marine health and criticised unsustainable fishing practices (e.g. Fishlove and Hugh's Fish Fight). High levels of disconnect between perceived coverage of highly protected UK MPAs in 2005 (19% coverage) and 2010 (11% coverage) and actual MPA coverage of <1% (most of which was little protected) at the time of these surveys, also illustrates a knowledge deficit regarding marine protection levels, similar to that found elsewhere (Eddy, 2014). People believe that UK seas receive a much higher level of conservation attention than is reality.

Enthusiasm for the designation of MPAs was consistent across all three surveys with almost two-thirds of respondents in each wanting to have >40% of the sea highly protected, and between 11% and 20% of respondents saying they wanted to see all of the UK's seas protected (Fig. 2). Similar levels of public support for protection exist in New Zealand where MPA coverage of 36% was desired (Eddy, 2014). Whether or not such figures are realistic, it is clear that our samples of the UK public would like to see a lot more marine protection than existed at the time of our surveys. Likewise high levels of dissatisfaction with progress made by the UK government in designating MCZs around England and the Welsh Assembly Government's withdrawal of the 10 proposed MCZs around Wales supports the idea that the UK public care about marine conservation. Many respondents expressed frustration that the advice provided to designate 127 English MCZs had not been followed in its entirety and thought the Welsh government had failed to follow overall public opinion. In addition, respondents considered the reduced number of English MCZs designated as evidence of the low priority government places on environmental and conservation issues. Nonetheless, many respondents considered each tranche of MCZs to be a step in the right direction suggesting that while they would prefer to see faster progress, they were pleased that progress was at least being made.

While the management of MCZs and Nature Conservation MPAs, and the activities to be permitted within each, are still largely being determined, over three-quarters of respondents stated they would be dissatisfied if dredging and trawling were permitted within MPAs. In particular, a quarter of comments explaining respondent's viewpoints stated that permitting these activities in protected areas would undermine their conservation purpose. This reinforces the conclusion that support for marine conservation in the UK is high and represents a case where public opinion is in line with scientific understanding of the impacts of mobile fishing gears (Tillin et al., 2006; Thurstan et al., 2013), and where management action is at odds with it.

Our results present snapshots of the viewpoints of the UK public over ten years and, as with any survey, insights produced rely on respondents involved, and the validity for extrapolating survey results to a wider population depends on how representative the sample is. To maintain consistency in our study we used postal surveys throughout and sent these to a representative sample of the UK population (see Methods). However, as not all surveys were returned our sample is unlikely to fully represent the UK population. In particular the low response rate in 2015 suggests that respondents then may especially be influenced by sampling bias, as well as indicating a considerable change in the ability of postal questionnaires to elicit responses between the last two surveys. Nonetheless, as the demographic profile based on age and gender of our 2015 respondents compares favourably with

the population demographics of the UK as a whole, we believe the conclusions from our study remain strong. For future public opinion surveys about marine conservation however, we recommend using a variety of survey techniques to help improve response rates and reduce sampling bias.

Since the most recent survey was undertaken in 2015, the UK government has designated the second tranche of 23 MCZs around England (January 2016), and intends to consult on a third and final tranche of sites in 2017. Management measures beyond those already in place in these areas are yet to be implemented in any of them. Of the 30 Nature Conservation MPAs designated in Scotland's seas, 17 are within inshore waters and therefore fall under the Marine (Scotland) Act. As of February 2016 Marine Scotland has implemented 10 agreed management plans for these sites which detail permitted or prohibited activities. However only four of the ten prohibit all forms of dredging and bottom trawling in all seasons within the entirety of their boundaries and none are fully protected from fishing.<sup>8</sup> Thirteen of the 30 Nature Conservation MPAs lie in offshore waters and hence require management under the European Union's Common Fisheries Policy. To date, no new management measures have been implemented for these sites.<sup>9</sup> An additional four locations for the protection of basking sharks and dolphins are being considered by Scottish Ministers.<sup>10</sup>

In view of the concern respondents showed regarding the 'health' of UK seas, their strong support for marine protection, and the lack of awareness of actual UK MPA coverage, greater public education and outreach could motivate socially driven conservation efforts and effect greater action in policy and practice, such as that seen in Lamlash Bay by the Community of Arran Seabed Trust (Prior, 2011). Moreover, given the strong support for marine conservation this study reveals, the UK government and devolved administrations should ensure that marine protection in the UK meets public expectations of conservation need.

#### Author contributions

Conceived the research: JPH, CMR. Designed and conducted the surveys: JPH, NB, SR, GR, CMR. Analysed the data: JPH, BCO, NB, HP, SR, GR, CMR. Wrote the paper: JPH, BCO, CMR. Reviewed the paper: JPH, BCO, NB, HP, SR, GR, CMR.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.marpolbul.2016.07.003>.

#### References

- Berg, N., 2005. In: Kempf-Leonard, K. (Ed.), Non-response Bias. Encyclopedia of Social Measurement. Academic Press, London, UK.
- Blair, J., Czaja, R.F., Blair, E., 2013. Designing Surveys: A Guide to Decisions and Procedures. third ed. SAGE Publications.
- Boyes, S.J., Elliott, M., 2014. Marine legislation – the ultimate 'horrendogram': international law, European directives & national implementation. Mar. Pollut. Bull. 86, 39–47.

<sup>8</sup> Based on information provided in the Marine Conservation Orders or Inshore Fisheries Orders for each site as of 16th February 2016: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/protectedareasmgmt>

<sup>9</sup> <http://jncc.defra.gov.uk/page-6895> [accessed 16th Feb 2016].

<sup>10</sup> <http://news.scotland.gov.uk/News/New-protection-for-Scotland-s-seas-f1e.aspx>.

- Brooks, J.S., Waylen, K.A., Mulder, M.B., 2012. How national context, project design, and local community characteristics influence success in community-based conservation projects. *Proc. Natl. Acad. Sci. U. S. A.* 109, 21265–21270.
- DEFRA, 2011. The UK Marine Policy Statement. HM Government, Northern Ireland Executive, Scottish Government, Welsh Assembly Government.
- DEFRA, 2014. East Inshore and East offshore Marine Plans. Marine Management Organisation.
- Eddy, T.D., 2014. One hundred-fold difference between perceived and actual levels of marine protection in New Zealand. *Mar. Policy* 46, 61–67.
- Natural England, 2008. Marine protected areas, qualitative value mode research. *Nat England* 2008, 101.
- Fiske, S.J., 1992. Sociocultural aspects of establishing marine protected areas. *Ocean Coast. Manag.* 18, 25–46.
- Fletcher, S., Potts, J.S., Heeps, C., Pike, K., 2009. Public awareness of marine environmental issues in the UK. *Mar. Policy* 33 (370–375).
- Guest, H., Lotze, H., Wallace, D., 2015. Youth and the sea: ocean literacy in Nova Scotia, Canada. *Mar. Policy* 58, 98–107.
- Horwich, R.H., Lyon, J., 2007. Community conservation: practitioners' answer to critics. *Oryx* 41, 376–385.
- Jefferson, R.L., Bailey, I., Laffoley, D.d.A., Richards, J.P., Attrill, M.J., 2014. Public perceptions of the UK marine environment. *Mar. Policy* 43, 327–337.
- Jefferson, R.L., McKinley, E., Capstick, S.B., Fletcher, S., Griffin, H., Milanese, M., 2015. Understanding audiences: making public perceptions research matter to marine conservation. *Ocean Coast. Manag.* 115, 61–70.
- JNCC, 2014. Fifth National Report to the United Nations Convention on Biological Diversity: United Kingdom. JNCC, Peterborough.
- Katsanevakis, S., Levin, N., Coll, M., Giakoumi, S., Shkedi, D., Mackelworth, P., Levy, R., Velegrakis, A., Koutsoubas, D., Caric, H., Brokovich, E., Öztürk, B., Kark, S., 2015. Marine conservation challenges in an era of economic crisis and geopolitical instability: the case of the Mediterranean Sea. *Mar. Policy* 51, 31–39.
- Lieberknecht, L.M., Jones, P.J.S., 2016. From stormy seas to the doldrums: the challenges of navigating towards an ecologically coherent marine protected area network through England's Marine Conservation Zone process. *Mar. Policy*, <http://dx.doi.org/10.1016/j.marpol.2016.05.023> (in press).
- McCracken, M.E., Woodcock, B.A., Lobley, M., Pywell, R.F., Saratsi, E., Swernam, R.D., Mortimer, S.R., Harris, S.J., Winter, M., Hinsley, S., Bullock, J.M., 2015. Social and ecological drivers of success in agri-environment schemes: the roles of farmers and environmental context. *J. Appl. Ecol.* 52, 696–705.
- Morrissey, K., 2014. Using secondary data to examine economic trends in a subset of sectors in the English marine economy: 2003–2011. *Mar. Policy* 50, 135–141.
- Pietri, D., Christie, P., Pollnac, R.B., Diaz, R., Sabonsollin, A., 2009. Information diffusion in two marine protected area networks in the Central Visayas region, Philippines. *Coast. Manag.* 37, 331–348.
- Potts, T., O'Higgins, T., Hastings, E., 2012. Oceans of opportunity or rough seas? What does the future hold for developments in European marine policy? *Phil. Trans. R. Soc. A* 370, 5682–5700.
- Prior, S., 2011. Investigating the use of voluntary marine management in the protection of UK marine biodiversity. Report to the Royal Society for the Protection of Birds, Sandy, UK.
- Pugh, D.T., 2008. Socio-Economic Indicators of Marine-Related Activities in the UK Economy. Technical Report. The Crown Estate, London.
- Rodwell, L.D., Fletcher, S., Glegg, G.A., Campbell, M., Rees, S.E., Ashley, M., Linley, E.A., Frost, M., Earll, B., Wynne, R.B., Mee, L., Almada-Villela, P., Lear, D., Stanger, P., Colenutt, A., Davenport, F., Barker Bradshaw, N.J., Covey, R., 2014. Marine and coastal policy in the UK: challenges and opportunities in a new era. *Mar. Policy* 45, 251–258.
- Rose, C., Dade, P., Scott, J., 2008. Qualitative and quantitative research into public engagement with the undersea landscape in England. *Nat England* 2008.
- Rossiter, J.S., Levine, A., 2014. What makes a "successful" marine protected area? The unique context of Hawaii's fish replenishment areas. *Mar. Policy* 44, 196–203.
- Smith, H.D., Ballinger, R.C., Stojanovic, T.A., 2012. The spatial development basis of marine spatial planning in the United Kingdom. *J. Environ. Policy Plan.* 14, 29–47.
- Steel, B.S., Smith, C., Opsommer, L., Curiel, S., Warner-Steel, R., 2005. Public ocean literacy in the United States. *Ocean Coast. Manag.* 48, 97–114.
- Thurstan, R.H., Hawkins, J.P., Roberts, C.M., 2013. Origins of the bottom trawling controversy in the British isles: 19th century witness testimonies reveal evidence of early fishery declines. *Fish Fish.* 15, 506–522.
- Tillin, H.M., Hiddink, J.G., Jennings, S., Kaiser, M.J., 2006. Chronic bottom trawling alters the functional composition of benthic invertebrate communities on a sea-basin scale. *Mar. Ecol. Prog. Ser.* 318, 31–45.