What are the key marine climate change areas to which the government may need to adapt?

ME5216 Impacts from climate change and ocean acidification on Fisheries and Marine biodiversity (IFMA)

What's the problem?

The 2008 UK Climate Change Act requires the government to conduct a Climate Change Risk Assessment (CCRA) every five years and shortly after that, to put in place a National Adaptation Programme (NAP). The first UK CCRA was published in January 2012 and in response to this report, the first National Adaptation Programme was published in July 2013. The NAP contains 20 different actions/commitments relating to the marine environment. These include important actions for which Defra, Cefas and the Marine Climate Change Impacts Partnership (MCCIP) are responsible. These actions cut across a number of the NAP themes, including the natural environment, human health, biodiversity and fisheries. In order to complete the next CCRA, research is required to fill some of these knowledge-gaps. MCCIP Annual Report Card topics on ocean acidification, HABs, human health, fish, fisheries and plankton, have suffered from a lack of adequate information in the past particularly on the implications for policy and the wider end-user community.

What are the aims of the project?

The IFMA project advanced the knowledge-base in a range of NAP priority areas relating to marine environmental changes:

1) Changes in ocean chemistry, covering ocean acidification and low oxygen impacts on marine fish, invertebrates and ecosystems, as well as the relationship between acidification and metal toxicity.

2) Impacts on human health, covering the risks in the marine environment presented by Vibrio pathogens and harmful algal blooms (HABs).

3) Impacts on biodiversity and fisheries, covering local scale economic losses of changing seabird distributions, as well as links between climate change, plankton and mackerel.

4) Emerging threats to the UK from Jellyfish outbreaks associated with present and future climate change.

The IFMA project aimed to address some of the issues that are of specific relevance to Defra including multiple actions on understanding and predicting impacts to human health and the impacts that ocean acidification could have on marine ecosystems, as well as the services they support. IFMA outputs have also contributed directly to the 2015 MCCIP Report Card.

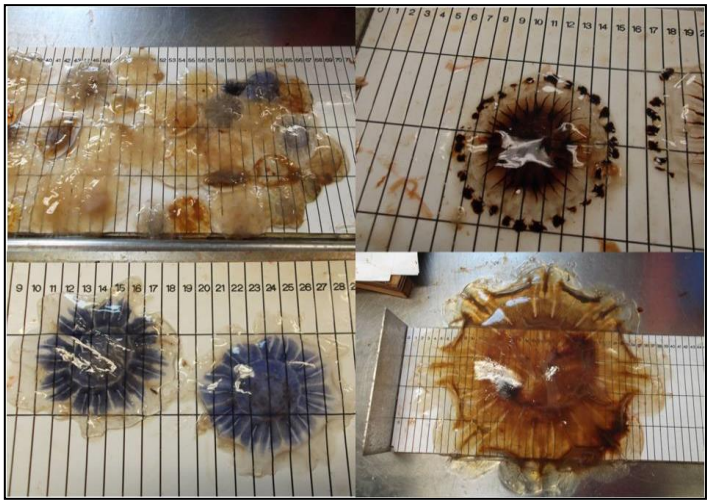

Figure 1: Examples of jellyfish caught during Cefas surveys.

Which policy areas will the research inform?

This work focused particularly on marine evidence to help the UK meet its obligations under the Climate Change Act. The project addressed issues that are related to all aspects of marine policy where climate change responses are considered including human health, fisheries and biodiversity.

Cefas Marine Climate Change Centre

Cefas

Department for Environment Food & Rural Affairs

What are the results from the project and how will they be used?

Ocean acidification and 'bottom up' impacts. Models for areas within the North Sea were used to investigate the potential effects of ocean acidification and stratification on lower and upper trophic level productivity. These models suggested that fisheries yield in the seasonally stratified and well-mixed areas is expected to increase, but that in transitional areas yield might decrease.

Fisheries and low oxygen. Low oxygen conditions are expected to proliferate in shelf seas as a result of climate change. Experiments investigated how these low oxygen conditions might affect commercial fish species.

Ocean pH and metal toxicity. Ocean acidification may alter the "behaviour" of sediment-bound metals, modifying their bioavailability and thus toxicity. Mapping techniques looked for regions where metal contamination coincides with currently reduced pH conditions. The results showed a number of locations that are at greatest risk from the interaction of future pH reduction projected for 2050 and elevated metal toxicity.

Assessing and predicting emerging Vibrio risk. Instances of Vibrio wound infections during anomalous warm weather episodes were investigated. The analysis confirmed the strong role of temperature and salinity in determining V. vulnificus growth and discussed the importance of remote sensing (satellite) based mapping approaches as a possible near 'real time' risk forecasting strategy.

Current status of harmful algal bloom modelling. A Cefas staff member served on the steering committee for the international GEOHAB initiative, to start to determine 'best practice' with regard to predictive climate models of HABs. Recommendations include the need to increase knowledge about life cycles, develop individual-based models, and engage the global ocean observing community.

Economic and societal impact of changes in seabird distribution. This study assessed potential economic and societal impacts of a change in seabird distributions associated with future climate change in the UK, including estimating visitor spending in four coastal reserves and the associated benefits for the local economy.

Climate change, plankton and mackerel. Analyses of the western UK mackerel sub-population were carried out to determine the factors affecting larval distribution. No relationship was found between plankton and larvae abundance. We might expect a slight tendency towards enhanced mackerel recruitment and larval abundance if the NAO is likely to become slightly more positive (on average) in the future.

Jellyfish outbreaks and climate change. Using baseline sampling data modelling was attempted to determine how environmental variables might affect jellyfish distribution. During 2012 and 2013 North Sea surveys, jellyfish abundances were generally low, but with localised higher abundance. Temperature was an important determinant of jellyfish abundance and so a general increase in incidence as a result of projected future climate change is anticipated.

V. vulnificus abundance as a function of temperature and salinity.

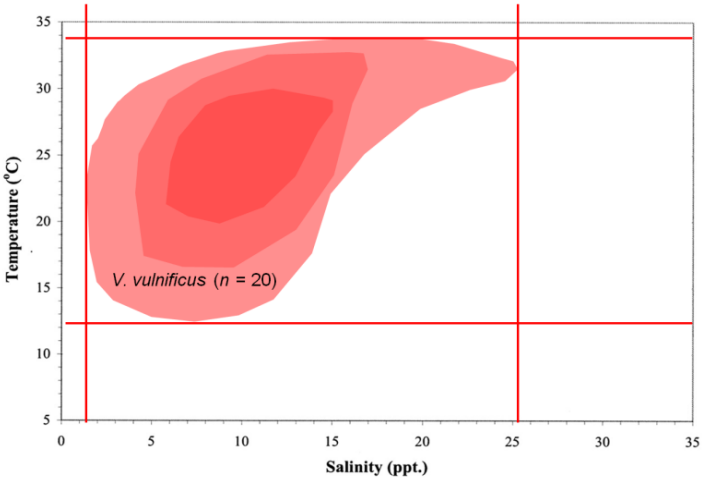

Figure 2: Response' plot, showing how the abundance of Vibrio vulnificus 'responds' to variability in temperature and salinity – darker red indicates the highest levels of bacterial growth.

Where can I find further information about this and related research?

More information can be found from

https://www.gov.uk/government/organisations/centre-for-environment-fisheries-and-aquaculture-science/about and https://www.cefas.co.uk/services/research-advice-and-consultancy/climate-change/

Alternatively, please contact Defra's Marine and Fisheries Science Unit: marinescience@defra.gsi.gov.uk

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