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Public understanding in Great Britain of ocean acidification: Supplementary Information

Supplementary Table 1: Perceived main causes of ocean acidification

Possible cause	**% responding**
Carbon dioxide in the atmosphere from human activities (for example, burning fossil fuels) being absorbed by the oceans	37.5%
Pollution from ships, such as from oil spills and discharge of waste products	34.1%
Increased seawater temperatures from climate change	6.3%
Normal cycles of change in ocean chemistry	5.6%
Naturally-occurring carbon dioxide in the atmosphere being absorbed by the oceans	4.0%
Over-fishing leading to disruption of ocean food chains	2.7%
The accumulation of calcium carbonate rocks (for example, limestone and chalk) in tidal waters	1.8%
None of these	8.0%

Respondents were asked: 'Which, if any, do you think is the main cause of ocean acidification?'

Of the possible causes provided to respondents, only 'carbon dioxide… from human activities' corresponds to current scientific understanding of the main cause of ocean acidification.

Supplementary Table 2: Perceived main consequences of ocean acidification

Possible consequences (*P*=potential impact; *D*=distractor item)	**% responding**
Less favourable conditions for some larger marine animals (including fish and squid) *P*	17.7%
Damage to coral reefs *P*	16.6%
Reduced ability of the oceans to absorb carbon dioxide from the atmosphere *P*	13.4%
Less favourable conditions for some very small marine organisms *P*	12.0%
Faster erosion of coastlines in certain parts of the world *D*	9.9%
Reduction in the volume of ice-shelves in the Arctic and Antarctic *D*	5.8%
Problems for people who make a living from the sea, for example due to decreased fish stocks *P*	4.4%
Changes to the chemistry of some land-based ice structures (for example, glaciers) *D*	4.1%
Increased ability of the oceans to absorb carbon dioxide from the atmosphere *D*	2.9%
Damage to the metal hulls of ships *D*	1.0%
Skin damage to those spending long periods of time at sea, such as fishermen *D*	0.8%
More favourable conditions for some very small marine organisms *P*	0.7%
More favourable conditions for some larger marine animals (including fish and squid) *P*	0.4%
None of these	10.4%

Respondents were asked: 'Which, if any, do you think is the main consequence of ocean acidification?'

Of the list of possible consequences presented, seven correspond to potential impacts highlighted in the scientific literature (we indicate these above using 'P'), whereas six further options were included as distractor items (we indicate these above using 'D').

Supplementary Table 3: Regression modelling of concern about OA following experimental manipulation (post information provision)

Predictor	Beta coefficients
Knowledge	.00 (NS)
Gender (ref: male)	.07**
Education	-.02 (NS)
Individualism	.05*
Egalitarianism	.08**
NEP score	.28***
Perceived climate change causation (higher score: human-caused)	.11***
Affect (negative scoring)	.08***
Framing condition (text provided) (ref: OA-only text)	.06 (NS)
Prior concern (pre information provision)	.37***
Framing condition * prior concern	-.01 (NS)
Framing condition * individualism	-.05*
Framing condition * egalitarianism	.01 (NS)
Framing condition * NEP score	-.06 (NS)

Dependent variable: level of concern about OA subsequent to information provision. Shaded cells show predictors used to assess effects of information provision (text presented to respondents) and prior concern (i.e. pre information provision). Adjusted R^2 for the full model is .37. * p<.05, ** p<.01, *** p<.001, NS 'not significant'.

Supplementary Information: Texts used for experimental manipulation

The two texts below were used to frame information about ocean acidification, respectively, as either a stand-alone issue (OA-only text) or in conjunction with information about climate change (OA-CC text). The additional wording used in the OA-CC text (second text provided below) is here shown in italics and underlined. In the experimental presentation of information to survey respondents this additional wording was not emphasised in this way.

Ocean acidification

The oceans absorb carbon dioxide (CO_2) from the atmosphere. This is a natural process, but as well as absorbing naturally occurring carbon dioxide, they have taken up over a quarter of the carbon dioxide emitted as a result of human activities over the past 200 years. Carbon dioxide is a colourless gas which is released when we burn fossil fuels (for example, coal, oil & gas) to produce electricity, heat our homes, and in transport and manufacturing.

The extra carbon dioxide that the oceans have absorbed has a number of consequences – and one of these is referred to as 'ocean acidification'. Ocean acidification means that the oceans are gradually becoming more acidic as a result of the extra carbon dioxide they are absorbing. A person would find this change almost impossible to detect without the use of scientific instruments (for example, if swimming in seawater now compared to 200 years ago). There may, however, be consequences from ocean acidification for some organisms which live in the oceans.

Scientific research has suggested that ocean acidification might affect coral reefs, animals which form shells (such as sea snails), and plankton (tiny, floating organisms). There may also be consequences for fish and other large animals, both directly (for example, their ability to reproduce) and indirectly (for example, the availability of their food supply). It is possible there will be further knock-on effects for human societies, especially for people who rely on the oceans to make a living. But there is at the moment a great deal of uncertainty about what the impacts of ocean acidification on ocean life and human societies will be. Whilst scientists are confident in their understanding of the basic chemical processes of ocean acidification, there is still a great deal that they do not understand about the wider consequences of ocean acidification.

Ocean acidification *and climate change*

The oceans absorb carbon dioxide (CO_2) from the atmosphere. This is a natural process, but as well as absorbing naturally occurring carbon dioxide, they have taken up over a quarter of the carbon dioxide emitted as a result of human activities over the past 200 years. Carbon dioxide is a colourless gas which is released when we burn fossil fuels (for example, coal, oil & gas) to produce electricity, heat our homes, and in transport and manufacturing. *Carbon dioxide emissions from human activities are the main cause of climate change*.

The extra carbon dioxide that the oceans have absorbed has a number of consequences – and one of these is referred to as 'ocean acidification'. Ocean acidification means that the oceans are gradually becoming more acidic as a result of the extra carbon dioxide they are absorbing. A person would find this change almost impossible to detect without the use of scientific instruments (for example, if swimming in seawater now compared to 200 years ago). There may, however, be consequences from ocean acidification for some organisms which live in the oceans, *in addition to the effects of climate change*.

The Intergovernmental Panel on Climate Change (IPCC) has suggested that ocean acidification might affect coral reefs, animals which form shells (such as sea snails), and plankton (tiny, floating organisms). There may also be consequences for fish and other large animals, both directly (for example, their ability to reproduce) and indirectly (for example, the availability of their food supply). *In addition to the effects of climate change*, it is possible there will be further knock-on effects of ocean acidification for human societies, especially for people who rely on the oceans to make a living. But there is at the moment a great deal of uncertainty about what the impacts of ocean acidification on ocean life and human societies will be. Whilst scientists are confident in the reality of *human-caused climate change*, and in their understanding of the basic chemical processes of ocean acidification, there is still a great deal that they do not understand about the wider consequences of ocean acidification.