TURNING THE TIDE

Findings from Reframing Research on Ocean Health & Marine Conservation in the United Kingdom

A FrameWorks Strategic Brief

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Authors

Rose Hendricks, PhD, Researcher
Andrew Volmert, PhD, Director of Research

FRAMEWORKS INSTITUTE

CALOUSTE GULBENKIAN FOUNDATION
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Why Do the Ocean and Marine Conservation Need New Frames?

The ocean* plays an essential role in the functioning of our planet. But right now, threats including climate change, overfishing and pollution jeopardise the health of the ocean and, in turn, the planet. Scientists, policy experts and advocates recognise the serious implications of these threats and the need to take concerted, collective action to improve the state of the ocean. Yet the UK public lacks a full understanding of the state of ocean health and the actions needed to improve it. As a result, there isn't public demand for the major policy changes needed to protect ocean health and support marine conservation; the issue simply has not yet risen to the top of policymakers' agenda.

To build public demand, marine experts and advocates need a new communications strategy – a way of reframing the issue that deepens public understanding of ocean health and builds support for the systemic solutions that can improve it. This report lays out the core components of such a strategy. It describes evidence from mixed-method, empirical research about what frames work – what frames don't – and why. This research, sponsored by the Calouste Gulbenkian Foundation, builds on earlier research that explored how the UK public thinks about the ocean and how existing ways of thinking impede and/or facilitate understanding of the ocean.[1]

* In this report, we refer to 'the ocean', by which we mean the interconnected system of Earth's oceanic waters, regardless of geographic location.

This report outlines the findings from a series of interrelated investigations aimed at identifying framing tools and techniques that can shift the public discussion. Its purpose is to review the evidence base behind the recommendations emerging from this project. We hope our transparent approach to the research, our methods and our findings will help scientists, policy experts and advocates trust our recommended reframing techniques, adopt them and share them with like-minded colleagues. While this report focuses on findings and evidence, the more applied products to follow – a 'playbook' and toolkit – will help those communicating about the ocean to understand what to do in practice to know how to turn this research into clear communications dos and don'ts.

Taken together, the findings point to a broader strategy for effectively communicating about the ocean and marine conservation. This overarching strategy foregrounds the concept of ocean *health* (a productive 'deep metaphor') and emphasises *temporal change* – the ways in which the ocean was different in the past and will change in the future. This strategy builds on existing but inconsistent tendencies in the field. In this report, we explain how these two key components are threaded through specific frame elements, such as metaphors, values and issue frames, and why they are so effective in shifting public thinking. The playbook and toolkit will build on these insights and show how to consistently and effectively execute the *Changing Health* frame.

What Does Reframing Need to Accomplish?

This report presents findings from the second, prescriptive phase of our research process in which we developed framing tools and strategies to expand public understanding of the ocean and marine conservation, cultivate productive attitudes toward the issues and increase support for evidence-based policies. This research builds on our earlier, descriptive research in which we 'mapped the gaps' between expert and public thinking on these issues.

At the beginning of this second phase of research, we identified a set of reframing 'tasks' based on the communications challenges identified in the first phase of research. This set of tasks served as a to-do list as researchers developed reframing tools. In particular, we set out to develop communications strategies that can:

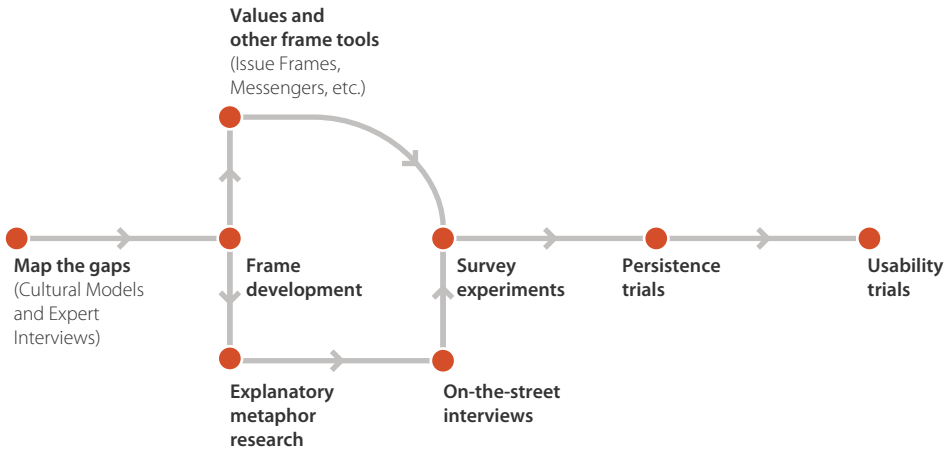
1. Generate understanding of the ocean's critical role in human health and the existence of the planet.
2. Broaden public understanding of ocean pollution and increase support for policies to curb it.
3. Create public understanding of the function of marine protected areas (MPAs) and increase support for strengthening them.
4. Generate support for efforts to make the fishing industry more sustainable.
5. Create a sense of public responsibility for ocean health.
6. Cultivate a sense of collective efficacy about marine conservation.

To develop and test framing strategies capable of accomplishing these tasks, FrameWorks researchers used a series of methods drawn from Strategic Frame Analysis®. Below, we outline these methods and present findings from this research, identifying framing strategies and tools that can accomplish each of the above tasks. We present key evidence from qualitative and quantitative research in support of these findings and interpret the results to offer insight into why these framing strategies work and how to use them to accomplish the above tasks.

How Did We Identify Effective Frames?

To identify effective ways of talking about the ocean and marine conservation, FrameWorks researchers developed a wide range of potential frames and tested 1. effectiveness with members of the UK public, and 2. usability with marine experts. These methods are described briefly below and the process is shown in Figure 1. For a fuller description of methods, see Appendix A.

Figure 1: Reframing Research Process



FRAME DEVELOPMENT

After specifying the reframing tasks outlined above, FrameWorks researchers brainstormed potential reframing strategies and tools that we hypothesised might accomplish one or more of these tasks. After generating a list of candidate reframes to test, researchers solicited feedback on these reframes from the Calouste Gulbenkian Foundation and a panel of experts to ensure

that the frames were both apt and potentially usable for those working in the field. Based on this feedback, researchers chose a set of frames to bring into empirical testing and refined the wording and presentation of these frames.

ON-THE-STREET INTERVIEWS

The first method for empirically testing the potential frames was on-the-street interviews. We conducted 49 interviews in London and Cardiff in December 2017. In these one-on-one interviews, we tested seven explanatory metaphors. We then used an exploratory method to understand how these frames affect how people think and talk about the ocean and MPAs.

SURVEY EXPERIMENTS

The second method for empirical frame testing was a set of two online survey experiments conducted with 8,065 respondents from April to August 2018. For these experiments, we used demographic quotas to render the sample representative of the UK public. In each experiment, respondents were randomly assigned to a message treatment or a null control group. After reading the message (or not, in the case of the null control group), respondents were asked a series of questions designed to measure their understanding of ocean threats, the consequences of marine problems and their support for policies that experts recommend. We measured thinking on each aspect of the issue (e.g., understanding of ocean pollution or support for policies that reduce pollution) with multiple questions that we grouped into separate 'batteries' for the purposes of analysis. The batteries are listed in the table below, along with sample questions from each. See Appendix B for the full set of survey questions.

Table 1: Survey Experiment Outcome Measures

BATTERY	SAMPLE SURVEY QUESTIONS	ANSWERS
Salience of Ocean Health	In your opinion, how serious of a problem is the current state of ocean health?	• Not at all serious; • Slightly serious; • Moderately serious; • Very serious; • Extremely serious
Understanding of Ocean Pollution	Many ocean pollutants are not obvious to the human eye.	• Strongly disagree; • Disagree; • Slightly disagree; • Neither agree nor disagree; • Slightly agree; • Agree; • Strongly agree

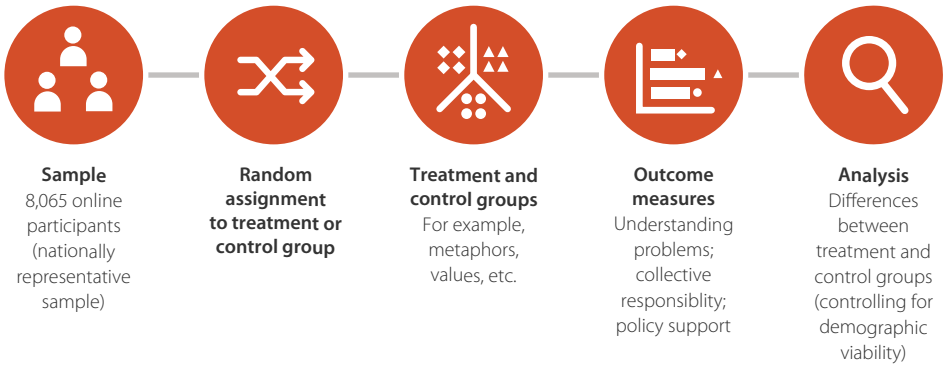
BATTERY	SAMPLE SURVEY QUESTIONS	ANSWERS
Understanding of the Ocean's Effects on Human Wellbeing	Human health is affected by the state of the ocean.	• Strongly disagree; • Disagree; • Slightly disagree; • Neither agree nor disagree; • Slightly agree; • Agree; • Strongly agree
	The state of the ocean affects the economy.	• Strongly disagree; • Disagree; • Slightly disagree; • Neither agree nor disagree; • Slightly agree; • Agree; • Strongly agree'
	How much do you think changes to the ocean affect other things? Please rank the following options so that whatever is most affected by changes to the ocean is at the top and whatever is least affected by the ocean is at the bottom.	• Human health [*goal was to increase ranking*] • The environment [*goal was to increase ranking*] • The economy [*goal was to increase ranking*] • The planet's orbit • Likelihood of earthquakes
Understanding of the Ocean's Role in the Climate System	How big of a role does the ocean play in the climate?	• No role; • A small role; • A medium-sized role; • A large role; • A very large role
Understanding of the Function of Marine Protected Areas	Marine protected areas are designed to do which of the following?	• Protect habitats for sea life [*correct answer*] • Keep beaches clean and beautiful • Protect local fishermen from foreign competition
Collective Responsibility for Improving the State of the Ocean	How much of a responsibility do you think we, as a society, have to improve the state of the ocean?	• No responsibility at all; • A very small responsibility; • A small responsibility; • A moderate responsibility; • A large responsibility; • A very large responsibility; • An extremely large responsibility
Collective Efficacy about Improving the State of the Ocean	In your view, how much can we do, as a society, to improve the state of the ocean?	• Nothing at all; • A very small amount; • A small amount; • A moderate amount; • A large amount; • A very large amount; • An extremely large amount

BATTERY	SAMPLE SURVEY QUESTIONS	ANSWERS
The questions in the following three batteries were preceded by the instruction, 'Please tell us how much you favour or oppose each of the following policies'.		
Support for Policies that Reduce Pollution	Put in place a plastic bottle deposit programme that requires people to pay an additional charge any time they buy a drink in a plastic bottle.	• Strongly oppose; • Oppose; • Slightly oppose; • Neither favour nor oppose; • Slightly favour; • Favour; • Strongly favour
Support for Policies that Strengthen Marine Protected Areas	Expand the size of existing marine protected areas.	• Strongly oppose; • Oppose; • Slightly oppose; • Neither favour nor oppose; • Slightly favour; • Favour; • Strongly favour
Support for Policies that Make Fishing More Sustainable	Tighten quotas for fishing so that the fishing industry cannot take as many fish from the ocean.	• Strongly oppose; • Oppose; • Slightly oppose; • Neither favour nor oppose; • Slightly favour; • Favour; • Strongly favour
Open-Ended Questions	In your view, what should be done to improve the state of the ocean?	
	In your opinion, what are some ways that the ocean affects people?	

In these two experiments, we tested values, explanatory metaphors, temporal frames and issue frames (which were tested on their own and with different messengers). For all closed-ended questions, frame effects – the effects of different treatment conditions on various outcomes – were determined through regression analysis, which identifies statistically significant differences in responses between each treatment group and the control group. This analysis also controlled for potential demographic differences between groups. A statistical significance level of $p<0.05$ (meaning there is less than a 5 percent probability that the observed difference is due purely to chance) was used to determine statistically significant differences between treatment and control groups. When we found significant differences between a treatment and the control condition, we inferred that the frame likely caused the difference. In such cases, we further explored the effects of that frame by examining additional evidence, including results on other closed-ended measures, findings from qualitative methods and consistency with our hypotheses.

For open-ended responses, WMatrix, a quantitative corpus analysis tool, was used to detect words and semantic domains that were used more frequently by participants in each treatment group relative to the control group.[2] When we found that terms or categories were used more or less frequently by participants who received a particular treatment than by those in the control group, we inferred that the frame was responsible for this difference. As with the closed-ended responses, we explored these differences in open-ended responses in the context of other evidence in order to gain a more holistic understanding of how the frame in question shapes thinking about the issue.

Figure 2: Experiment Design Graphic



PERSISTENCE TRIALS AND PEER DISCOURSE SESSIONS

The third method used to empirically test frames was persistence trials. Persistence trials are a group-based method in which pairs of participants are asked to discuss and communicate a metaphor to one another in conversational discourse. This method enables us to learn more about how explanatory metaphors affect people's thinking and are communicated in social discourse.

We conducted six sessions, testing one of two metaphors (*Planet as a Body* and *Planet as a Machine*) in each. A total of 36 people participated (six in each trial). These sessions were held in London and Edinburgh in October 2018. Participants were recruited to vary across a range of demographic characteristics including race, education, political ideology, age and gender.

After persistence trials concluded, we conducted brief, 30-minute peer discourse sessions with the six participants who had participated in each persistence trial. These sessions were used to examine how members of the public understand and process specific versions of the general metaphor explored in the persistence trial (*Physiotherapy* as a specific version of *Body* and *Machine Repair* as a specific version of *Machine*) for thinking about marine protected areas.

USABILITY TRIALS

The fourth and final method for testing frames was usability trials. Usability trials are a group-based method in which two experts are asked to use a metaphor to communicate with members of the public. This method allows us to test the usability of the metaphor for experts and advocates and to refine the ways in which the metaphor is best used. By observing how marine specialists used the metaphor – and, in particular, when they applied the metaphor with ease and when they struggled to use it – we were able to better understand the metaphor's strengths and limitations and further refine recommended language to increase usability.

Which Frames Worked, and Which Didn't?

The findings below are organised by type of framing tool or strategy. We review, in order:

- Explanatory Metaphors
- Values
- Temporal Foci
- Issue Frames
- Messengers

Each tool, or frame element, has a different function. For example, explanatory metaphors compare an issue (such as the ocean's role in the planetary system) to something familiar to help people understand how the process works and unlock new ways of thinking about the it. Values are organising principles that help people understand why an issue matters and inform decision-making. Within a comprehensive reframing strategy, each tool has a specific role to play. Some tools accomplish one specific task, while others accomplish multiple framing functions. As we present findings, we note which task(s) each tool accomplishes.

CONNECTING THE OCEAN TO OTHER DOMAINS: EXPLANATORY METAPHORS

Explanatory metaphors are framing tools that enable people to reason about an issue in a different way. Explanatory metaphors compare a target issue to something more familiar to help people better understand how the target issue works. At the beginning of the prescriptive research process, FrameWorks researchers identified task #1 – generating an understanding of the ocean's critical role in human health and the function of the planet – as a task that explanatory metaphors are well equipped to address. While the public understands, in a vague way, that the ocean is part of a larger set of

interconnected natural systems, this understanding does not enable people to understand the nature or scope of threats to ocean health, nor does it lead to productive thinking about solutions. We hypothesised that a metaphor could help members of the public understand the interconnectedness of natural systems – and the ocean's role within these systems – in more concrete ways that support systemic thinking about solutions. In turn, we predicted that a greater understanding of what needs to be done and why might encourage support for the kinds of policies that experts recognise as essential.

We also identified task #3 – which includes increasing public understanding of the function of MPAs – as a task for explanatory metaphors. Experts highlight the need to expand MPAs and more consistently enforce protections within them, yet the public has limited knowledge of what they are or how they can improve the state of the ocean. We predicted that explanatory metaphors could increase understanding of what MPAs are and how they work and, in so doing, increase support for policies that would strengthen them.

Given the hypothesised value of metaphors for these two tasks, FrameWorks researchers developed two sets of metaphors – one to explain the ocean's role in the planetary system and another to explain the function of MPAs. In several cases, we identified domains that seemed apt for addressing both tasks. For example, we developed a metaphor for task #1 that compared the planet to a body and a metaphor for task #3 that compared MPAs to physiotherapy. The *Body* domain also provided the opportunity to adapt and retest *Climate's Heart* in the United Kingdom. Prior FrameWorks research found this metaphor helped Americans think and talk about the role of the ocean within the climate system.[3]

Our first metaphor test took place in on-the-street interviews. We tested seven explanatory metaphors – four about the role of the ocean within the planet (*Body, Internet, Building* and *Climate's Heart*) and three about MPAs (*Physiotherapy, Support Beams* and *Blue Belt* (a term the field currently uses). (See Appendix A for all messages tested.) Although it was not possible to pair each metaphor explaining the role of the ocean within the planet (Task #1) with one explaining MPAs (Task #3), we did design two pairs that used the same general domain: (1) *Body* and *Physiotherapy* and (2) *Building* and *Support Beams.* Our analysis revealed that *Body, Climate's Heart*, and *Physiotherapy* enhanced understanding and supported solutions thinking. Participants also readily understood and applied *Blue Belt* as a way of understanding MPAs. By contrast, the limitations of *Internet, Building* and *Support Beams* metaphors outweighed their strengths. Participants struggled to make sense of the comparison between buildings and the internet, which are understood as static and abstract, with the dynamic and tangible ocean.

In addition to *Blue Belt,* we brought the three body-related metaphors forward for quantitative testing, and we explored a new domain – machinery. We developed a *Machine* metaphor for the general task and a *Machine Repair* metaphor for the more specific one to increase

understanding of and support for MPAs. With the exception of *Blue Belt*, each metaphor tested was either body-related (*Planet as a Body, Climate's Heart* and *Physiotherapy)* or machine-related (*Planet as a Machine* and *Machine Repair*).

Explanatory Metaphors Tested in the Survey Experiment

Metaphors for Task #1: Generating an understanding of the ocean's critical role in human health and the existence of the planet.

Planet as a Body: The planet is made up of a set of interconnected and interdependent parts, just like the human body. In the body, an injury or illness in one part can lead to problems in others. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of the body, what happens in each part affects the others.

Climate's Heart: The ocean regulates the climate system the way your heart regulates the flow of blood throughout your body. The heart sustains the body by controlling the circulation of blood, making sure the right amount gets to all parts of the body – not too much and not too little. The ocean acts as the climate's heart, sustaining the climate by controlling the circulation of things like heat and humidity.

Planet as a Machine: The planet is made up of a set of interconnected and interdependent parts, just like a finely tuned machine. If one part of a machine is out of alignment, this affects how the whole machine functions. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of a machine, what happens in each part affects the others.

Metaphors for Task #3: Creating public understanding of the function of marine protected areas and increasing support for strengthening them.

Blue Belt: Marine protected areas can form a 'blue belt' that protects nature in the ocean, just as the 'green belt' protects nature on land. In the UK, the green belt limits new construction in certain areas to protect the natural environment. In the same way, a blue belt can protect the natural environment in the ocean by limiting activities like fishing and industry. In addition, a blue belt of connected marine protected areas would create a safe migration route for fish and other animals, allowing them to survive and thrive.

MPAs as Physiotherapy: Marine protected areas take care of ocean health by allowing the ocean to heal, just as physiotherapy helps injuries heal. If you pull a muscle or strain a ligament, you need to limit certain activities and do specific things to regain strength and stability. In the same way, marine protected areas allow the ocean to regain health and strength by limiting activities like fishing and industry. This physiotherapy for the ocean prevents already injured environments and ecosystems from being further strained.

MPAs as Machine Repair: Marine protected areas fix the ocean so it functions well, just as repairing a machine helps it work the right way. If a machine is thrown out of alignment or is dirty or worn out, it needs to be adjusted and cleaned so it remains in good working order. In the same way, marine protected areas put the ocean back in alignment by limiting activities like fishing and industry. This adjustment protects ocean environments and ecosystems from being further strained.

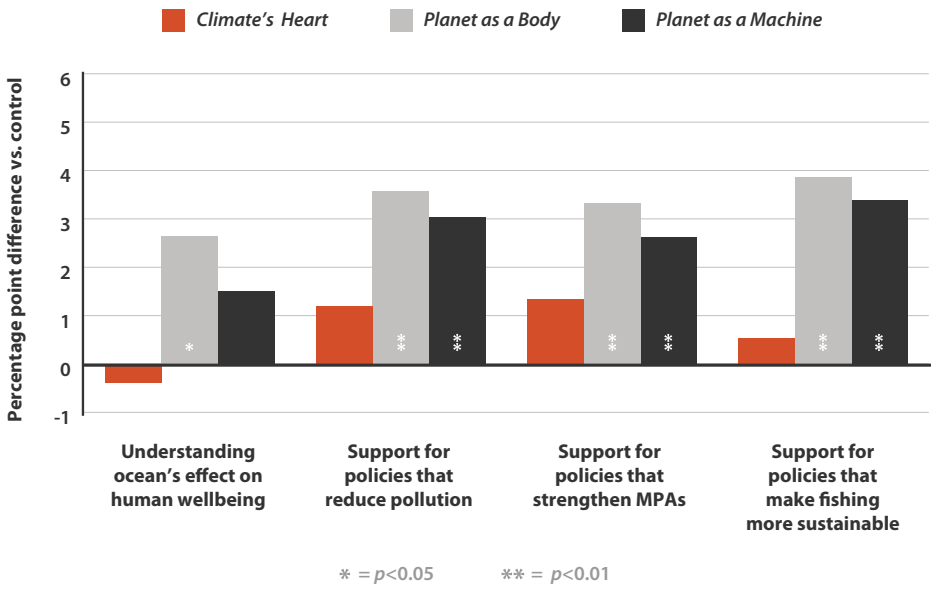
Finding 1

The *Planet as a Body* explanatory metaphor deepens understanding of the interdependencies between the ocean, land and atmosphere and increases support for policy change.

Across qualitative and quantitative methods, we found that the *Planet as a Body* metaphor increases understanding of the ocean's critical role in planetary systems. It does this by tapping into universally accessible, experience-based understandings of the human body. People know that our bodies are complex and interconnected systems. They understand that when one part of the body is unwell, other parts suffer. For example, a knee injury doesn't only affect the knee; it can affect the back, leg muscles and so on. When people use this familiar set of understandings to think about the ocean, they are able to reason productively about the wide-reaching consequences of harm to the ocean.

The ability of the *Planet as a Body* metaphor to deepen understanding of the consequences of ocean threats was evident in the survey experiment, where the metaphor significantly boosted understanding that the ocean affects human wellbeing, as shown in Figure 3. This metaphor also increased people's sense that *all* people – not only those who live in coastal communities – are affected by the state of the ocean (p=0.03; item not depicted on the graph). As Figure 3 shows, the *Planet as a Body* metaphor also had highly statistically significant positive effects in all policy areas tested in the survey experiment.[4]

Figure 3: Effects of Explanatory Metaphors on Understanding and Policy Support



Persistence trials confirmed the power of this metaphor to deepen understanding of the ocean's role and its effects on human life, and analysis of these sessions provides insights into why it is effective and how it can best be used. The effectiveness of the *Planet as a Body* metaphor is due, at least in part, to facilitating more holistic and systemic thinking about the ocean and the things that threaten it. Members of the public were able to easily grasp and apply the idea that harm to ocean health puts a 'strain' on other parts of the planet. They connected the concept of knock-on effects, familiar in the domain of human health, to the planet, inferring that an unhealthy ocean would lead to many other negative consequences in other planetary systems.

Once the *Planet as a Body* metaphor unlocked systemic thinking about the *problem*, participants in persistence trials frequently took this understanding one step further and recognised that this systemic problem requires systemic solutions. These sessions help explain why the metaphor was so effective in shifting policy support in the survey experiment. By enabling people to recognise the consequences of harm to the ocean – and the consequences of ignoring this harm – for the entire planet and for human health, it leads to an increased sense of the importance of taking action. In other words, the metaphor enables people to see that problems will remain and escalate if they aren't addressed, just as human health problems that aren't tended to often cause further illness or injury. Moreover, by helping people see harm to the ocean in systemic terms, rather than as localised, the metaphor boosts understanding of the need for concerted collective action that is systemic and comprehensive. Finally, health is a dynamic and powerful concept that not only conveyed

importance but also cued *spectrum* thinking. In other words, it helped people understand that, though ocean health is declining, it could get worse if we don't act or, if we do, it could gradually improve.

As Figure 3 illustrates, the survey experiment suggested that another metaphor – *Planet as a Machine* – also effectively increased policy support. However, further qualitative research revealed that it is not as effective as *Planet as a Body*. While *Planet as a Machine* significantly increased support in all three policy areas, persistence trials revealed that it is much more limited than the *Body* metaphor in helping people think about links between the ocean and atmosphere. Participants found the comparison between the ocean and a machine hard to work with for several reasons. They tended to think of machines as either functioning or broken, with little room in between. This made it hard for people to think about gradual changes to and incremental differences in the state of the ocean. Further, when a machine breaks, parts can be replaced. Yet, as participants pointed out, neither the ocean – nor its component parts – can be replaced. People's understandings of machine breakdowns did not align well with important points about ocean health; in short, the *Machine* metaphor clouded people's thinking.

Finding 2

The *Planet as a Body* explanatory metaphor is easy to use, sticky and highly communicable.

In on-the-streets interviews, persistence trials and usability trials, participants who received a version of the *Planet as a Body* metaphor used it with ease. The language of the metaphor stuck in people's minds, and the metaphor was easily picked up and passed around in group discourse. This indicates that this metaphor has a strong capacity to enter into and shape public discourse.

The metaphor's stickiness likely results from its intuitiveness. In on-the-street interviews and persistence trials, participants who were exposed to metaphors unrelated to health or bodies sometimes spontaneously talked about the ocean as similar to a human body. This suggests that comparing bodily and planetary systems is intuitive and, therefore, easy to understand. Ideas that are easy to understand are more memorable and ultimately more usable. They 'stick' in the mind and spill into communications.

The *Planet as a Body* metaphor's usability also stems from its flexibility. Participants used it intuitively to talk about a diverse range of goals and points. Members of the public and experts alike drew on a wide variety of body-related language, like health, strength, illness, muscles, tendons and ligaments to explain the ways in which the ocean is in danger and the consequences of ocean threats for humans and the planet. The following quotes provide examples of how participants used the *Body* domain in creative ways.

On-the-Street Interview Participant: *It's like putting bad foods into your body. If you put bad foods into your body, your body won't function the way it should.*

Persistence Trial Participant: *The ocean is the largest body part, so it could link to the skin because that's the largest organ of the body. If you damage the skin, you can get [an] infection, which could affect whole body.*

Persistence Trial Participant: *If you have a stroke, it affects your eyes, your mouth, sometimes you're not able to walk. And if you have a stroke, you're more likely to get a secondary illness, so you could end up with diabetes or cardiovascular disease, which ultimately leads to death. Now if we turn to the ocean, if we mess with it, for example by putting plastics into the ocean, that affects the mammals and the fish in the ocean, which ultimately will affect the land and us.*

As these quotes demonstrate, the *Body* metaphor encouraged elaboration; people extended it to talk productively about many facets of the issue. This is encouraging. When a metaphor can be used flexibly, it has more opportunities to enter into public discourse and more potential to facilitate productive reasoning in more areas. This metaphor's adaptability is thus a real strength.

In summary, the *Body* domain is easy to use and communicate, sticky and adaptable, suggesting that the *Body* metaphor has significant potential to catch on and work its way into public discourse easily and quickly. Metaphors only shift people's thinking if they are heard or read, so this metaphor's potential to enter public discourse – to become part of how the ocean is talked about – is a significant asset.

Finding 3
***Climate's Heart* showed signs of helping people understand the ocean's role in the climate system.**

Past FrameWorks research found that the explanatory metaphor *Climate's Heart* helped members of the American public think and talk about the role of the ocean within the climate system.[5] It conveys the importance of the ocean within the broader climate system and helps people understand how the ocean regulates climate and how human activity is disrupting the ocean's capacity to do so effectively. In this way, it addresses the public's lack of understanding about what the climate system is, how it works and the ocean's role within it.

Because of the metaphor's effectiveness in the United States, we retested an adapted version of *Climate's Heart* in the United Kingdom. In on-the-street interviews, we found this metaphor helped participants understand the

links between the ocean and the climate system and enabled them to think more productively about some of the ways the ocean affects human health and wellbeing. The following quote provides an example of how participants used *Climate's Heart* to talk about the role and importance of the ocean.

> **On-the-Street Interview Participant:** *Without your heart you can't live, so it's pretty much the same thing. Without the ocean in its optimum state, it'll affect climate in such a negative way that it'll affect us, life-wise.*

As this quote illustrates, hearts are well understood as a crucial component of a crucial system. The comparison of the ocean to the heart not only carries an association of importance but also conveys the idea that the climate is a system, like the circulatory system. The idea that the ocean 'regulates' the flow of heat and humidity, like the heart regulates the flow of blood, made it possible for on-the-street interview participants to grasp the ocean's role in keeping the climate system in balance. The *Climate's Heart* metaphor capitalised on the strengths of the *Body* domain, applying the general *Body* metaphor in a more specific way.

In the survey experiment, *Climate's Heart* did not produce statistically significant effects on the experiment's outcome measures (see Table 1 above). While it is possible that this is an indication that the metaphor does not work as well in the United Kingdom as the United States, we suspect that this is not the case. Because communicating the ocean's role in the climate system was not a primary task for this project, we dedicated most of the survey to other outcomes, which left space for only two questions focusing on the relationship between the ocean and the climate. As a result, these questions were, of necessity, general and not optimised to capture how the metaphor affected thinking. What's more, there were 'ceiling effects' for these questions; the modal response for both questions in the control condition was the response at the far end of the scale. For example, when asked, 'How big a role does the ocean play in the climate?', the most common response was, 'A very large role'. This left little room for movement on these outcome measures, making it difficult to detect any frame effects.

Given the metaphor's effectiveness in on-the-street interviews and in Frameworks' prior research, we believe *Climate's Heart* is likely effective in the United Kingdom for communicating the relationships between the ocean and the climate system.

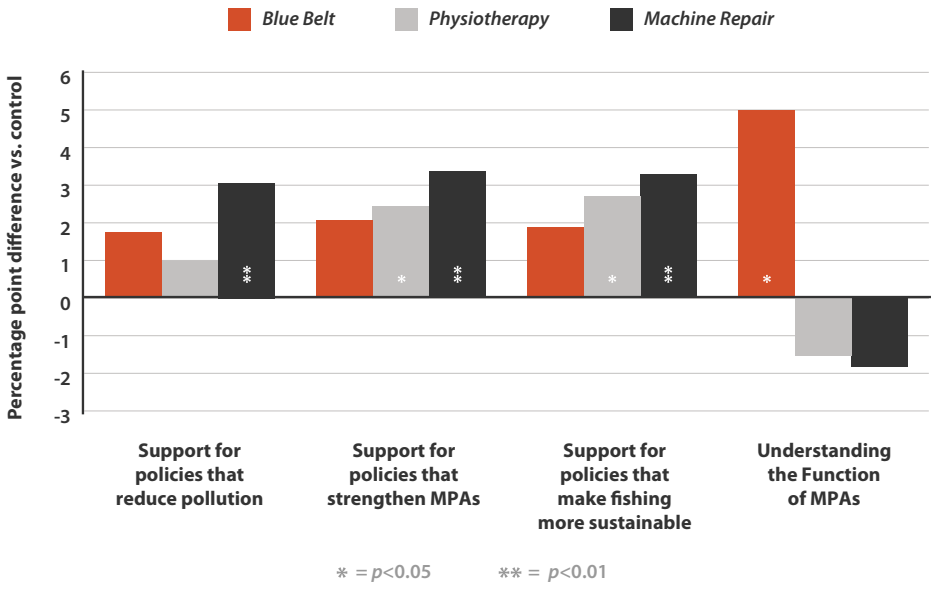
Finding 4

The *Physiotherapy* explanatory metaphor expands understanding of, and support for, marine protected areas.

The *Physiotherapy* metaphor builds on the strengths of the other body metaphors discussed earlier. Consistent with findings relating to these other metaphors, we found that *Physiotherapy* helped people understand and think about MPAs in ways that aligned with expert thinking. By connecting people's understandings of healing to their thinking about the ocean, the metaphor clarified the role that MPAs can play in improving the health of the ocean.

In the survey experiment, participants who read the *Physiotherapy* metaphor were more inclined to support policies to strengthen MPAs (p=0.04), as shown in Figure 4. The metaphor also increased support for related policies that make fishing more sustainable (p=0.019). These represent spillover effects – effects on outcomes that were not directly targeted. These effects likely stem from the metaphor's effectiveness in boosting understanding of the value of collective action to protect the marine environment. By helping people see the value of MPAs, the metaphor enabled people to see the need for other policies to protect the environment.

Figure 4: Effects of Explanatory Metaphors for Marine Protected Areas



It is puzzling, then, that we did not detect an increase in understanding of the function of MPAs as the result of exposure to *Physiotherapy* (as shown in Figure 4). This puzzle disappears when we compare the general way in which the metaphor was iterated in experimental treatments and the more specific knowledge measured by the survey questions about MPAs' function, such as their capacity to make fish migration routes safer. (See Appendix B.)

Qualitative research indicates that *Physiotherapy* increases *general* understanding of MPAs' protective and recuperative functions and enables people to reason productively about their value, but the metaphor itself – the simple comparison with physiotherapy – does not provide information about specific aspects of MPAs. It is thus unsurprising that the general message tested in the experiment did not affect answers to these more specific questions. Metaphors enable people to reason about information in new ways. But this is a useful reminder that, when people lack a basic understanding of the issue, anyone communicating about the issue must provide information *along with* an effective metaphor in order for it to enhance uptake of the information. *Physiotherapy* opens the door to thinking about how MPAs work and why they are important, but it must be accompanied by any specific information that those communicating wish to get across.

As Figure 4 shows, *Machine Repair* also produced statistically significant positive effects on policy support in the survey experiment, but qualitative research revealed that *Physiotherapy* was more effective for communicating about MPAs. In persistence trials, participants understood *Physiotherapy* as a process that permanently restores health, while *Machine Repair* was seen as a temporary fix. In this way, *Physiotherapy* subverted people's fatalism – the sense that nothing can be done to sustainably improve the state of the ocean – but *Machine Repair* did not. By helping people think about how MPAs heal the ocean, *Physiotherapy* enabled people to recognise that MPAs are a practical, realistic and potentially effective solution for many of the threats facing the ocean.

A primary reason that *Physiotherapy* was so helpful for thinking about solutions is that members of the public hold common understandings of physiotherapy. They know that people engage in physiotherapy when they have a problem that could worsen without treatment and that physiotherapy can address physical problems through a combination of rest and intentional action. By emphasising similarities between physiotherapy and MPAs, the metaphor encouraged participants to apply their knowledge of physiotherapy to thinking about the ocean. In doing so, participants inferred that the current state of the ocean is unhealthy and that we must take appropriate action to prevent further deterioration. The metaphor fostered the understanding that MPAs could play a valuable role not only in halting further deterioration but also in restoring ocean health. Members of the public made these connections in both on-the-street interviews and persistence trials.

Another strength of *Physiotherapy* is its flexibility, a trait that was especially evident in usability trials, where experts with unique understandings of MPAs were able to apply the metaphor to talk about different aspects of MPAs. For instance, experts noted that physiotherapy, like an MPA, is not a one-size-fits-all solution. Both address specific and localised problems – whether a shoulder injury or overfished species – with a specialised solution. Further, physiotherapy and protecting certain marine areas can take passive (e.g., avoiding use of a specific body part or designating areas where activity is prohibited) as well as active forms (e.g., exercises or interventions such as replanting coral species).

The effectiveness of *Physiotherapy* affirms the power of language to invoke the foundational concept of *health* and to tap into our experiential understandings of how and why it changes – for better and worse – over time.

Finding 5

The *Blue Belt* metaphor explains the specific migratory function of marine protected areas.

Experts in ocean conservation often talk about how MPAs can and should form a 'blue belt'. The idea is that they can and should form a 'blue belt' of areas that should connect to each other. One benefit of a connected system is that it would allow fish to more safely migrate through the entire belt than if their route passed through unprotected areas.

Because of the popularity of the 'blue belt' term in field communications, we wanted to test it alongside other ways of talking about MPAs. Although 'blue belt' tends to be used as a stand-alone term, our earlier descriptive research suggested that people are highly unlikely to understand this term without an explicit explanation of what a blue belt would look like or why the 'belt' is so important. Because people lack basic information about MPAs, using the term on its own is unlikely to be effective. To improve the metaphor's effectiveness, researchers explicitly compared MPAs to the 'green belt' on land and emphasized why the belt-like nature is important. This resulted in a version of the metaphor that was equitable to the other metaphors we were testing in the explicitness of the comparison.

In on-the-streets interviews, we found that participants were able to relate the *Blue Belt* to the widely known concept of a green belt. The idea of the *Blue Belt* was easily understood because people drew on existing associations between colours and parts of the planet – that 'green' equals 'land' and 'blue' equals 'ocean'. Because many people take the value of land conservation for granted, participants believed that MPAs must also be important. In addition, they could easily visualise the 'belt' as a migratory pathway, making this aspect particularly salient. Given these strengths, we tested *Blue Belt* in the survey experiment to better understand its impact on public thinking about MPAs.

We found that *Blue Belt* increased understanding of one important function of MPAs: that they provide safe routes for fish migration (p=0.003; see Figure 4). This confirms that the field's current practice of using this term to talk about migration is effective. This was, however, the only outcome that *Blue Belt* affected in the experiment. The metaphor did not increase understanding of other functions of MPAs or support for relevant policies, which suggests that its utility may be limited to conveying how MPAs aid fish migration. While the metaphor intuitively highlights the migratory function of MPAs, it does nothing to convey other important features of MPAs, such as their ability to protect or regenerate ecosystems and particular species.

DESCRIBING OCEAN HEALTH OVER TIME: TEMPORAL FOCUS

Successfully addressing the tasks our frames were designed to accomplish requires an overarching understanding that the state of the ocean *can change* and *is changing* in problematic ways. The effective metaphors we tested imply change over time, but they do not explicitly highlight it.

Because of the importance of communicating the changing nature of the ocean, we designed two frames that explicitly focused on this by foregrounding different time horizons. In one, we emphasised changes that the ocean has already undergone (*Past Focus*), and in the other, we focused on changes that are likely to take place in the future, depending on whether we improve marine conservation efforts now (*Future Focus*).

We suspected that the *Past Focus* frame, which focuses on decline in ocean health, might help people recognise the seriousness of the problems we face and, in turn, increase people's sense of urgency about acting and their sense of responsibility (Task #5). We suspected that the *Future Focus* frame, in focusing on the possibility of improvement, might boost people's sense of collective efficacy – the belief that we can make a difference in ocean health (Task #6).

Temporal Frames Tested in the Survey Experiment

Past Focus: The ocean used to be healthy. Throughout history, it has been a key part of the planet's natural environment and has supported our economy and health. But the state of the ocean has worsened dramatically over time. Because the ocean has become less healthy, its ability to support other parts of the environment, the economy and human health has declined. We need to restore the ocean to its past condition.

Future Focus: Our future depends on a healthy ocean. If we improve the health of the ocean, it can function as a key part of the planet's natural environment and it can support both our economy and our health for years to come. If the ocean continues to get worse, the environment, the economy and human health will all be in jeopardy in the coming years. We need to improve the condition of the ocean for the future.

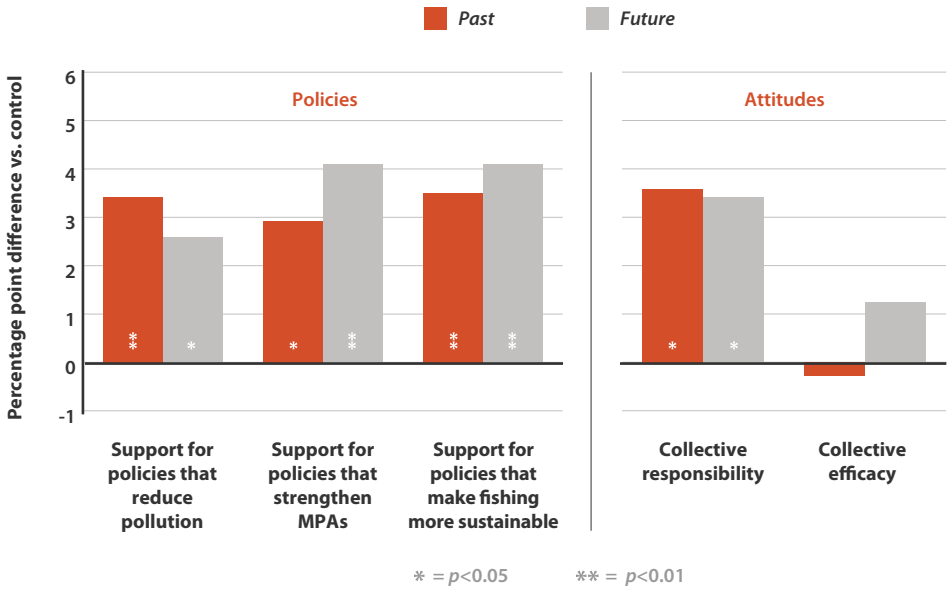
For full message treatments, see Appendix A.

Finding 1

Temporal frames encourage a sense of collective responsibility and increase support for policy solutions.

In the survey experiment, both the *Past* and *Future* frames increased participants' sense of collective responsibility for addressing the issues facing the ocean[6] and their support for all policy types tested,[7] as shown in Figure 5. We hypothesised that drawing attention to the scale of changes that have occurred (through the *Past* frame) might lead people to feel fatalistic and disengage from the topic, but that was not the case. Instead, both temporal frames led to productive thinking about collective responsibility and support for necessary policies.

Figure 5: Effects of Temporal Frames



Because the temporal frames shifted thinking in similar ways, their effectiveness doesn't lie in bringing a specific temporal interval into focus. Contrary to our expectations, the *Past* frame did not generate a greater sense of urgency or responsibility, and the *Future* frame did not significantly affect efficacy. Their similar effects suggest that the simple act of highlighting temporal change is what matters.

Why is temporal framing so effective? One likely reason is that they counter the widespread assumption that the ocean is so large that it is immune to substantive change.[8] By illustrating how the ocean *has* or *will* drastically change, the temporal frames help people see that the ocean's scale does not make it immune to harm and also help people to see the need for action to address and prevent harm.

Notably, the temporal frame messages specifically talked about changes in 'ocean health' and, in doing so, tied together the concepts of *change* and ocean *health*. As noted earlier, the concept of bodily health carries associations of improvement and decline. The *Body* metaphors' temporal component helps make them work. The temporal frames explicitly foreground change over time, and, by linking change and ocean health, they amplify people's implicit, experiential understandings of how health changes over time while leveraging the recognised importance of addressing threats to health. In doing so, they increase the recognition that collective action is critical.

HELPING PEOPLE SEE WHY MARINE CONSERVATION MATTERS: VALUES

Values tap into people's shared commitments and priorities to make a case for why people should care about a particular issue and work to address it. Because values help people understand why an issue matters and provide reasons for action, we expected that values messages would elevate concern for ocean health and lead to a sense that we are responsible for addressing it through effective policies. We thus predicted values would increase people's sense of collective responsibility (Task #5) and support for policies that can improve the state of the ocean (Tasks #3 and #4).

To determine which values to test, we first looked to our prior work on the ocean and climate change in the United States, which found that *Protection* (the importance of taking care of the ocean to protect people from harm) expands understanding of both climate and the ocean and also increases support for systemic policies.[9] We predicted that *Protection* would also be productive in the United Kingdom in addressing the current project's related tasks. In our US research, a message that included elements of three values – *Responsible Management*, *Pragmatism* and *Stewardship* – increased understanding of climate and ocean change. We tested *Stewardship* in the survey experiment for this project because it is a frequently invoked value for communicating

about environmental issues. We also predicted that the temporal component of *Stewardship,* which makes the case for marine conservation by alluding to future generations who need a habitable planet and a healthy ocean, might make this particular value especially effective.

While *Stewardship* makes the case that we must protect the ocean for future generations because *it is not ours,* the value of *Fairness between Generations* makes the case that we should protect the ocean for future generations because it's the *fair* thing to do. Although *Stewardship* and *Fairness* share a similar premise – that we must take action now to ensure that people in the future have a healthy ocean – they provide different reasons *why* this is important, so we tested *Fairness* as well.

To round out a set of values to test, we developed two other value frames – *Self-Interest* and *Scientific Authority*. The *Self-Interest* frame, unlike the other- and future-oriented values of *Stewardship* and *Fairness between Generations*, makes the case for marine intervention by arguing that we all stand to lose from an unhealthy ocean and to gain from a healthy one. The value of *Scientific Authority*, which appeals to scientists' expertise to argue for marine intervention, is worth testing because it is widely used by advocates and experts.

Values Tested in the Survey Experiment

Protection: We need to address threats to our natural environment to protect people from harm. Current changes to the environment threaten people's safety and wellbeing, and we must be vigilant in addressing these threats to protect ourselves against harm. Safeguarding ourselves from environmental threats means protecting the ocean.

Stewardship: We are stewards of the natural environment and have a responsibility to take care of it for future generations. The planet is not ours, but merely in our keeping, and we must pass it on in good condition to those who follow us. Being good stewards of the environment means taking better care of the ocean.

Fairness between Generations: If we want to be fair to future generations, we need to address the issues facing the natural environment. Our actions now affect people later, and if we don't pass on an environment in good condition, this is unfair to those who follow us. We owe it to future generations to protect the ocean environment.

Self-Interest: We need to address the issues facing the natural environment because it's vital for our wellbeing, our economy and our culture. If we damage the environment, we won't be able to fully enjoy what it provides going forward. We need to preserve

the ocean because it is the source of all life and because it provides resources for our economy, supports mental health and is a key part of our culture.

Scientific Authority: We need to follow the guidance of the scientific community and address the issues facing the natural environment. Scientific research has identified specific ways that our environment is being damaged, and we must adopt an evidence-based approach to address this harm. Taking scientists' advice begins with protecting the ocean.

For full message treatments, see Appendix A.

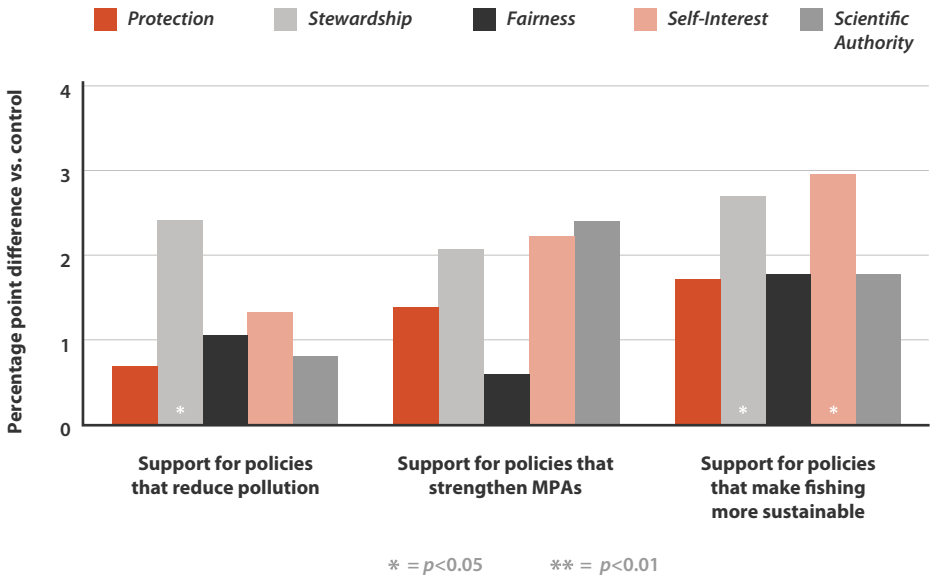
Finding 1

The value of *Stewardship* builds support for policies that reduce threats to ocean health.

A *Stewardship* message emphasises that the planet does not *belong* to us – it does not belong to anyone, any group or even to all people alive today. Instead, it emphasises that we are all responsible for caring for the planet. It communicates that marine conservation is important because we have a duty to make sure the ocean is healthy for future generations.

In the survey experiment, *Stewardship* was more effective than any of the other values tested. It increased support for policies that reduce pollution (p=0.035) and policies that make fishing more sustainable (p=0.02), as shown in Figure 6. While *Self-Interest* positively affected support for policies for sustainable fishing (p=0.01), it did not significantly affect support for pollution policies and its effects on other batteries trended negative. These negative effects were very small and not significant, and certainly do not indicate that it is counterproductive. But the more consistent trend of positive results for *Stewardship* – and its significant positive effects on two different policy batteries – show that this is the more effective value.

Figure 6: Effects of Values on Support for Policies



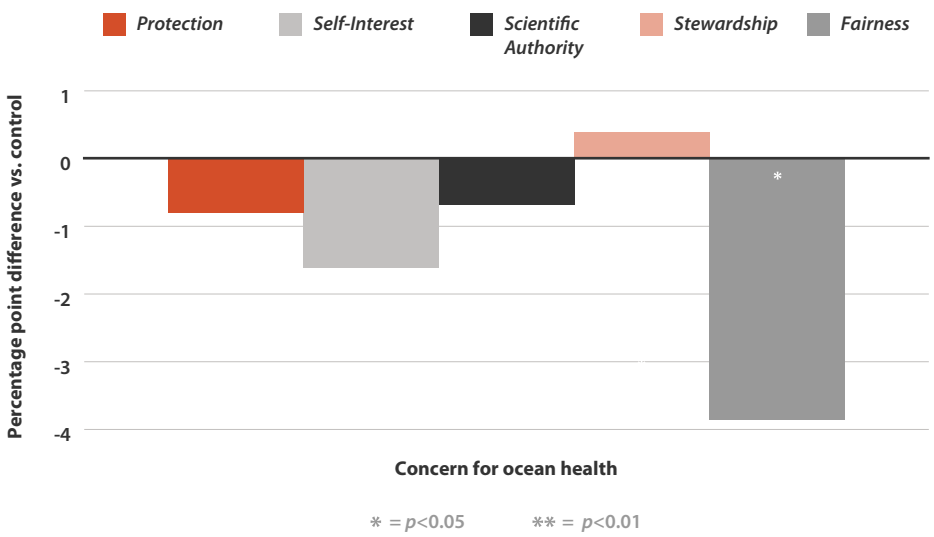
It is notable that *Stewardship* contains language and associations that bring to mind both health and change – the two elements that consistently appeared in effective frames. For example, the idea of 'taking care of' the planet and the ocean applies the relational, human activity of caretaking to the planet, treating it – as does the *Body* metaphor – as a person capable of experiencing wellbeing and injury. And the value's explicit orientation toward future generations demonstrates an obvious temporal dimension.

At this point, we can see an overarching framing strategy coalesce. This frame – which we call *Changing Health* – encourages people to connect their understandings of *health* and *change over time* to the ocean. The effectiveness of *Stewardship* provides further evidence of the importance of these features for increasing understanding of, and support for, protecting the ocean.

Finding 2
The value of *Fairness between Generations* can backfire.

As noted earlier, *Fairness between Generations* and *Stewardship* share an orientation toward the future, and, given the effectiveness of temporal framing, we might expect the two values to perform similarly. However, we found that *Fairness between Generations decreased* participants' concern about the health of the ocean (p=0.007), as shown in Figure 7. This result makes clear that *Fairness between Generations* is a counterproductive frame for conveying the importance of the ocean's health.

Figure 7: Effects of Values on Concern for Ocean Health



Why is *Fairness between Generations* less effective than *Stewardship* and, in fact, counterproductive? We offer two explanations. First, *Fairness* sets up a sharp distinction between those of us who are alive now and those who will be alive in the future. This formulation sets up an 'us vs. them' dichotomy and distinguishes between the two groups' interests. *Stewardship,* by contrast, implicitly connects current and future inhabitants of the planet and highlights our commonalities; as stewards of the planet, we are all responsible for caring for it. No one in particular is called on to care for the planet in the service of others. Instead, we all care for it in the service of all of us. It may be that calling out these connections makes it easier for people to put themselves in the position of future inhabitants.

Second, *Fairness* lacks language that invokes life and health. *Stewardship* leverages the relational language of *caring for* to help people see the need for action to protect the planet, but *Fairness* lacks this productive feature. It may be that without this language, people struggle to see ocean threats and their consequences as concrete problems that demand action.

REDEFINING WHAT MARINE CONSERVATION IS ABOUT: ISSUE FRAMES

Issue frames establish what a topic is actually *about*. For example, one could say that marine conservation is, at its core, an issue of *human health and wellbeing*. Alternatively, marine conservation could be considered to be first and foremost about *the environment*. Experts recognise that there are many dimensions of marine conservation, including, but not limited to, human health and wellbeing and the environment. But in public discourse, one dimension

of a topic – also known as an 'issue-specific' or 'issue' frame – is frequently invoked.[10] Framing research shows that foregrounding particular dimensions of an issue – framing it as a particular *kind* of issue – can dramatically affect public thinking and policy support.[11]

To that end, we tested three issue frames that emphasised different reasons that the ocean is important: *Human Health,* the *Environment* and the *Economy.* We selected these three issue frames because the consequences of poor ocean health for each domain were prominent in our interviews with subject-matter experts during an earlier phase of this project.[12] Because issue frames, like values frames, establish why a problem is important, we predicted that these frames might elevate the importance people attribute to ocean health and marine conservation, and in turn foster a sense of collective responsibility (Task #5), a sense of collective efficacy (Task #6) and support for relevant policies (Tasks #3 and #4).

Issue Frames Tested in the Survey Experiment

Human Health: The ocean is important for human health. It sustains human life by generating oxygen; in fact, it provides most of the oxygen we breathe on land. It is also a major source of food, as many people rely on fish from the ocean to eat. In addition, plants and animals in the sea are sources of medicines that help to treat illnesses like cancer, infections and asthma. The ocean is vital to our health. As a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support human health.

Environment: The ocean is an important part of the environment. It sustains all life on the planet – including animals and plants in the sea – and provides oxygen and food for life on land. It is a key part of the planet's ecosystems, providing a habitat and resources that species need to survive. In addition, it regulates the climate by controlling the flow of heat and humidity. The ocean is vital to our natural environment and the whole planet. As a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support the planet's ecosystems and climate.

Economy: The ocean is important for the economy. It supports key industries, including fishing, tourism and mining. The ocean sustains the economy by providing resources that enable these and other industries to thrive. In addition, the ocean provides a critical transportation route for shipping goods around the world. The ocean is vital to the economy. As a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support economic growth and development.

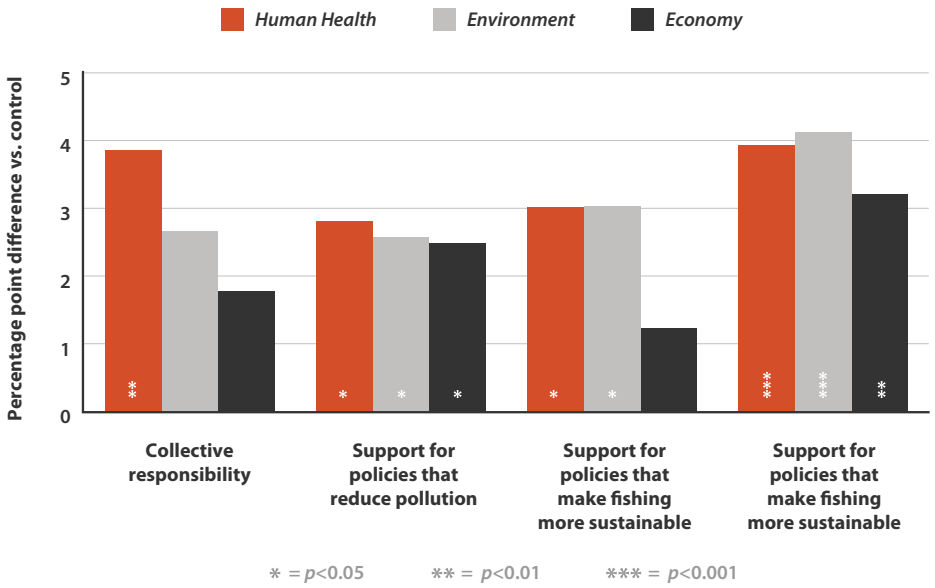
For full message treatments, see Appendix A.

Finding 1

Highlighting the concrete consequences of poor ocean health increases support for policies.

In the survey experiment, all three issue frames were strikingly effective in increasing support for marine conservation policies (see Figure 8). The *Human Health* and *Environment* frames boosted support for all three policy areas, while the *Economy* frame significantly increased support for two of the three policy areas (pollution and sustainable fishing).[13]

Figure 8: Effects of Issue Frames



Responses to open-ended survey questions suggest why these frames were so effective in building support for policy change. In their responses, participants in the *Human Health* condition were more likely to use words like *oxygen*, *health* and *provide(s)* (in reference to the ocean providing both food and oxygen). Those in the *Environment* condition were more likely to use the words *climate* and *wildlife*. And those in the *Economy* condition were more likely to write about *laws* and *tourism* than participants in the control condition. In each case, specific consequences of harm to the ocean stuck with participants. The issue frames helped people move beyond vague assertions that the ocean is important to an understanding of some of the specific ways in which this is so.

The issue frames appear to work by specifying *how* the ocean is changing. By adding specificity to people's understanding of the problem, these frames helped people think about and prioritise the specific solutions included in the policy batteries.

Finding 2

Explaining the effects of the ocean on human health cultivates a sense of collective responsibility for improving the state of the ocean.

Although all issue frames bolstered support for systemic policies, *Human Health* was the only issue frame to increase participants' sense of collective responsibility for addressing threats to the ocean (see Figure 8).

Human Health works by leveraging and filling in an existing understanding. Our earlier research on this project revealed that members of the UK public assume that the ocean is a sustaining force for human wellbeing, but they do not have a clear understanding of how that it so.[14] By filling in this vaguenotion with an account of the ways that our health depends on the ocean – like supplying oxygen, food and medicine – *Human Health* concretises the idea that human beings have an existential stake in ocean health. By explaining how ocean health affects the health of *all* human beings, this issue frame generates the sense that responsibility for improving the state of the ocean is necessarily collective.

VARYING THE VOICES: MESSENGERS

A messenger is a person or group who delivers a message. Although a messenger must convey a specific message, the messenger themself shapes how the message is received and is therefore an important frame element. In the survey experiment, we tested three messengers whose expertise paralleled the issue frames under consideration: a *Medical Professional,* an *Environmental Professional* and a *Business Professional.*

This test was designed to answer two questions. First, does attributing a message to a specific messenger amplify the effectiveness of messages about human health or the environmental or economic consequences of ocean health? Second, does the *alignment* of messenger and message matter? To explore this question, we crossed the *Environment* and *Economic* messages and messengers. That is, we tested each of the two issue frames with an *Environmental Professional* and a *Business Professional* as the messenger. This test tells us whether there are limitations in *who* can effectively use these frames.

We predicted that aligned messengers might amplify the effects we found for the issue frames and that unaligned messengers could undermine effectiveness. Messengers' effects stem in part from their authority on the topic, so, to the extent authority is the key, aligned messengers should enhance the credibility of factual claims while unaligned messengers should not. However, we thought it was also possible that messages might appear *more* credible when coming from an unaligned messenger. In particular, we suspected that a *Business Professional* using an *Environmental* issue frame might lead people to see environmental concerns as a widely recognised problem and counter the public's tendency to see environmental and economic interests in opposition to each other.[15]

In each case, messengers were signalled through the attribution of opinions to a fictional organisation of professionals. The message treatments included fictional quotes from the 'president' of the organisation.

Messengers Tested in the Survey Experiment

Medical Professional: President of the National Association of Medical Professionals

Environmental Professional: President of the National Association of Environmental Scientists

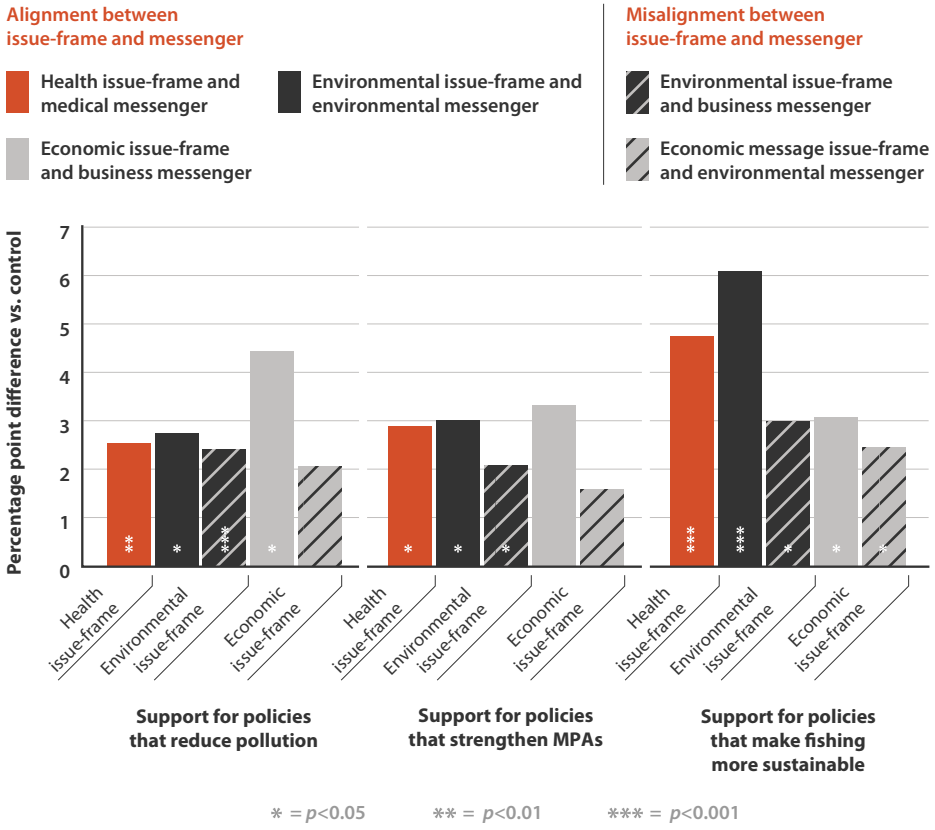
Business Professional: President of the National Association of Business Executives

Finding 1

Alignment between messenger and message can enhance support for collective policies.

We found that alignment between messenger and message was most effective. When issue-specific messages were delivered by messengers with expertise in those issues, they were highly effective in building support across policies (see Figure 9).[16] Unaligned messengers who delivered an issue-specific message were less effective. While messages that were attributed to professionals who weren't experts on the topic of the message were not wholly ineffective, the choice of messenger nonetheless undercut the power of messages that would otherwise be more effective, yielding fewer significant results than the unattributed issue frames shown in Figure 8.

Figure 9: Effects of Issue Frame-Messenger Pairs



It is likely that issue-specific messages with aligned messengers were especially effective in boosting support for policies because the messengers' presumed expertise made the statement seem more credible. This interpretation also explains why messages with unaligned messages were less effective – the messengers lacked credibility on the issue.

Conclusion

The findings presented in this report provide the basis for a cohesive strategy for reframing the public conversation about the ocean and marine conservation. This emerging strategy – the *Changing Health* frame – is animated by the twin concepts of health and temporal change. As we have reviewed, these concepts animate a range of different effective frame elements, such as explanatory metaphors and values, which anyone who communicates about the ocean can use as specific tactics within the broader framing strategy.

Companions to this report – a framing playbook and a toolkit – will model how to put together the various tools discussed here to effectively execute this reframing strategy. We have laid out the evidence for these tools as a contribution to the field's ongoing conversation about how to use communications to ensure we are prioritising marine conservation. We hope these findings and the strategy that emerges from them will encourage members of the field to consider new ways of talking about the ocean and marine conservation.

Appendix A: Methods for Testing Frames

ON-THE-STREET INTERVIEWS

We conducted 49 total interviews in London and Cardiff in December 2017. In intercepting passers-by in public locations to participate in interviews, researchers were attentive to recruiting participants from different demographic groups, although, due to the mode of recruitment, we were unable to use specific demographic quotas. In these one-on-one interviews, we tested seven explanatory metaphors: four about the role of the ocean within the planet (*Body, Internet, Building* and *Climate's Heart*) and three about marine protected areas (MPAs) (*Physiotherapy, Support Beams* and *Blue Belt*). These interviews were video-recorded with written consent from all participants.

In the interviews, researchers began by asking participants a short series of open-ended questions designed to gather information about people's top-of-mind thinking about the ocean. Participants were then read a passage with one of the metaphors and were asked a series of follow-up questions to ascertain whether and how their thinking shifted as a result of exposure to the metaphor.

Researchers analysed the resulting data, looking for patterned ways in which each metaphor affected thinking and talking about the ocean – particularly about threats to the ocean and ways to improve the state of the ocean. The analysis also focused on isolating the reasons *why* each metaphor had its respective effects. Based on the results of this analysis, we brought four metaphors (*Body, Climate's Heart, Physiotherapy* and *Blue Belt*) forward for further investigation in a controlled survey experiment. The results also led us to develop and bring forward two new metaphors for experimental testing: a *Machine* metaphor for explaining the role of the ocean within the broader planetary system and a *Machine Repair* metaphor for explaining the function of MPAs. These metaphors were added to clarify the interdependent nature of the ocean, land and atmosphere, as our analysis revealed that the *Building* and *Internet* metaphors were too opaque to do so. See Appendix B for the experimental survey treatments.

Explanatory Metaphors Tested in On-the-Street Interviews

Body

The planet is made up of a set of interconnected and interdependent systems, just like the human body. When you have a problem in one of the earth's systems, such as the climate or ecosystems, it can cause problems in others, just as injury or illness in one bodily system can lead to problems in others. And because the parts of the planet are connected, like the parts of the body, what happens in the ocean, atmosphere and land all affect each other.

Harm to the ocean affects humans on land, just as an injury to your knee can cause back problems. For example, the ocean is warming, which decreases oxygen in the ocean. This makes it harder for fish to breathe, so many of them die. This harms the health of whole ecosystems and other kinds of fish die, too. Because many people rely on fishing for food and jobs, people's wellbeing and livelihoods are injured. This is just one example of how the systems of the planet's body are connected and how harm to one system affects others.

Internet

The planet is made up of a set of interconnected and interdependent systems, just like the internet is. When you have a problem in one of the earth's systems, such as the climate or ecosystems, it can cause problems for animals and human beings, just as a problem in any part of a network – software or hardware – causes problems for users. And because the parts of the planet are connected, like the internet, what happens in the ocean, atmosphere and land affects the whole planet.

The inhabitants of our planet rely on all its systems working properly, just as internet users rely on its systems. For example, the ocean is warming, which decreases oxygen in the ocean. This makes it harder for fish to breathe, so many of them die. This takes whole ecosystems offline and other kinds of fish die, too. Because many people rely on fishing for food and jobs, people lose access and their wellbeing and livelihoods are affected. This is just one example of how the systems in our planet's network are connected and how harm to one system affects others and all of our planet's users.

Building

The planet is made up of a set of interconnected systems, just like a building. When you have a problem in one of the earth's systems, such as the climate or ecosystems, it can cause problems for animals and human beings, just as a problem in any of a building's systems – like heating, plumbing or electrical systems – causes problems for inhabitants. And because the parts of the planet are connected, like the parts of a building, what happens in the ocean, atmosphere and land affects the whole planet.

The inhabitants of our planet rely on all its systems working properly, just as the inhabitants of a building rely on its systems. For example, the ocean is warming, which decreases oxygen in the ocean. This makes it harder for fish to breathe, so many of them die. This disrupts whole ecosystems and other kinds of fish living nearby die too. Because many people rely on fishing for food and jobs, people living in the area are affected too, and people's wellbeing and livelihoods start to crumble. This is just one example of how the systems of our planet's structure are connected and how harm to one system affects others and all of our planet's inhabitants.

Climate's Heart

The ocean regulates the climate system the way your heart regulates the flow of blood throughout your body. The heart sustains the body by controlling the circulation of blood, making sure the right amount gets to all parts of the body – not too much and not too little. The ocean acts as the climate's heart, sustaining the climate by controlling the circulation of things like heat and humidity.

Physiotherapy

Marine protected areas help the ocean heal, just as physiotherapy helps injuries heal. If you pull a muscle or strain a ligament, you need to limit certain activities and do exercises that help it regain its strength and stability. Without physiotherapy, your injury could get worse. In the same way, marine protected areas allow the ocean to regain health and strength by regulating certain types of human activity, like fishing or industry, that could further strain injured environments and ecosystems. Marine protected areas allow injured areas of the ocean to recuperate and heal so that humans can continue to experience the ocean's cultural and economic benefits for years to come.

Support Beams

Marine protected areas reinforce the ocean's ecosystems, just as support beams or buttresses reinforce a building's structure. If a building's structure has weakened, it must be reinforced with supports to maintain structural integrity. If the building isn't reinforced, the whole structure can crumble. In the same way, marine protected areas reinforce the structure of the ocean's ecosystems by regulating certain types of human activity, like fishing or industry. By doing so, marine protected areas strengthen the structure of our planet's ecosystems and ensure that humans can continue to experience the ocean's cultural and economic benefits for years to come.

Blue Belt

Marine protected areas form a 'blue belt' that protects the ocean environment, just as the 'green belt' protects the environment on land. In the UK, the green belt limits new construction in certain areas and makes sure that the public can enjoy the social, environmental and economic benefits of healthy natural

environments. In the same way, a 'blue belt' can help marine life to flourish by protecting the natural environments necessary for their survival. The 'blue belt' regulates activities like fishing and industry to ensure that marine life can thrive and that humans can continue to experience the ocean's cultural and economic benefits for years to come.

SURVEY EXPERIMENTS

We conducted two online survey experiments in April and August 2018, respectively. They included 4,211 and 3,854 members of the public, respectively, for a total of 8,065 respondents. Respondents were adults (over the age of 18) matched to national demographic benchmarks for age, sex, income, education, race and ethnicity, and political party affiliation.

In each experiment, respondents were randomly assigned to a message 'treatment' or a null control group. The first experiment tested 11 message treatments to understand how exposure to these frames affects public understanding of and opinion about oceans. We tested six metaphors (*Body, Machine, Climate's Heart, Physiotherapy, Machine Repair* and *Blue Belt*) and five values (*Protection, Self-Interest, Scientific Authority, Stewardship* and *Fairness*). In the second experiment we tested two temporal frames (*Past* and *Future*), three issue frames explaining what the issue is about (*Health, Environment* and *Economy*), and five issue-messenger combinations, in which the issue frames mentioned previously were attributed to different messengers (*Health Issue with Medical Messenger*, *Environment Issue with Environmental Messenger*, *Environmental Issue with Business Messenger*, *Economic Issue with Environmental Messenger* and *Economic Issue with Business Messenger*).

After reading the message (or not, in the case of the null control group), respondents were asked a series of questions designed to measure understanding of and attitudes about the ocean and support for recommended policies. Questions were either Likert-type items with five- or seven-point scales, multiple choice questions with three options or, in the second experiment only, open-ended questions. Item order was pseudo-randomised, as described in Appendix B. For the purpose of analysis, questions were presented in 'batteries' (sets of questions related to a common idea). But when participants took the survey, questions were randomised across batteries, such that those belonging to a single battery did not necessarily appear in immediate succession. In the second experiment, the open-ended questions appeared at the end of the survey. See Appendix B for all survey questions.

We used multiple regression analysis to identify differences between the treatment groups and the control group. Regressions controlled for demographic variables and determined statistical significances between the treatment and

control groups. A threshold of $p > 0.05$ was used to determine significance. Significant differences between the treatment and control groups indicated that the messages affected people's opinions.

Treatments Tested in the First Survey Experiment

Explanatory Metaphors

Climate's Heart

The Ocean Is the Climate's Heart: Why We Must Protect the Ocean

The ocean regulates the climate system the way your heart regulates the flow of blood throughout your body. The heart sustains the body by controlling the circulation of blood, making sure the right amount gets to all parts of the body – not too much and not too little. The ocean acts as the climate's heart, sustaining the climate by controlling the circulation of things like heat and humidity.

The ocean is the heart of a circulatory system that moves heat and moisture through all parts of the climate system, including ocean, land and atmosphere. As the heart of this circulatory system, the ocean regulates the climate by helping to control the earth's temperature. By absorbing heat from the sun and emitting it back into the atmosphere, the ocean maintains a regular flow of heat and stabilises the earth's temperature. And ocean currents and winds move heat and moisture to different parts of the world, which keeps the climate stable.

Burning fossil fuels damages the ocean's ability to maintain good circulation of heat and moisture. When we burn fossil fuels, we put a lot of stress on the ocean, which damages its ability to keep the climate stable – so sometimes the ocean pumps too much heat and moisture through the system, sometimes too little. Burning fossil fuels weakens the ocean's ability to regulate the climate system.

Body

The Planet Is like a Body: Why We Must Protect the Ocean's Health

The planet is made up of a set of interconnected and interdependent parts, just like the human body. In the body, an injury or illness in one part can lead to problems in others. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of the body, what happens in each part affects the others.

Just as stress weakens our immune system and leaves us open to other illnesses, stress on the ocean from things like climate change and pollution threatens the whole planet's health. For example, global warming is increasing the temperature of the ocean. Warmer waters cause coral reefs to die. Because coral reefs are habitats for many fish and other marine animals, when coral reefs die, this

harms whole ecosystems. And because coral reefs protect coastal communities from flooding during storms, human beings are affected too. This is just one example of how harm to the ocean hurts the whole planet and human beings.

To protect the health of our planet, we must protect the health of the ocean.

Machine

The Planet Is like a Finely Tuned Machine: Why We Must Keep the Ocean Functioning Properly

The planet is made up of a set of interconnected and interdependent parts, just like a finely tuned machine. If one part of a machine is out of alignment, this affects how the whole machine functions. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of a machine, what happens in each part affects the others.

Just as strain on one part of a machine wears out other parts, strain on the ocean from things like climate change and pollution can throw a spanner in the works. For example, global warming is increasing the temperature of the ocean. Warmer waters cause coral reefs to die. Because coral reefs are habitats for many fish and other marine animals, when coral reefs die, this disrupts whole ecosystems. And because coral reefs protect coastal communities from flooding during storms, human beings are affected too. This is just one example of how harm to the ocean threatens the functioning of the whole planet, including human life.

To keep the planet working properly, we must protect the ocean.

Blue Belt

Marine Protected Areas: Why We Need a Blue Belt

Right now, the ocean environment is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas can form a 'blue belt' that protects nature in the ocean, just as the 'green belt' protects nature on land. In the UK, the green belt limits new construction in certain areas to protect the natural environment. In the same way, a blue belt can protect the natural environment in the ocean by limiting activities like fishing and industry. In addition, a blue belt of connected marine protected areas would create a safe migration route for fish and other animals, allowing them to survive and thrive. By creating a blue belt, we can make sure that the ocean's natural environment is protected for years to come.

Physiotherapy

Marine Protected Areas Are Like Physiotherapy for the Ocean

Right now, ocean health is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas take care of ocean health by allowing the ocean to heal, just as physiotherapy helps injuries heal. If you pull a muscle or strain a ligament, you need to limit certain activities and do specific things to regain strength and stability. In the same way, marine protected areas allow the ocean to regain health and strength by limiting activities like fishing and industry. This physiotherapy for the ocean prevents already injured environments and ecosystems from being further strained. By putting in place more marine protected areas, we can help the natural environment heal so that the ocean is healthy for years to come.

Machine Repair

Marine Protected Areas Repair the Ocean

Right now, the functioning of the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas fix the ocean so it functions well, just as repairing a machine helps it work the right way. If a machine is thrown out of alignment or is dirty or worn out, it needs to be adjusted and cleaned so it remains in good working order. In the same way, marine protected areas put the ocean back in alignment by limiting activities like fishing and industry. This adjustment protects ocean environments and ecosystems from wearing out. By putting in place more marine protected areas, we can repair the natural environment so that the ocean works the way it should for years to come.

Values

Protection

We Must Protect the Ocean to Protect Ourselves

We need to address threats to our natural environment to protect people from harm. Current changes to the environment threaten people's safety and wellbeing, and we must be vigilant in addressing these threats to protect ourselves against harm.

Safeguarding ourselves from environmental threats means protecting the ocean. Right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. These activities harm the environment and, in turn, threaten the safety and welfare of human beings.

To address these risks and protect ourselves, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. We must preserve the planet's health to protect our own safety and wellbeing.

Stewardship

We Must Take Care of the Ocean for Future Generations

We are stewards of the natural environment and have a responsibility to take care of it for future generations. The planet is not ours, but merely in our keeping, and we must pass it on in good condition to those who follow us.

Being good stewards of the environment means taking better care of the ocean. Right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. These activities harm the environment and, in turn, human beings – now and, even more, in the future.

To make sure that the environment is healthy when future generations inherit it from us, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. The planet is not ours but merely ours to care for, and we have a responsibility to be good stewards and to pass on a healthy planet to those who come after us.

Fairness Between Generations

We Owe It to Future Generations to Protect the Ocean

If we want to be fair to future generations, we must address the issues facing the natural environment. Our actions now affect people later, and if we don't pass on an environment in good condition, this is unfair to those who follow us.

We owe it to future generations to protect the ocean environment. Right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. These activities harm the environment and, in turn, human beings – now and, even more, in the future.

It's only fair that future generations inherit a healthy environment, and, to make that happen, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. It would be unfair to damage the planet for future generations, so we must take steps now to make sure we pass on a healthy planet.

Self-Interest

We Must Preserve the Ocean Because We All Rely on It

We need to address the issues facing the natural environment because it's vital for our wellbeing, our economy and our culture. If we damage the environment, we won't be able to fully enjoy what it provides going forward.

We need to preserve the ocean because it is the source of all life and because it provides resources for our economy, supports mental health and is a key part of our culture. Right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. These activities harm the environment and, in turn, harm our way of life.

To make sure the ocean can continue to support us, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. It's in our interest to keep the planet in good condition.

Scientific Authority

We Must Follow Science and Take Evidence-Based Steps to Protect the Ocean

We need to follow the guidance of the scientific community and address the issues facing the natural environment. Scientific research has identified specific ways that our environment is being damaged, and we must adopt an evidence-based approach to address this harm.

Taking scientists' advice begins with protecting the ocean. Right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. There is clear scientific consensus that these activities generate significant harm to the environment and, in turn, human beings.

Following science means doing what evidence tells us to do, and that includes reducing pollution and overfishing, regulating industrial activity in the ocean and protecting marine life. We must listen to scientists in order to effectively deal with our planet's problems.

Treatments Tested in Second Survey Experiment

Temporal Frames

Past Focus

Looking Back: The Health of the Ocean Is Worsening

The ocean used to be healthy. Throughout history, it has been a key part of the planet's natural environment and has supported our economy and health. But the state of the ocean has worsened dramatically over time. The ocean has been damaged by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Because the ocean has become less healthy, its ability to support other parts of the environment, the economy and human health has declined.

We need to restore the ocean to its past condition. To do this, we must reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. These changes will return the ocean to its former state and benefit the environment, the economy and human health.

Future Focus

Looking Forward: The Health of the Ocean Must Improve

Our future depends on a healthy ocean. If we improve ocean health, it can function as a key part of the planet's natural environment and it can support our economy and health for years to come. But right now, the ocean is damaged because of human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. If the ocean continues to get worse, the environment, the economy, and human health will all be in jeopardy in the coming years.

We need improve the condition of the ocean for the future. To do this, we must reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life. These changes will help make sure that we have a thriving ocean that supports the environment, the economy and human health in the years to come.

Issue Frames & Messengers

Human Health – No Messenger

The Ocean Plays a Critical Role in Our Health

The ocean is important for human health. It sustains human life by generating oxygen – in fact, it provides most of the oxygen we breathe on land. It is also a major source of food, as many people rely on fish from the ocean to eat. In addition, plants and animals in the sea are sources of medicines that help to treat illnesses like cancer, infections and asthma.

But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm human health. They not only contaminate the water and fish we consume and expose us to toxins, but they also deplete the ocean of things we need to be healthy, like food and medicine. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to our health. As a society, we need to take steps to address threats to the ocean so that it can continue to support human health.

Human Health – Health Messenger

Medical Professionals Address the Ocean's Critical Role in Our Health

The National Association of Medical Professionals is alerting the government and members of the public to the ways that the health of the ocean affects human health. Dr. David Johnson, president of the association, issued the following statement last Tuesday:

> At the National Association of Medical Professionals, we are committed to the health of all people. And years of scientific research have shown us that the ocean is important for human health. It sustains human life by generating oxygen; in fact, it provides most of the oxygen we breathe on land. It is also a major source of food, as many people rely on fish from the ocean to eat. In addition, plants and animals in the sea are sources of medicines that help to treat illnesses like cancer, infections and asthma. Scientists and doctors recognise that for humans to be healthy, the ocean we depend on must also be healthy.
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> But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm human health. They not only contaminate the water and fish we consume and expose us to toxins, but they also deplete the ocean of things we need to be healthy, like food and medicine. Our association has conducted many studies that make it clear that changes to the ocean are having negative effects on people's health. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.
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> The ocean is vital to our health. At the National Association of Medical Professionals, we feel strongly that, as a society, we need to take steps to address threats to the ocean so that it can continue to support human health.

Environment – No Messenger

The Ocean Plays a Critical Role in Our Planet's Environment

The ocean is an important part of the environment. It sustains all life on the planet – including animals and plants in the sea – and provides oxygen and food for life on land. It is a key part of the planet's ecosystems, providing a habitat and resources that species need to survive. In addition, it regulates the climate by controlling the flow of heat and humidity.

But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the environment more broadly. They harm the environment not only by harming plants and animals in the ocean but by destabilizing ecosystems on land as well. They also disrupt the ocean's ability to regulate the climate. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to our natural environment and the whole planet. As a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support the planet's ecosystems and climate.

Environment – Environmental Messenger

Environmental Scientists Address the Ocean's Critical Role in Our Planet's Environment

The National Association of Environmental Scientists is alerting the government and members of the public to the ways that the health of the ocean affects the whole environment. Dr. David Johnson, president of the association, issued the following statement last Tuesday:

> At the National Association of Environmental Scientists, we are committed to the health of the environment. And years of scientific research have shown us that the ocean is an important part of the environment. It sustains all life on the planet – including animals and plants in the sea – and provides oxygen and food for life on land. It is a key part of the planet's ecosystems, providing a habitat and resources that species need to survive. In addition, it regulates the climate by controlling the flow of heat and humidity. Scientists recognise that for the environment as a whole to be healthy, the ocean must also be healthy.
>
> But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the environment more broadly. They harm the environment not only by harming plants and animals in

the ocean, but by destabilising ecosystems on land as well. They also disrupt the ocean's ability to regulate the climate. Our association has conducted many studies that make it clear that changes to the ocean are having negative effects on all of nature. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to our natural environment and the whole planet. At the National Association of Environmental Scientists, we feel strongly that, as a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support the planet's ecosystems and climate.

Environment – Business Messenger

Business Leaders Address the Ocean's Critical Role in Our Planet's Environment

The National Association of Business Executives is alerting the government and members of the public to the ways that the health of the ocean affects the environment. Dr. David Johnson, president of the association, issued the following statement last Tuesday:

At the National Association of Business Executives, we are committed to the health of the environment. And years of scientific research have shown us that the ocean is an important part of the environment. It sustains all life on the planet – including animals and plants in the sea – and provides oxygen and food for life on land. It is a key part of the planet's ecosystems, providing a habitat and resources that species need to survive. In addition, it regulates the climate by controlling the flow of heat and humidity. Scientists recognise that for the environment as a whole to be healthy, the ocean must also be healthy.

But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the environment more broadly. They harm the environment not only by harming plants and animals in the ocean but by destabilising ecosystems on land as well. They also disrupt the ocean's ability to regulate the climate. We need to adopt business practices that prioritise the health of the ocean. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to our natural environment and the whole planet. At the National Association of Business Executives, we feel strongly that, as a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support the planet's ecosystems and climate.

Economy – No Messenger

The Ocean Plays a Critical Role in Our Economy

The ocean is important for the economy. It supports key industries, including fishing, tourism and mining. The ocean sustains the economy by providing resources that enable these and other industries to thrive. In addition, the ocean provides a critical transportation route for shipping goods around the world.

But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the economy. They hurt the economy by depleting the ocean of key resources that critical industries need. And when fishing, tourism and other industries are harmed, this undermines the strength of the broader economy. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to the economy. As a society, we need to take steps to address threats to the ocean so that the ocean can continue to support economic growth and development.

Economy – Business Messenger

Business Leaders Address the Ocean's Critical Role in Our Economy

> The National Association of Business Executives is alerting the government and members of the public to the ways that the health of the ocean affects the economy. Dr. David Johnson, president of the association, issued the following statement last Tuesday:
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> At the National Association of Business Executives, we are committed to the health of the economy. And years of economic research have shown us that the ocean is important for the economy. It supports key industries, including fishing, tourism and mining. The ocean sustains the economy by providing resources that enable these and other industries to thrive. In addition, the ocean provides a critical transportation route for shipping goods around the world. Economists recognise that for the economy to be strong, the ocean must be healthy.
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> But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the economy. They hurt the economy by depleting the ocean of key resources that critical industries need. And when fishing, tourism and other industries are harmed, this undermines the strength of the broader economy. Our association has conducted many studies that make it clear that changes to the ocean are having negative effects

on the economy. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to the economy. At the National Association of Business Executives, we feel strongly that, as a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support economic growth and development.

Economy – Environmental Messenger

Environmental Scientists Address the Ocean's Critical Role in Our Economy

The National Association of Environmental Scientists is alerting the government and members of the public to the ways that the health of the ocean affects the economy. Dr. David Johnson, president of the association, issued the following statement last Tuesday:

At the National Association of Environmental Scientists, we are committed to the health of the economy. And years of economic research have shown us that the ocean is important for the economy. It supports key industries, including fishing, tourism and mining. The ocean sustains the economy by providing resources that enable these and other industries to thrive. In addition, the ocean provides a critical transportation route for shipping goods around the world. Economists recognise that for the economy to be strong, the ocean must be healthy.

But right now, the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste, chemical runoff and fossil fuel emissions. When these activities harm the ocean, they also harm the economy. They hurt the economy by depleting the ocean of key resources that critical industries need. And when fishing, tourism and other industries are harmed, this undermines the strength of the broader economy. Our association has collaborated on many studies that make it clear that changes to the ocean are having negative effects on the economy. To improve the state of the ocean, we need to reduce pollution and overfishing, regulate industrial activity in the ocean and protect marine life.

The ocean is vital to the economy. At the National Association of Environmental Scientists, we feel strongly that, as a society, we need to take steps to address threats to the ocean, so that the ocean can continue to support economic growth and development.

PERSISTENCE TRIALS AND PEER DISCOURSE SESSIONS

We conducted three persistence trials, each with six members of the public on the *Body* metaphor and three trials each with six members on the *Machine* metaphor. Sessions were held in London and Edinburgh in October 2018. Participants in these sessions were recruited to vary across a range of demographic characteristics, including ethnicity, gender, age and political affiliation.

In a persistence trial, an initial pair of participants is presented with an explanatory metaphor, first as text and then conversationally by the researcher. The participants then discuss the explanatory metaphor with the moderator before teaching it to a subsequent pair of participants. Following the transfer, the second pair explains the explanatory metaphor to a third pair. Finally, the first pair returns to hear the transmitted metaphor from the third pair. This last step allows us to see whether the metaphor has persisted over the session and to enlist participants in explaining any changes that may have occurred to the metaphor.

Researchers analysed the resulting video data to identify patterned ways in which participants used the metaphor, how much the metaphor stuck in people's minds and persisted in being communicated from one group to the other and whether communication of the metaphor led to any distortions in its application.

After persistence trials concluded, we conducted brief, 30-minute peer discourse sessions with the six participants who had participated in the persistence trial. These sessions were used to further understand how members of the public understand and reason about MPAs in response to specific instantiations of the metaphor they had worked with in the persistence trial (for participants who learned the *Body* metaphor, the peer discourse session explored *Physiotherapy*; for those who learned the *Machine* metaphor, the session explored *Machine Repair*). In the sessions, moderators presented participants with the specific metaphor, in writing and orally, and then asked a series of questions to elicit a group discussion about the metaphor. Analysing video data from this discussion enabled researchers to better understand how participants understood and reasoned about MPAs in light of the metaphors and develop recommendations about how to refine this frame. Overall, the analysis of the persistence trials and peer discourse session provided further evidence of the effectiveness of the *Body* metaphor while also providing insight into *how* it can be used most effectively. The analysis also revealed that the *Machine* metaphor has substantial shortcomings, and that it is therefore less effective than the survey experiment suggested.

Explanatory Metaphors Tested in Persistence Trials

Body

The Planet Is Like a Body: Why We Must Protect the Ocean's Health

The planet is made up of a set of interconnected and interdependent parts, just like the human body. In the body, an injury or illness in one part can lead to problems in others. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of the body, what happens in each part affects the others.

Just as when we're stressed, our immune system is weakened and we are more likely to get sick, when the ocean is stressed by things like climate change and pollution, the planet's health suffers. For example, climate change is increasing the temperature of the ocean. Warmer waters cause coral reefs to die. Because coral reefs are habitats for many fish and other marine animals, when coral reefs die, this harms whole ecosystems. And because coral reefs protect coastal communities from flooding during storms, human beings are affected too. This is just one example of how harm to the ocean hurts the whole planet and human beings.

To protect the health of our planet, we must protect the health of the ocean.

Machine

The Planet Is like a Finely-Tuned Machine: Why We Must Keep the Ocean Functioning Properly

The planet is made up of a set of interconnected and interdependent parts, just like a finely tuned machine. If one part of a machine is out of alignment, this affects how the whole machine functions. In the same way, a problem in one of the Earth's systems, like the climate or an ecosystem, can cause problems in others. And because the ocean, atmosphere and land are connected, like the parts of a machine, what happens in each part affects the others.

Just as strain on one part of a machine wears out other parts, strain on the ocean from things like climate change and pollution can throw a spanner in the works and affect the whole planet. For example, climate change is increasing the temperature of the ocean. Warmer waters cause coral reefs to die. Because coral reefs are habitats for many fish and other marine animals, when coral reefs die, this disrupts whole ecosystems. And because coral reefs protect coastal communities from flooding during storms, human beings are affected too. This is just one example of how harm to the ocean threatens the functioning of the whole planet, including human life.

To keep the planet working properly, we must protect the ocean.

Explanatory Metaphors Tested in Peer Discourse Sessions

Physiotherapy

Marine Protected Areas Are like Physiotherapy for the Ocean

Right now, ocean health is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas take care of ocean health by allowing the ocean to heal, just as physiotherapy helps injuries heal. If you pull a muscle or strain a ligament, you need to limit certain activities and do specific things to regain strength and stability. In the same way, marine protected areas allow the ocean to regain health and strength by limiting activities like fishing and industry. This physiotherapy for the ocean prevents already injured environments and ecosystems from being further strained. By putting in place more marine protected areas, we can help the natural environment heal so that the ocean is healthy for years to come.

Machine Repair

Marine Protected Areas Repair the Ocean

Right now, the functioning of the ocean is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas fix the ocean so it functions well, just as repairing a machine helps it work the right way. If a machine is thrown out of alignment or is dirty or worn out, it needs to be adjusted and cleaned so it remains in good working order. In the same way, marine protected areas put the ocean back in alignment by limiting activities like fishing and industry. This adjustment protects ocean environments and ecosystems from wearing out. By putting in place more marine protected areas, we can repair the natural environment so that the ocean works the way it should for years to come.

USABILITY TRIALS

We conducted six usability trials, involving a total of nine professionals who work in the field of marine conservation and 12 members of the public. The trials were conducted in London in December 2018.

In a usability trial, the professional or pair of professionals is given background information about the nature of the project and told about a particular metaphor that has emerged from earlier stages of research. Initially, the moderator only states the metaphor, but after initial discussion, the professionals are given more information about the metaphor in writing, including a paragraph using the metaphor to communicate about the issue and an outline making key concepts

and ideas included in the metaphor explicit. After a period of preparation, the professionals give a short informal presentation to the two members of the public.

In this research, we tested two metaphors related to the broader domain of the human body, which proved to be most productive in previous methods. The professionals were given one of the metaphors for marine protected areas (*Physiotherapy* or *Plaster Cast*) and asked to use the metaphor to explain what MPAs are, including their purpose and effects. Members of the public were encouraged to ask questions, and, after the professionals addressed those questions, the members of the public were dismissed so the professionals and moderator could debrief together.

Finally, the professionals were introduced to the metaphor that they hadn't received initially. The moderator shared the metaphor verbally and asked them to share their thoughts about the metaphor and how they might use it to give a similar presentation on MPAs.

Researchers analysed the video data from these sessions to determine how usable each of the explanatory metaphors was for professionals, which aspects were more likely to be taken up, and which aspects the professionals struggled to use. This analysis revealed resistance to and trouble applying the *Plaster Cast* metaphor and greater ease with the *Physiotherapy* metaphor. The analysis helped researchers understand the features of MPAs that the *Physiotherapy* metaphor was most conducive to explaining. On the basis of this analysis, researchers refined their understanding of *how* the *Physiotherapy* metaphor can be used most effectively.

Explanatory Metaphors Tested in Usability Trials

Physiotherapy

The Metaphor

Marine Protected Areas Are like Physiotherapy for the Ocean

Right now, ocean health is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas take care of ocean health by allowing the ocean to heal, just as physiotherapy helps injuries heal. If you pull a muscle or strain a ligament, you need to limit certain activities and take time to regain strength and stability. In the same way, marine protected areas allow the ocean to regain health and strength by limiting activities like fishing and industry. This physiotherapy for the ocean prevents already injured environments and ecosystems from being further strained. By putting in place more marine protected areas, we can help the natural environment heal so that the ocean is healthy for years to come.

Concepts and Ideas Included in the Metaphor

Human Body	*Ocean*
When a part of the human body is overworked or injured, it becomes strained, which can affect the health of the rest of the body.	When a part of the ocean is overworked or threatened, it becomes strained, which can affect the health of the rest of the ocean.
When we limit strain to injured areas, our body heals itself.	Limiting certain activities in the ocean reduces the strain on marine ecosystems.
Physiotherapy helps injuries heal by allowing the body to regain strength.	Marine protected areas help the ocean heal by allowing life to regenerate.

Plaster Cast

The Metaphor

Marine Protected Areas Are like Plaster Casts for the Ocean

Right now, ocean health is threatened by human activities like overfishing, drilling for oil and natural gas and pollution from plastic waste and chemical runoff. Marine protected areas take care of ocean health by allowing the ocean to heal, just as plaster casts help injuries heal. If you break a bone, you need to wear a plaster to avoid strain to the injured area and give the bone time to regain strength and stability. In the same way, marine protected areas allow the ocean to regain health and strength by limiting activities like fishing and industry. This plaster cast for the ocean prevents already injured environments and ecosystems from being further strained. By putting in place more marine protected areas, we can help the natural environment heal so that the ocean is healthy for years to come.

Concepts and Ideas Included in the Metaphor

Human Body	*Ocean*
When a part of the human body is overworked or injured, it becomes strained, which can affect the health of the rest of the body.	When a part of the ocean is overworked or threatened, it becomes strained, which can affect the health of the rest of the ocean.
When we limit strain to injured areas, our body heals itself.	Limiting certain activities in the ocean reduces the strain on marine ecosystems.
Plaster casts help injuries heal by allowing the body to regain strength.	Marine protected areas help the ocean heal by allowing life to regenerate.

Appendix B: Experimental Survey Outcome Measures

In both experiments, randomisation was done at the item level. This means that the questions were all randomised together; they were not presented with others from the same battery. At the same time, the batteries were pseudo-randomised, such that those pertaining to policy preferences and understanding of MPAs always appeared after questions from the rest of the batteries. In the second experiment, open-ended questions were the last questions, following the policy and MPA understanding batteries.

Both survey experiments included the following outcome measures:

COLLECTIVE RESPONSIBILITY FOR IMPROVING THE STATE OF THE OCEAN

- How much of a responsibility do you think we, as a society, have to improve the state of the ocean?

  [7-point Likert scale: 'No responsibility at all'; 'A very small responsibility'; 'A small responsibility'; 'A moderate responsibility'; 'A large responsibility'; 'A very large responsibility'; 'An extremely large responsibility']

- How much of a responsibility do you think our government has to improve the state of the ocean?

  [7-point Likert scale: 'No responsibility at all'; 'A very small responsibility'; 'A small responsibility'; 'A moderate responsibility'; 'A large responsibility'; 'A very large responsibility'; 'An extremely large responsibility']

- How much of a responsibility do you think businesses and corporations have to improve the state of the ocean?

  [7-point Likert scale: 'No responsibility at all'; 'A very small responsibility'; 'A small responsibility'; 'A moderate responsibility'; 'A large responsibility'; 'A very large responsibility'; 'An extremely large responsibility']

COLLECTIVE EFFICACY ABOUT IMPROVING THE STATE OF THE OCEAN

- In your view, how much can we do, as a society, to improve the state of the ocean?

  [7-point Likert scale: 'Nothing at all'; 'A very small amount'; 'A small amount'; 'A moderate amount'; 'A large amount'; 'A very large amount'; 'An extremely large amount']

- How optimistic or pessimistic do you feel that we, as a society, can improve the state of the ocean?

  [7-point Likert scale; 'Extremely pessimistic'; 'Pessimistic'; 'Somewhat pessimistic'; 'Neither optimistic nor pessimistic'; 'Somewhat optimistic'; 'Optimistic'; 'Extremely optimistic']

- If we took action as a society to address threats to the ocean, how much of an improvement in the state of the ocean do you think we would see?

  [5-point Likert scale: 'No improvement at all'; 'A small improvement'; 'A moderate improvement'; 'A large improvement'; 'A very large improvement']

SUPPORT FOR POLICIES THAT REDUCE POLLUTION

Please tell us how much you favour or oppose each of the following policies.

Some of the following questions ask for your thoughts about *Marine Protected Areas*, which are parts of the sea where human activity is restricted.

(For each policy, respondents will be asked to give their response on a 7-point Likert scale: 'Strongly oppose'; 'Oppose'; 'Slightly oppose'; 'Neither favour nor oppose'; 'Slightly favour'; 'Favour'; 'Strongly favour'.)

- Put in place a plastic bottle deposit programme that requires people to pay an additional charge any time they buy a drink in a plastic bottle.
- Give tax credits to corporations if they stop producing throwaway plastic.

- Put in place stricter regulations on how corporations deal with human sewage, agricultural runoff and chemical waste, even if this is expensive for businesses.
- Give companies the freedom to make their own plans for dealing with waste that might end up in the ocean, without government interference [*reverse*].

SUPPORT FOR POLICIES THAT STRENGTHEN MARINE PROTECTED AREAS

- Increase the number of marine protected areas, even if doing so has costs for businesses.
- Expand the size of existing marine protected areas.
- Impose large fines on corporations that engage in prohibited activities within marine protected areas.
- Further restrict human activities within existing marine protected areas.

SUPPORT FOR POLICIES THAT MAKE FISHING MORE SUSTAINABLE

- Tighten quotas for fishing, so that the fishing industry cannot take as many fish from the ocean.
- Loosen restrictions on fishing to make it easier for fishermen to make a living [*reverse*].
- Increase government subsidies for environmentally friendly fishing practices.

UNDERSTANDING OF THE FUNCTION OF MARINE PROTECTED AREAS

- Marine protected areas are designed to do which of the following?
  a. Protect habitats for sea life
  b. Keep beaches clean and beautiful
  c. Protect local fishermen from foreign competition
- How do marine protected areas help fish?
  a. They provide safe routes for migration
  b. They provide new sources of food
  c. They provide increased natural light

- What are the long-term effects of marine protected areas?
  a. Wildlife in the sea will recover from pollution and overfishing
  b. More beaches will be available for public enjoyment
  c. People will eat less fish

The following questions were used only in the first survey experiment:

SALIENCE OF OCEAN HEALTH

- In your opinion, how serious of a problem is the current state of the ocean?

  [5-point Likert scale: 'Not at all serious'; 'Slightly serious'; 'Moderately serious'; 'Very serious'; 'Extremely serious']

- How concerned are you personally about the state of the ocean?

  [5-point Likert scale: 'Not at all concerned'; 'Slightly concerned'; 'Moderately concerned'; 'Very concerned'; 'Extremely concerned']

UNDERSTANDING OF OCEAN POLLUTION

- Many ocean pollutants are not obvious to the human eye.

  [7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

- Ocean pollution comes in many forms, including solids, liquids and gases.

  [7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

- Oil spills are the greatest human-caused threat to marine life.

  [Reverse; 7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

UNDERSTANDING OF THE OCEAN'S EFFECTS ON HUMAN WELLBEING

- Human health is affected by the state of the ocean.

  [7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

- People who live inland aren't really affected by the state of the ocean.

  [Reverse; 7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

- The state of the ocean affects the economy.

  [7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

UNDERSTANDING OF THE OCEAN'S ROLE IN THE CLIMATE SYSTEM

- How big a role does the ocean play in the climate?

  [5-point Likert scale: 'No role'; 'A small role'; 'A medium-sized role'; 'A large role'; 'A very large role']

- Changes to the ocean affect the climate on land.

  [7-point Likert scale: 'Strongly disagree'; 'Disagree'; 'Slightly disagree'; 'Neither agree nor disagree'; 'Slightly agree'; 'Agree'; 'Strongly agree']

The following questions were used only in the second survey experiment:

UNDERSTANDING OF THE OCEAN'S EFFECTS ON HUMAN WELLBEING

- How much do you think changes to the ocean affect other things? Please rank the following options so that whatever is most affected by changes to the ocean is at the top and whatever is least affected by changes to the ocean is at the bottom.

  a. Human health

  b. The environment

  c. The economy

  d. The planet's orbit

  e. Likelihood of earthquakes

OPEN-ENDED QUESTIONS

- In your view, what should be done to improve the state of the ocean?
- In your opinion, what are some ways that the ocean affects people?

Endnotes

1. 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.
2. Rayson, P. (2008). From key words to key semantic domains. *International Journal of Corpus Linguistics. 13:4 pp. 519–549. DOI:* 10.1075/ijcl.13.4.06ray.
3. Volmert, A. (2014). Getting to the heart of the matter: Using metaphorical and causal explanation to increase public understanding of climate and ocean change. Washington, DC: FrameWorks Institute.
4. The *Planet as a Body metaphor* increased support for policies to reduce pollution (p=0.002), to strengthen marine protected areas (p=0.005) and to make fishing more sustainable (p=0.001).
5. Volmert, A. (2014). Getting to the heart of the matter: Using metaphorical and causal explanation to increase public understanding of climate and ocean change. Washington, DC: FrameWorks Institute.
6. Increases in collective efficacy: *Past*, p=0.015; *Future*, p=0.024.
7. The *Past* frame increased support for policies that reduce pollution (p=0.005), that strengthen MPAs (p=0.023) and that make fishing more sustainable (p=0.007). The *Future* frame also increased support for policies that reduce pollution (p=0.036), strengthen MPAs (p=0.002) and that make fishing more sustainable (p=0.002).
8. Lindland & Volmert, Getting below the surface.
9. Simon, A., Volmert, A. Bunten, A. & Kendall-Taylor, N. (2014). The value of explanation: Using values and causal explanations to reframe climate and ocean change. Washington, DC: FrameWorks Institute.
10. For example, see: de Vreesse, C., Semetko, H. & Peter, J. (2001). Framing politics at the launch of the Euro: A cross-national comparative study of frames in the news. *Political Communication, 18: 107–122.*

11. For example, see: Nelson, T.E. & Oxley, Z.M. (1999). Issue framing effects on belief importance and opinion. *The Journal of Politics, 61(4), 1040–1067.*

    For prior FrameWorks research showing the importance of issue frames for attitudes, see: L'Hôte, E., Kendall-Taylor, N., O'Neil, M., Busso, D., Volmert, A. & Nichols, J. (2017). *Talking about the science of parenting.* Washington, DC: FrameWorks Institute.

12. Lindland & Volmert, Getting below the surface.

13. The *Human Health* frame boosted support for all three policy types (pollution: p=0.014, strengthening MPAs: p=0.013, sustainable fishing: p=0.001), as did the *Environment* frame (pollution: p=0.023, strengthening MPAs: p=0.012, sustainable fishing: p=0.001) and the *Economy* frame significantly increased support for two of the three policy areas (pollution: p=0.028, sustainable fishing: p=0.008).

14. Lindland & Volmert, Getting below the surface.

15. On the *Economy vs. Environment* cultural model, see Lindland & Volmert, Getting below the surface.

16. The effects of different message-messenger pairs for each policy area tested were as follows: *Health-Medical Messenger,* pollution: p=0.04, strengthening MPAs: p=0.027, sustainable fishing: p<0.001; *Environment-Environmental Messenger*, pollution: p=0.025, strengthening MPAs: p=0.02, sustainable fishing: p<0.001; *Economy-Business Messenger,* pollution: p<0.001, strengthening MPAs: p=0.011, sustainable fishing: p=0.018).

ABOUT THE FRAMEWORKS INSTITUTE

The FrameWorks Institute is a nonprofit think tank that advances the nonprofit sector's communications capacity by framing the public discourse about social problems. Its work is based on Strategic Frame Analysis®, a multi-method, multidisciplinary approach to empirical research. FrameWorks designs, conducts, publishes, explains and applies communications research to prepare nonprofit organisations to expand their constituency base, to build public will, and to further public understanding of specific social issues – the environment, government, race, children's issues and health care, among others. Its work is unique in its breadth – ranging from qualitative, quantitative and experimental research to applied communications toolkits, eWorkshops, advertising campaigns, FrameChecks® and in-depth FrameLab study engagements. In 2015, it was named one of nine organisations worldwide to receive the MacArthur Foundation's Award for Creative and Effective Institutions.

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This research was commissioned and supported as part of our Valuing the Ocean strand of work. Valuing the Ocean seeks to test new ways of communicating why the ocean matters to help build communications capacity and create a new 'sea story' in the UK.

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