



UNDERSTANDING OCEAN LITERACY AND OCEAN CLIMATE-RELATED BEHAVIOUR CHANGE IN THE UK - WORK PACKAGE 1: EVIDENCE SYNTHESIS

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Policy Summary

Project background

- The field of ocean literacy has been developing since the 2000s; the initial focus of the field took a ‘knowledge deficit’ approach (i.e. more knowledge equals enhanced awareness and concern and even fosters behaviour change) and was largely approached from a natural science perspective.
- However, recently there has been a shift in focus in recognising that ocean literacy is much more than ‘knowledge’, with a recent study suggesting the concept comprises of six dimensions, including ‘knowledge’, ‘awareness’, ‘attitude’, ‘communication’, ‘behaviour’ and ‘activism’.
- As such, ocean literacy must be considered as being not only about increasing public awareness of the state of the ocean, our impacts upon it and its impacts upon us, but also about providing tools and approaches to transform ocean knowledge into behaviours and actions that promote ocean sustainability.
- There is also a need to further explore how enhancing ocean literacy at different geographical scales and among different audiences or groups of people can be used to develop more effective ocean policy and management, both for the UK and further afield.
- For ocean literacy to be used effectively in policy development across the ocean-climate nexus, there is a need to have a better understanding of the link between ocean literacy and climate-related behaviours; how to measure ocean literacy across the UK; and the levels of ocean literacy and climate-related behaviours in the UK population.

Review of the links between ocean literacy and behaviour change

- A rapid literature review assessment was carried out to explore the current evidence base on ocean literacy, as well as other relevant concepts and models, such as marine citizenship, ocean or nature connectedness, climate stewardship and pro-environmental behaviour.
- The review highlights the currently recognised ocean literacy factors and dimensions which are common across these models; however, it also identifies gaps and highlights drivers of behaviour change that are not explicitly considered within the existing definition and dimensions of ocean literacy.
- Additional dimensions which should also be considered for inclusion within ocean literacy with a view to influencing behaviour change for both the ocean, and in the context of climate change adaptation, include connection to the ocean, emotions and empathy, motivations, and access.

Review of indicators and question-modules

- Sixteen surveys were identified and reviewed which assess public attitudes to the natural environment and/or its management within the UK or devolved nations of the UK.
- The surveys adopted a range of sampling methodologies including random, self-selection and convenience sampling and a range of data collection tools including online, face-to-face, focus groups and telephone interviews.
- Only five of these surveys collected data from the UK population, with most surveys being undertaken at the devolved nation level.
- Five surveys provide time series data on an annual or biennial basis whilst other surveys have only been conducted as standalone surveys or were repeated sporadically.

- Eight surveys focus on the natural environment as a whole, and therefore cover multiple dimensions of 'Environmental Literacy' but do not explicitly focus on the marine environment and ocean literacy.
- Eight surveys focus on public perceptions specifically on the coastal and marine environment; only one of these surveys has so far been conducted in multiple years using the same questions.
- The eight public opinion surveys which focus on the marine environment cover multiple dimensions of ocean literacy, generally relating to 'Awareness', 'Knowledge' and 'Attitude', with only five of these surveys covering aspects of 'Communication', five covering aspects of 'Activism', and four covering aspects of 'Behaviour' and 'Behavioural Choices and Decision-Making'.
- There are currently no UK-wide surveys which relate to all six currently recognised dimensions of ocean literacy ('knowledge', 'awareness', 'attitude', 'communication', 'behaviour' and 'activism'), as well as aspects of climate-related behaviour change (e.g. curtailment behaviour, behavioural choices and decision-making, technology change).

Policy recommendations

- There is currently a lack of data on ocean literacy, and how this translates to behaviour change, collected at the UK level, and therefore we recommend that an ocean literacy specific survey is developed and implemented for the UK.
- There is a lack of longitudinal surveys on ocean literacy, and therefore it is recommended that surveys of this nature have to be suitably designed and funded to detect changes over time.
- This assessment has shown that there is currently a paucity of data on the different dimensions of ocean literacy, with the majority of surveys focussing on 'Attitudes', 'Knowledge' and 'Awareness'. Therefore it is recommended that any ocean literacy survey should also make sure it incorporates questions relating to the other dimensions (such as 'Communication', 'Behaviour' and 'Activism').
- It is recommended that the definitions used for the dimensions of ocean literacy be revisited to ensure they are fit-for-purpose in a UK context. For example, the definition of 'Communication' as proposed by Brennan et al. (2019) does not reflect communication as a two way process and therefore should include data on how information about the marine environment is accessed (e.g. from social media, nature documentaries, newspapers etc.) as well as the extent to which a person communicates with others. Furthermore, the dimension of 'Knowledge' should extend to more than knowledge of ocean environments and should also include an assessment of people's knowledge of where to access information, how to participate in discussions about the ocean and what behaviour change opportunities might be available to them. Each of the currently accepted dimensions should be explored and amended or expanded to suit a UK context – and where appropriate, additional dimensions should be considered.
- Although not assessed within this report, this review identified a range of additional dimensions of ocean literacy which are not currently addressed. These include aspects of Emotions; Access, experience and proximity; Social values; Motivations; and Trust and transparency. It is recommended that these additional dimensions are also included within the design of any future survey on ocean literacy.
- When focussing on the relationship between ocean literacy and behaviour change, very few questions were identified which attempted to make this connection. Therefore in the context

of the ocean-climate nexus additional questions are required which address climate-related behaviour change.

- In addition to asking questions about ocean literacy dimensions and climate-related behaviour change, socio-demographic data (including, but not limited to, age, gender, employment, education, experience of the ocean and coast, area of residence) are important to understand the motivations of respondents and the diversity of views, attitudes and connections held by different segments of the UK population. Therefore, it is recommended that a specific ocean literacy survey is required which has sufficient space to obtain this data and that socio-demographic data are also used within the analysis and not just presented as supporting data. This data will provide valuable insight into the variation in current and future dimensions of ocean literacy and can be used to support developed of geographically or community specific approaches and activities.
- Despite having a shared vision for the UK seas, environmental policy in the UK is administered and implemented at the devolved nation level. Therefore it is recommended that for such surveys to be of relevance for policy then careful consideration is needed to ensure that the questions are of relevance at both the devolved and UK level and that the sample size is sufficient to analyse the data at the devolved level.

1. Introduction

1.1. Project background

Initially, ocean literacy was defined as “understanding your influence on the ocean, and its influence on you”; however, recent developments have seen the concept begin to evolve. Whilst the field of ocean literacy has been developing since the 2000s (Steel et al., 2005), the initial focus of the field took a ‘knowledge deficit’ approach (i.e. more knowledge would equal more concern and even a behaviour change) and was largely approached from a natural science perspective. However, recently there has been a shift in focus in recognising that ocean literacy is much more than ‘knowledge’ but should also encompass ‘awareness’, ‘attitude’, ‘communication’, ‘behaviour’ and ‘activism’ (Brennan et al., 2019). The majority of ocean literacy related research in the UK has focused on awareness, knowledge and attitudes towards marine issues and climate change (e.g. ocean acidification). However, research into other dimensions of ocean literacy, and how this can be successfully translated in either behaviour or policy change, has been limited (e.g. communication, behaviour and activism). This requires a truly interdisciplinary approach which is largely driven by marine social science disciplines (as indicated by a recent Defra funded review by McKinley, 2020; as well as in the academic literature e.g. Bennett, 2019; McKinley et al., 2020). As such, ocean literacy must be considered as being not only about increasing public awareness on the state of the ocean, our impacts upon it and its impacts upon us, but also about providing tools and approaches to transform ocean knowledge into behaviours and actions that promote ocean sustainability (UNESCO, 2018). There is also a need to further explore how enhancing ocean literacy at different scales and among different audiences or groups of people can be used to develop more effective ocean policy and management, both for the UK and further afield.

1.2. Aim and objectives

For ocean literacy to be used effectively in policy development, there is a need to have a better understanding of the link between ocean literacy and climate-related behaviours; how to measure ocean literacy across the UK; and the levels of ocean literacy and climate-related behaviours in the UK population. To gain a better understanding of these issues, two objectives and a series of tasks are outlined below.

Objective 1 Review the links between ocean literacy and behaviour change:

- Review the evidence base on the relationship between ocean literacy and behaviour change.
- Summarise the links between ocean literacy and behaviour change.

Objective 2 Review indicators and question-modules:

- Review and examine indicators and existing surveys and secondary datasets relevant to ocean literacy and climate-related behaviour change.
- Provide recommendations on indicators and supporting datasets relevant to ocean literacy and climate-related behaviour change.

This report is a scoping study, and will provide a baseline evidence assessment and recommendations of feasibility for potential follow-on empirical research: Follow-on phases would design and test questions and indicators for inclusion in an online survey, using both qualitative and quantitative pre-testing; as well as implement an online survey which will gain baseline data on the level of ocean literacy and engagement in ocean climate-related behaviours in the English population.

2. Review the links between ocean literacy and behaviour change

There is currently limited understanding of the behaviour dimension within ocean literacy, in particular with respect to whether societies' understanding of the benefits they receive from the ocean, such as regulation of our climate, and the impact of climate change on the ocean, can lead to behaviour change within society. Such behaviour changes may include, for example, switching to energy from marine renewable sources, buying more locally produced products and using sustainable transport.

Despite the importance of the ocean to communities globally, there is currently a lack of understanding as to how ocean literacy can be used as a pathway to wider societal behaviour change for the ocean, and other related areas (e.g. engagement in more climate-related behaviours). Looking towards COP26¹, and bringing in a more holistic and whole system way of thinking across the ocean-climate nexus, there are opportunities to explore how enhancing ocean literacy could be used to benefit UK seas and coasts, but also to support enhanced climate-related behaviour change. It is important to note that a multitude of both internal and external factors will influence individual and societal behaviours and decision-making – this report explores the relationship between ocean literacy and other relevant concepts and how these may feed into behaviour change, but does not comment on the role of other influencing factors, such as political environment, governance systems or wider social or economic drivers. Additionally, the report considers what this relationship between ocean literacy and behaviour change might mean for developing indicators and metrics for better understanding existing levels of ocean literacy among UK audiences and harnessing this for future change for the ocean and climate.

2.1. Review of the evidence base on the relationship between ocean literacy and behaviour change

While the role and importance of ocean literacy in supporting and delivering effective global ocean governance has received increasing recognition in recent years, calls for improving public participation in environmental matters are not new. The concept of ocean literacy, and other related concepts and frameworks, build on existing models such as environmental citizenship, marine/ocean citizenship, nature connectedness (and more recently, ocean connectedness), as well as a range of frameworks for pro-environmental behaviour change. To understand the relationship between ocean literacy and behaviour change, it is first necessary to explore the evolution of ocean literacy since its inception in the early 2000s. The next section presents a high-level overview of a selection of these models, highlighting commonalities with ocean literacy and identifying additional influencing factors that may need to be considered alongside the existing dimensions of ocean literacy.

2.1.1. Approach

To review the existing evidence and literature base relating to ocean literacy and other relevant models, a rapid literature review assessment approach was adopted. To support this, a set of key terms was developed, with input from Ocean Conservation Trust (OCT) and Defra, and then used to guide the literature review (see Box 2.1).

¹ 26th UN Climate Change Conference of the Parties (COP26) at the Scottish Event Campus (SEC) in Glasgow, planned for 1 – 12 November 2021 – the UK holds the COP26 Presidency. For more information: <https://www.gov.uk/government/topical-events/cop26>

Box 2.1: Key search terms to explore existing evidence base for ocean literacy and climate-related behaviour change.

'ocean literacy' OR 'climate literacy' OR 'systems literacy' OR 'marine literacy' OR 'marine citizenship' OR 'environmental citizenship' OR 'marine stewardship' OR 'ocean citizenship' OR 'environmental behaviour change' OR 'behaviour change' OR 'climate behaviour' OR 'marine citizens' OR 'climate stewardship' OR 'environmental literacy' OR 'social marketing' OR 'conservation marketing' OR 'health literacy' OR 'climate related behaviour' Or 'ocean connectedness' OR 'nature connectedness' Or 'pro-environmental behaviour**'

The initial approach aimed to carry out a wide-ranging literature search using the list of search terms outlined below (Table 2.1). Using Scopus, this identified extremely high numbers of papers – the team took the view that this identified an unmanageable number of papers for inclusion due to the scope of the project. A series of individual searches on key terms were also conducted; however, again, these searches identified very high numbers of papers. As a result, rather than adopting a systematic literature style approach to the literature review component, the project team agreed to take a snowball approach for this rapid evidence assessment. Using expert knowledge, key sources were collected and reviewed, with forward and backward reference checks to identify additional relevant literature sources.

Table 2.1: Summary of individual literature searches.

Search string	Limitations	Numbers of articles found
(Marine OR coast* OR climate OR ocean OR nature OR environment*) AND (literacy OR citizens* OR stewards* OR 'behaviour change' OR stewardship OR connectedness OR behaviour)	Limited to relevant topics	Over half a million articles
("Marine" OR "ocean" OR "climate") AND ("literacy" OR "citizenship" OR "stewardship")	Limited to relevant topics	2,300+ articles
Ocean literacy	No limits applied	231
Marine OR ocean citizenship	No limits applied	108
Ocean stewardship	No limits applied	879*
Environmental citizenship	Limited search to keywords, citizenship and climate change	242
Climate literacy	Limited to environmental and social sciences	260
Systems literacy	Limited to environmental sciences, social sciences and arts and humanities	75

*Note: this search highlighted a significant focus on seafood/ fisheries due to the Marine Stewardship Council

2.1.2. Ocean literacy, and other related concepts: An overview

Ocean literacy

Initially coined in the United States in the early 2000s, recent years have witnessed the concept of ocean literacy become a central component of international frameworks and policy goals – for example the UN Sustainable Development Goals (UN, 2015), UN Decade of Ocean Science for Sustainable Development, as well within national drivers for UK marine policy, such as the 25 Year

Environment Plan and the various marine planning processes. The concept of 'ocean literacy' began as an explanation of what appeared to be a relatively linear relationship between people and the sea. At a basic level, ocean literacy is defined as having an understanding the ocean's influence on you and your influence on the ocean, and is grounded through seven principles (NMEA, 2020):

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.

Whilst the concept of ocean literacy has been around for at least the past two decades, there has been relatively little attention paid to its application, particularly in terms of whether 'enhancing ocean literacy' can actually deliver improved behaviour. For example, Guest et al. (2015) examine levels of ocean literacy in Nova Scotia, Canada, finding that increasing a person's level of ocean literacy through enhancing knowledge and awareness might result in their attributing a higher value to the marine environment, and may mean they are more likely to consider ocean based careers. While this study, and others like it (see for example, Steel et al., 2005; Hynes et al., 2014), provide us with valuable insight into potential impacts of increasing knowledge and awareness to improve levels of ocean literacy, they do not explore whether increased ocean literacy actually had an impact or led to different choices or behaviour change. It is also important to note that ocean literacy has historically been explored through the lens of formal education, raising questions as to whether teachers themselves have sufficient levels of ocean literacy and therefore the capacity to deliver the education and information required - a handful of studies have attempted to assess this (e.g. Lambert, 2006; Markos et al., 2015; McCauley et al., 2019) and have found that significant effort would be required to ensure teachers at both primary and secondary schools have the levels of ocean literacy needed to pass on to their students. This brings into question the role of formal education in ocean literacy, and further highlights the weaknesses and challenges of the original knowledge and information-based interpretation of the ocean literacy concept.

Early discussions on the role of ocean literacy were grounded in the notion that by increasing public awareness and knowledge of the ocean (i.e. literacy), there would be a parallel increase in public support for ocean protection and restoration (Steel et al., 2005). However, while knowledge and awareness have long been recognised as crucial drivers within behaviour (Steel et al., 2005), recent years have seen the concept undergo an evolution, moving away from the knowledge deficit type model of ocean literacy inferred through the principles set out above. This has been underpinned by the recognition that attitudes and behaviour are influenced by more than knowledge, and that realising behaviour change requires an understanding of how audiences connect with a particular topic, place or issue (Kollmuss & Agyeman, 2002; Jefferson et al., 2015). This is reflected in contemporary models of ocean literacy, such as that shown in Figure 2.1, which presents ocean literacy as being underpinned by knowledge and effective communication, and positions an ocean literate individual as one who understands the ocean, can make responsible decisions about the ocean and communicate effectively to others about the ocean and the issues facing it (Kopke et al., 2020).

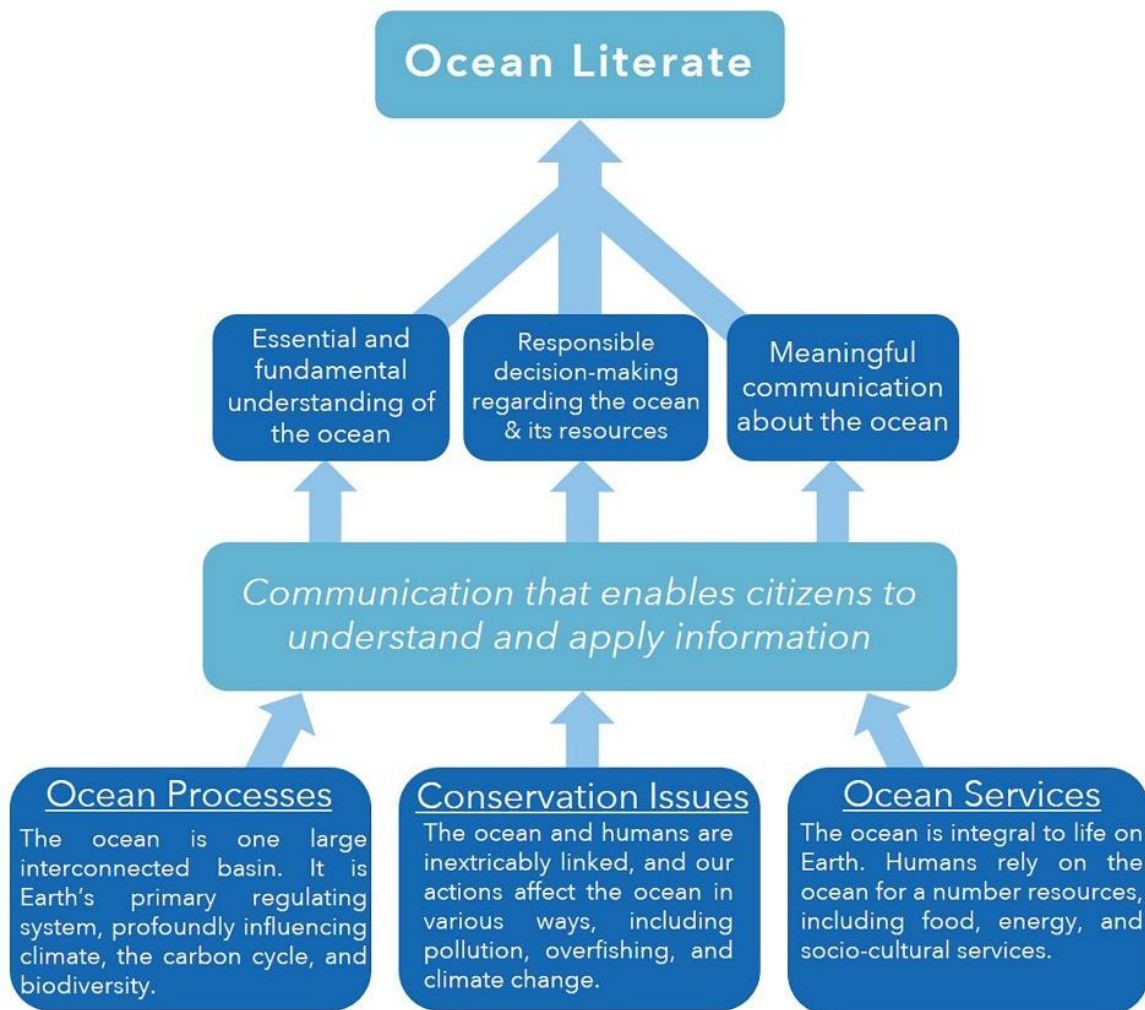


Figure 2.1: Ocean Literacy Development Framework (Kopke et al., 2020).

While the last two decades have seen an evolution of the concept of ocean literacy alongside a growth of active ocean literacy practitioners and experts, it is important to recognise that efforts and success to enhance and operationalise ocean literacy vary, with limited focus on marine education seen within formal education (Barracosa et al., 2019). However, established in 1976 in the United States, the National Marine Educators Association (<https://www.marine-ed.org/>) paved the way for champions of ocean literacy (Cava et al., 2005). Building on the success of NMEA, the European Marine Science Educators Association, established in 2002, represents a Europe wide community of researchers and practitioners working across marine education, with the goal of delivering ocean literacy across society (www.emsea.eu). Globally, design, delivery and success of initiatives to enhance ocean literacy across society vary, influenced in part by national investment and political backing for activities and projects – in 2018, Portugal launched their Blue School Program, whilst in 2019, influenced by the UN Decade of Ocean Science for Sustainable Development, UNESCO’s Ocean Literacy Toolkit was launched for use in schools across Brazil.

A recent Special Issue of *Frontiers in Marine Science* (Borja et al., 2020) provides the most comprehensive and up to date exploration of ocean literacy and its current, and potential, application. Through the papers in this Special Issue, the evolution of ocean literacy from an almost passive, knowledge centric model to one which draws on, and fosters, active participation, connection, and engagement from the diversity of audiences across society is explored. Taking account of this, Brennan et al. (2019) expanded the pre-existing notions of ocean and literacy and define six dimensions of ocean literacy as:

- **Awareness** as the basic knowledge that a situation, problem or concept exists.
- **Knowledge** is what a person knows about an ocean related topic and the links between topics.
- **Attitude** is related to a level of agreement with or concern for a particular position.
- **Communication** is the extent to which a person communicates with others, such as family and peer groups, on ocean related topics.
- **Behaviour** relates to decisions, choices, actions, and habits with respect to ocean related issues.
- **Activism** is the degree to which a person engages in activities such as campaigning (for example through social media) to bring about changes in policy, attitudes, behaviour, etc.

Although the concept has obviously evolved since its initial inception, questions remain as to whether the existing dimensions of ocean literacy sufficiently encompass all the factors necessary to enact and realise individual and collective behaviour change. In a bid to address this, a selection of related models and concepts are explored next.

Stewardship

The concept of 'stewardship' is frequently linked to notions of pro-environmental behaviour, starting first with the notion of environmental stewardship (see environmental citizenship), and, evolving to include discussion around protected area stewardship (Cole et al., 2008), coastal and ocean stewardship (Griffis & Kimball, 1996) - for more, see section on marine citizenship, and place stewardship (Groulx et al., 2019). More recently, the notions of planetary and climate stewardship have been put forward as models based on the environmental system as a whole. Planetary stewardship particularly highlights the complexity and interconnectedness of many of the challenges facing the natural environment (Steffen et al., 2011), while climate stewardship has been described the perceptions, relationship and behaviours that individuals exhibit towards the wider climate system (Walker & McNeal, 2013; McNeal et al., 2014). While both concepts recognise the urgent need to take collective, integrated and holistic approaches to addressing these broadscale 'wicked' problems (e.g. climate change, biodiversity loss), climate stewardship appears to be grounded in the dimensions of knowledge and perceptions (i.e. knowledge deficit model), while Steffen et al. (2011) sets out planetary stewardship as a broader model and sets out a 'challenge [to] humanity to become active stewards of our own life force'.

Environmental citizenship

Initially coined in the mid-1960s, environmental citizenship evolved as a model in response to increased calls for public engagement and improved environmental education set out by Agenda 21 (Hawthorne & Alabaster, 1999). The goals of improved public awareness, knowledge and concern continue to be recognised as central to developing solutions to modern environmental challenges. Although environmental citizenship has been explored in the context of terrestrial ecosystems (see for example Brown, 2014, on outdoor citizenship), it should be examined alongside the concept of ocean literacy, and crucially, the complexity of the model and the interdependencies between the various influencing factors and drivers should be recognised (Figure 2.2).

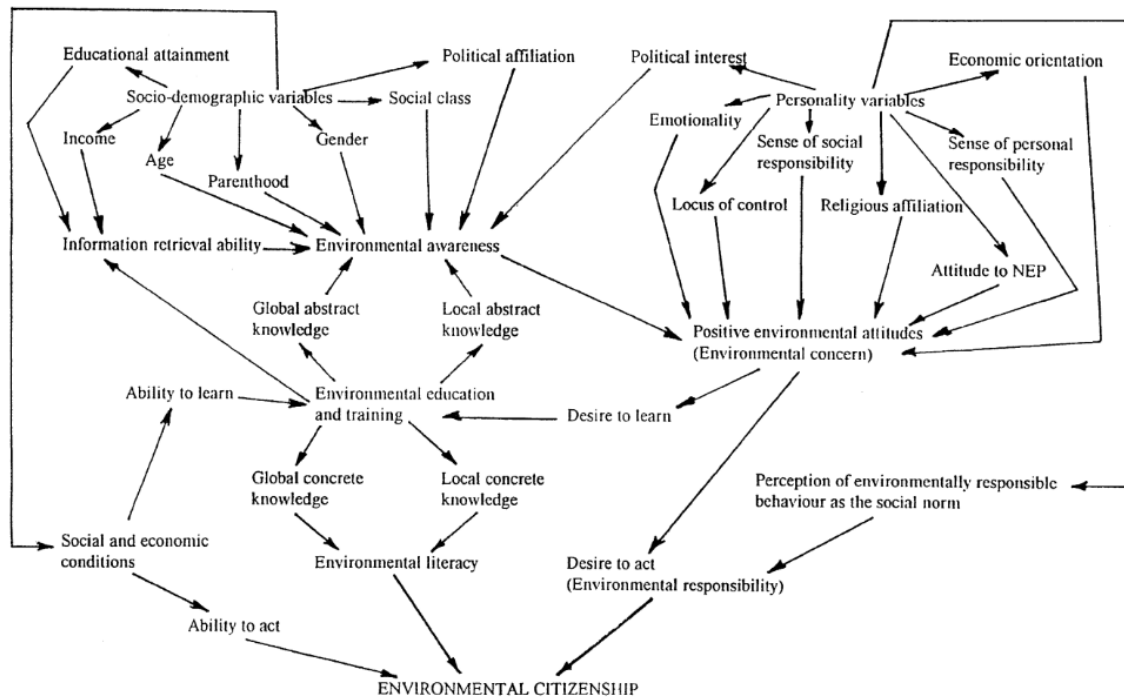


Figure 2.2: Model of Environmental Citizenship (Hawthorne & Alabaster, 1999).

As illustrated above, environmental citizenship includes many of the dimensions included in the current definition of ocean literacy (e.g. knowledge, awareness, attitude, behaviour) (Brennan et al., 2019). However, models of environmental citizenship, such as this one from Hawthorne and Alabaster (also see Berkowitz et al., 2005) are perhaps more comprehensive, and also recognise the role of social demographic characteristics (e.g. economic background, educational attainment, gender), personality variables (e.g. alignment with the New Environmental Paradigm - Dunlap & Van Liere, 1978), and the role of social norms in driving behaviour, for example.

Marine citizenship

Initially described by Fletcher and Potts (2007) as ocean citizenship, the concept had strong parallels with the early definition of ocean literacy – “Ocean citizenship describes a relationship between our everyday lives and the health of the coastal and marine environment” – the notion of marine citizenship draws on earlier models of environmental citizenship. However, the uniqueness of the ocean and coastal systems, including challenges of remoteness and access i.e. the often ‘out of sight, out of mind’ nature of marine environments, is recognised by existing models of marine citizenship through the inclusion of additional influencing factors (Figure 2.3 and Table 2.1) (McKinley and Fletcher, 2010; 2012). While some research has explored ocean/marine citizenship through the lens of environmental education and knowledge (e.g. Squarcina & Pecorelli, 2017), McKinley and Fletcher (2010; 2012) define marine citizenship as “individual rights and responsibilities towards the marine environment, having an awareness and concern for the marine environment and the impacts of individual and collective behaviour, and having a desire to have a role in ensuring on-going sustainable management of the marine environment”, marine citizenship builds on initial concepts of ocean literacy; however, crucially, an awareness of responsibilities, a desire to be involved and the capacity to take appropriate action for meaningful participation, including knowing how to exercise these rights to participate, are integral components of the marine citizenship model and definition (McKinley, 2010).

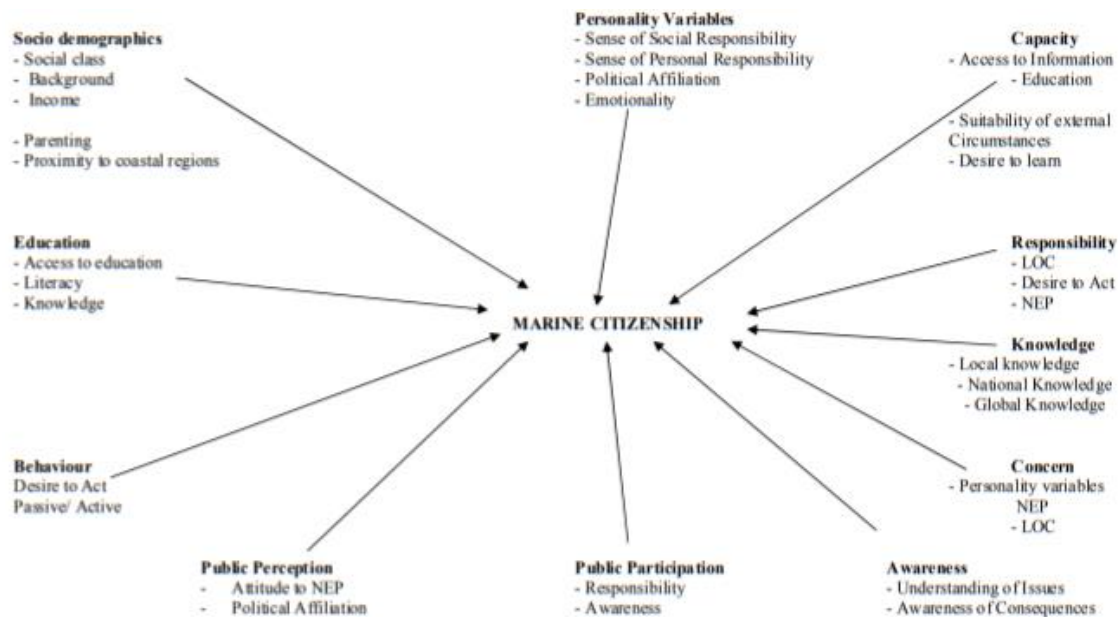


Figure 2.3: Conceptual model of marine citizenship (McKinley, 2010).

Table 2.1: Comparison between influencing factors included in models of environmental and marine citizenship. (McKinley, 2010). Note: ‘Proximity to the resource’ and ‘Livelihood dependency’ were explored through an overarching theme of ‘personal connection’ – for more information see McKinley, 2011).

Potentially Affecting Factors	Environmental Citizenship	Marine Citizenship
Education	✓	✓
Responsibility	✓	✓
Capacity	✓	✓
Socio-economics	✓	✓
Awareness	✓	✓
Personality traits	✓	✓
Desire to Act	✓	✓
Literacy	✓	✓
Attitude	✓	✓
Concern	✓	✓
Perception		✓
Participation		✓
Livelihood dependency		✓
Proximity to the resource		✓

Additionally, McKinley and Fletcher (2012) recognise that expression of citizenship (i.e. desired) behaviours can only be realised in the presence of certain enabling factors, such as a favourable economic situation, opportunities to engage, presence of convenient and accessible alternative behaviour choices. This acknowledges that individuals and communities may have varying levels of marine citizenship, or in the case of this report, ocean literacy, and that understanding baseline levels is a necessary starting point of any behaviour change effort or campaign (Figure 2.4). Fundamentally, there is a need to know where people ‘are’ so that the most effective and appropriate pathways and drivers of positive change can be employed.

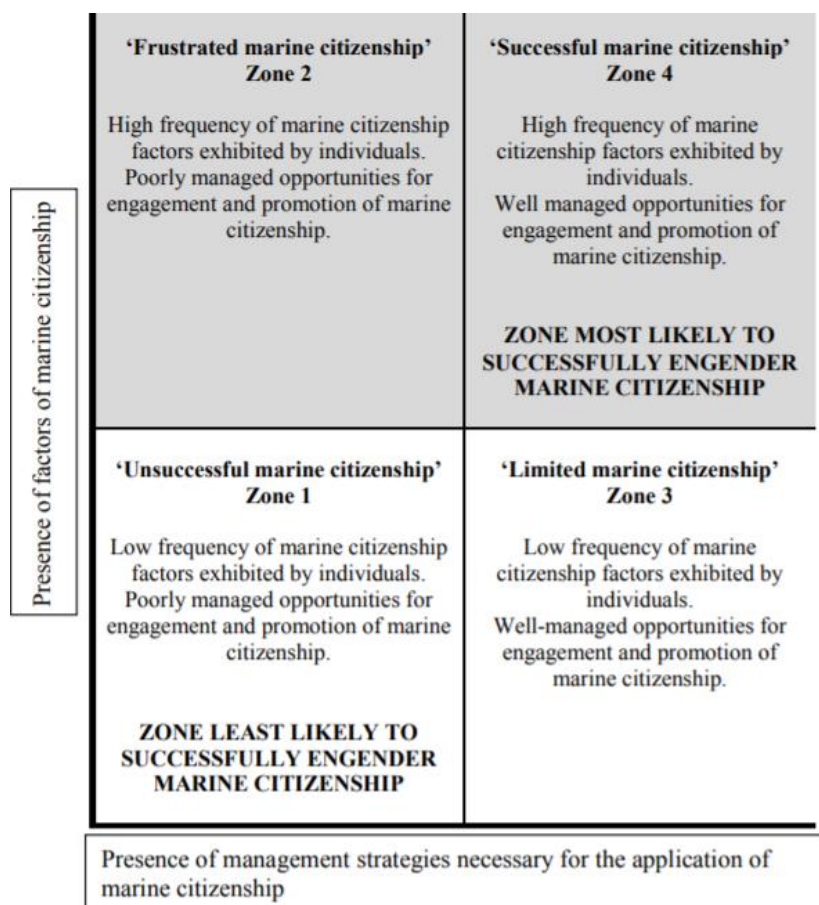


Figure 2.4: Phases of marine citizenship (McKinley, 2010).

More recently, current research being undertaken through the Interreg Ireland-Wales funded Coastal Communities Adapting Together (CCAT) project is updating this model of marine citizenship, including additional drivers and influential factors, such as ocean connectedness (see below), social justice and equity (including concepts of social licence - Kelly et al., 2019), governance and adaptive capacity, eco-anxiety and system thinking, and exploring how this can be applied to climate citizenship (<https://www.ccatproject.eu/>). The need to develop an improved understanding of global marine citizenship has been recognised by multiple authors (Fletcher et al., 2012; Rees et al., 2013; Parsons et al., 2014), and there is perhaps a need to consider that marine citizenship may provide a more comprehensive framework for behaviour change, with ocean literacy being one component of this.

Public perceptions research

In the context of marine and coastal environments, public perceptions research provides a suite of tools and lenses through which the relationship between society and the ocean can be explored – it is an overarching term and includes dimensions of ocean literacy, such as knowledge, attitudes, in addition to concern, values, emotions, and positive connections (Jefferson et al., 2015). Clearly, given the inclusion of some of the dimensions of ocean literacy means that the wider field of marine public perceptions research can potentially be drawn upon to provide some insight into existing levels of public ocean literacy. Recent years have seen increased emphasis on public perceptions research focusing on a range of topics including: charismatic species such as sharks (Friedrich et al., 2014), the perhaps less charismatic coastal fringe environments, such as saltmarshes, (McKinley et al., 2020), marine renewable energy (Bailey et al., 2011), marine protected areas (Lotze et al., 2018), ocean acidification (Capstick et al., 2016), marine plastics (Pahl et al., 2017), as well as some emphasis on the wider marine environment (Jefferson et al., 2014; Gelcich et al., 2014; Potts et al., 2016). However, an

ongoing review (covering 349 studies) indicates that this research tends to include one-off periods of data collection, and is often topic or location specific, with limited focus on overarching perceptions, attitudes and values towards marine and coastal environments (Jefferson et al., in prep). Despite the gaps in the current literature base, there are clear pathways between understanding public perceptions towards the marine environment and applying this knowledge to encourage behaviour change which could be applied to ocean literacy and climate-related behaviours (Figure 2.5).

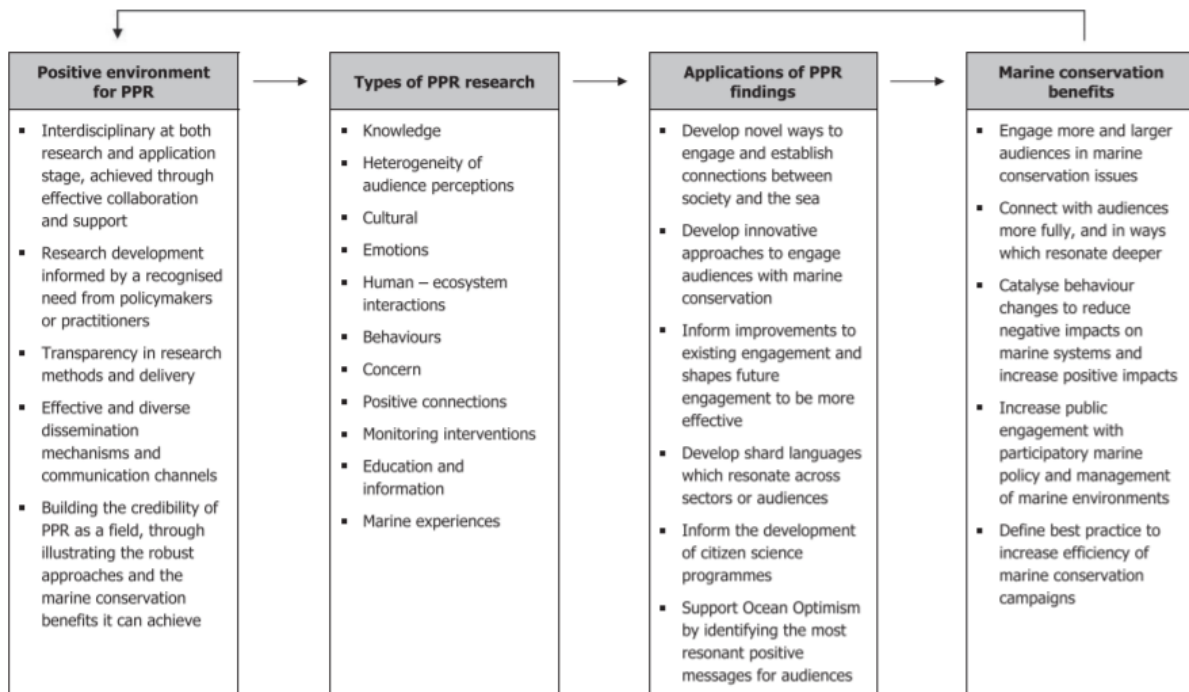


Figure 2.5: Framework summarising components of public perceptions research and how it can be applied (in this case for marine conservation goals) (Jefferson et al., 2015).

Linking into the research on public perceptions, it is apparent that there has long been agreement of the role of knowledge, awareness, concern and attitudes within environmental behaviour change – this is evidenced through the inclusion of these components or drivers across a range of the models explored in this report i.e. environmental and marine citizenship, public perceptions, and indeed, ocean literacy. Following on from Jefferson et al.’s work on public perceptions (2015), the growing consideration of social values held towards the ocean and their inclusion within a values-based approach must also be explored in the context of ocean literacy and related behaviour change. Currently, there is no explicit consideration of values in the dimensions of ocean literacy; however, recent work by the Marine CoLABoration, funded by the Calouste Gulbenkian Foundation, explores the importance of taking a values-based approach and effectiveness of framing ocean messaging in this way.

The basic premise of the Marine CoLAB approach advocates for the communication of the ‘total value of the ocean in all its diversity’, with the view that by accounting for multiple values, a deeper connection across multiple and diverse audiences will be achieved (Chambers et al., 2019). Adopting a living lab approach, this ethos has been explored through a number of projects, including the ‘#OneLess campaign’, which sought to reduce use of single use plastic water bottles across London, UK, as well as the ‘We are Ocean’ initiative, which sought to enhance ocean literacy. Understanding the values underpinning societal relationships with the ocean is positioned as being fundamental to developing effective communication, enhancing levels of ocean literacy and engendering a desire and capacity among audiences to make changes in their behaviour. The importance of taking social values

into account is further emphasised by a recent Frameworks Institute Report, which clearly states that communicating about the ocean in ways that enhances and increases awareness, concern, connection and positive behaviours, requires an understanding of how different people and communities think about, and value, the ocean (Lindland & Volmert, 2017). Crucially, it must be recognised that while the social values held by different individuals and communities may be changeable and dynamic, research suggests that efforts to change values can be ineffective – rather the focus should be on understanding where people are, what their values are currently, and exploring how these can be used to develop effective communication around the ocean and ocean literacy (Manfredo et al., 2017).

Nature and ocean connectedness

In the context of societal relationships between nature and the environment, there has been increasing emphasis on the role of emotions, which is emphasised by Milton (2002) as being integral to people's ability to relate to, and connect with, an environment and a caring relationship with a non-human entity to be created. Increasingly, emotions are recognised as playing a key role in how an individual experiences and interacts with the world; Jacobs et al. (2012) go as far as to describe emotions as a 'basic mental capacity' which influences perceptions, attitudes, decision making, and behaviour choices. While knowledge, attitudes and other dimensions of ocean literacy or, indeed, other models linked to behaviour change relating to the ocean, have been of interest to researchers for some time, emotions relating to marine and coastal environments have received relatively limited attention (Kearns & Collins, 2012), and their role in realising behaviour change is largely unstudied. A recent report commissioned by the European Commission Mission Board for Healthy Oceans, Seas, Coasts and Inland Waters highlights the growing interest in this area as efforts to foster pro-environmental behaviour change for the ocean continue (McKinley et al., 2020).

In a broader environmental context, the concept of nature connectedness has developed to explore the impact of experience, and contact with, nature on an individual's mental and physical health and wellbeing, and positions nature connectedness as an indicator of pro-environmental attitudes and behaviour (Howell et al., 2011; Capaldi et al., 2014; Martin et al., 2020). Despite increasing interest in the wellbeing value of blue space (Wheeler et al., 2012; White et al., 2013), applying nature connectedness to marine and coastal environments has received relatively limited focus (e.g. Yerbury & Weiler, 2020). However, the concept of ocean connectedness is in the very early stages of development, further emphasising the increasing attention being paid to the connection and experiences individuals have with the ocean and better understanding how this can be harnessed to support transformational behaviour change. The dimension of personal connection (which could include experience, livelihood dependency, proximity to the coast, sense of place/place attachment, emotional connection and social values) to the ocean and coasts is also presented as a foundational component of marine citizenship by McKinley and Fletcher (2012).

When thinking about ocean literacy, and indeed ocean connectedness, there is a need to recognise that ocean environments pose a very different set of characteristics than terrestrial environments. A key challenge facing the ocean, seas and coasts is the common perception that these are areas that are hard to reach, vast, remote or inaccessible, meaning they are often 'out of sight, out of mind' for many, as previously described. A similar disconnect may also be present when exploring public awareness and connection with concepts such as climate change. This perceived distance can result in a lack of sense of urgency to act – people are more likely to act in response to something they can change in the here and now, rather than on something that feels too large, unsurmountable or when they perceive their actions as ineffective or meaningless (Pahl et al., 2017). While this remains a challenge, efforts are being made to overcome and reduce this 'distance' and associated disconnect through a growing suite of approaches, including citizen science (Cigliano et al., 2015; Dean et al.,

2018), as well as adopting a diverse range of communication techniques, including digital technologies and high profile campaigns and documentaries. The 2017 BBC Blue Planet 2 series has been widely celebrated as being a crucial tipping point in relation to public attitudes towards, and indeed use of, single use plastics and marine litter more broadly (The Guardian, 2019) – although the evidence to support a direct link between the series and pro-environmental behaviour change is limited (Dunn et al., 2020). Furthermore, the complex relationship between how people obtain information, the perception of impact and actual evidence of behaviour change is also explored by Palm et al. (in prep.) whose work suggests that messaging on environmental challenges and the potential role of individual behaviour change must be carefully balanced, with a risk that some messages will disengage some.

Access and participation

Recent decades have seen increasing calls for improved public engagement with environmental issues, influenced through numerous international policy and legislative drivers, including the Aarhus Convention and Agenda 21. These calls built on the Arnstein’s Ladder of Participation (Arnstein, 1969), which sets out a framework of public participation that remains one of the foundational concepts of effective public participation (Figure 2.6). The Ladder encompasses everything from passive methods of engagement to tokenistic processes of consultation to more active and truly participative, such as those closely aligned with co-design, co-development and parentship working (e.g. Burdon et al., 2019).

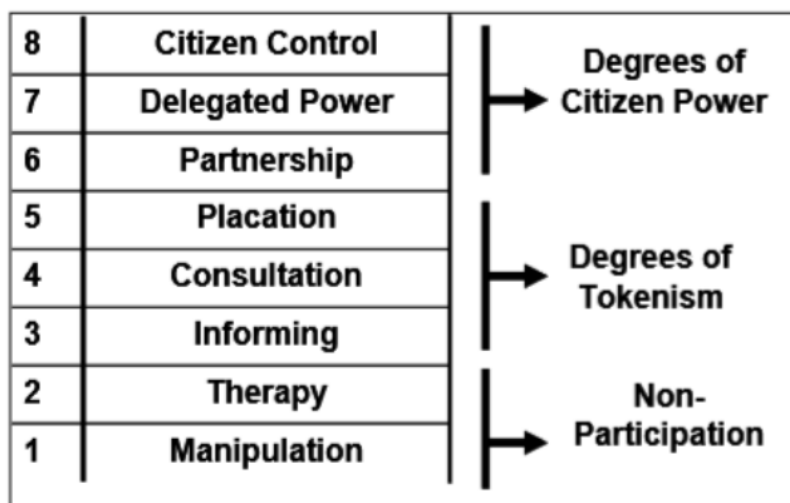


Figure 2.6: Arnstein's Ladder of Participation (Arnstein, 1969).

In the context of ocean literacy and climate-related behaviour change, participation could potentially be encompassed through the Activism dimension. However, in addition to understanding *how* people participate, there is also a need to understand the level of knowledge and access (and indeed the perception of this access) to opportunities for meaningful and effective engagement, and useful and collaborative participation for diverse audiences. For example, what is the level of public awareness of the opportunities to participate in marine spatial planning consultations, or within development of Environmental Impact Assessments? There is a need to better understand how and where people get information about these opportunities and how these factors relating to participation might translate into ocean literacy and behaviour change.

Pro-environmental behaviour change

There are a vast number of models and frameworks drawing on insight from across psychology, sociology and other areas of social sciences that are commonly used to explore and explain environmental behaviour change. One of the most frequently cited is Kollmuss and Agyeman (2002;

Figure 2.7) which acknowledges and explores the relationship and influence of both internal (e.g. emotions and social values) and external (e.g. socio-economic context, political drivers) factors on an individual's behaviour and any capacity for change. Other scholars have further explored a range of these specific influencing factors, including the role of the 'warm glow' or the intrinsic motivations on behaviours (van der Linden, 2019); social values, identity and the role of social norms in behaviour, including individuals attitudes towards the acceptability of a behaviour itself (e.g. Gatersleben et al., 2014); and the need to take account of how these drivers might change over time, resulting in different attitudes, perceptions and, therefore, behaviours (Steg et al., 2014).

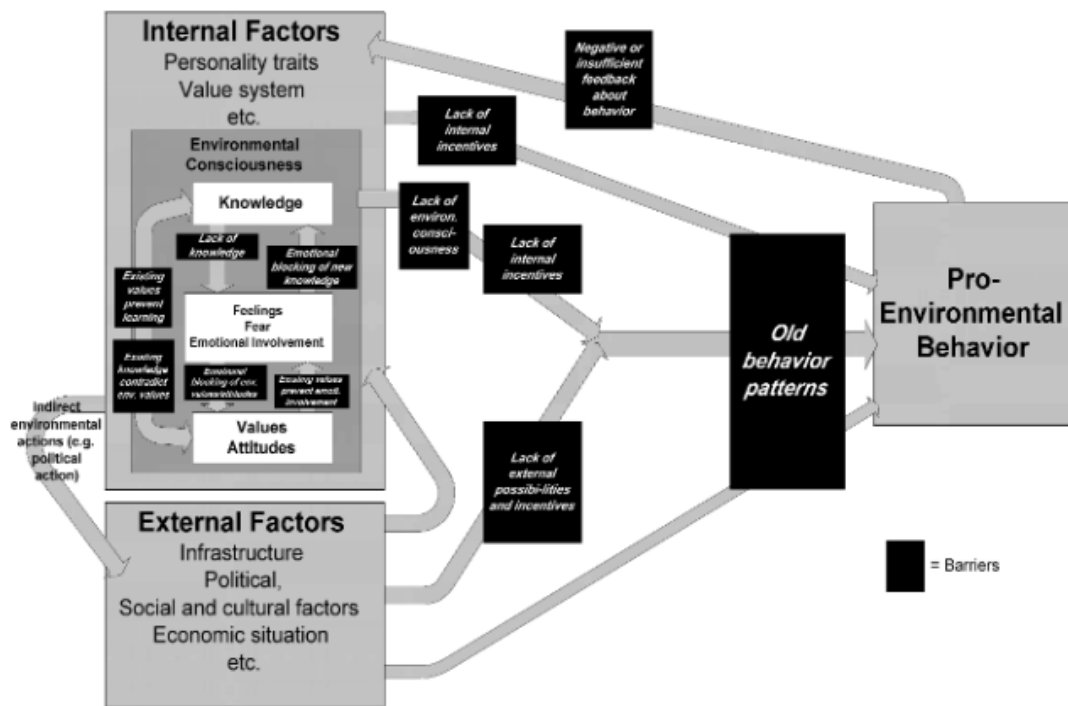


Figure 2.7: Model of Pro Environmental Behaviour (Kollmuss & Agyeman, 2002).

In an ocean context, Stoll-Kleeman (2019) further adapts the model presented above and conducts a systematic literature review to specifically explore the current relationship between ocean literacy and behaviour change. While some of the drivers identified already exist within the dimensions of ocean literacy set out above (e.g. knowledge, awareness, attitudes), it is important to note the inclusion of additional components in Figure 2.8, many of which have already been highlighted in this report through other models (e.g. marine/ ocean citizenship). For example, Stoll-Kleeman (2019) discuss the challenge of engendering behaviour change when people have a cognitive dissonance (i.e. they feel detached or conflicted about an issue) or have become disengaged with a topic. Furthermore, the role of emotions was found to be increasingly recognised as being significant in ocean related behaviour change – and yet, the current dimensions of ocean literacy do not adequately take account of this potentially fundamental driver of change (Stoll-Kleeman, 2019). More broadly, the importance of understanding a diverse range of motivations, including both internal external drivers (e.g. economic incentive schemes or penalties for engaging in harmful action as illustrated in Figure 2.8), behind action and behaviour are therefore central to truly harnessing the potential of ocean literacy and realising the change needed at both an individual and collective level.

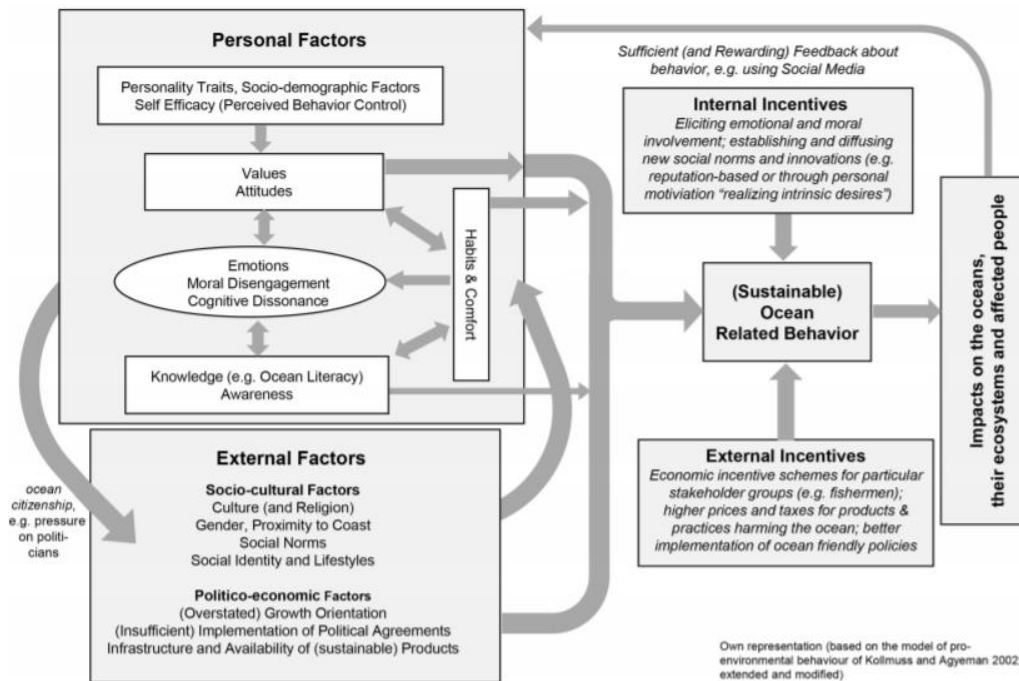


Figure 2.8: Conceptual model of factors influencing ocean-related sustainable behaviour (Stoll-Kleeman, 2019).

By better understanding what motivates behaviour change, there may be opportunities to promote spill over behaviours i.e. when an individual takes part in one pro-environmental behaviour, they are more likely to engage in more behaviours (Nash et al., 2017), although it should be noted that evidence on the effectiveness of this approach remains unclear (Maki et al., 2019). In an ocean context, for example, there has been a great deal of interest in exploring whether the recent public outcry on marine plastics could be or indeed has already been effectively harnessed to lead to other behaviour changes. While some have suggested that recent focus on plastics has been distracting (e.g. Stafford & Jones, 2019), others have responded to emphasise the potential value of spill over behaviour, commenting that there is significant value, and indeed an urgent need, in addressing environmental issues in an integrated way to increase speed of response and maximise impact (Avery-Gomm et al., 2019).

As conversations around behaviour change have evolved, the tools, techniques and approaches adopted within social marketing to encourage positive behaviour changes in other areas (e.g. health) have been increasingly recognised and valued by those working in environmental management and conservation (Barr et al., 2011; Wright et al., 2015). Conservation marketing, for example, draws on the tools and principles offered by marketing to encourage behaviour change and action to address conservation priorities (Wright et al., 2015; Verissimo & McKinley, 2016). The adoption of marketing approaches to address conservation and understanding environmental challenges recognises the role of advertising and promotion as a communication pathway, and also highlights consumerism as a key mechanism for people to exercise their pro-environmental views, beliefs and behavioural decisions – it is worth noting that consumerism is also recognised in the models of marine citizenship as a key pathway for behaviour (McKinley, 2010). Table 2.2 presents an illustration of how the Consumer Decision Journey can be adapted to reflect conservation goals – this approach, and the associated marketing tools and techniques, could, in turn, contribute to wider efforts to enhance societal ocean literacy and climate related behaviour change.

Table 2.2: Conservation Decision Journey based on the Consumer Decision Journey (Wright et al., 2015).

Stages of the consumer decision journey	Brief description of phase	Example from a conservation decision journey
Initial-consideration set	Consideration of information an individual has already gathered for a specific issue.	"I know polar bears are an at risk species."
Active evaluation	Familiarity stage where initial ideas are explored and more information is gathered.	"I see how a healthy Arctic can benefit me and my family. I want to know more about how I can take action to protect polar bear habitat."
Moment of purchase	Committing to a specific decision.	"I believe more laws are needed to protect polar bear habitat and will contact my leaders."
Post-purchase experience	Purchase or consumer buy-in based on exposure to results of decision.	"I have written letters to the leader of my country to improve the laws protecting polar bear habitat. I'll see what happens next."
Loyalty loop (Option A)	Gather more information to participate in same action, or continue with new, yet similar actions.	"I enjoyed learning how my actions create positive changes for polar bears and want to do more."
Loyalty loop (Option B)	Revisit Stages 1, 2, 3 or 4 to re-evaluate actions.	"My leaders are not responsive, so may be I can reduce my energy usage and convince friends to do the same."
Decision journey exit	Exit this decision making process and focus interests elsewhere, potentially after revisiting Stages 1, 2, 3 or 4.	"I realize polar bears are at risk, but I feel I'm not getting enough out of helping save them. I'm not interested in this cause any more."

In a marine context, successful examples of these approaches being used to engender change already exist evidenced through the Selfridges and ZSL sponsored Project Ocean, as well as through the impact of the Blackfish film documentary on the revenue for Sea World and other aquaria, as well as on global policies regarding capture and breeding programmes of marine mammals (Wright et al., 2015). Central to the successful application of these tools, however, it is the understanding of target audiences in terms of their knowledge, connection, motivation and drivers which may trigger behaviour change, and also, taking a research based approach to evaluating efforts to enhance knowledge, literacy or behaviour change. Additionally, the role of marine social sciences in driving behaviour change is further emphasised by Martin et al. (2017) who apply a range of socio-psychological models to understand public attitudes and behaviours towards marine protected areas, and highlight the importance of gathering this insight so as to develop effective communication and education campaigns.

2.2. Additional dimensions to consider within ocean literacy and behaviour change

While ocean literacy appears to have become the internationally recognised term for a myriad of concepts relating to improving how society perceives, understands, cares about and behaves towards the ocean, the previous section highlights a number of other areas of work which should be considered and indicate that there are some gaps in the existing ocean literacy model which might limit its capacity to deliver meaningful and long-lasting behaviour change. Drawing on the information presented above, the following section highlights some additional components, drivers and enablers that should be considered as part of the wider framework and model relating to ocean literacy and behaviour change. These include:

Emotions, ocean literacy and behaviour change – There is increasing evidence to suggest that emotional connection, including empathy, apathy, fear, enthusiasm etc., has a central role to play in driving behaviour change. Exploration of these elements in an ocean/coastal context is relatively nascent, including the strength of emotional connection an individual may have and how this relates to their behaviours and decision making, requires investment; however, as we see more and more reports on eco-anxiety (Cunsolo et al., 2020) and ecological grief, it is clear that the emotional connection and experience an individual has with nature, the ocean, and indeed, the impacts of climate change must be better understood. Recent work indicates some recognition of this at a strategic level (e.g. the European Mission Board on Healthy Oceans, Seas, Coasts and Inland Waters on emotional connection, and the deficit of this within society – McKinley et al., 2020). Despite the increasing acknowledgment of their role, however, emotions are not well represented within the current dimensions and definitions of ocean literacy. This omission, and corresponding lack of understanding of the role of emotions in decision making and behaviour is perhaps limiting the

potential for ocean literacy initiatives to deliver meaningful behaviour change. We need to know more about why people choose to go to the ocean/coast and what they value about their experience there – this information can then be used to support strategic communication, and even support the use of the conservation marketing techniques discussed above, to enhance ocean *and* climate literacy at a range of scales.

Access, experience and proximity - Access can be defined in a number of ways. Firstly, access to information about the ocean, either through formal (e.g. school) or informal pathways (e.g. television, social media), and how this translates into ocean literacy is clearly an important driver of behaviour change – and something that ocean literacy experts and practitioners have been specialising in for some time (see EMSEA and NMEA, for example). However, in terms of understanding variation in ocean literacy across communities, it is also important to understand access in terms of access to the ocean, and how this might influence individual experiences, connection and therefore, levels of ocean literacy. Related to the previous point on emotions, it is evident that a strong emotional connection between society and the environment is usually strongest with environments and species that are easiest to experience first-hand. Both ocean issues and those related to climate change are often ‘out of sight, out of mind’ or complex and harder to visualise or experience on a personal level. Developing emotional connections and incentivising a desire to know more or become more aware (i.e. the ocean literacy dimensions of Knowledge and Awareness) can therefore be difficult due to temporal, spatial and even conceptual distance between people and marine environments or climate change issues. Equally, the relationship between proximity and connection is increasingly being shown to be less linear than perhaps expected i.e. those living in coastal areas, and therefore expected to be more aware and connected to the ocean do not always exhibit these traits (Stoll-Kleeman, 2019). The role of access and experience of the ocean and related issues, including climate change, should be further explored to better understand how we can engender widespread changes in awareness and behaviour change.

Social values – Taking account of multiple value types, and the role of social values in attitudes, perceptions and decision-making is, again, another driver which is garnering increasing attention. Taking a ‘values based approach’ to encouraging behaviour change can be effective, as evidenced by the successes of the Marine CoLAB, for example, and taking account of how people *value* (both in terms of monetary and non-monetary values) is encompassed within a number of the models and areas of work covered in this report i.e. public perceptions research, marine citizenship, nature connectedness and pro-environmental behaviour. Crucially, from a policy perspective, diverse values are also becoming more central to the natural capital dialogue. Currently, the dimensions of ocean literacy do not explicitly consider value; however, given the growing emphasis on this from both research and policy, it seems essential that any future work on understanding societal levels of ocean literacy considers the values attributed to the ocean, and the services and benefits it provides relating to climate change.

Motivations – As we have seen models of environmental citizenship, and ocean literacy, move away from the historical knowledge deficit style model, the importance of understanding *why* people make the decisions they do, and act as they do, is of increasing importance. The inclusion of motivation as a key driver of behaviour change is evidenced by a number of scholars, including Kollmuss and Agyeman (2002), Steg and Vlek (2009), and Martin et al. (2017) who explore this in terms of understanding internal (altruism, perceptions of social norms) and external factors that might influence behaviour change (e.g. using fines and incentives to encourage or discourage certain actions). In order to properly harness ocean literacy to deliver behaviour change, it is therefore necessary to understand who or what influences an individual’s decision making (potentially linking to the earlier point regarding trust). For example, would people respond to widespread, top-down initiatives to reduce their impact on the ocean or mitigate/adapt to climate change, such as the recent

levies and incentive schemes associated with single use plastics? Are fines or incentives the most effective way of changing behaviour or would these have short-lived impact on behaviour? Understanding what motivates is fundamental to achieving the goals of ocean literacy and adaptive climate change related behaviour. It should, however, be noted that understanding what works in terms of motivating a particular segment of society may not be a one size fits all solution or approach and will likely be subject to change. As a result, assessment of the effectiveness of ocean literacy and behaviour change initiatives should be a core component of any future work (Martin et al., 2017; McKinley et al., 2020).

Trust and transparency – Increasingly, there is a need to understand where and how people become informed about issues relating to the ocean and coasts. While the current dimensions of ocean literacy include communication, this is defined as how people communicate about the ocean once they become informed and aware. To effectively enhance ocean literacy and, thereby deliver necessary action and shifts in behaviour, there is also a need to understand more about how and where people get information about the ocean, and climate change. More specifically, there is a need to consider how much people trust both the information they receive as well as the platform it is delivered through i.e. perception of reliability of information may influence an individual’s desire to learn more about the ocean, or opportunities they might have to engage in pro-environmental behaviours. Trust, and transparency, relating to information are central to achieving a society wide behaviour shift towards the ocean, and/or in response to the climate emergency, and more effort should be taken to understand existing public attitudes towards both.

In summary, it is evident that there are some common dimensions and overlapping thinking between ocean literacy and the other models and concepts considered within this review. This is perhaps becoming more apparent as the concept of ocean literacy has begun to evolve in recent years. However, as described above, there are additional dimensions, including those encompassed within other frameworks and models, which may need to be explored to facilitate and engender meaningful behaviour change. These commonalities and gaps are summarised in Table 2.2. This table uses the accepted dimensions of ocean literacy (i.e. knowledge, awareness, attitudes, communication, behaviour and activism) and maps their inclusion in other models (although in some cases it should be noted that different terminology may have been used) and also highlights additional components that may be outside the current thinking of ocean literacy. Crucially, it should be noted that while a number of the additional components highlighted in Table 2.3 are, or perhaps could be, considered as being reflected in the six recognised ocean literacy dimensions, the current definition of these dimensions do not clearly reflect these. Where there might be opportunity to expand the definition to include these additional dimensions has been noted in Table 2.3. Drawing on these insights, a series of recommendations for evaluating current levels of ocean literacy, across a range of dimensions, and how this might relate to behaviour change, are presented later in the report.

Table 2.3: Summary of the overlaps and gaps between ocean literacy and other related models.

		Ocean literacy	Marine citizenship	Environmental behaviour change	Nature / ocean connectedness	Public perceptions research
Dimensions of Ocean Literacy	Knowledge		Included as education in marine citizenship			
	Attitudes					
	Awareness					
	Communication					
	Behaviour					
	Activism					
Additional Drivers and Enablers	Concern		Attitude or Awareness	Attitude or Awareness		
	Capacity to engage					
	Personal responsibility		Activism	Activism		
	Personal or emotional connection		Also considers livelihood dependency as a connecting factor			
	Access, experience, and proximity		Access to information could be included in Knowledge			
	Participation		Activism	Activism		
	Social values		Attitudes	Attitudes		
	Awareness of rights to engage		Knowledge	Knowledge		
	Personal characteristics*					
	External motivators**					

* Including social demographic information and socio-economic background.

** Economic incentives or penalties, social norms etc.

3. Review of indicators and question-modules

Given the complexity of the marine environment and the need for integrated management (Burdon et al., 2018), indicators are required to provide insight into the behaviour of the ecosystems and state of coastal and marine ecosystems, together with an indication of the trajectory of change due to natural and human events (Atkins et al., 2015; Hattam et al., 2015). Indicators can be used to provide a sense of how we are progressing (process indicators) or whether we have achieved what we are aiming to achieve (outcome indicators). It has been suggested that indicators have three basic functions: to simplify, to quantify and to communicate (Aubry & Elliott, 2006). Indicators can also provide a link between scientific knowledge and policy practice and link objectives to management (Potts, 2006). Indicators can be used to reflect the state of the science of an area (Atkins et al., 2015) and provide a useful tool for supporting management decisions (Hattam et al., 2015). From a policy context, indicators can also be specifically used to assess process and outcomes, for example to monitor the efficacy of policy responses or programmes. For example, a recent review undertaken by Burdon (2020a) provided a baseline assessment of the development and application of social, cultural and heritage indicators in the UK marine environment from which a research agenda can be built upon going forwards. This section reviews existing indicators and question modules relating to ocean literacy and climate-related behaviours and then assesses these indicators/question modules with respect to their appropriateness.

3.1. Review of indicators and question modules relating to ocean literacy and climate change behaviours.

A review and examination of existing public attitude/opinion surveys was undertaken from the UK and further afield to assess whether data currently gathered are relevant to the six dimensions of ocean literacy and climate-related behaviours. An assessment was made as to whether the survey includes questions relating to these six dimensions or not (Yes or No) but also identifies whether these issues have been addressed for the 'natural environment' (NE) as a whole rather than specifically for the marine environment given that the type of questions employed could be adapted specifically for the marine environment. This review included both surveys undertaken by Statutory Nature Conservation Bodies as well as academic marine researchers. A summary of the assessment of each survey is presented in Table 3.1 with further details on each survey (including links to the survey methodology and outputs) provided below the table.

This examination identified a number of headline findings:

- Sixteen surveys were identified and reviewed which assess public attitudes to the natural environment and/or its management within the UK or devolved nations of the UK.
- The surveys adopted a range of sampling methodologies including random, self-selection and convenience sampling and a range of data collection tools including online, face-to-face, focus groups and telephone interviews.
- Only five of these surveys collected data from the UK population (No. 1, 9, 11, 14, 15), with most surveys being undertaken at the devolved nation level (e.g. No. 2-8, 16).
- Five surveys provide time series data on an annual or biennial basis (No. 1, 2, 4, 5, 6) whilst other surveys have only been conducted as standalone surveys (e.g. No. 9, 10, 14, 15) or were repeated sporadically (e.g. No. 11, 16).
- Eight surveys focus on the natural environment as a whole, and therefore cover multiple dimensions of 'Environmental Literacy' but do not explicitly focus on the marine environment and ocean literacy (e.g. No. 1-5).

- Eight surveys focus on public perceptions specifically on the coastal and marine environment (No. 8-15); only one of these surveys (No. 11) has so far been conducted in multiple years using the same questions (although data from the latter two surveys are yet to be published).
- The eight public opinion surveys which focus on the marine environment (No. 8-15) cover multiple dimensions of ocean literacy, generally relating to 'Awareness', 'Knowledge' and 'Attitude', with only five of these surveys covering aspects of 'Communication', five covering aspects of 'Activism', and four covering aspects of 'Behaviour' and 'Behavioural Choices and Decision-Making'.
- There are currently no UK-wide surveys which relate to all six currently recognised dimensions of ocean literacy ('knowledge', 'awareness', 'attitude', 'communication', 'behaviour' and 'activism') as well as aspects of climate-related behaviour change (e.g. curtailment behaviour, behavioural choices and decision-making, technology change).

Table 3.1: Summary of existing public surveys and their relevance to ocean literacy and climate related behaviours (Y=Yes; N=No; NE=Natural Environment focussed not marine/ocean specific).

No.	Survey	Geographical Coverage	Time Series	Sample Size	Survey Method	Ocean Literacy Dimensions*						Climate Related Behaviours		
						Awareness	Knowledge	Attitude	Communication	Behaviour	Activism	Curtailment Behaviour	Behavioural Choices and Decision-making	Technology Choices
1a	Eurobarometer	28 EU Countries	1973 to date (annual)	c. 1,000 (UK)	Face-to-face	N	N	N	N	N	N	N	N	N
1b	Attitudes of EU Citizens to Environment	28 EU Countries	2017 (one off)	c. 1,000 (UK)	Face-to-face	NE	NE	NE	N	N	N	NE	NE	NE
2	MENE Survey	England	2009-2019 (annual)	45,000+	Face-to-face	N	N	N	N	N	N	N	N	N
3	People and Nature Survey	England	2020-2021	Up to 25,000 depending on question module	Online panel	NE	NE	NE	N	NE	NE	NE	NE	N
4	National Survey Wales	Wales	2012 to date (annual)	c. 12,000	Telephone interviews	N	N	N	N	N	NE	NE	NE	N
5	Scottish Recreation Survey	Scotland	2003-2012 (annual)	c. 12,000	Face-to-face	N	N	N	N	N	N	N	N	N
6	Scotland's Nature Omnibus (SNO) Survey	Scotland	2009-2015 2017 to date	c. 1,000 (+100 BAME)	Face-to-face Online	Y	Y	Y	N	N	NE	N	N	N
7	Scotland's People and Nature Survey (SPANS)	Scotland	2013/2014; 2017/2018	12,502	Face-to-face omnibus survey	N	N	N	N	N	N	N	N	N

No.	Survey	Geographical Coverage	Time Series	Sample Size	Survey Method	Ocean Literacy Dimensions*						Climate Related Behaviours		
						Awareness	Knowledge	Attitude	Communication	Behaviour	Activism	Curtailment Behaviour	Behavioural Choices and Decision-making	Technology Choices
8	Attitudes in Scotland on the Marine Environment and Marine Issues	Scotland	2018 (one off)	2,198	Online panel (+6 face-to-face focus groups)	Y	Y	Y	Y	Y	Y	N	Y	N
9	Public Perceptions of the UK Marine Environment (Jefferson et al., 2014)	UK	2009 (one off)	1,047	Online	Y	Y	Y	Y	N	N	N	N	N
10	Investigating Societal Attitudes Towards the Marine Environment (Hynes et al., 2014)	Republic of Ireland	2012 (one off)	812	Face-to-face	Y	Y	Y	Y	N	Y	N	N	N
11	European Attitudes Towards Marine and Coastal Environments (Potts et al., 2016)	7 EU countries	2010/11; 2013; 2018 (3x in UK, Portugal & Italy)	c. 1,000 (UK)	Online	Y	Y	Y	N	N	N	N	Y	N
12	The Irish Citizen Engagement: Ocean Survey (EU Mission, 2020)	Ireland	2020	Ongoing	Online	Y	Y	Y	Y	N	Y	N	N	N
13	Development of the International Ocean Literacy Survey (Fauville et al., 2019)	Global 16-18 year old students	2016	6,871	Online	N	Y	N	N	N	N	N	N	N
14a	Application of Marine Citizenship in Sustainable Marine Management in the UK: Education (McKinley, 2010)	UK	2009-2010	126 (from 3 schools)	Questionnaires	Y	Y	Y	Y	Y	N	N	N	N

No.	Survey	Geographical Coverage	Time Series	Sample Size	Survey Method	Ocean Literacy Dimensions*						Climate Related Behaviours		
						Awareness	Knowledge	Attitude	Communication	Behaviour	Activism	Curtailment Behaviour	Behavioural Choices and Decision-making	Technology Choices
14b	Application of Marine Citizenship in Sustainable Marine Management in the UK: Personal Attachment (McKinley 2010)	UK	2010	275 (from 5 UK sites)	Interviews	Y	Y	Y	N	Y	Y	N	Y	N
15	Investigating marine citizenship and its role in promoting good marine environmental health (Buchan, in progress)	UK	2018/2019 (one off)	280 (active marine citizens) 3 UK case studies	Online interview, shadowing of participation, face-to-face interview	Y	Y	Y	N	Y	Y	N	Y	N
16a	Survey of public attitudes and behaviours towards the environment	England	2009 & 2011	1,700	Face-to-face Omnibus Survey	NE	NE	NE	NE	NE	NE	NE	NE	N
16b	Survey on attitudes to the environment	England	2019	8,023	Computer-Assisted Self Interviewing	Y	Y	Y	NE	NE	NE	NE	NE	N

* Definitions: **Awareness** is the basic knowledge that a situation, problem or concept exists; **Knowledge** is what a person knows about an ocean related topic and the links between topics; **Attitude** is related to a level of agreement with or concern for a particular position; **Communication** is the extent to which a person communicates with others, such as family and peer groups, on ocean related topics; **Behaviour** relates to decisions, choices, actions, and habits with respect to ocean related issues; **Activism** is the degree to which a person engages in activities such as campaigning (for example through social media) to bring about changes in policy, attitudes, behaviour, etc.

1a. The Eurobarometer.

- Since 1973, the European institutions commission have conducted regular public opinion surveys, the Eurobarometer, in all EU Member States (<https://www.secure.europarl.europa.eu/at-your-service/en/be-heard/eurobarometer>).
- Within the UK, approximately 1,000 people (aged 15 and over) are surveyed each year using a face-to-face methodology.
- In 2007, the European Parliament launched its own specific Eurobarometer series. These surveys cover a wide range of issues, focusing on citizens' perceptions and expectations towards EU action, and the main challenges the Union is facing. The surveys also measure in detail citizens' attitudes towards the EU and the European Parliament, while also keeping a close eye on the public's views on the European elections.
- No questions relating to dimensions or ocean literacy or climate-related behaviour change are currently included in this survey.

1b. The Eurobarometer - Attitudes of European Citizens Towards the Environment.

- In 2017, a Special Eurobarometer public opinion survey on the 'Attitudes of European citizens towards the environment' was undertaken within 28 EU Member States (https://data.europa.eu/euodp/data/dataset/S2156_88_1_468_ENG). The survey focussed on a number of environmental issues including: general attitudes towards the environment and sources of information; the impact of environmental issues, and the impact of plastic products and chemicals; ways of taking action to tackle environmental issues; the role of the EU in environmental protection; awareness of and attitudes towards ecolabels; and perceptions of air quality and ways of tackling air pollution.
- The survey asked a number of questions relating to how important the environment is to the respondent, who should be responsible for ensuring its protection (i.e. polluter pays), and where should decisions regarding the environment be taken (local, regional, national, etc.). The survey was general in focus, covering environmental issues in all ecosystems, with no specific ocean related questions. However, issues such as 'marine pollution' were included within a list of options within broader questions relating to identifying the top four environmental challenges currently facing the EU.
- The survey included a range of questions relating to the main sources of information used by the respondents to learn about the environment, and which environmental-related activities have respondents undertaken in the last six months (e.g. choosing more environmentally-friendly transport, avoiding buying over-packaged products, avoiding single-use plastics, using the car less frequently, buying products with an environmental label, buying more local produce, and reducing water and energy consumption). Some of this latter information may provide valuable evidence when investigating climate related behaviour change, although it is not necessarily marine/ocean specific.

2. MENE Survey.

- The Monitor of Engagement with the Natural Environment (MENE) Survey has been undertaken by Natural England for a decade in England from 2009 to 2019 using an in-home face-to-face methodology, with a random population of 16+ year olds spread over 51 weeks of the year (<https://www.gov.uk/government/collections/monitor-of-engagement-with-the-natural-environment-survey-purpose-and-results>).

- The MENE survey aims to provide robust data about the relationship between people and the natural environment within England. Whilst the main focus of the survey is on visits, it also seeks to capture other ways of using or enjoying the natural environment such as time spent in the garden and watching nature programmes on television. Between October 2014 and September 2018 an additional question module was included in the survey which related to respondents health and wellbeing.
- The data enables users to: understand how people use, enjoy and are motivated to protect the natural environment; monitor changes in use of the natural environment over time, at a range of different spatial scales and for key groups within the population; inform on-the-ground initiatives to help them link more closely to people's needs; evaluate the impact and effectiveness of related policy and initiatives; and measure the impact of and inform policy relating to the natural environment.
- Although visits to the coast and beaches are included within the survey, there are currently no questions which specifically relate to any of the recognised dimensions of ocean literacy (knowledge, awareness, attitude, communication, behaviour and activism) or climate related behaviour change (curtailment behaviour, choices and decision-making, technology choices).
- The People and Nature Survey builds on the MENE survey (2009-2019) following an extensive review period.

3. People and Nature Survey.

- The People and Nature Survey for England gathers information from adults (16+) across England through an online panel (<https://www.gov.uk/government/collections/people-and-nature-survey-for-england>).
- The People and Nature Survey uses an online panel survey, sampling up to 25,000 adults in England on a continuous basis over 2020/21.
- The data obtained will support Natural England's delivery of statutory duties, inform Defra policy and natural capital accounting, and contribute to the outcome indicator framework for the 25 Year Environment Plan.
- The People and Nature Survey builds on the MENE survey (2009-2019), with the data collected enabling users to: understand how people use, enjoy and are motivated to protect the natural environment; monitor changes in use of the natural environment over time, at a range of different spatial scales and for key groups within the population; understand how being in the natural environment can have an effect on wellbeing; and understand environmental attitudes and the actions people take at home, in the garden and in the wider community to protect the environment.
- The questionnaire is based on seven question modules, each with a different number of respondents. Of particular relevance, Module 5 consists of 17 questions on 'Environmental attitudes and behaviours' and was completed by 5,000 respondents.
- Although visiting a 'Beach/other coastline/sea' is an option for recent visits, the questionnaire focusses on the natural environment and environmental issues more generally and therefore focuses on dimensions of 'Environmental Literacy' rather than specifically on 'Ocean Literacy'.

4. National Survey for Wales.

- The National Survey for Wales involves around 12,000 people each year who are contacted for a telephone interview and asked about a wide range of topics, divided into 10 broad categories. The survey runs all year round, across the whole of Wales, with the results being

used by the Welsh Government to help make Wales a better place to live. (<https://gov.wales/national-survey-wales>).

- In 2018-19, the National Survey for Wales included a set of questions about people's views on climate change and types of environmental action that governments and individuals can take. Whilst these questions covered issues such as environmental 'Activism' and 'Behaviour Change' these were related to the natural environment with no marine specific questions included in the survey.

5. Scottish Recreation Survey.

- The Scottish Recreation Survey (ScRS) measures participation in outdoor recreation by the Scottish adult population (aged 16 and over) (<https://www.nature.scot/professional-advice/land-and-sea-management/managing-access-and-recreation/increasing-participation/measuring-participation>).
- The questions for this survey are included in the Scottish Opinions Survey, which is undertaken annually using 18 face-to-face interviews from 55 sampling points across Scotland.
- The overall aim of the ScRS is to provide continuous monitoring of participation in outdoor recreation in Scotland. The specific objectives of the ScRS include the following: To provide a picture of the types of location that recreational users visit – including countryside, inland water and coastal locations as well as urban sites, e.g. woodlands in towns and cities; To report on other issues, such as social and economic links with recreational use of the outdoors, e.g. expenditure, transport, party composition and social grade of users; and to act as one of the monitors of awareness of the Scottish Outdoor Access Code, including levels of responsible behaviour.
- Although the survey collects information about recreational visits to 'The seaside (a resort or the coast)' around Scotland, no questions are asked relating to the six dimensions of ocean literacy or climate-related behaviour change (e.g. 'Behavioural Choices and Decision-making').

6. Scotland's Nature Omnibus.

- The Scottish Nature Omnibus (SNO) survey is a survey of the adult population in Scotland which was first commissioned by SNH in 2009 and now runs on a biennial basis and aims to measure the extent to which the general public is engaged with SNH and its work (<https://www.nature.scot/professional-advice/land-and-sea-management/managing-access-and-recreation/increasing-participation/measuring-participation>). In 2017, the survey switched to an on-line interview methodology, with respondents sourced from members of the public who had agreed to be part of a survey panel.
- Seventeen separate waves of research have been undertaken since 2009, each one based on interviews with a representative sample of around 1,000 adults living in Scotland; interviews with a booster sample of around 100 adults from ethnic minority groups are also undertaken in each survey wave to enable us to report separately on this audience.
- In 2013 a number of questions relating to Scotland's marine environment were added to the survey with the results of this aspect of the study being analysed in 2019 (<https://www.nature.scot/scottish-nature-omnibus-summaries-public-perception-scotlands-marine-environment>). The study includes questions relating to 'Knowledge' (e.g. knowledge on the purpose of marine protected areas), 'Awareness' (e.g. awareness of marine wildlife) and 'Concern' (e.g. concern about marine wildlife and the health of Scottish Seas).

7. Scotland's People and Nature Survey.

- Scotland's People and Nature Survey (SPANS) provides information on how people living in Scotland use, value and enjoy the natural environment (<https://www.nature.scot/scotlands-people-and-nature-survey-participation-outdoor-recreation>).
- The methodology for the survey follows that developed for the ScRS survey with question modules been included within the Scottish Opinions Survey (SOS).
- SPANS was undertaken for the first time in 2013/14 when it included questions on a variety of topics ranging from outdoor recreation, to forests and woodland, urban greenspace, national parks, Scotland's landscapes and the health and well-being benefits associated with visiting the outdoors.
- A second survey was undertaken in 2017/18 with the questionnaire content reduced to include only questions on participation in outdoor recreation and the associated health and wellbeing benefits.
- Although the survey collects information about recreational visits to 'The seaside (a resort or the coast)' around Scotland, no questions are asked relating to the six dimensions of ocean literacy or climate-related behaviour change.

8. Attitudes in Scotland on the Marine Environment and Marine Issues.

- This survey aimed to improve understanding of how Scottish residents interact with the marine environment (sea and coastal areas), their perceptions of how it should be managed and their environmental concerns, amongst other issues (<https://www.gov.scot/publications/attitudes-scotland-marine-environment-marine-issues/>).
- A survey of 2,198 adults in Scotland was carried out online using the YouGov panel. The sample was representative by gender, age, social grade and region. Alongside this, six face-to-face focus groups were conducted across coastal, rural and urban locations in Scotland.
- Question modules included: Leisure activities at the coast; Business trips to the coast; Marine knowledge; Using the sea; Marine Protected Areas; Marine sectors; Marine Issues; Environmental concerns; Environmental behaviours; Coastal management; and Seafood and sustainability.
- This survey included questions relating to dimensions of ocean literacy including 'Awareness', 'Knowledge', 'Attitude' and 'Behaviour'. In addition, it asked questions relating to climate-related behaviour change. The full set of questions are provided in Annex 1.

9. Public Perceptions of the UK Marine Environment (Jefferson et al., 2014).

- This survey was undertaken in 2009 using an online survey platform (n=1047) to investigate UK public perceptions of subtidal species and marine health to assess whether it is possible to build more positive connections between society and the sea.
- The survey included three question modules: (1) species questions to assess knowledge about, and interest in, a suite of 12 subtidal UK marine species; (2) health questions to assess public perceptions of healthy and unhealthy marine environments; and (3) respondent profiling, including interactions with the marine environment, standard socio-demographic variables and social values.
- This survey covered aspects of 'Awareness', 'Knowledge', and 'Attitude' with respect to the subtidal marine environment in the UK. The full set of questions are provided in Annex 1.

10. Investigating Societal Attitudes Towards the Marine Environment (Hynes et al., 2014).

- This nationwide face-to-face survey (n=812) was undertaken in 2012 and explored the values, concerns and preferences of individuals towards the Irish marine environment. The results of this survey are compared to the results obtained by Potts et al. (2011) in their 2011 European survey of attitudes towards marine and coastal environments (see below).
- To ascertain their personal opinions and attitudes towards the marine environment, respondents were asked a series of attitudinal questions using Likert Scales.
- This survey methodology follows that applied by Potts et al. (2011) and therefore covered aspects of 'Awareness', 'Knowledge', and 'Attitude' towards the marine and coastal environment in Ireland. The full set of questions are provided in Annex 1.

11. European Attitudes Towards Marine and Coastal Environments (Potts et al., 2016).

- This novel European survey explores the values, concerns and aspirations of individuals regarding the marine environment in seven countries (UK, France, Germany, Portugal, Spain, Poland and Italy) across four regional seas.
- The initial online survey (n=7,003) was undertaken in 2011/2012; with repeat surveys undertaken in the UK, Portugal and Italy in 2013 and 2018 (data still to be published). The survey consisted of eleven questions with responses collected across a range of Likert scales and a number of socio-demographic questions including distance from the coast, age, gender, region, educational level and country (Potts et al., 2011).
- The survey of 1,000 UK residents (each year) therefore covered aspects of 'Awareness', 'Knowledge', and 'Attitude' towards the marine and coastal environment in the UK and six other EU Member States. The full set of questions are provided in Annex 1.

12. The Irish Citizen Engagement: Ocean Survey (EU Mission, 2020).

- This survey is currently live, is being administered online, and is open to all citizens on the island of Ireland and aims to help us understand people's opinions and levels of awareness of oceans, seas, coastal and inland waters (<https://missions-get-involved.ec.europa.eu/conferences/oceans/f/164/?locale=en>).
- The results of the survey will be used to inform the development of a major flagship 'mission' to be funded by the European Union under the forthcoming Horizon Europe programme (2021-2027).
- The survey includes three dimensions of ocean literacy ('Attitude', 'Knowledge' and 'Awareness') but does not include elements of behaviour or climate related behaviour change. The full set of questions are provided in Annex 1.

13. Development of the International Ocean Literacy Survey (Fauville et al., 2019).

- The International Ocean Literacy Survey (IOLS) aims to serve as a community-based measurement tool that allows the comparison of levels of ocean knowledge across time and location (Fauville et al., 2019).
- The survey has undergone two phases of testing and this paper presents the second phase of testing which was rolled out in 17 languages across 24 countries in 2016. Further testing was due to begin in 2018 but results are yet to be published.
- The survey is aimed at 16-18 year old secondary school students and largely focusses on 'Knowledge' and 'Awareness' of marine issues. The full questions are provided in Annex 1.

14a,b. Application of Marine Citizenship in Sustainable Marine Management in the UK (McKinley 2010).

- This study (undertaken in 2007-2010) sought to establish the potential role of citizenship specific to the marine environment.
- A mixed methods approach was undertaken which focussed on two key drivers for marine citizenship: Education (linked to notions of ocean literacy) and Personal Attachment (linked to proximity to the coast, experience, and connection through livelihood or engagement with the coast or sea). These themes were identified during a series of telephone interviews with UK marine stakeholders.
- In order to examine these issues further, two thematic case studies were designed to further evaluate their role in the inculcation of marine citizenship.
- The first survey (14a) used a questionnaire survey of 3 UK schools (n=126) whilst the second survey (14b) employed interviews at 5 locations within the UK. Both surveys included aspects of four dimensions of ocean literacy ('Attitude', 'Knowledge', 'Awareness' and 'Behaviour') with the latter survey also including aspects of 'Behavioural Choices and Decision-making'. The full set of questions are provided in Annex 1.

15. Investigating marine citizenship and its role in promoting good marine environmental health (Buchan, in progress).

- This study, with fieldwork undertaken in 2018-2019, takes an holistic, interdisciplinary approach to qualifying marine citizenship and motivations for participation in it. A novel metric was used to quantify marine citizenship participation.
- Participants were UK-based adult, active marine citizens from three case study groups (two local marine groups and one national citizen science project).
- A mixed methods approach incorporated a comprehensive online survey and follow up interviews, with a sample purposefully selected for diversity. The survey incorporated metrics for demographics, values, environmental attitudes, identities, place attachment/dependency/identity, and the policy framework surrounding marine citizenship.
- As a whole, the study demonstrated six ocean literacy dimensions. Purposeful investigation directly measured aspects of general environmental 'attitude', marine pro-environmental 'behaviour', and 'activism'. Inductive findings additionally demonstrated marine 'attitude', 'knowledge', 'awareness', and 'communication'.
- Findings are currently being compiled in the PhD thesis and as yet are unpublished; therefore, the questions are not included in this paper

16a. Survey of public attitudes and behaviours towards the environment.

- The Survey of Public Attitudes and Behaviours towards the Environment was undertaken by Defra in 2009 and 2011, using a face-to-face omnibus survey of 1,700 individuals in England.
- The survey reported people's attitudes and behaviours towards key environmental issues, such as energy use, climate change, water use, waste, transport and the natural environment and updated data collected in 2007.
- <https://data.gov.uk/dataset/ab16e19f-a4e1-42e4-9f6e-5ffe2dc7680/survey-of-public-attitudes-and-behaviours-towards-the-environment>

- The survey covered aspects of knowledge of and attitudes towards the environment, including: Energy and water use in the home; Purchasing behaviours; Recycling, composting and reusing waste; Food and food waste; Travel behaviours and attitudes; Carbon offsetting; Biodiversity and green space; Volunteering behaviours; and Wellbeing.
- There were no specific marine-related questions asked.

16b. Survey on Attitudes to the Environment.

- The 'Survey on Attitudes on the Environment' (NT0818) was undertaken in 2019, with 8,023 surveys completed using computer-assisted self-interviewing within England.
- The aim of the survey is to provide robust insight into the public's awareness, attitudes and behaviours in relation to a number of Defra policy areas, particularly in relation to the implementation of the 25 Year Environment Plan.
- The survey on attitudes to the environment is intended to support Defra in delivering its objectives by providing insight on key areas to inform, shape and effectively deliver policy.
- This survey is a new form of Survey 16a, and now incorporates some new questions on the health of the seas.
- <http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=20397>

3.2. Recommendations on indicators and supporting datasets relevant to ocean literacy and climate change.

Indicators of ocean literacy and climate related behaviour change were identified within Section 3.1 from existing public opinion surveys (Table 3.1; Questions in Annex 1). The indicators identified within these surveys are listed in Table 3.2 and were scored for their potential application to the marine environment using six pre-defined criteria:

1. **Measurability:** are there data available for the measurement and quantification of the indicator?
2. **Sensitivity:** does the indicator detect change over time?
3. **Specificity:** can the indicator respond over time to changes in management as opposed to natural variability? Is this response predictable and does it have low variability?
4. **Scalability:** can the indicator be aggregated or disaggregated to a different spatial scale and still retain its ability to indicate the change of interest?
5. **Transferability:** is the indicator useful for other locations and hence studies?
6. **Policy Relevance:** is the indicator of relevance to UK marine policy?

The criteria used had been successfully applied by Hattam et al. (2015) to the Dogger Bank, and by Burdon (2020b) with respect to marine social, cultural and heritage indicators with the addition of a sixth category to capture the policy relevance of the indicators. Each criterion was scored using one of three categories: Yes ('Y'), Potentially ('P') and No ('N'). The initial assessment was undertaken by the authors and was subsequently reviewed by colleagues at Defra, the Ocean Conservation Trust and the Ocean Literacy Working Group.

From reviewing the surveys it became clear that there were a much greater number of questions relating to 'Attitude', followed by 'Knowledge and 'Awareness'. Relatively few questions were focussed on the dimensions of 'Behaviour', 'Communication' and 'Activism'. The indicators assessed in Table 3.2 are not exhaustive, but reflect the types of questions from each of the dimensions of ocean literacy identified within the review of surveys (Section 3.1). Each indicator has been linked with specific survey questions, which are all provided in full in Annex 1.

With respect to 'Measurability', all questions were scored 'Yes' given that they were all extracted from existing surveys and therefore data are available. However, it must be noted that in general data was gathered at the case study or devolved nation level, with very few questions been asked at the whole UK level. In addition, the questions identified within the survey tracked different facets of the dimensions of ocean literacy, however not all aspects of each dimension were necessarily covered by the questions.

With respect to 'Sensitivity', the majority of questions scored 'Yes' as they would be able to track changes over time, however to enable this to happen, longitudinal surveys would be required. The majority of surveys reviewed in this section were one off surveys and therefore their ability to track changes is very limited. In addition, some aspects of 'Knowledge' (e.g. KN6-KN8) were scored 'No' as these questions tested a particular piece of knowledge/fact and therefore are less sensitive to change.

With respect to 'Specificity', all questions were judged to have the 'Potential' to relate to a particular policy or management action, however this was dependent on how the question was phrased. None of the surveys which were reviewed focussed on a particular change in management or policy and therefore the questions, as they were asked, did not test for 'Specificity'. It has been suggested that

there is a need to collect data over long time periods (say a decade) and the need to be confident that the question / indicator / data would be collectable over that timeframe (Prof. Steve Fletcher, Ocean Literacy Working Group, pers. comm.). This would enable changes in the dimensions of ocean literacy to be tracked in relation to specific changes in UK marine policy or management.

With respect to 'Scalability', all of the questions were scored 'Yes'. The majority of surveys focussed on a case study or devolved nation level (identified by the use of square brackets in the questions) however the questions can easily be rephrased to focus on the appropriate level of data required, for example, at the global, EU, UK, devolved nation or case study level.

With respect to 'Transferability', all of the questions scored 'Yes' as with some rephrasing of the question, all of the questions could be applied to other locations or studies.

With respect to 'Policy Relevance', some of the questions clearly related directly to policy and therefore scored 'Yes'. Other questions are potentially of interest to policy however it was felt that these questions would need to be rephrased so that they are of more direct relevance to policy.

Based on the findings of this assessment, the following recommendations can be made:

- There is currently a lack of data on ocean literacy, and how this translates to behaviour change, collected at the UK level, and therefore we recommend that an ocean literacy specific survey is developed and implemented for the UK.
- There is a lack of longitudinal surveys on ocean literacy, and therefore it is recommended that surveys of this nature have to be suitably designed and funded to detect changes over time.
- This assessment has shown that there is currently a paucity of data on the different dimensions of ocean literacy, with the majority of surveys focussing on 'Attitudes', 'Knowledge' and 'Awareness'. Therefore it is recommended that any ocean literacy survey should also make sure it incorporates questions relating to the other dimensions ('Communication', 'Behaviour' and 'Activism').
- It is recommended that the definitions used for the dimensions of ocean literacy be revisited to ensure they are fit for purpose in a UK context. For example, the definition of 'Communication' as proposed by Brennan et al. (2019) does not reflect communication as a two way process and therefore should include data on how information about the marine environment is accessed (e.g. from social media, nature documentaries, newspapers etc.) as well as the dissemination of marine knowledge to colleagues, friends and family. Furthermore, the dimension of 'Knowledge' should extend to more than knowledge of ocean environments and should also include an assessment of people's knowledge of where to access information, how to participate in discussions about the ocean and what behaviour change opportunities might be available to them. Each of the currently accepted dimensions should be explored and amended or expanded to suit a UK context – and where appropriate, additional dimensions should be considered.
- Although not assessed within this report, this review identified a range of additional dimensions of ocean literacy which are not currently addressed. These include aspects of Emotions; Access, experience and proximity; Social values; Motivations; and Trust and transparency. It is recommended that these additional dimensions are also included within the design of any future survey on ocean literacy.
- When focussing on the relationship between ocean literacy and behaviour change related to the climate, very few questions were identified which attempted to make this connection. Therefore it is recommended that additional questions are required which specifically address climate-related behaviour change.

- In addition to asking questions about ocean literacy dimensions and climate-related behaviour change, socio-demographic data (including, but not limited to, age, gender, employment, education, experience of the ocean and coast, area of residence) are important to understand the motivations of respondents and the diversity of views, attitudes and connections held by different segments of the UK population. Therefore, it is recommended that a specific ocean literacy survey is required which has sufficient space to obtain this data and that socio-demographic data are also used within the analysis and not just presented as supporting data. This data will provide valuable insight into the variation in current and future dimensions of ocean literacy and can be used to support development of geographically or community specific approaches and activities.
- It is also recommended that any future efforts to understand ocean literacy across the UK take account of individual awareness of participation opportunities that would allow them to engage in the wider discussion around the UK's ocean and coastal environments (e.g. participation in marine planning consultation processes).
- Despite having a shared vision for the UK seas, environmental policy in the UK is administered and implemented at the devolved nation level. Therefore it is recommended that for such surveys to be of relevance for policy then careful consideration is needed to ensure that the questions are of relevance at both the devolved and UK level.

Table 3.2: Assessment of example ocean literacy and behavioural change indicators.

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
AWARENESS (AW)								
AW1	In the past year, do you think the health of [Scotland's] seas has...improved, stayed the same, worsened, don't know.	Y	Y	P	Y	Y	Y	Survey 8 (Q10b)
AW2	Thinking about coastal waters and beaches in your country, how would you rate their condition? (Very poor to Very good).	Y	Y	P	Y	Y	P	Survey 10 (Q12), Survey 11 (Q3)
AW3	Thinking about deep oceans away from the coast (out of sight of land), how would you rate their condition? (Very poor to Very good).	Y	Y	P	Y	Y	P	Survey 10 (Q13), Survey 11 (Q4)
AW4	Which, if any, of the following do you think are the main causes of marine litter in [Scotland's] sea and coast? You can pick up to FIVE. E.g. commercial fishing by boats, farming of fish and shellfish, non-renewable energy such as oil and gas, ...	Y	Y	P	Y	Y	P	Survey 8 (Q14)
AW5	Which, if any of the following, do you think should be responsible for reducing marine litter in Scotland? You can pick the FOUR you think should bear most responsibility. e.g. [1] Industrial users of the coast and sea; [2] Tourists / leisure users of the coast and sea; [3] Scottish households/residents in general...	Y	Y	P	Y	Y	Y	Survey 8 (Q15)
AW6	How familiar are you with Marine Protected Areas (MPAs)? (Very familiar, quite familiar, not very familiar, heard of them but know nothing about them, not previously heard of MPAs)	Y	Y	P	Y	Y	Y	Survey 8 (Q23)
AW7	Which if any of these sustainability labels have you seen before? Please tick all that apply.	Y	Y	P	Y	Y	P	Survey 8 (Q30)
AW8	Thinking of the seabed and landscape beneath the sea in your region, or off the coast where you visit the seaside, do you think it is most likely (to be): (range from 'Utterly featureless and barren' to 'A variety of distinctive landscapes, some of which are unique to our region').	Y	Y	P	Y	Y	P	Survey 9 (Q1 Natural England Survey) – see Jefferson (2010)
AW9	Do you think that changes to the marine environment affect you, personally? (No effect on me to Major effect on me).	Y	Y	P	Y	Y	P	Survey 10 (Q4)
AW10	Prior to undertaking this survey, please select from the list below, which items you were aware of (i.e. had heard of or had some knowledge about) e.g. the UN Decade of Ocean Science and Sustainability, UN Sustainable Development Goal 14, ...	Y	Y	P	Y	Y	Y	Survey 12 (Q11)
AW11	The following [Irish state] agencies and cross-border bodies have a full or partial role in managing, regulating, protecting, monitoring, mapping and/or studying Ireland's marine waters and territory and inland waters (note, list is not exhaustive). Please select those you are aware of or have heard about	Y	Y	P	Y	Y	P	Survey 12 (Q12)

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
	previously. e.g. The Sea Fisheries Protection Agency, The Environmental protection Agency, ...							
AW12	Please identify which of these terms you are familiar with i.e. indicate by ticking the correct box whether they are terms you know and understand, terms you have heard of but do not know what they mean or if you have never heard of them. e.g. ecosystem, biodiversity, coral bleaching, ...	Y	Y	P	Y	Y	P	Survey 14a (Term Familiarity)
AW13	Have you heard of the following groups? e.g. MCS, MSC, WWF, Defra...	Y	Y	P	Y	Y	P	Survey 14a (Short Marine Quiz)
AW14	Indicate which of the following designations you have heard of: MPA, NTZ, AONB, Ramsar, ...	Y	Y	P	Y	Y	P	Survey 14a (Short Marine Quiz)
AW15	Who do you think is responsible for the management of the marine and coastal environment? Tick all that apply. e.g. individuals, everyone, non-government agencies, Government, Coastal Groups.	Y	Y	P	Y	Y	P	Survey 14a (Section 3 Q4)
AW16	How would you rate your awareness of problems facing the marine environment? (Not at all to Extremely)	Y	Y	P	Y	Y	P	Survey 14a (Section 3 Q1), 14b (Part 1 Q1)
KNOWLEDGE (KN)								
KN1	How much knowledge do you think you have about each of the following sectors or industries in [Scotland's] marine environment? e.g. commercial sea fishing, farming of fish and shellfish, non-renewable energy such as oil and gas, ...	Y	Y	P	Y	Y	P	Survey 8 (Q7)
KN2	How interested are you in learning more about the marine environment in [Scotland], the rest of the UK and in general around the world?	Y	Y	P	Y	Y	P	Survey 8 (Q9)
KN3	Can you name any specific features of the undersea landscape or creatures or plants likely to be found on the seabed in the seas in our region?	Y	Y	P	Y	Y	P	Survey 9 (Q5 Natural England Survey) – see Jefferson (2010)
KN4	How much of what I just told you about the seas and oceans around [Ireland] did you know beforehand? How well do you think you understand this issue now? (Likert scale)	Y	Y	P	Y	Y	P	Survey 10 (Q1, Q19, Q20)
KN5	How would you rate your knowledge of the ocean, coastal and inland waters? (High to None)	Y	Y	P	Y	Y	P	Survey 12 (Q4)
KN6	Please indicate what you think of the following statement: The health of the ocean and my health are connected	Y	Y	P	Y	Y	P	Survey 12 (Q)
KN7	Which statement is true: The ocean covers 70% of the Earth's surface; The land covers 70% of the Earth's surface; The ocean and land cover 50% each of the Earth's surface; The ocean covers 10% of the Earth's surface.	Y	N	P	Y	Y	P	Survey 13 (Q2). Tests a particular piece of knowledge therefore is less sensitive to change.
KN8	Approximately how much of the Earth's water is in the oceans? Very little; a small amount; about half of it; almost all of it?	Y	N	P	Y	Y	P	Survey 13 (Q8). Tests a particular piece of knowledge therefore is

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
								less sensitive to change.
KN9	Underline the correct answer in each sentence e.g. a) ocean fisheries are affected by climate change, red tides, over-fishing, all of the above; b) most sea life lives in the top 500ft of the ocean, lives on the sea floor, lives in the great ocean basins, is evenly dispersed through the ocean depths.	Y	N	P	Y	Y	P	Survey 14a (Short Marine Quiz). Tests a particular piece of knowledge therefore is less sensitive to change.
KN10	How informed do you think you are about issues currently facing the marine and coastal environment? (Not at all to Extremely)	Y	Y	P	Y	Y	P	Survey 14a (Section 2 Q5)
KN11	How much impact do you think your day to day activities have on the marine and coastal environment? (Not at all to Extremely)	Y	Y	P	Y	Y	P	Survey 14a (Q6)
ATTITUDE (AT)								
AT1	How concerned are you about the following issues? e.g. pollution, poverty, climate change, ...	Y	Y	P	Y	Y	Y	Survey 8 (Q2), Survey 9 (Q1), Survey 10 (Q2), Survey 11 (Q1), Survey 12 (Q5)
AT2	To what extent do you support or oppose the following ways of using the sea and coastline in [Scotland]? (strongly support to strongly oppose) e.g. commercial sea fishing, farming of fish and shellfish, ...	Y	Y	P	Y	Y	P	Survey 8 (Q10)
AT3	Our marine environment provides a number of services and benefits. Which of the following do you think are most important? recreation and tourism, source of food, trade and shipping, ...	Y	Y	P	Y	Y	P	Survey 8 (Q10a), Survey 10 (Q14), Survey 11 (Q6)
AT4	When thinking about the marine environment do you feel the government should pay more, less or equal attention to the views of scientists or the views of the public?	Y	Y	P	Y	Y	P	Survey 8 (Q12)
AT5	Some people have suggested that governments should designate certain parts of the ocean as protected areas, in the same way that they do with national parks on land, whilst others have said this is not a good idea. To what extent do you agree or disagree with this suggestion?	Y	Y	P	Y	Y	Y	Survey 8 (Q24), Survey 10 (Q18), Survey 11 (Q8)
AT6	How important or not do you feel these sectors or industries are to [Scotland] in terms of their social value? By social value we mean their value to society as a whole or local communities.	Y	Y	P	Y	Y	P	Survey 8 (Q25)
AT7	How important or not do you feel these sectors or industries are to [Scotland] in terms of their economic value? By economic value we mean generating tax revenue, creating and providing jobs.	Y	Y	P	Y	Y	P	Survey 8 (Q26)
AT8	To what extent do you agree or disagree with the following statements? e.g. Enough is being done to protect the [Scottish] marine environment.	Y	Y	P	Y	Y	P	Survey 8 (Q32_1)

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
AT9	The government plans to set up more marine protected areas in the seas around the coasts of England. Thinking about the seas off the coast in this region, how sure do you feel that there would be undersea landscapes worth protecting here? ('Not at all sure' to 'Very Certain')	Y	Y	P	Y	Y	Y	Survey 9 (Q3 – Natural England Survey) – see Jefferson (2010)
AT10	It has been suggested that governments should make plans that specify the different activities that can happen and where they can happen in the sea. To what extent do you agree or disagree with this idea? (Likert scale)	Y	Y	P	Y	Y	Y	Survey 10 (Q17), Survey 11 (Q9)
AT11	Do you think that good environmental status in [Irish] seas should be aimed for?	Y	Y	P	Y	Y	Y	Survey 10 (Q25)
AT12	Please indicate to what extent do you agree or disagree with the following statement. The oceans are so large, it is unlikely that humans will cause lasting damage to them	Y	Y	P	Y	Y	P	Survey 11 (Q2)
AT13	In your opinion, how much of a threat, if any, does each of the following pose to the marine environment? Please use a scale of 1 to 5. e.g. oil and gas extraction, pollution from industry, ...	Y	Y	P	Y	Y	P	Survey 11 (Q5)
AT14	When it comes to managing and protecting the ocean environment, how competent do you think are each of the following? Please use a scale of 1 to 5 where 1 means not at all competent and 5 means highly competent. e.g. the EU, National Government, Local Authorities, ...	Y	Y	P	Y	Y	Y	Survey 11 (Q7)
AT15	What do you think should be the top priorities for the development of marine and coastal areas? Please select two answers from the list below. e.g. conservation and protection, energy production, food production, ...	Y	Y	P	Y	Y	Y	Survey 11 (Q10)
AT16	Please indicate what you think of the following statement: The ocean is being damaged by human actions.	Y	Y	P	Y	Y	P	Survey 12 (Q6)
AT17	Please indicate what you think of the following statement: More action is needed to improve the health of the ocean	Y	Y	P	Y	Y	P	Survey 12 (Q7)
AT18	Please indicate what you think of the following statement: The ocean, seas and inland waters have the potential to support economic growth and the generation of new jobs	Y	Y	P	Y	Y	P	Survey 12 (Q10)
AT19	In your opinion, how important to society in general is the collection of marine environmental data?	Y	Y	P	Y	Y	P	Survey 12 (Q15)
AT20	To what extent do you think you are provided with enough information to help you make appropriate decisions with regard to the marine environment?	Y	Y	P	Y	Y	Y	Survey 14a (Q4)

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
AT21	To what extent is the conservation of the marine environment important to you? (not at all to extremely)	Y	Y	P	Y	Y	Y	Survey 14a (Section 3 Q2)
AT22	How much do the problems facing the marine environment, that you know about, worry you? (Not at all to Extremely)	Y	Y	P	Y	Y	P	Survey 14b (Q3)
AT23	To what extent would you say that you care about the marine environment? (Not at all to Extremely).	Y	Y	P	Y	Y	P	Survey 14a (Section 3 Q2), Survey 14b (Q8)
AT24	How responsible do you feel for the condition of the marine environment? (Not at all to Extremely).	Y	Y	P	Y	Y	P	Survey 14b (Q10)
AT25	To what extent do you think responsibility for the marine and coastal environment should fall to the government?	Y	Y	P	Y	Y	Y	Survey 14b (Q11)
AT26	To what extent do you think responsibility for the marine and coastal environment should fall to the public?	Y	Y	P	Y	Y	Y	Survey 14b (Q12)
AT27	How effective do you think current management of the marine and coastal environment is?	Y	Y	P	Y	Y	Y	Survey 14b (Q13)
AT28	To what extent do you feel that you have a personal connection to the marine environment?	Y	Y	P	Y	Y	P	Survey 14b (Q14)
COMMUNICATION (CO)								
CO1	From which, if any, of the following sources have you ever found information about the [Scottish] marine environment? Please select all that apply. e.g. education, films or nature/wildlife documentaries, friends/family, newspapers/books/ magazines...	Y	Y	P	Y	Y	P	Survey 8 (Q8)
CO2	How should information be presented to the public on the state of the marine environment?	Y	Y	P	Y	Y	Y	Survey 9 (Q3) – see Jefferson (2010)
CO3	What evidence would you use to illustrate these issues [of concern in the marine environment] to the public?	Y	Y	P	Y	Y	Y	Survey 9 (Q2 Marine Scientist Survey) – see Jefferson (2010)
CO4	Take a moment to reflect on the 5 attributes, I just described (marine biodiversity and healthy ecosystems, sustainable and healthy fisheries, pollution levels in seas, non-native species, physical impacts on the sea). Can you remember what they are and say them back?	Y	Y	P	Y	Y	P	Survey 10 (Q21)
CO5	Please select the top 3 sources you use to receive factual information. (Max choices: 3) e.g. TV, newspapers, books, radio, internet, social media, scientific publications, ...	Y	Y	P	Y	Y	P	Survey 12 (Q13)
CO6	Please select the top 3 types of event in terms of how effective they are in informing Irish citizens about the ocean, seas, coastal and inland waters (Max choices: 3) e.g. festivals, community environmental events, exhibitions, talks/seminars, online webinars, media events	Y	Y	P	Y	Y	P	Survey 12 (Q14)

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
CO7	How would you say you get your information about the marine environment? School, TV, Internet, Peers, Radio, Newspapers, others...	Y	Y	P	Y	Y	P	Survey 14a (Part 2 Q1)
BEHAVIOUR (BE)								
BE1	Which, if any, of the following have you done in the last 12 months to help reduce marine litter? e.g. [1] Reduced your use of plastic straws, [2] Reduced your use of single use plastic bags...	Y	Y	P	Y	Y	P	Survey 8 (Q17b) – parts of this question may also relate to ‘Activism’ and ‘Behaviour choices and decision-making’
BE2	How likely or unlikely are you to do the following in the next 12 months to help reduce marine litter? [1] Very likely [2] Quite likely [3] Not very likely [4] Not at all likely [99] Not sure [98] Not applicable	Y	Y	P	Y	Y	P	Survey 8 (Q17c) – parts of this question may also relate to ‘Activism’ and ‘Behaviour choices and decision-making’
BE3	Which, if any, of the following have influenced your environmental behaviours in the last 12 months? (Please select all that apply. e.g. newspapers, online media, social media, friends or family, TV/radio, celebrities, ...)	Y	Y	P	Y	Y	P	Survey 8 (Q18)
BE4	To what extent do you agree or disagree with the following statements? e.g. I can personally make a difference to improving the [Scottish] marine environment. [1] Strongly agree [2] Tend to agree [3] Neither agree nor disagree [4] Tend to disagree [5] Strongly disagree [99] Don’t know	Y	Y	P	Y	Y	P	Survey 8 (Q32_5)
BE5	Do you consider the marine and coastal environment when shopping for food, ordering food or buying other goods? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	P	Survey 14a (Section 2 Q7)
BE6	To what extent would you be prepared to change your lifestyle if it would benefit the marine environment? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	P	Survey 14b (Part 1 Q7)
ACTIVISM (AC)								
AC1	Which, if any, of the following have you done in the last 12 months to help reduce marine litter? e.g. actively campaign for the marine environment, beach clean-up	Y	Y	P	Y	Y	P	Survey 8 (Q17b) – parts of this question may also relate to ‘Behaviour’ and ‘Behaviour choices and decision-making’
AC2	How likely or unlikely are you to do the following in the next 12 months to help reduce marine litter? (Likert scale) e.g. actively campaign for the marine environment, beach clean-up	Y	Y	P	Y	Y	Y	Survey 8 (Q17c) – parts of this question may also relate to ‘Behaviour’ and ‘Behaviour Choices and decision-making’
AC3	To what extent do you agree or disagree with the following statements? e.g. I can personally make a difference to improving the [Scottish] marine environment, I feel I can influence choices that are	Y	Y	P	Y	Y	Y	Survey 8 (Q17c) – parts of this question may also relate to ‘Knowledge’, ‘Attitude’

No.	Indicator	Criteria						Comments (Refer to surveys and questions listed in Annex 1)
		Measurability	Sensitivity	Specificity	Scalability	Transferability	Policy Relevance	
	made that impact the marine environment (Likert scale)							
AC4	Are you [or anyone in your household] a member of any environmental organisations?	Y	Y	P	Y	Y	P	Survey 10 (Q10a, b)
AC5	What would you be willing to pay as an annual payment towards achieving good environmental status in the seas around the UK?	Y	Y	P	Y	Y	Y	Survey 10 (Q26)
AC6	If you had to decide which climate change and marine policy issues should be prioritised by the European Union, which three would you select from the list below? (Max choices: 3)	Y	Y	P	Y	Y	Y	Survey 12 (Q17)
AC7	To what extent would policy towards the marine environment affect how you vote at an election? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	Y	Survey 14b (Q9)
CURTAILMENT BEHAVIOUR (CB)								
No questions within the surveys assessed included elements of Curtailment Behaviour								
BEHAVIOUR CHOICES AND DECISION-MAKING (BC)								
BC1	Which, if any, of the following have you done in the last 12 months to help reduce marine litter? Please tick all that apply. e.g. reduce your use of plastic straws, reduce your use of single use plastic bags, avoid products with excess packaging.	Y	Y	P	Y	Y	Y	Survey 8 (Q17b) – parts of this question may also relate to ‘Behaviour’ and ‘Activism’
BC2	How likely or unlikely are you to do the following in the next 12 months to help reduce marine litter? (Likert scale) e.g. reduce your use of plastic straws, reduce your use of single use plastic bags, avoid products with excess packaging.	Y	Y	P	Y	Y	Y	Survey 8 (Q17c) – parts of this question may also relate to ‘Behaviour’ and ‘Activism’
BC3	When buying seafood (fish or shellfish), to what extent, would each of the following influence your purchase? Please use a scale of 1 to 5 where 1 means it would definitely not influence your purchase and means it definitely would influence your purchase.	Y	Y	P	Y	Y	Y	Survey 11 (Q)
BC4	To what extent do you consider the potential implications for the marine environment when you buy food? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	Y	Survey 14b (Part 1 Q5)
BC5	To what extent do you consider the potential implications for the marine environment when you buy any other products for your home? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	Y	Survey 14b (Part 1 Q6)
BC6	To what extent would you be prepared to change your lifestyle if it would benefit the marine environment? ([0] Not at all to [5] Extremely)	Y	Y	P	Y	Y	Y	Survey 14b (Part 1 Q7)
TECHNOLOGY CHANGE (TC)								
No questions within the surveys assessed included elements of Technology Change.								

4. Glossary of key terms

A glossary of key terms is presented below including a reference(s) for each definition.

Term	Definition	Reference(s)
Climate (Science) Literacy	An understanding of your influence on climate and climate's influence on you and society.	USGCRP, 2009
Climate Related Behaviour	A group of behaviours which impact the natural environment and may include curtailment behaviours (e.g. using less water or saving energy), behavioural choices and decision making about (not) doing something or doing something differently (e.g. compensating airline travel CO ₂ emissions, using public transport) and technology choices (e.g. driving hybrid cars, installing solar panels).	Lokhorst & van Woerkum, 2011
Conservation Marketing	The ethical use of marketing concepts and principles to influence a target audience towards the adoption of more environmentally sustainable behaviours that benefit the individual as well as society.	Wright et al. 2015; Verissimo & McKinley 2016.
Environmental Behaviour Change	Environmental behaviour change or pro-environmental behaviour can be defined as behaviour that seeks to minimise the negative impact of individual and collective actions on the natural and built world (e.g. minimise waste production, limit consumption of energy and resources).	Kollmuss & Agyeman, 2002
Environmental Citizenship	The ultimate outcome of education for sustainability, a process which is all about changing people's attitudes, providing access to knowledge and developing skills which combine to influence behaviour.	Hawthorne & Alabaster, 1999
Environmental Literacy	Comprises an awareness of and concern about the environment and its associated problems, as well as the knowledge, skills, and motivations to work toward solutions of current problems and the prevention of new ones	NAAEE, 2004; McBride et al., 2013.
Knowledge Deficit Approach	This approach to behaviour change assumes that providing an individual with more information will lead to the desired change in behaviour.	Kollmuss & Agyeman, 2002; McKinley et al., 2020
Marine Citizen	Marine citizens are those who exhibit high levels of the factors influencing marine citizenship (high levels of awareness, concern, knowledge, connection to the ocean) and who participate in marine citizenship behaviours.	McKinley, 2010
Marine Citizenship	Describes the rights and responsibilities of an individual towards the marine environment, which support the achievement of marine policy objectives at the national level.	McKinley & Fletcher, 2012
Ocean Citizenship	Describes a relationship between our everyday lives and the health of the coastal and marine environment.	Fletcher & Potts, 2007
Nature / Ocean Connectedness	Nature connectedness is a measurable psychological construct which captures the relationship between people and the rest of the natural world. Ocean connectedness is an emergent concept building on the foundation of nature connectedness to explore the relationship between people and the ocean.	Nature Connectedness Research Group, 2020

Term	Definition	Reference(s)
Ocean Literacy	An understanding of the ocean's influence on you and your influence on the ocean.	UNESCO, 2018
Ocean Literacy Dimensions		
Awareness	The basic knowledge that a situation, problem or concept exists.	Brennan et al., 2019
Knowledge	Is what a person knows about an ocean related topic and the links between topics.	
Attitude	Is related to a level of agreement with or concern for a particular position.	
Communication	Is the extent to which a person communicates with others, such as family and peer groups, on ocean related topics.	
Behaviour	Relates to decisions, choices, actions, and habits with respect to ocean related issues.	
Activism	Is the degree to which a person engages in activities such as campaigning (for example through social media) to bring about changes in policy, attitudes, behaviour, etc.	
Social Marketing	The adaptation of commercial marketing technologies to programs designed to influence the voluntary behaviour of target audiences to improve their personal welfare and that of the society of which they are a part.	Andreasen, 1994
Stewardship	Stewardship can be broadly defined as society taking care of the natural environment, with a number of types of stewardship evident in the literature (ocean, environmental, climate and planetary)	Brown & Brent, 1998

5. References

- Andreasen, A.R., 1994. Social marketing: Its definition and domain. *Journal of Public Policy & Marketing*, 13(1), pp. 108–114.
- Arnstein, S.R., 1969. A Ladder of Citizen Participation. *Journal of the American Planning Association*, 35(4), pp. 216-224.
- Atkins, J.P., Burdon, D. & Elliott, M., 2015. Chapter 5. Identification of a practicable set of indicators for coastal and marine ecosystem services. In: Turner, R.K. & Schaafsma, M. (Eds.) Coastal zones ecosystem services: from science to values and decision making. Studies in Ecological Economics, Volume 9, Springer, Switzerland.
- Aubry, A. & Elliott, M., 2006. The use of Environmental Integrative Indicators to assess seabed disturbance in estuaries and coasts: application to the Humber Estuary, UK. *Marine Pollution Bulletin*, 53, pp. 175-185.
- Avery-Gomm, S., Walker, T.R., Mallory, M.L. & Provencher, J.F., 2019. There is nothing convenient about plastic pollution. Rejoinder to Stafford and Jones “Viewpoint – Ocean plastic pollution: A convenient but distracting truth?”. *Marine Policy*, 106, 103552.
- Azevedo, J. & Marques, M., 2017. Climate literacy: a systematic review and model integration. *Int. J. Global Warming*, 12, pp 414-430.
- Bailey, I., West, J. & Whitehead, I., 2011. Out of Sight but Not out of Mind? Public Perceptions of Wave Energy, *Journal of Environmental Policy & Planning*, 13(2), pp. 139-157.
- Barr, S., Gilg, A. & Shaw, G., 2011. ‘Helping People Make Better Choices’: Exploring the behaviour change agenda for environmental sustainability. *Applied Geography*, 31(2), pp. 712-720.
- Barracosa, H., de los Santos, C.B., Martins, M., Freitas, C. & Santos, R., 2019. Ocean literacy to mainstream ecosystem services concept in formal and informal education: the example of coastal ecosystems of southern Portugal. *Front. Mar. Sci.*, 6:626.
- Bennett, N.J., 2019. Marine social science for the peopled seas. *Coastal Management*, 47(2), pp. 244-252.
- Berkowitz, A.R., Ford, M.E. & Brewer, C.A., 2005. A framework for integrating ecological literacy, civics literacy, and environmental citizenship in environmental education. In *Environmental Education and Advocacy: Perspectives of Ecology and Education*. E. Johnson, A., and Mappin, M., J. Editors, Cambridge University Press. Cambridge. pp. 227-266.
- Borja, A., Santoro, F., Scowcroft, G., Fletcher, S. & Strosser, P., (Eds.), 2020. Connecting people to their oceans: issues and options for effective ocean literacy. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-509-2.
- Brennan, C., Ashley, M. & Molloy, O., 2019. A System Dynamics Approach to Increasing Ocean Literacy. *Front. Mar. Sci.* 6:360. doi: 10.3389/fmars.2019.00360
- Brown, J.L. & Brent, M.A., 1998. Stewardship: A working definition. *Environments Waterloo*, 26(1): 8
- Brown, K.M., 2014. Spaces of play, spaces of responsibility: Creating dichotomous geographies of outdoor citizenship. *Geoforum*, 55: pp. 22-32.
- Burdon, D., 2020a. *Review of marine cultural, social and heritage indicators*. Report ME5118 for Defra by Daryl Burdon Ltd., Willerby, UK (Report No. DB LTD 005/2019).

- Burdon, D., 2020b. *Marine cultural, social and heritage indicators workshop report*. Internal report for Defra by Daryl Burdon Ltd., Willerby, UK. February 2020 (Report No. DB LTD 006/2019).
- Burdon, D., Boyes, S.J., Elliott, M., Smyth, K., Atkins, J.P., Barnes, R.A. & Wurzel, R.K., 2018. Integrating natural and social marine science to manage sustainably vectors of change: Dogger Bank transnational case study. *Estuarine, Coastal and Shelf Science*, 201, pp. 234-247.
- Burdon, D., Potts, T. McKinley, E.J., Lew, S., Shilland, R., Gormley, K., Thomson, S. & Forster, R., 2019. Expanding the role of participatory mapping to assess ecosystem service provision in local coastal environments. *Ecosystem Services*, 39, October 2019, 101009.
- Capaldi, C.A., Dopko, R.L. & Zelenski, J.M., 2014. The relationship between nature connectedness and happiness: a meta-analysis. *Frontiers in Psychology*, 5: 976.
- Capstick, S., Pidgeon, N., Corner, A. et al., 2016. Public understanding in Great Britain of ocean acidification. *Nature Climate Change*, 6, pp. 763–767.
- Cava, F., Schoedinger, S., Strang, C. & Tuddenham, P., 2005. Science content and standards for ocean literacy: A report on ocean literacy. <http://cosee-ne.cosee.net/about/documents/OLitFinalReport.pdf>
- Chambers, R., Hart, N., Ranger, S., Birney, A., Angheloiu, C., Loring, J., Williams, S. & Hooper, L., 2019. The Marine CoLAB: Taking a CoLABorative, values based approach to connect people to the ocean. *Front. Mar. Sci.* 6:619.
- Cigliano, J.A., Meyer, R., Ballard, H.L., Freitag, A., Phillips, T.B. & Wasser, A., 2015. Making marine and coastal citizen science matter. *Ocean and Coastal Management*, 115, pp. 77-87.
- Cole, D.N., Yung, L., Zavaleta, E.S., et al., 2008. naturalness and beyond: protected area stewardship in an Era of global environmental change. *The George Wright Forum*, 25(1), pp. 36-56.
- Court, D., Elzinga, D., Mulder, S. & Vetvik, O.J., 2009. “The Consumer Decision Journey,” McKinsey Quarterly No.3. Marketing and Sales Practice. McKinsey and Company.
- Cunsolo, A., Harper, S.L., Minor, K., et al. 2020. Ecological grief and anxiety: the start of a healthy response to climate change? *The Lancet. Planetary Health*, 4(7), pp. 261-263.
- Dean, A.J., Church, E.K., Loder, J., Fielding, K.S. & Wilson, K.A., 2018. How do marine and coastal citizen science experiences foster environmental engagement? *Journal of Environmental Management*, 213, pp. 409-416.
- Dunlap, R.E. & Van Liere, K.D., 1978. The “New Environmental Paradigm”: A proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9(4), pp. 10–19.
- Dunn, M.E., Mills, M. & Veríssimo, D. 2020. Evaluating the impact of the documentary series Blue Planet II on viewers' plastic consumption behaviors. *Conservation Science and Practice*. 2:e280. <https://doi.org/10.1111/csp2.280>
- Fletcher, S. & Potts, J., 2007. Ocean citizenship: an emergent geographical concept. *Coastal Management*, 35, pp. 511–524.
- Friedrich, L.A., Jefferson, R. & Glegg, G., 2014. Public perceptions of sharks: Gathering support for shark conservation. *Marine Policy*, 47, pp. 1-7.
- Gatersleben, B., Murtagh, N. & Abrahamse, W., 2014. Values, identity and pro-environmental behaviour. *Contemporary Social Science*, 9(4), pp. 374-392.

- Gelcich, S., Buckley, P., Pinnegar, J.K., Chilvers, J., Lorenzoni, I., Terry, G., Guerrero, M., Castilla, J.C., Valdebenito, A. & Duarte, C.M., 2014. Public awareness of impacts on marine environments. *Proceedings of the National Academy of Sciences*, Oct 111 (42), pp. 15042-15047.
- Griffis, R. & Kimball, K., 1996. Ecosystem approaches to coastal and ocean stewardship. *Ecological Applications*, 6(3), pp. 708-712.
- Groulx, M., Boluk, K., Lemieux, C., J. & Dawson, J., 2019. Place stewardship among last chance tourists. *Annals of Tourism Research*, 75, pp. 202-212.
- Guest, H., Lotze, H.K. & Wallace, D., 2015. Youth and the sea: Ocean literacy in Nova Scotia, Canada. *Marine Policy*, 58, pp. 98-107.
- Hattam, C., Atkins, J.P., Beaumont, N., Borger, T., Böhnke-Henrichs, A., Burdon, D., De Groot, R., Hoefnagel, E., Nunes, P., Piwowarczyk, J., Sergio, S. & Austen, M., 2015. Marine ecosystem services: linking indicators to their classification. *Ecological Indicators*, 49, pp. 61–75.
- Hawthorne, M. & Alabaster, T., 1999. Citizen 2000: development of a model of environmental citizenship. *Global Environmental Change*, 9, pp. 25-43.
- Howell, A.J., Dopko, R.L., Passmore, H. & Buro, K., 2011. Nature connectedness: Associations with well-being and mindfulness. *Personality and Individual Difference*, 51(2), pp. 166-171.
- Hynes, S., Norton, D. & Corless, R., 2014. Investigating societal attitudes towards the marine environment of Ireland. *Marine Policy*, 47, pp. 57-65.
- Jacobs et al., 2012. Towards a mental systems approach to human relationships with wildlife: The role of emotional dispositions. *Human Dimensions of Wildlife*, 17 (1), pp. 4-15.
- Jefferson, R., Griffin, H., Nimmo, A., Fletcher, S. and McKinley, E. (in prep) Public perceptions of the marine environment: a review of existing research.
- Jefferson, R., McKinley, E., Capstick, S., Fletcher, S., Griffin, H. & Milanese, M., 2015. Understanding audiences: making public perceptions research matter to marine conservation. *Ocn. Coast. Manag.* 115, pp. 61–70.
- Jefferson, R.L., 2010. *Communicating marine environmental health: Connecting science, social and policy values*. PhD Thesis, University of Plymouth, UK.
- Jefferson, R.L., Bailey, I., Laffoley, D., d'A., Richards, J.P. & Attrill, M.J., 2014. Public perceptions of the UK marine environment. *Marine Policy*, 43, pp. 327-337.
- Kearns, R. & Collins, D., 2012. Feeling for the coast: The place of emotion in resistance to residential development. *Social and Cultural Geography*, 13(8), pp. 937-955.
- Kelly, R., Fleming, A., Pecl, G.T., Richter, A. & Bonn, A., 2019. Social license through citizen science: a tool for marine conservation. *Ecology and Society*, 24(1):16.
- Kollmuss, A. & Agyeman, J., 2002. Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), pp. 239-260.
- Kopke, K., Black, J. & Dozier, A., 2019. Stepping Out of the Ivory Tower for Ocean Literacy. *Front. Mar. Sci.* 6:60. doi: 10.3389/fmars.2019.00060
- Lambert, J., 2006. High school marine science and scientific literacy: The promise of an integrated science course. *International Journal of Science Education*, 28(8), pp. 633-654.

- Lindland, E. & Volmert, A., 2017. *Getting below the surface: Mapping the gaps between expert and public understandings of ocean change and marine conservation in the UK*. Washington, DC: FrameWorks Institute.
- Lokhurst, A.M. & van Woerkum, C., 2011. Changing Climate Related Behaviors: A Review of Social-Scientific Interventions. Climate change-socioeconomic effects, In Kheradmand, H (Ed.): pp.31–42, ISBN:978-953-307-411-5, InTech [online] <http://www.intechopen.com/books/climate-change-socioeconomic-effects/changing-climate-related-behaviors-a-review-of-social-scientific-interventions>.
- Lotze, H.K., Guest, H., O'Leary, J., Tuda, A. & Wallace, D., 2018. Public perceptions of marine threats and protection from around the world. *Ocean & Coastal Management*, 152, pp. 14-22.
- Maki, A., Carrico, A.R., Raimi, K.T., et al., 2019. Meta-analysis of pro-environmental behaviour spillover. *Nat. Sustain.*, 2, pp. 307–315.
- Manfredo, M.J., Bruskotter, J.T., Teel, T.L., Fulton, D., Schwartz, S.H., Arlinghaus, R., Oishi, S., Uskul, A.K., Redford, K., Kitayama, S. & Sullivan, L., 2017. Why social values cannot be changed for the sake of conservation. *Conservation Biology*, 31, pp. 772-780.
- Markos, A., Boubonari, T., Mogias, A. & Kevrekidis, T., 2015. Measuring ocean literacy in pre-service teachers: psychometric properties of the Greek version of the Survey of Ocean Literacy and Experience (SOLE). *Environmental Education Research*, 23(2), pp. 231-251.
- Martin, L., White, M.P., Hunt, A., Richardson, M., Pahl, S. & Burt, J., 2020. Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *Journal of Environmental Psychology*, 68, 101389.
- Martin, V.Y., Weiler, B., Reis, A., Dimmock, K. & Scherrer, P., 2017. 'Doing the right thing': How social science can help foster pro-environmental behaviour change in marine protected areas. *Marine Policy*, 81, pp. 236-246.
- McBride, B.B., Brewer, C.A., Berkowitz, A.R. & Borrie, W.T., 2013. Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*, 4(5):67.
- McCauley, V., McHugh, P., Davison, K. & Domegan, C., 2019. Collective intelligence for advancing ocean literacy. *Environmental Education Research*, 25(2), pp. 280-291.
- McKinley, E. & Fletcher, S., 2010. Individual responsibility for the oceans? An evaluation of marine citizenship by UK marine practitioners. *Ocean Coastal Management*, 53 (7), pp. 379-384.
- McKinley, E. & Fletcher, S., 2012. Improving marine environmental health through marine citizenship: a call for debate. *Marine Policy*, 36, pp. 839-843.
- McKinley, E., 2020. Marine social science research and practice in the UK: A review. Report for Defra Marine and Fisheries Team. Available online.
- McKinley, E., Acott, T.G. & Yates, K.L., 2020. Marine Social Sciences: Looking towards a sustainable future. *Environmental Science and Policy*, 108, pp. 85-92.
- McKinley, E., Jefferson, R. & Hart, N., 2020. Emotional disconnect with the ocean: A Report for the EC Mission Board Healthy Oceans, Seas, Coastal and Inland Waters. Available on request.
- McNeal, K.S., Walker, S.L. & Rutherford, D., 2014. Assessment of 6- to 20-Grade Educators' Climate Knowledge and Perceptions: Results From the Climate Stewardship Survey, *Journal of Geoscience Education*, 62:4, pp. 645-654, DOI: 10.5408/13-098.1
- Milton, K., 2002. *Loving nature: towards an ecology of emotion*. Routledge.

- Nash, N., Whitmarsh, L., Capstick, S., Hargreaves, T., Poortinga, W., Thomas, G., Sautkina, E. & Xenias, D., 2017. Climate-relevant behavioral spillover and the potential contribution of social practice theory. *WIREs Clim Change*, 8: e481.
- National Marine Education Association. 2020. Ocean literacy: the essential principles and fundamental concepts of ocean sciences for learners of all ages. Access here: <https://www.marine-ed.org/ocean-literacy/overview>
- Nature Connectedness Research Group, 2020. <https://www.derby.ac.uk/research/centres-groups/nature-connectedness-research-group/>
- North American Association for Environmental Education (NAAEE), 2004. *Excellence in environmental education: guidelines for learning (K–12)*. NAAEE, Washington, D.C., USA.
- Pahl, S., Wyles, K.J. & Thompson, R.C., 2017. Channelling passion for the ocean towards plastic pollution. *Nat. Hum. Behav.*, 1, pp. 697–699.
- Palm, R., Bolsen, T. & Kingsland, J., T. In prep. ‘Don’t Tell Me What to Do’: Resistance to Climate Change Messages Suggesting Behavior Changes. *Weather, Climate and Society*. DOI: 10.1175/WCAS-D-19-0141.1.
- Parsons, E.C.M., Favaro, B., Aguirre, A.A., Bauer, A.L., Blight, L.K., Cigliano, J.A., Coleman, M.A., Côté, I.M., Draheim, M., Fletcher, S., Foley, M.M., Jefferson, R., Jones, M.C., Kelaher, B.P., Lundquist, C.J., McCarthy, J.-B., Nelson, A., Patterson, K., Walsh, L., Wright, A.J. & Sutherland, W.J., 2014. Seventy-One Important Questions for The Conservation Of Marine Biodiversity. *Conservation Biology*, 28, pp. 1206-1214.
- Potts, T., 2006. A framework for the analysis of sustainability indicator systems in fisheries. *Ocean & Coastal Management*, 49, pp. 259-280.
- Potts, T., O’Higgins, T., Mee, L. & Pita, C., 2011. Public Perceptions of Europe's Seas: A policy brief, EU FP7 KNOWSEAS Project, SAMS, 2011, ISBN0-9529089-3-X.
- Potts, T., Pita, C., O’Higgins, T. & Mee, L., 2016. Who cares? European attitudes towards marine and coastal environments. *Marine Policy*, 72, pp. 59-66.
- Rees, S., Fletcher, S., Glegg, G., Marshall, C., Rodwell, L., Jefferson, R., Campbell, Langmead, O., Ashley, M., Bloomfield, H., Brutto, D., Colenutt, A., Conversi, A., Earll, B., Hattam, C., Ingram, S., McKinley, E., Mee, L., Oates, J., Peckett, F., Portus, J., Reed, M., Rogers, S., Saunders, J., Scales, K. & Wynn, R., 2013. Priority questions to shape the marine and coastal policy research agenda in the United Kingdom. *Marine Policy*, 38, pp. 531-537.
- Squarcina, E. & Pecorelli, V., 2017. Ocean Citizenship: The time to adopt a useful concept for environmental teaching and citizenship education is now. *Journal of Research and Didactics in Geography*, 2, pp. 45-53.
- Stafford, R. & Jones, P.J., 2019. Viewpoint – Ocean plastic pollution: A convenient but distracting truth? *Marine Policy*, 103, pp. 187-191.
- Steel, B.S., Smith, C., Opsommer, L., Curiel, S. & Warner-Steel, R., 2005. Public ocean literacy in the United States. *Ocean and Coastal Management*, 18, pp. 97–114.
- Steffen, W., Persson, Å., Deutsch, L. et al., 2011. The Anthropocene: From Global Change to Planetary Stewardship. *AMBIO*, 40, 739.
- Steg, L. & Vlek, C., 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29 (3), pp. 309-317.

- Steg, L., Bolderdijk, J.W., Keizer, K. & Perlaviciute, G., 2014. An Integrated Framework for Encouraging Pro-environmental Behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology*, 38, pp. 104-115.
- Stoll-Kleemann, S., 2019. Feasible options for behavior change toward more effective ocean literacy: a systematic review. *Front. Mar. Sci.*, 6:273.
- The Guardian. 2019. The Blue Planet effect: the plastics revolution is just the start. <https://www.theguardian.com/commentisfree/2019/mar/25/plastics-revolution-marine-life>
- UNESCO, 2018. Ocean Literacy Portal. <https://oceanliteracy.unesco.org/>
- United Nations, 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Access here: <https://sdgs.un.org/2030agenda>
- US Global Change Research Program (USGCRP), 2009. *Climate Literacy: The Essential Principles of Climate Science*, [eBook], Global Change Research Program, Washington DC, USA.
- Van der Linden, S., 2015. Intrinsic motivation and pro-environmental behaviour. *Nature Clim. Change*, 5, pp. 612–613.
- Veríssimo, D. & McKinley, E., 2016. Introducing conservation marketing: Why should the devil have all the best tunes? *Oryx*, 50(1), 14.
- Walker, S., L., and McNeal, K., S. 2013. Development and Validation of an Instrument for Assessing Climate Change Knowledge and Perceptions: The Climate Stewardship Survey (CSS). *International Electronic Journal of Environmental Education*, v3 n1 p57-73.
- Wheeler, B.W., White, M., Stahl-Timmins, W. & Depledge, M.H., 2012. Does living by the coast improve health and wellbeing? *Health & Place*, 18(5), pp. 1198-1201.
- White, M.P., Alcock, I., Wheeler, B.W. & Depledge, M.H., 2013. Coastal proximity, health and well-being: Results from a longitudinal panel survey. *Health & Place*, 23, pp. 97-103.
- World Health Organisation (WHO), 2020. WHO European Office Website Accessed 18/08/2020 <https://gateway.euro.who.int/en/themes/health-literacy/>
- Wright, A.J., Veríssimo, D., Pilfold, K., Parsons, E., Ventre, K., Cousins, J., Jefferson, R., Koldewey, H., Llewellyn, F. & McKinley, E., 2015. Competitive outreach in the 21st century: Why we need conservation marketing. *Ocean & Coastal Management*, 115, pp. 41–8.
- Yerbury, R. & Weiler, B., 2020. From human wellbeing to an ecocentric perspective: how nature-connectedness can extend the benefits of marine wildlife experiences. *Anthrozoös*, 33(4), pp. 461-479.

Annex 1: Question Modules

This annex contains the full sets of questions from the various public perception surveys which focus on the marine environment. Questions of relevance to ocean literacy and climate related behaviour change have been included in Section 3.1 and were assessed in Section 3.2.

The full questions from the following surveys are included within this Annex:

- 8. Attitudes in Scotland on the Marine Environment and Marine Issues
- 10. Investigating Societal Attitudes Towards the Marine Environment (Hynes et al., 2014)
- 11. European Attitudes Towards Marine and Coastal Environments (Potts et al., 2016)
- 12. The Irish Citizen Engagement: Ocean Survey (EU Mission, 2020)
- 13. Development of the International Ocean Literacy Survey: measuring knowledge across the world (Fauville et al., 2019).
- 14a. Application of Marine Citizenship in Sustainable Marine Management in the UK: Education (McKinley, 2010).
- 14b. Application of Marine Citizenship in Sustainable Marine Management in the UK: Personal Attachment (McKinley, 2010).

8. Attitudes in Scotland on the Marine Environment and Marine Issues

[Q1] {grid} For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think “most people” feel.

[1] Disagree strongly [2] Disagree a little [3] Neither agree or disagree [4] Agree a little [5] Agree strongly

[Q1_1] My ideal vacation spot would be a remote, wilderness area.

[Q1_2] I always think about how my actions affect the environment.

[Q1_3] My connection to nature and the environment is a part of my spirituality.

[Q1_4] I take notice of wildlife wherever I am.

[Q1_5] My relationship to nature is an important part of who I am.

[Q1_6] I feel very connected to all living things and the earth.

[Q2] {grid} How worried do you personally feel about each of these issues?

[1] Very worried [2] Quite worried [3] Not worried [4] Not worried at all

[Q2_1] Raw sewage put into sea

[Q2_2] Nuclear energy / nuclear waste

[Q2_3] Protection of wildlife

[Q2_4] Protection of areas of conservation interest

[Q2_5] Forestry

[Q2_6] Genetically modified crops

[Q2_7] Pesticides, fertilisers and chemical sprays

[Q2_8] Pollution of rivers, lochs and seas

[Q2_9] Waste disposal

[Q2_10] New developments in the countryside

[Q2_11] Farming methods

[Q2_12] Using up non-renewable resources

[Q2_13] Quality of drinking water

[Q2_14] Road traffic

[Q2_15] Global warming by greenhouse effect

[Q2_16] Derelict land in towns and cities

[Q2_17] Fish farming

[Q2_18] Fumes and smoke from factories

[Q2_19] Over fishing

[Q2_20] Lack of access to parks

[Q2_21] Plastics in the oceans

[Q3] {single} How often on average, if at all, do you watch nature/wildlife programmes?

(Allows one selection)

[1] Every day

[2] A few times a week

[3] Once a week

[4] A few times a month

[5] Once a month

[6] Less often than once a month

[7] Never

[99] Not sure

[Q4] {multiple} Which, if any, of the following nature/wildlife programmes have you watched in the past 12 months? Please select all that apply.

(Allows multiple selections)

[1] Blue Planet 1 / 2

[2] Coast

[3] Countryfile

[11] Dynasties

[4] Frozen Planet

[5] Landward

- [6] Life
- [7] Natural World
- [8] Planet Earth 1 / 2
- [9] Spring/Autumn/Winter Watch
- [10] The Living Planet
- [96] Other
- [99] None of these
- [98] Don't know

[Q5] {grid} Thinking about the last 12 months, how often have you visited each of these outdoor spaces in Scotland?

[1] Once a week or more often [2] Once every 2 or 3 weeks [3] Once a month [4] Once every 2 or 3 months [5] Once or twice [6] Not in the last 12 months [98] Not sure

[Q5_1] Parks or gardens

[Q5_2] The coast, beaches or cliffs

[Q5_3] The sea or ocean (for example for swimming, diving, sailing surfing etc)

[Q5_4] Woodlands or forests

[Q5_5] Hills, mountains, moors or heathland

[Q5_6] Lochs, lakes or reservoirs

[Q5_7] Rivers or canals

[Q5a] {single} Have you visited the Scottish coast or sea for **work / business reasons**** in the last year?**

(Allows one selection)

[1] Yes

[2] No

[99] Not sure

[Q5b] {multiple} If you have visited the Scottish sea or coast for work / business, was it for any of the following industry sectors? Please tick all that apply

(Allows multiple selections)

[1] Commercial sea fishing

[2] Fish farming

[3] Oil / Gas sector

[4] Renewable energy sector

[5] Scientific research

[6] Shipping sector

[7] Tourism industry

[96] Other

[Q6] {multiple} Which, if any, of the following leisure activities have you done at the Scottish coast or sea in the last year? Please select all that apply.

(Allows multiple selections)

[1] Beach activities / games / picnics / BBQs

[14] Beachcombing

[15] Beach clean ups

[2] Diving / snorkelling

[3] Dog walking

[4] Eating seafood (fish/shellfish)

[5] Kayaking/rowing/canoeing

[6] Photography

[7] Recreational fishing on the coast or in the sea

[8] Sailing

[9] Surfing/bodyboarding

[10] Swimming

[11] Walking / hiking / running

[12] Wildlife watching

- [13] Windsurfing/kite-surfing
- [97] Other
- [99] None of these
- [98] Don't know

[Q6a] {grid} How often have you done each of the following leisure activities at the Scottish coast or sea in the last year?

[1] Once a week or more often [2] Once every 2 or 3 weeks [3] Once a month [4] Once every 2 or 3 months [5] Once or twice a year [99] Don't know

[Q6a_1] Beach activities / games / picnics / BBQs

[Q6a_14] Beachcombing

[Q6a_15] Beach clean ups

[Q6a_2] Diving / snorkelling

[Q6a_3] Dog walking

[Q6a_4] Eating seafood (fish/shellfish)

[Q6a_5] Kayaking/rowing/canoeing

[Q6a_6] Photography

[Q6a_7] Recreational fishing on the coast or in the sea

[Q6a_8] Sailing

[Q6a_9] Surfing/bodyboarding

[Q6a_10] Swimming

[Q6a_11] Walking / hiking / running

[Q6a_12] Wildlife watching

[Q6a_13] Windsurfing/kite-surfing

[Q6a_97] Other

[Q6c1] {grid-check} And where on the Scottish coast have you most frequently done each of these activities in the last year? Please choose only one location for each.

[1] Argyll [2] Clyde [3] Forth and Tay [4] Moray Firth [5] North Coast [6] North East [7] Orkney Islands [8] Outer Hebrides [9] Shetland Islands [10] Solway [11] West Highlands [99] Not sure

[Q6c1_1] Beach activities / games / picnics / BBQs

[Q6c1_14] Beachcombing

[Q6c1_15] Beach clean ups

[Q6c1_2] Diving / snorkelling

[Q6c1_3] Dog walking

[Q6c1_4] Eating seafood (fish/shellfish)

[Q6c1_5] Kayaking/rowing/canoeing

[Q6c1_6] Photography

[Q6c1_7] Recreational fishing on the coast or in the sea

[Q6c1_8] Sailing

[Q6c1_9] Surfing/bodyboarding

[Q6c1_10] Swimming

[Q6c1_11] Walking / hiking / running

[Q6c1_12] Wildlife watching

[Q6c1_13] Windsurfing/kite-surfing

[Q6c1_97] Other transpose: None

[Q7] {grid} How much knowledge do you think you have about each of the following sectors or industries in Scotland's marine environment?

[1] Know very well [2] Know a fair amount [3] Know just a little [4] Heard of, know almost nothing about [99] Not heard of

[Q7_1] Commercial sea fishing

[Q7_2] Farming of fish and shellfish

[Q7_3] Non-renewable energy such as oil and gas

[Q7_4] Renewable energy such as wind, waves, tide

[Q7_5] Transportation of goods / commercial shipping

- [Q7_6] Coastal tourism / recreation / cruises
- [Q7_7] Coastal protection such as seawalls
- [Q7_8] Scientific research such as marine biology
- [Q7_9] Ports and harbours
- [Q7_10] Military exercises such as by the Royal Navy
- [Q7_11] Construction such as shipbuilding

[Q8] {multiple} From which, if any, of the following sources have you ever found information about the Scottish marine environment? Please select all that apply.

(Allows multiple selections)

- [1] Education (school, college, university)
- [2] Films or nature / wildlife documentaries
- [3] Friends or family
- [4] Newspapers, books magazines or online articles
- [5] Scottish Government
- [6] Social media
- [7] TV or radio news
- [8] Environmental charities / organisations
- [9] Museum
- [10] Visitor centre by the coast
- [97] Other
- [98] None of these – I haven't found information on the Scottish marine environment
- [99] Don't know

[Q9] {grid} How interested are you in learning more about the marine environment in Scotland, the rest of the UK and in general around the world?

- [1] Very interested [2] Quite interested [3] Not very interested [4] Not at all interested [98] Not sure
- [Q9_1] In Scotland
- [Q9_2] Rest of the UK
- [Q9_3] Around the world

[Q10] {grid} To what extent do you support or oppose the following ways of using the sea and coastline in Scotland?

- [1] Strongly support [2] Slightly support [3] Neither support nor oppose [4] Slightly oppose [5] Strongly oppose
- [99] Don't know
- [Q10_1] Commercial sea fishing
- [Q10_2] Farming of fish and shellfish
- [Q10_3] Non-renewable energy such as oil and gas
- [Q10_4] Renewable energy such as wind, waves, tide
- [Q10_5] Transportation of goods / commercial shipping
- [Q10_6] Coastal tourism / recreation / cruises
- [Q10_7] Coastal protection such as seawalls
- [Q10_8] Scientific research such as marine biology
- [Q10_9] Ports and harbours
- [Q10_10] Military exercises such as by the Royal Navy
- [Q10_11] Construction such as shipbuilding

[q10a] {multiple} Our marine environment provides a number of services and benefits. Which of the following do you think are most important? You can choose up to 5 priorities

(Allows multiple selections)

- [1] Oil and gas
- [2] Renewable Energy
- [3] Food to eat
- [4] Coastal protection
- [5] Climate regulation
- [6] Health and well-being

- [7] Tourism, leisure and recreation
- [8] Transport and shipping
- [9] Habitats for marine plants and animals
- [10] Providing jobs
- [11] Supporting the wider UK economy
- [98] None of the above
- [99] Don't know

[Q10b] {single} In the past year, do you think the health of Scotland's seas has...

(Allows one selection)

- [1] Improved
- [2] Stayed the same
- [3] Worsened
- [99] Don't know

[Q10c] {open} You said that you think the health of Scotland's seas has worsened in the past year. Why do you think this?

A text field with 4 lines of 70 characters.

[Q10d] {open} You said that you think the health of Scotland's seas has improved in the past year. Why do you think this?

A text field with 4 lines of 70 characters.

[Q11] {multiple} Which of the following are you most concerned about in the marine environment globally?

You can pick up to FOUR.

(Allows multiple selections)

- [1] Change in sea levels
- [2] Change in sea temperatures
- [3] Accidents such as oil spills
- [4] Ocean acidification
- [5] Over fishing
- [6] Litter / plastics in the sea
- [7] Reduction in marine biodiversity / loss of marine species
- [8] Coastal development
- [96] Other
- [98] None of the above
- [99] Don't know

[Q12] {single} When thinking about the marine environment do you feel the government should pay more, less or equal attention to the views of scientists or the views of the public?

(Allows one selection)

- [1] Much more to scientists
- [2] A little more to scientists
- [3] Both equally
- [4] A little more to the public
- [5] A lot more to the public
- [99] Not sure

[Q13] {multiple} Which, if any, of the following do you think are the main types of litter in Scotland's sea and coast? You can tick up to FIVE.

(Allows multiple selections)

- [1] Plastic bottles
- [2] Plastic bags
- [3] Cotton buds
- [4] Wet wipes
- [5] Straws

- [8] Fishing gear
- [9] Micro plastics
- [11] Paper
- [12] Sanitary items
- [13] Cigarettes
- [14] Plastic containers
- [15] Rope/string
- [16] Food packets and wrapping
- [96] Other
- [98] None of the above, they are no main types of litter
- [99] Don't know

[Q14] {multiple} Which, if any, of the following do you think are the main causes of marine litter in Scotland's sea and coast? You can pick up to FIVE.

(Allows multiple selections)

- [1] Commercial fishing by boats
- [2] Farming of fish and shellfish
- [3] Non-renewable energy such as oil and gas
- [4] Renewable energy such as wind, waves
- [5] Transportation of goods / commercial shipping
- [6] Coastal tourism / recreation / cruises
- [7] Ports and harbours
- [8] Military
- [9] Households (general waste)
- [12] Waste water and sewerage systems
- [10] Tourist waste
- [11] Food and drinks production and packaging
- [96] Other
- [98] None of the above, they are no producers of litter
- [99] Don't know

[Q15] {multiple} Which, if any of the following, do you think should be responsible for reducing marine litter in Scotland? You can pick the FOUR you think should bear most responsibility.

(Allows multiple selections)

- [1] Industrial users of the coast and sea
- [2] Tourists / leisure users of the coast and sea
- [3] Scottish households/residents in general
- [4] Food and drinks companies
- [5] Scottish Environment Protection Agency (SEPA)
- [6] Water supply and treatment companies
- [7] Local councils
- [8] Scottish Government
- [9] Environmental groups or charities
- [96] Other
- [99] None of these, marine litter is not an issue that needs tackling
- [98] Don't know

[Q16] {single} Thinking about your use of the Scottish sea or coast, to what extent are you or your family affected by marine litter?

(Allows one selection)

- [1] A great deal
- [2] A fair amount
- [3] Not very much
- [4] Not at all
- [98] Don't know

[Q17b] {multiple} Which, if any, of the following have you done in the last 12 months to help reduce marine litter? Please tick all that apply.

(Allows multiple selections)

- [1] Reduced your use of plastic straws
- [2] Reduced your use of single use plastic bags
- [3] Doing something to support a ban on plastic products
- [4] Avoided products known to harm the marine environment
- [5] Recycled more
- [6] Reduced use of disposable tea / coffee cups
- [7] Avoided products with excess packaging
- [8] Actively campaigned for the marine environment
- [9] Beach clean ups / litter picking
- [96] Other
- [99] None of the above

[Q17c] {grid} How likely or unlikely are you to do the following in the next 12 months to help reduce marine litter?

[1] Very likely [2] Quite likely [3] Not very likely [4] Not at all likely [99] Not sure [98] Not applicable

- [Q17c_1] Reduce your use of plastic straws
- [Q17c_2] Reduce your use of single use plastic bags
- [Q17c_3] Something to support a ban on plastic products
- [Q17c_4] Avoid products known to harm the marine environment
- [Q17c_5] Recycle more
- [Q17c_6] Reduce use of disposable tea / coffee cups
- [Q17c_7] Avoid products with excess packaging
- [Q17c_8] Actively campaign for the marine environment
- [Q17c_9] Beach clean ups / litter picking

[Q18] {multiple} Which, if any, of the following have influenced your environmental behaviours in the last 12 months? Please select all that apply.

(Allows multiple selections)

- [1] Newspapers (e.g. Times, Guardian, Mirror)
- [2] Online media (e.g. HuffPost, BBC)
- [3] Social media
- [4] Friends or family
- [5] TV / radio news
- [6] Scottish Government
- [7] Environmental campaigns
- [8] TV / radio programmes or documentaries
- [9] Celebrities
- [10] Sustainable consumer products or brands
- [11] Information from children through their school
- [12] Charities
- [13] Politicians
- [15] School / University education
- [97] Other
- [99] None of these have influenced environmental behaviour in the last 12 months
- [98] Don't know

[Q23] {single} How familiar are you with Marine Protected Areas (MPAs)?

(Allows one selection)

- [1] Very familiar
- [2] Quite familiar
- [3] Not very familiar
- [4] Heard of, but know nothing about
- [5] Not previously heard of MPAs

Marine Protected Areas (MPAs) are areas of sea that are designated to ensure protection of some of the most vulnerable marine animals and habitats (e.g. marine mammals, seabirds and seagrass beds) and important historic sites (e.g. ship wrecks). MPAs are protected under Scottish and UK legislation and are managed to reduce the impact of human activities on marine animals and/or habitats. This management can restrict some industries, such as fishing, shipping, renewable developments, oil and gas, which can have both positive and negative economic impacts to different people and businesses.

[Q24] {single} To what extent do you support or oppose the creation of MPAs in Scotland?

(Allows one selection)

- [1] Strongly support
- [2] Tend to support
- [3] Neither support or oppose
- [4] Tend to oppose
- [5] Strongly oppose
- [98] Don't know

[Q24a] {open} If there are any Scottish marine animals that you are concerned about for the future, please type in here.

A text field with 3 lines of 60 characters.

[Q25] {grid} How important or not do you feel these sectors or industries are to Scotland in terms of their social value? By social value we mean their value to society as a whole or local communities.

[1] Very important [2] Quite important [3] Not very important [4] Not at all important [99] Don't know

[Q25_1] Commercial sea fishing

[Q25_2] Farming of fish and shellfish

[Q25_3] Non-renewable energy such as oil and gas

[Q25_4] Renewable energy such as wind, waves, tide

[Q25_5] Transportation of goods / commercial shipping

[Q25_6] Coastal tourism / recreation / cruises

[Q25_7] Coastal protection such as seawalls

[Q25_8] Scientific research such as marine biology

[Q25_9] Ports and harbours

[Q25_10] Military exercises such as by the Royal Navy

[Q25_11] Construction such as shipbuilding

[Q26] {grid} How important or not do you feel these sectors or industries are to Scotland in terms of their economic value? By economic value we mean generating tax revenue, creating and providing jobs.

[1] Very important [2] Quite important [3] Not very important [4] Not at all important [99] Don't know

[Q26_1] Commercial sea fishing

[Q26_2] Farming of fish and shellfish

[Q26_3] Non-renewable energy such as oil and gas

[Q26_4] Renewable energy such as wind, waves, tide

[Q26_5] Transportation of goods / commercial shipping

[Q26_6] Coastal tourism / recreation / cruises

[Q26_7] Coastal protection such as seawalls

[Q26_8] Scientific research such as marine biology

[Q26_9] Ports and harbours

[Q26_10] Military exercises such as by the Royal Navy

[Q26_11] Construction such as shipbuilding

[Q27] {single} How often, if ever, do you eat seafood?

(Allows one selection)

- [1] A few times a week
- [2] Once a week
- [3] A few times a month

- [4] Once a month
- [5] Less often than once a month
- [6] Never

[Q28] {single} How important or not is it to you that the seafood you eat is farmed or caught in Scottish waters?

(Allows one selection)

- [1] Very important
- [2] Quite important
- [3] Not very important
- [4] Not at all important
- [98] Don't know

[Q29] {single} Would you be prepared to pay a bit extra for Seafood that is caught or farmed in Scottish waters compared to the similar produce from elsewhere?






(Allows one selection)

- [1] Yes
- [2] No
- [98] Don't know

[Q30] {multiple} Which if any of these sustainability labels have you seen before? Please click on all that apply.

YouGov

Which if any of these sustainability labels have you seen before? Please click on all that apply

<input type="checkbox"/> 	<input type="checkbox"/>  <small>Certified from sustainable fisheries www.fishchoice.org</small>	<input type="checkbox"/> 
<input type="checkbox"/> 	<input type="checkbox"/>  <small>CERTIFIED SUSTAINABLE SEAFOOD MSC www.msc.org</small>	<input type="checkbox"/>  None of these
<input type="checkbox"/> 	<input type="checkbox"/> 	

[Q31] {grid} Has seeing these labels on a product influenced your decision to buy?

- [1] Yes, it has influenced my decision to buy
- [2] No, it has not influenced my decision to buy
- [99] Not sure

[Q32] {dyngrid} To what extent do you agree or disagree with the following statements?

- [1] Strongly agree
- [2] Tend to agree
- [3] Neither agree nor disagree
- [4] Tend to disagree
- [5] Strongly disagree
- [99] Don't know

[Q32_1] Enough is being done to protect the Scottish marine environment

[Q32_2] I need to do more to protect the marine environment

[Q32_3] Government needs to do more to protect the marine environment

[Q32_4] Business needs to do more to protect the marine environment

[Q32_5] I can personally make a difference to improving the Scottish marine environment

[Q32_6] I feel I have the knowledge I need to protect the marine environment

[Q32_7] I feel I can influence choices that are made that impact the marine environment

[Q33] {multiple} Now you have completed this survey, is there anything else about the marine environment that you would like to know more about? Please tick all that apply.

(Allows multiple selections)

- [1] Changes to the marine environment from exiting the European Union
- [2] Fish farming
- [3] Impacts on climate change on the marine environment
- [4] Impacts to marine environment overseas
- [5] Industries that work in the marine environment
- [6] Marine biodiversity
- [7] Marine Protected Areas
- [8] Renewable energy
- [9] Scientific developments in the marine environment
- [10] Sustainability fishing
- [11] Waste management
- [96] Other
- [99] No, nothing more I'd like to know about

10. Investigating Societal Attitudes Towards the Marine Environment (Hynes et al., 2014).

The Irish government is interested in introducing new protection for the seas and oceans around Ireland. The seas around Ireland provide Irish people with many goods such as fish and energy (e.g. gas and off-shore wind) and are also valued by people for recreational purposes. Some people might even just value having clean and healthy seas. However, due to increased exploitation of the marine environment and increased risk of pollution combined with the increased influence of land based activities on the sea, the marine environment (e.g. fish, whales, seaweeds, etc) is at risk of being degraded. Therefore there is a trade-off between using the seas versus maintaining or restoring the marine environment to healthy and clean status.

We are interested in your opinion regarding how much protection should be afforded to the seas around Ireland. While you may not have thought much about this issue, this survey may help to guide policy makers in the marine area; therefore we need to get a wide range of opinions on this subject, including yours.

Q.1 How much of what I just told you about the seas and oceans around Ireland did you know beforehand?

SINGLE CODE, READ OUT

	(34)
I knew none of what I have been told	1
I knew very little	2
I knew half of it	3
I knew most of it	4
I knew everything	5

Q.2 How important, if at all, do you think each of the following issues are?

SHOWCARD 1, READ OUT, CHOOSE RANDOM STARTING POINT, ONE ANSWER PER ISSUE

	Not at all important	A little important	Somewhat important	Important	Very important	Don't Know	
The economy	1	2	3	4	5	V	(35)
Cost of living	1	2	3	4	5	V	(36)
Health	1	2	3	4	5	V	(37)
Education	1	2	3	4	5	V	(38)
Terrorism	1	2	3	4	5	V	(39)
Species loss	1	2	3	4	5	V	(40)
Pollution	1	2	3	4	5	V	(41)
Affordable energy	1	2	3	4	5	V	(42)
Poverty	1	2	3	4	5	V	(43)
Ocean health	1	2	3	4	5	V	(44)
Climate change	1	2	3	4	5	V	(45)
Safe available food	1	2	3	4	5	V	(46)

Q.3 Do you consider where you live as being in a coastal area?

	(47)
Yes	1
No	2

Q.4 Do you think that changes to the marine environment affect you, personally?

READ OUT, SINGLE CODE

	(48)
No affect on me	1
Some affect on me	2
Major affect on me	3

Q.5 Approximately how far do you live from the coast?

CAN ANSWER IN EITHER KILOMETRES OR MILES BUT NOT BOTH. IF LESS THAN 1 ENTER AS 0.

USE LEADING ZEROS E.G. 24 = 024

Kilometres	OR	Miles							
<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>				(49-51)	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>				(52-54)

Q.6 Approximately how often during the last year did you visit the seaside or coast anywhere on the island of Ireland? This can include daily walks on a local beach or coast (including promenades) plus any other trips. Please also include visits to coastal areas in Northern Ireland but not visits to other nations.

SINGLE CODE, PROBE TO PRECODES.

	(55)	
Everyday	1	CONTINUE
5 days a week	2	CONTINUE
Twice a week	3	CONTINUE
Once a week	4	CONTINUE
Once a month	5	CONTINUE
6-10 times in the year	6	CONTINUE
2-5 times in the year	7	CONTINUE
Once	8	CONTINUE
Not in the past year	9	Go to Q.9

ASK ALL WHO HAVE VISITED SEASIDE OR COAST AT LEAST ONCE IN THE PAST YEAR (CODE 1-8 IN Q.6)

Q.7a Have you been to a beach anywhere in Ireland or Northern Ireland in the past 12 months?

	(56)	
Yes	1	CONTINUE
No/can't recall	2	Go to Q.8

ASK ALL WHO VISITED A BEACH IN THE PAST 12 MONTHS (CODE 1 IN Q.7a)

Q.7b Can you tell me the location of the beach you visit most often? If you don't often go to the beach, where was the last beach you visited?

INTERVIEWER: MAKE SURE TO WRITE NAME OF BEACH IN A READABLE FORMAT USING CAPITAL LETTERS.

Name of Beach:

IF NAME OF BEACH NOT KNOWN ASK:

Q.7c What is the name of the nearest town or village to the beach you are thinking of?

INTERVIEWER: MAKE SURE TO WRITE NAME OF TOWN IN A READABLE FORMAT USING CAPITAL LETTERS.

Name of Town:

ASK ALL WHO HAVE VISITED SEASIDE OR COAST AT LEAST ONCE IN THE PAST YEAR (CODE 1-8 IN Q.6)

Q.8 Approximately, how many trips have you undertaken for the following marine or coastal based activities in the past year in Ireland? This can include trips where you personally or someone you were with did this activity.

READ OUT AND ROTATE ORDER.

ALL ACTIVITIES MUST BE ANSWERED - IF RESPONDENT HAS NOT DONE THIS ACTIVITY IN IRELAND DURING THE LAST YEAR, WRITE IN 000.

IF RESPONDENT IS NOT SURE, ASK FOR BEST ESTIMATE/GUESS.

USE LEADING ZEROS E.G. 24 = 024

ROTATE ORDER _____ No. Trips _____

Fishing from seashore				(12-14)
Fishing at sea				(15-17)
Swimming				(18-20)
Wind surfing				(21-23)
Diving				(24-26)
Sea Kayaking				(27-29)
Sailing				(30-32)
Snorkelling				(33-35)
Bird Watching at coast or sea				(36-38)
Walking along coast/sea/beach				(39-41)
Other Boating				(42-44)
Surfing				(45-47)
Kite Surfing				(48-50)
Whale/ Dolphin Watching				(51-53)
Sunbathing				(54-56)
Picnicking				(57-59)
Family Day Trip/entertaining children				(60-62)
Gathering Seaweed				(63-65)
Gathering Shellfish				(66-68)
Other(Please specify)_____				(69-71)

ASK ALL

Q.9a Have you ever worked in any of the following industries?

Q.9b Has anyone else in your household ever worked in any of the following industries?

READ OUT LIST.

	Q.9a Self	Q.9b Other household member
	(57)	(58)
Fisheries	1	1
Aquaculture	2	2
Marine Transport	3	3
Marine-based Oil or Gas Exploration	4	4
None of these	X	X

Q.10a Are you a member of any environmental organisation?

Q.10b Is anyone else in your household a member of any environmental organisation?

	Q.10a Self	Q.10b Other household member
	(59)	(60)
Yes	1	1
No	2	2

Q.11 How often do you eat fish or shellfish?

SINGLE CODE, PROMPT TO PRECODES

	(61)
Never	1
Less often than once a month	2

Once a month	3
Weekly	4
Daily	5

- Q.12 Thinking about coastal waters and beaches in Ireland, how would you rate their condition?
Would you say they are...

SHOWCARD 2. SINGLE CODE.

	(62)
Very poor	1
Fairly poor	2
Neither good nor poor	3
Fairly good	4
Very good	5
Don't know	V

- Q.13 Thinking about deep oceans away from the coast (out of sight of land), how would you rate their condition? Would you say they are...

SHOWCARD 2. SINGLE CODE.

	(63)
Very poor	1
Fairly poor	2
Neither good nor poor	3
Fairly good	4
Very good	5
Don't know	V

- Q.14 Thinking about the importance of the ocean to you personally, how important is the ocean, in each of the following ways?

SHOWCARD 1, READ OUT, CHOOSE RANDOM STARTING POINT, ONE ANSWER PER ISSUE

	Not at all important	A little important	Somewhat important	Important	Very important	Don't Know	
Recreation and tourism	1	2	3	4	5	V	(64)
Trade and shipping	1	2	3	4	5	V	(65)
Weather and climate	1	2	3	4	5	V	(66)
Source of food	1	2	3	4	5	V	(67)
For its scenery	1	2	3	4	5	V	(68)
Producer of energy	1	2	3	4	5	V	(69)
Culture and identity	1	2	3	4	5	V	(70)
Employment	1	2	3	4	5	V	(71)
For creativity	1	2	3	4	5	V	(72)
Education and science	1	2	3	4	5	V	(73)

Q.15 When it comes to managing and protecting the ocean environment, how competent do you think each of the following are?

SHOWCARD 3, READ OUT, CHOOSE RANDOM STARTING POINT

	Not at all competent	A little competent	Somewhat competent	Competent	Highly competent	Don't Know	
Environment groups	1	2	3	4	5	V	(12)
Scientists	1	2	3	4	5	V	(13)
European Union	1	2	3	4	5	V	(14)
Community groups	1	2	3	4	5	V	(15)
Irish government	1	2	3	4	5	V	(16)
Individuals	1	2	3	4	5	V	(17)
County councils	1	2	3	4	5	V	(18)
Private industry	1	2	3	4	5	V	(19)
Irish Marine Institute	6	7	8	9	0	X	(19)

Q.16 In your opinion, to what extent do each of the following pose a threat to the marine environment?

SHOWCARD 4, READ OUT, CHOOSE RANDOM STARTING POINT

	Does not pose any threat	Poses little threat	Poses somewhat of a threat	Poses a threat	Poses a severe threat	Don't know	
Climate change	1	2	3	4	5	V	(20)
Non native species	1	2	3	4	5	V	(21)
Farming	1	2	3	4	5	V	(22)
Aquaculture excluding fishing (i.e. underwater agriculture – growing of aquatic animals or plants of any kind)	1	2	3	4	5	V	(23)
Marine renewables	1	2	3	4	5	V	(24)
Industry pollution	1	2	3	4	5	V	(25)
Litter	1	2	3	4	5	V	(26)
Oil and gas extraction	1	2	3	4	5	V	(27)
Ocean acidification	1	2	3	4	5	V	(28)
Shipping	1	2	3	4	5	V	(29)
Fisheries	1	2	3	4	5	V	(30)

Q. 17 It has been suggested that governments should make plans that specify the different activities that can happen and where they can happen in the sea. To what extent do you agree or disagree with this idea?

SHOWCARD 5, SINGLE CODE

	(31)
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

Q.18 Some people have suggested that governments should designate parts of the ocean as protected areas, in the same way that they do with national parks on land, while others have said this is not a good idea. To what extent do you agree or disagree with this suggestion?

SHOWCARD 5, SINGLE CODE

	(32)
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

ASK ALL – READ OUT THE FOLLOWING TEXT AND MAKE SURE RESPONDENT UNDERSTANDS

We would now appreciate your opinion on the marine environment of Ireland – this involves the use of choice cards.

INTERVIEWER: USE THE EXAMPLE CHOICE CARD (PAGE 2 IN THE CHOICE CARD SET) TO EXPLAIN WHAT IS REQUIRED:

The health of the marine environment is measured using a number of attributes. We have combined these attributes into different scenarios. We ask you to look at a number of choice cards, where you will have 3 choices. For each choice card, please choose one option. Within each choice card there will always be a choice (Choice C) reflecting the status quo in which you will pay nothing. If you choose an alternative, there will be an amount that you as an individual will have to pay annually for 10 years to help protect the marine environment under this alternative. Payment is expected to be made through a ring fenced tax dedicated to protecting the marine environment either through your income tax or VAT. Please consider how much money is available in your budget considering all your other expenses before making your decision. Before you make your choices please let us describe the different attributes that measure the health of the marine environment and the levels associated with them.

a) Marine Biodiversity and Healthy Ecosystem

High levels of biodiversity are often a sign of a healthy well-functioning ecosystem. An area has high biodiversity if there are high numbers of different species (especially high level predators), high numbers of those species and the areas in which they live are protected from damage. Biodiversity and healthy ecosystems in Irish waters are known to be under threat from a variety of human activities (i.e. fishing, pollution, marine construction, etc). Currently, most of the seas and oceans around Ireland are rated as at good status with some areas of moderate and poor status; without protection, it is expected that biodiversity will decrease (less species) and there will be a reduction in the area and number of healthy ecosystems.

b) Sustainable and healthy fisheries

The sea provides a variety of fish species which are both nutritious and tasty. In Irish seas while some fisheries currently have stable populations (e.g. it is sustainable to harvest them) and are safe to eat, other fisheries have been overfished and no longer produce the same yield as in previous years (e.g. it is unsustainable to harvest them). Providing sustainable fisheries may mean closing some fisheries in the short term to allow fish stock to replenish so that they are available both for us in the longer term and for future generations. Management may also be required to ensure fish are healthy and safe to eat.

c) Pollution levels in sea

A variety of polluting substances and litter are known to be entering the seas around Ireland. These pollutants can cause damage to marine environment (e.g. oil slicks), can affect humans by being absorbed through eating fish and can cause harmful algae blooms (e.g. red tides) which can close bathing areas and cause shellfish poisoning. Marine litter can look unsightly and cause damage to marine life. Preventive measures will be needed to reduce the levels of pollution and litter in Irish seas.

d) Non-native species

Marine non-native species are animals and plants that humans transport to Ireland either on purpose or accidentally (attached to ships or in ballast water of ships). There are small numbers of marine non-native species

in Irish marine waters currently. Non-native species are known to cause damage to oyster beds and disrupt ecosystems. Without preventative measures, these species could spread and new non-native species could travel to Irish waters.

e) Physical impacts on the sea

Physical altering of the seabed and changing flows can cause damage to habitats on which various marine species depend and also may cause pollution by stirring up pollutants which were buried in the seabed. Different human activities in the sea and on the coast can change the sea bed and the flows of tides and currents. Underwater noise caused by sonar, ships propellers and construction within the marine environments can also cause disturbance to fish populations and induce stress in marine mammals that use sonar like whales and dolphins. It is expected that some of these activities will increase in the future which is expected to cause more changes to the sea bed and flows. Management of these activities will be needed to prevent significant damage to the marine environment.

ASK ALL

Q.19 How much of what I just told you about the marine environment around Ireland did you know beforehand?

SINGLE CODE, READ OUT.

	(33)
I knew none of what I have been told	1
I knew very little	2
I knew half of it	3
I knew most of it	4
I knew everything	5

Q.20 How well do you think you understand this issue now?

SINGLE CODE. READ OUT.

	(34)
I do not understand it at all	1
I understand very little	2
I understand half of it	3
I understand most of it	4
I understand everything	5

REMOVE EXAMPLE CHOICE CARD

Q.21 Take a moment to reflect on the 5 attributes, I just described. Can you remember what they are and say them back?

DO NOT PROMPT/READ OUT. CODE ALL THAT APPLY. INTERVIEWER: THE RESPONDENT DOES NOT NEED TO SAY EACH ATTRIBUTE BY EXACT WORDING, IT IS ENOUGH THAT HE/SHE CAN DESCRIBE THEM.

	(35)
Biodiversity and Healthy Marine Ecosystem	1
Non-native species	2
Sustainable fisheries	3
Pollution levels in sea	4
Physical Impacts to the Sea	5
None	V

INTERVIEWER: SHOW EXAMPLE CHOICE CARD (PAGE 2 IN THE CHOICE CARD SET) AGAIN:

These are the five attributes that measure the health of the marine environment:

- Biodiversity and Healthy Marine Ecosystem
- Sustainable fisheries
- Pollution levels in sea
- Non-Native Species

- Physical Impacts to the Sea

The final row represents:

- An annual increase in income tax
- To be paid for next 10 years
- The money raised will be ring fenced to fund improvements in Irish marine and coastal waters

EXPLANATION OF HOW THE CHOICE CARDS WORK:

Each choice card has three options shown in three columns: Option A, Option B and Option C

- Each option differs in at least one way and each has a price.
- Option C is always the status quo option with no required payment.
- For each choice card I show you, could you please choose the column that you prefer most out of all three options on the card.

INTERVIEWER INSTRUCTION: PLEASE SHOW THE EXAMPLE CHOICE CARD TO THE RESPONDENT (PAGE 2 IN CHOICE CARD SET) AND GIVE THE RESPONDENT TIME TO EXAMINE IT.

ASK THE RESPONDENT THE FOLLOWING QUESTION AND RECORD THE ANSWER IN THE GRID ON THE BOTTOM OF THE CHOICE CARD PAGE:

Which of the three options do you prefer?

INTERVIEWER, MAKE SURE THE RESPONDENT UNDERSTANDS THE CHOICE CARD EXERCISE BEFORE CONTINUING TO THE NEXT 12 CHOICE CARDS IN THE CHOICE CARD BOOKLET(PAGE 3-14). GO THROUGH THE EXERCISE AGAIN IF NECESSARY.

You will now be presented with a series of similar choice cards and on each choice card you will see three options like the example show cards. I would like you to tell me for each page in the choice card set which of the three options you would choose.

EACH PAGE IN THE CHOICE CARD MUST HAVE A RESPONSE IN THE GRID WHERE IT ASKS ‘REGISTER CHOICE’. CIRCLE ONE CODE ONLY IN EACH GRID ON EVERY PAGE IN THE CHOICE CARD SET. REMIND RESPONDENTS TO TREAT EACH PAGE IN THE CHOICE CARD SET INDEPENDENTLY. AN INTERVIEW WILL NOT BE VALID UNLESS EVERY PAGE ON THE CHOICE CARD HAS A RESPONSE IN THE GRID.

SHOW RESPONDENT THE 12 REMAINING CHOICE CARDS ONE BY ONE AND ASK HER/HIM TO CHOOSE ONE OF THE OPTIONS PROVIDED ON EACH PAGE.

PLEASE NOTE THE CHOICE CARDS MUST BE SHOWN ONE BY ONE AND THE RESPONDENT IS NOT ALLOWED TO LOOK BACK ON PREVIOUS CHOICE CARDS. MAKE SURE TO REGISTER CHOICE ON EACH CHOICE CARD BEFORE PROCEEDING.

MAKE SURE TO ATTACH CHOICE CARD WITH REGISTERED ANSWERS TO QUESTIONNAIRE AND DOUBLE-CHECK THAT EACH PAGE HAS A RESPONSE BEFORE FINISHING INTERVIEW.

PLEASE TRANSFER THE RESPONDENT ID FROM THE QUESTIONNAIRE TO THE CHOICE CARD SET TO ENSURE WE ARE CLEAR IN THE OFFICE WHICH CHOICE CARD SET BELONGS TO WHICH QUESTIONNAIRE.

ASK ALL

Q.22 Thinking back over the choice cards you’ve just gone through, how confident are you about the choices you made?

SHOWCARD 7

	(36)
Not very confident	1
Somewhat confident	2
Fairly confident	3
Confident	4
Very confident	5

Q.23 When making your decision, did you consider all of the different attributes when making your choices or did you ignore any? More specifically, did you... **READ OUT**

INTERVIEWER EACH STATEMENT MUST HAVE EITHER A ‘YES’ OR ‘NO’ RESPONSE

	Yes	No
--	-----	----

	(37)	(38)
....ignore the non-native species attribute	1	1
....ignore the biodiversity & healthy ecosystems attribute	2	2
....ignore the sustainable and healthy fisheries attribute	3	3
....ignore pollution levels in sea attribute	4	4
....ignore the physical impacts attribute	5	5
....ignore the cost attribute	7	7
....consider all attributes when picking an option	8	8

ASK THOSE WHO ANSWERED OPTION C (NO CHANGE) FOR ALL TWELVE CHOICE CARDS

Q.24 You have chosen Option C (status quo) throughout, could you tell us why?

Prompt fully: Any other reasons? What other reasons?

DO NOT READ OUT, CODE ALL THAT APPLY	(39)
I cannot afford to pay	1
I object to paying taxes	2
The improvements are not important to me	3
The "No Change" option is satisfactory	4
The Government/ County Council/EU or other body should pay	5
I don't believe the improvements will actually take place	6
Those who pollute the seas and ocean should pay	7
I didn't know which option was best, so I stayed with the "No Change" option	8
I don't use the sea or marine environment	9
Don't know	0
Other (please specify) _____	X

ASK ALL

Q.25 Do you think that good environmental status in Irish seas should be aimed for?

	(40)
Yes	1
No	2
Don't know	X

Q.26 Based on all the information you have heard so far and again remembering your income and budget, what would be the most that you would be willing to contribute as an annual payment towards achieving good environmental status in the seas around Ireland? SINGLE CODE

SHOWCARD 8

	(41)		(42)		(43)
Nothing/€0	1	€25	1	€100	1
€1	2	€30	2	€120	2
€3	3	€35	3	€150	3
€5	4	€40	4	€200	4
€8	5	€45	5	More than €200	5
€10	6	€50	6		
€12	7	€55	7		
€15	8	€60	8		
€18	9	€70	9		
€20	0	€80	0		

INTERVIEWER: RESPONDENT MUST ANSWER THIS QUESTION!

ASK ALL

Q.27 Do you think on average other people in Ireland would be willing to pay towards achieving good environmental status in Irish waters?

	(44)	
--	------	--

Yes	1	CONTINUE
No	2	GO TO Q.29

ASK IF YES AT Q.27 (CODE 1 IN Q.27)

Q.28 How much do you think on average each person would be willing to contribute as an annual payment?
SHOWCARD 9

	(45)		(46)		(47)
		€25	1	€100	1
€1	2	€30	2	€120	2
€3	3	€35	3	€150	3
€5	4	€40	4	€200	4
€8	5	€45	5	More than €200	5
€10	6	€50	6		
€12	7	€55	7		
€15	8	€60	8		
€18	9	€70	9		
€20	0	€80	0		

**ASK ALL WHO SAY THEY WOULD BE WILLING TO PAY €1 OR MORE AT Q.26.
ALL OTHERS GO TO Q.30**

Q.29a Would you prefer to pay more towards certain areas or let policymakers decide how to target the funds?

USE SHOWCARD 6 (map)

The map below shows the Irish territorial waters outlined in black. We want to know whether you would prefer your contribution to be targeted at a particular marine area or all Irish seas. The different choices of marine areas are the Irish Sea, Celtic Sea, Atlantic Ocean or all Irish Seas.

All Irish waters are outlined in the thick black line. Irish Sea is to the east (right) of the island of Ireland shaded dark grey. The Celtic Sea is to the south of the island of Ireland shaded light grey. The Atlantic Ocean is to the west (left) of the island of Ireland and is shaded mid grey.

	(48)	
Direct 100% of your payment to all of seas around Ireland (policymakers will decide how to target funds)	1	Go to Q.30
Direct a percentage towards a certain sea/ ocean	2	CONTINUE

**ASK ALL WHO PREFER TO DIRECT A PERCENTAGE TOWARDS A CERTAIN SEA/OCEAN
(CODE 2 AT Q.29a)**

Q.29b What percentage would you like to direct towards each sea/ocean?

USE SHOWCARD 6 (map)

READ OUT. TOTAL MUST ADD TO 100%

USE LEADING ZEROS E.G. 24 = 024

Irish Sea	<input type="text"/>	<input type="text"/>	<input type="text"/>	% (49-51)
Celtic Sea	<input type="text"/>	<input type="text"/>	<input type="text"/>	% (52-54)
Atlantic Ocean	<input type="text"/>	<input type="text"/>	<input type="text"/>	% (55-57)
	1	0	0	%

ASK ALL

Q.30 We would also like to give you the option of contributing some of your time towards helping towards achieving good environmental status in Ireland's seas (perhaps by volunteering for beach clean up duties, educating school children on the importance of our marine environment, coastal erosion prevention works, marine wildlife conservation, etc).

Approximately how many hours a year would you be willing to help out?

Number of hours per
year

USE LEADING ZEROS E.G. 24 = 024

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(58-60)

Q.31. If given the choice, would you prefer to contribute some of your time or would you prefer to pay any of the tax amount mentioned earlier?

	(61)
Would prefer to contribute time	1
Would prefer to pay	2

FINALLY, I WOULD LIKE TO ASK A FEW QUESTIONS ABOUT YOUR HOUSEHOLD.

Q.32 Including you, how many people are there in your household in the following age groups:

USE LEADING ZEROS, E.G. 04 FOR 04 PEOPLE

	NO. OF PEOPLE		
a) Below 5 years old			(62-63)
b) Between 5-15 years old			(64-65)
c) Between 16-60 years old			(66-67)
d) Over 60 years old			(68-69)

Q.33 Could you please indicate the letter that best describes your total personal income per year (whether from employment, pensions, state benefits, investments or any other sources) before deduction of tax.

SHOWCARD 10

IF RESPONDENTS DO NOT WANT TO DISCLOSE THEIR INCOME REMIND THEM THAT IT WILL BE KEPT CONFIDENTIAL.

INTERVIEWER -THIS QUESTION HELPS US TO CLASSIFY RESPONDENTS AND IS VERY IMPORTANT SO PLEASE REASSURE RESPONDENT. HAND THEM THE SHOWCARD AND ASK THEM TO READ OUT THE LETTER IF THEY DON'T WANT TO SAY THE MONETARY AMOUNT.

	(70)
A) Less than €10,000	1
B) €10,001 – €20,000	2
C) €20,001 – €30,000	3
D) €30,001 – €40,000	4
E) €40,001 – €50,000	5
F) €50,001 - €60,000	6
G) €60,001 - €70,000	7
H) €70,001 - €80,000	8
I) €80,001-€90,000	9
J) €90,001 - €99,999	0
K) €100,000+	X
L) Refused	V

11. European Attitudes Towards Marine and Coastal Environments (Potts et al., 2016)

Question	Categories	Scoring
Q.1 How concerned, if at all, are you about each of the following issues?	Pollution, Poverty, Climate change, The economy, Terrorism, Food safety and availability, Health and education, Affordable energy, The cost of living, Loss of species, The health of the world's oceans.	Not concerned (1) to very concerned (5)
Q.2 Now, please indicate to what extent do you agree or disagree with the following statement. The oceans are so large, it is unlikely that humans will cause lasting damage to them		Strongly agree, tend to agree, neither agree / disagree, tend to disagree, strongly disagree.
Q.3 Thinking about coastal waters and beaches in your country, how would you rate their condition? Would you say it is ..		Very good, fairly good, neither good nor poor, fairly poor, very poor, don't know.
Q.4 Thinking about deep oceans away from the coast (out of sight of land), how would you rate their condition? Would you say it is ...?		Very good, fairly good, neither good nor poor, fairly poor, very poor, don't know.
Q.5 In your opinion, how much of a threat, if any, does each of the following pose to the marine environment? Please use a scale of 1 to 5.	Oil and gas extraction, Pollution from industry, Farming, Fisheries, Shipping, Aquaculture (fish and shellfish farming), Marine renewable energy, Climate change, New or introduced species, Litter Ocean acidification,	Does not pose a threat (1) to severe threat (5).
Q.6 How important is the ocean to you as in individual, in each of the following ways? Please use a scale of 1 to 5 where 1 means it is not at all important and 5 means it is very important.	Recreation and tourism, as a source of food, for trade and shipping, for employment, as a producer of energy, as a part of your culture and identity, for education and science, for creativity, for its scenery, for the weather and climate.	Not at all important (1) to very important (5).
Q.7 When it comes to managing and protecting the ocean environment, how competent do you think are each of the following? Please use a scale of 1 to 5 where 1 means not at all competent and 5 means highly competent:	The European Union (EU), National Government, Local authorities, Environmental groups, Private Industry, Scientific organisations, Community organisations, Individuals (you, family, friends etc)	Not at all competent (1) to highly competent (5).
Q.8 Some people have suggested that governments should designate certain parts of the ocean as protected areas, in the same way that they do with national parks on land, whilst others have said this is not a good idea. To what extent do you agree or disagree with this suggestion?		Strongly agree, Tend to agree, Neither agree nor disagree, Tend to disagree, Strongly disagree, don't know.

Question	Categories	Scoring
Q.9 It has also been suggested that governments should make plans that specify the different activities (e.g. fishing, recreation etc.) that can happen and where they can happen in the sea, and many governments are looking at making these plans. To what extent do you agree or disagree .		Strongly agree, Tend to agree, Neither agree nor disagree, Tend to disagree, Strongly disagree, Don't know.
Q.10 What do you think should be the top priorities for the development of marine and coastal areas? Please select two answers from the list below.	Conservation and protection Energy production, Food production, Education and science, Recreation and tourism, Infrastructure and ports, Other, None of these, Don't know	Select two.
Q.11 When buying seafood (fish or shellfish), to what extent, would each of the following influence your purchase? Please use a scale of 1 to 5 where 1 means it would definitely not influence your purchase and 5 means it would definitely influence your purchase.	Information about whether or not the fish is endangered or overfished, A label that indicates the product is environmentally friendly, Information about the origin of the fish, Information about how the fish was caught.	Would not influence (1) to would definitely influence (5).
Information about distance from the coast, age, gender, region, educational level and country was also collected.		

12. The Irish Citizen Engagement: Ocean Survey (EU Mission, 2020)

This survey is open to all citizens on the island of Ireland and should take no more than 10 minutes to complete. The aim of the survey is to help us understand people's opinions and levels of awareness of oceans, seas, coastal and inland waters. The results of the survey will be used to inform the development of a major flagship 'mission' to be funded by the European Union under the forthcoming Horizon Europe programme (2021-2027). The mission will bring together funding, expertise, stakeholders and citizens to help restore our ocean and waters.

Please answer as many questions as you can as honestly as possible. Your responses will be treated anonymously. Thank you for your valuable contribution.

1. Which of these statements best describes how often, if ever, you visit the coast or the sea?

- Once a week or more often
- Once every 2 or 3 weeks
- Once a month
- Once every 2 or 3 months
- One or twice a year
- Never

2. Please indicate whether you or any member of your household works in any of the following professions/industries associated with the marine environment.

Select all that apply

- Shipping / maritime transport
- Port or port-based activity
- Marine/coastal tourism & recreation
- Fisheries / Aquaculture / Seafood
- Offshore renewable energy
- Offshore oil/gas
- Dredging / marine aggregates
- Marine planning, regulation, governance
- Marine environmental protection
- Marine Research
- Marine policy
- Coastal management
- Other (please specify)
- None of the above

3. In the past 6 months, which, if any, of the following marine water-based activities have you engaged in?

Select all that apply

- Sailing
- Rowing/kayaking/canoeing
- Power boating (outboard/inboard engine)
- Sea fishing (from shore or boat)
- Surfing / Body boarding
- Stand-up paddle boarding
- Windsurfing / Kite surfing
- Scuba diving / snorkelling
- Jet skiing
- Sea swimming
- Pier diving
- Beach walking
- Coasteering
- Sea/coastal bird/wildlife watching
- Other (please specify)
- None of the above

4. How would you rate your knowledge of the ocean, coastal and inland waters?

- High
- Good
- Medium
- Limited
- None

5. From the following list, please select the three issues that concern you most. (Max choices: 3)

- Ocean current changes
- Melting sea-ice
- Sea level rise
- Coastal flooding
- Changes in the frequency of extreme weather events (e.g. storms)
- Environmental impacts of aquaculture (fish or shellfish farming)
- Overfishing
- Effects of marine invasive species
- Oceans becoming more acidic
- Sea temperature changes
- Destruction of habitats at the coast or in the sea
- Pollution at the coast or in the sea
- Coastal erosion
- Changes in the distribution of marine wildlife
- Increased jellyfish blooms/swarms
- Ocean current changes

6. Please indicate what you think of the following statement: The ocean is being damaged by human actions

- Strongly agree
- More or less agree
- Neither agree nor disagree
- More or less disagree
- Strongly disagree
- Don't know

7. Please indicate what you think of the following statement: More action is needed to improve the health of the ocean

- Strongly agree
- More or less agree
- Neither agree nor disagree
- More or less disagree
- Strongly disagree
- Don't know

8. Please indicate what you think of the following statement: There is sufficient teaching about the ocean and inland waters in our schools

- Strongly agree
- More or less agree
- Neither agree nor disagree
- More or less disagree
- Strongly disagree
- Don't know

9. Please indicate what you think of the following statement: The health of the ocean and my health are connected

- Strongly agree
- More or less agree
- Neither agree nor disagree
- More or less disagree
- Strongly disagree
- Don't know

10. Please indicate what you think of the following statement: The ocean, seas and inland waters have the potential to support economic growth and the generation of new jobs

- Strongly agree
- More or less agree
- Neither agree nor disagree
- More or less disagree
- Strongly disagree
- Don't know

11. Prior to undertaking this survey, please select from the list below, which items you were aware of (i.e. had heard of or had some knowledge about)

Select all that apply

- The European Commission's proposed Mission for Healthy Oceans, Seas, Coastal and Inland Waters
- The 'Real Map' of Ireland's marine territory
- SeaFest – Ireland's largest annual maritime festival
- The United Nations (UN) Decade of Ocean Science for Sustainable Development (2021-2030).
- UN Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- The European Green Deal
- The EU Marine Strategy Framework Directive
- Harnessing Our Ocean Wealth – Ireland's integrated marine plan

12. The following Irish state agencies and cross-border bodies have a full or partial role in managing, regulating, protecting, monitoring, mapping and/or studying Ireland's marine waters and territory and inland waters (note, list is not exhaustive). Please select those you are aware of or have heard about previously

Select all that apply

- The Sea Fisheries Protection Authority
- The Environmental Protection Agency
- Bord Iascaigh Mhara
- Waterways Ireland
- The Marine Institute
- Inland Fisheries Ireland
- The National Parks and Wildlife Service
- Geological Survey Ireland
- The Commissioners of Irish Lights

13. Please select the top 3 sources you use to receive factual information. (Max choices: 3)

- Television
- Newspapers
- Books
- Radio
- Internet
- Social Media
- Scientific Publications
- Government Reports
- Media Streaming Services (Netflix / Amazon Prime / Now TV)

- Interactive TV services via the 'red button'
- Magazines
- Word of mouth (family/friends/colleagues)

14. Please select the top 3 types of event in terms of how effective they are in informing Irish citizens about the ocean, seas, coastal and inland waters (Max choices: 3)

- Festivals
- Community Environmental Events
- Exhibitions
- Talks/Seminars
- Online webinars
- Media Events

15. In your opinion, how important to society in general is the collection of marine environmental data?

- Very important
- Somewhat important
- Of limited importance
- Not important at all
- Don't know or don't understand the question

16. In your opinion, how important to society in general is a high-resolution map of the ocean seabed?

- Very important
- Somewhat important
- Of limited importance
- Not important at all
- Don't know or don't understand the question

17. If you had to decide which climate change and marine policy issues should be prioritised by the European Union, which three would you select from the list below? (Max choices: 3)

- Researching climate change impacts at the coast or in the sea
- Developing technologies to remove carbon dioxide from the atmosphere
- Improving coastal defenses to help prevent coastal flooding and erosion
- Enabling coastlines to respond naturally to rising sea levels
- Increasing the amount of energy from low carbon sources
- Reducing the amount of fish that can be caught at sea to allow fish populations to recover
- Strengthening commitments to safeguard habitats and marine life
- Tightening controls over commercial activities allowed in the sea (e.g. oil rigs or sand extraction)
- Tightening controls over chemicals that can be released into the sea
- Reducing greenhouse gas emissions from ships
- Agreeing on international commitments to cut greenhouse gas emissions
- Creating a circular economy to reduce waste and marine pollution
- Regulating the production, use and disposal of plastic to reduce marine plastic pollution
- Increasing the protection and conservation of the marine environment through establishment of Marine Protected Areas

18. There is currently no dedicated European agency for the ocean and seas. Do you think it would be a good idea to establish a 'European Ocean Agency'?

- Yes
- No
- Don't know

19. The European Commission is seeking a suitable name for the Mission on Healthy Oceans, Seas, Coastal and Inland Waters. If you are interested in suggesting a name, please do so in the space provided below. Note: the name should be catchy, memorable, meaningful and reflect the importance level of ambition of the Mission.

20. How old are you?

- 18-25
- 26-35
- 36-45
- 46-55
- 56-65
- 66+

21. What is your gender?

- Male
- Female
- Prefer to not specify

22. Approximately, how far do you live from the coast?

- Less than 1km
- Between 1km and 5km
- Between 5km and 10km
- Between 10km and 50km
- >50km

13. Development of the International Ocean Literacy Survey: measuring knowledge across the world (Fauville et al., 2019).

Q.	C.	V2
Q1	1a	Which statement is the most accurate:
Q1_1		The water in the Pacific Ocean will never reach the Indian Ocean
Q1_2		Water in Pacific Ocean will eventually reach all other parts of the world ocean
Q1_3		The water in the North Atlantic Ocean will eventually move throughout the Northern Hemisphere, but cannot move to the Southern Hemisphere
Q1_4		The water in the Gulf of Mexico can never reach the Pacific Ocean
Q2	3a	Which statement is true:
Q2_1		The ocean covers 70% of the Earth's surface
Q2_2		The land covers 70% of the Earth's surface
Q2_3		The ocean and the land each cover 50% of the Earth's surface
Q2_4 ^ψ		The ocean covers 10% of the Earth's surface
Q3	1b	How deep is the deepest part of the ocean?
Q3_1 ^ψ		500 meters
Q3_2 ^ψ		1000 meters
Q3_3		6000 meters
Q3_4		11,000 meters
Q4	1c	Ocean circulation is influenced by (select all that apply):
Q4_1		Satellites
Q4_2		The shapes of ocean basins
Q4_3		Adjacent land masses
Q4_4		Acidity of the ocean
Q5		By which process does the ocean lose heat that it absorbs from solar radiation?
Q5_1		Precipitation
Q5_2		Condensation
Q5_3		Evaporation
Q5_4		Sublimation
Q6	1d	How is sea level measured?
Q6_1		Average depth of the ocean
Q6_2		Average height of the ocean relative to the land
Q6_3		Level of the ocean at the lowest tide
Q6_4		Level of the ocean at the highest tide
Q7	1e	Which of these statements is TRUE?
Q7_1		Seawater freezes at a lower temperature than freshwater
Q7_2		Seawater freezes at the same temperature as freshwater
Q7_3		Seawater freezes at a higher temperature than freshwater
Q7_4		Seawater cannot freeze

Table A1. (Continued).

Q.	C.	V2
Q8	1e	Approximately how much of the Earth's water is in the ocean?
Q8_1 ^ψ		Very little
Q8_2 ^ψ		A small amount
Q8_3		About half of it
Q8_4		Almost all of it
Q9	1f	Which is the most accurate statement about the water in the Earth's water cycle?
Q9_1		Much of the same water has been traveling through the water cycle for millions of years
Q9_2		Water joins the water cycle when new water is made through condensation
Q9_3		Water leaves the water cycle through evaporation
Q9_4 ^ψ		All of the water in the water cycle is liquid
Q10	1f	Water moves from the ocean to the atmosphere to the land and back again to the ocean by a process called:
Q10_1 ^ψ		Watershed
Q10_2 ^ψ		Hurricane
Q10_3 ^ψ		Cyclone
Q10_4 ^ψ		Tsunami
Q10_5		Water cycle
Q11	1f	What connects the ocean to all of Earth's water reservoirs? Select all that apply
Q11_1		Sublimation
Q11_2		Precipitation
Q11_3		Evaporation
Q11_4		Deposition
Q12	1g	Rivers supply most of the salt to the ocean. The salt comes from:
Q12_1		Seafloor reactions
Q12_2		Eroding land
Q12_3		Volcanic emissions
Q12_4		The atmosphere
Q13	1g	Which of the following are transported by rivers from watersheds to estuaries and to the ocean? Select all that apply
Q13_1		Nutrients
Q13_2		Salts
Q13_3		Sediments
Q13_4		Pollutants
Q14	1h	Which statement is the most accurate?
Q14_1		There is one ocean, it is large, and it has enough resources to support the growing human population
Q14_2		When resources are depleted from one ocean, we can always find them in another ocean
Q14_3		There are many oceans and they can each replenish themselves
Q14_4		There is one ocean, it is large, it is finite, and the resources are limited

Q15	1 h	What is one example of an ocean resource at risk of being depleted?
Q15_1		Fishes and invertebrates.
Q15_2		Wave energy
Q15_3		Sand
Q15_4 ^ψ		Salt
Q17	2c	Which statement is the most accurate?
Q17_1		The sand present on most beaches has probably been there for 100 years
Q17_2		Sand on the shoreline is constantly moving and being redistributed by waves and currents
Q17_3		Sand on the shoreline is constantly moving and being redistributed by animals that live there
Q17_4		The sand present on most beaches has probably been there for 10,000 years
Q18	1d	What processes cause changes to sea level? Select all that apply
Q18_1		Movement of Earth's crust
Q18_2		Ice caps melt and grow
Q18_3		Seawater expands and contracts when it warms and cools.
Q18_4		Coastal erosion
Q19	2e	What naturally influences the physical structure and landforms of the coast? Select all that apply
Q19_1		Sea level changes
Q19_2		Changing salinity of the seawater
Q19_3		Tectonic activity
Q19_4		Forces of waves
Q20	3a,b	Imagine there are two cities of the same size that are at the same latitude (same distance north or south of the equator). One is on the coast, and the other is 200 km inland. On average, which of the following conditions would you expect? Choose the best answer
Q20_1		The coastal city will have hotter summer temperatures and cooler winters
Q20_2		The inland city will have cooler summer temperatures and warmer winters
Q20_3		The coastal city will have cooler summer temperatures and warmer winters
Q20_4		Temperature is not affected by distance from the ocean.
Q21	3a,b	What is the difference between weather and climate? Choose the best answer
Q21_1 ^ψ		Weather and climate are the same
Q21_2		Weather is what is happening right now, and climate is what happens over many years
Q21_3		Climate is what is happening right now, and weather is what happens over many years
Q21_4		Weather is everywhere while climate is local

Table A1. (Continued).

Q.	C.	V2
Q22	3b	If Earth did not have an ocean, what would the surface temperatures on Earth be like?
Q22_1		Would surface temperatures be:
Q22_2		More extreme than they are now
Q22_3 ^ψ		More uniform around the globe
Q22_4		About the same as today
Q23	3c	We don't have enough information to know what would happen
Q23_1		What is the most common impact of an El Niño year?
Q23_2		The salinity of the ocean water changes
Q23_3		The temperature of the ocean gets colder
Q23_4		There are significant temporary changes in global weather.
Q24	3c	There are significant permanent changes in global weather.
Q24_1		El Niño originates from which ocean basin?
Q24_2		Atlantic
Q24_3		Indian
Q24_4		Arctic
Q24_5 ^ψ		Pacific
Q25	3d	Southern
Q25_1		Most rain that falls on land originally evaporated from:
Q25_2 ^ψ		The tropical ocean
Q25_3		The polar ocean
Q25_4		The temperate ocean
Q25_5		The Great Lakes
Q26	3f	The ocean nearest the land where it fell
Q26_1		The ocean has a significant influence on climate change by absorbing, storing, and moving what? Select all that apply
Q26_2		Salts
Q26_3		Carbon
Q26_4		Heat
Q27	3 g	Fresh water
Q27_1 ^ψ		In what way is global warming impacting the Arctic?
Q27_2		Humpback whales populations are decreasing
Q27_3 ^ψ		Polar ice is decreasing
Q27_4 ^ψ		Mountain glaciers are growing larger
		Arctic fish populations are increasing

Q28		What is one possible impact of a warming Arctic?
Q28_1		Less snow and ice, causing more solar energy to be absorbed by the Earth's surface
Q28_2		Less snow and ice, causing less solar energy to be absorbed by the Earth's surface
Q28_3		Decrease in sea level
Q28_4		Less fresh water available to coastal communities
Q29		The uneven heating of Earth's surface causes the temperature of the ocean to vary with latitude. Which of the following maps is correct if 1 represents the warmest ocean water and 3 the coldest ocean water?
Q29_1		Image 1
Q29_2		Image 2
Q29_3		Image 3
Q29_4		Image 4
Q30	4a	The accumulation of oxygen in Earth's atmosphere was necessary for life to develop and be sustained on land. Where did this oxygen originate?
Q30_1		Oxygen was already there when the Earth was formed
Q30_2		All oxygen originated from photosynthetic organisms on land
Q30_3		All oxygen originated from photosynthetic organisms both on land and in the ocean
Q30_4		All oxygen originated from photosynthetic organisms in the ocean
Q31		What produces most of Earth's oxygen?
Q31_1		Tropical Rain Forests
Q31_2		Photosynthetic organisms in the ocean
Q31_3 ^ψ		Respiration from marine animals
Q31_4 ^ψ		Decomposition of dead plants and animals
Q32	4b	Where did the first life on Earth evolve?
Q32_1 ^ψ		In the desert
Q32_2		In the ocean
Q32_3		Under rocks on high mountains
Q32_4 ^ψ		In the atmosphere
Q33	5a	What is the largest animal ever to live on Earth?
Q33_1		Giant squid
Q33_2 ^ψ		Elephant
Q33_3		Blue whale
Q33_4		Tyrannasaurus rex
Q34	5b	Which types of living things are there the most of in the ocean?
Q34_1		Fish
Q34_2		Plankton
Q34_3 ^ψ		Animals with shells
Q34_4 ^ψ		Whales and seals
Q34_5 ^ψ		Sharks

Table A1. (Continued).

Q.	C.	V2
Q35	5c	How large is the variety of living things in the ocean compared to other environments?
Q35_1		More in the ocean than in forests
Q35_2		Equally in the ocean and in the jungle
Q35_3		Less in the ocean than in the forests
Q35_4 ^ψ		Equally in the ocean and in the desert
Q36	5e	Both land and ocean provide space for animals and other organisms to live. How much of Earth's living space is found in the ocean?
Q36_1		Only a little bit
Q36_2		About half
Q36_3		A little more than half
Q36_4		Nearly all
Q37	5e	In the ocean living organisms are found (select all that apply):
Q37_1		At the surface
Q37_2		In the water column
Q37_3		On the seafloor
Q37_4		In the tidal zone
Q38	5f	Which of the following influences the vertical distribution of organisms in the open ocean?
Q38_1		Amount of time exposed to air
Q38_2		Crashing waves
Q38_3		Light levels
Q38_4		Human activity
Q39	5 g	What is the source of energy for primary productivity in ocean ecosystems where there is no sunlight?
Q39_1		Chemical energy
Q39_2		Wave energy
Q39_3		Nuclear energy
Q39_4		Cold fusion
Q40	5 h	What is the main cause of vertical zonation patterns along the shore that influence the distribution and diversity of organisms?
Q40_1		Sunlight
Q40_2		Salinity
Q40_3		Tides
Q40_4		Trampling by people

Q41	5i	The marine habitat that provides the most important and productive nursery areas for many marine and aquatic species are:
Q41_1		Regional seas
Q41_2		The deep sea
Q41_3		Rivers
Q41_4		Open ocean
Q41_5		Estuaries
Q42	6b	Which of the following statements are true about how humans depend on the ocean? Select all that apply
Q42_1		It provides us with food and medicine
Q42_2		It provides us with mineral and energy resources
Q42_3		It provides us with transportation and jobs
Q42_4		It benefits our economy
Q42_5		It is important to our national security
Q43	6b	Which statement about eating animals from the ocean is true?
Q43_1		All kinds of ocean animals are endangered, so no one should eat any ocean animals
Q43_2		Some populations of ocean animals are declining, so people should choose carefully what to eat
Q43_3		In the ocean, only whales and dolphins are declining so it is OK to eat fish
Q43_4		There are plenty of all the kinds of ocean animals that people normally eat
Q44	6d	What statement about ocean acidification is the most accurate?
Q44_1		Burning fossil fuels adds carbon dioxide to the atmosphere, which is then absorbed by the ocean and increases its acidity
Q44_2		Human caused pollution adds toxic chemicals to the ocean that increases its acidity
Q44_3		Fertilizers used in agriculture are washed into the ocean by rainfall and this increases the acidity of seawater
Q44_4		Ocean currents and other natural cycles are constantly changing the acidity of the ocean around the world
Q46	6d	Humans affect the ocean in a variety of ways. What does human development and activity often lead to? Select all that apply
Q46_1		Pollution.
Q46_2		Physical changes to beaches
Q46_3		Changes to ocean chemistry
Q46_4		Increased frequency of tsunamis
Q47	6e	What will be the most immediate effects of climate change on the ocean? Select all that apply
Q47_1		Changes to ocean chemistry
Q47_2		Changes to sea level
Q47_3		More oil spills
Q47_4		Changes in sea surface temperatures

Table A1. (Continued).

Q.	C.	V2
Q48	6f	Most humans live:
Q48_1		Near rivers
Q48_2		In rural areas
Q48_3		In coastal areas
Q48_4 ^ψ		In inland areas
Q49	7a	About what percentage of the ocean has been explored to date?
Q49_1		5%
Q49_2		25%
Q49_3		50%
Q49_4		75%
Q49_5		90%
Q50	7d	Fewer ocean scientists go to sea to conduct their research than in the last century. They rely more on satellites, buoys and unmanned submersibles. What impact is that having on our understanding of the ocean: Select the best answer
Q50_1		It improves our understanding because the new technology can collect vastly more data than scientists on ships can
Q50_2		It decreases our understanding because scientists don't collect data with their own hands
Q50_3		It decreases our understanding because the technology isn't very reliable
Q50_4		It improves our understanding because it eliminates human error

14a. Application of Marine Citizenship in Sustainable Marine Management in the UK: Education (McKinley, 2010).

Student Questionnaire

Gender: Male Female

Section 1: Marine Knowledge

Term Familiarity

Please identify which of these terms you are familiar with i.e. indicate by ticking the correct box whether they are terms you know and understand, terms you have heard of but do not know what they mean or if you have never heard of them.

	Know and Understand	Heard of but do not understand	Have never Heard term
1. Ecosystem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Biodiversity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Coral Bleaching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Over fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Climate change	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Sea Level Rise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Coastal erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Exclusive Economic Zone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Integrated Coastal Zone Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Marine Bill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Citizenship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. No-Take Zone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Short Marine Quiz

Underline the correct answer in each sentence

a) Ocean fisheries are affected by:

climate change red tides over-fishing all of the above

b) Most sea life:

lives in the top 500ft of the ocean lives on the sea floor lives in the great ocean basins
 is evenly dispersed through the ocean depths

c) The movement of cold, nutrient rich water to the surface of the ocean is referred to as:

upwelling southern oscillation trade winds
 reversal tide

d) The transportation of sediment along the coast is known as:

sediment drift across coast drift longshore drift

e) By catch refers to:

regular fish caught by nets over fishing fish that are harvested, but not sold or kept for personal use
 a climate phenomenon

Have you heard of the following groups?

Marine Conservation Society WWF Marine Stewardship Council UNESCO DEFRA Crowne Estate

Indicate which of the following designations you have heard of:

SSSI (Site of Special Scientific Interest) MPA (Marine Protected Area)
No-take Zone AONB (Area of Outstanding Natural Beauty)
RAMSAR World Heritage Site

Section 2: Marine Education

1. How would you say you get your information about the marine environment?

School TV Internet Peers Radio Newspaper or Magazines Other

2. Have you watched the following programmes?

Planet Earth Blue Planet Oceans South Pacific
Spring watch

3. To what extent are marine and coastal issues covered in school?

0 1 2 3 4 5
Not at all Extremely

4. To what extent do you think you are provided with enough information to help you make appropriate decisions with regard to the marine environment?

0 1 2 3 4 5
Not at all Extremely

5. How informed do you think you are about issues currently facing the marine and coastal environment?

0 1 2 3 4 5
Not at all Extremely

6. How much impact do you think your day to day activities have on the marine and coastal environment?

0 1 2 3 4 5
Not at all Extremely

7. Do you consider the marine and coastal environment when shopping for food, ordering food or buying other goods?

0 1 2 3 4 5
Not at all Extremely

8. Do you take part in any hobbies linked to the marine and coastal environment?

Yes No

If yes, please specify?

9. From your own experiences, do you think that there is a threat to the marine and coastal environment?

Yes No

Section 3: Concern

1. How would you rate your awareness of problems facing the marine environment?

0 1 2 3 4 5
Not at all Extremely

