FUTURE OCEAN ACIDIFICATION IMPACTS ON MEDITERRANEAN SEAFOODS: FIRST INVESTIGATION OF THE ECONOMIC COSTS

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Abstract

There is increasing concern with regard to future impacts of ocean acidification on marine biological resources, fisheries and aquaculture and the potential economic and social consequences. Here we give a summary report on the status of following sets of data required to evaluate the likely scales of future economic losses to Mediterranean fisheries and aquaculture; a) direct and indirect effects of reduced pH on Mediterranean species of socio-economic significance, b) effects of different global atmospheric carbon emission rates on future acidity of Mediterranean seawater, and c) the economic values of shellfish from both wild fisheries and aquaculture industries. The areas of uncertainty that warrant further investigation are also identified.
Keywords: Ph, Aquaculture, Global Change, Fisheries

Ocean acidification (OA) refers to changes in ocean chemistry brought about by increases in atmospheric CO_2 from combustion of fossil fuels, deforestation and cement production. Ocean acidification leads to an increase in hydrogen ion concentration [H^+], which we refer to as acidity, and thus a decrease in pH (defined as $-\log[H^+]$) and carbonate ion concentration. The Mediterranean Sea is a semi-enclosed basin with different properties than typical seawater, including generally higher surface temperatures and salinities. However, the 21st-century reductions in Mediterranean Sea surface-water pH and carbonate ion concentration are expected to be similar to those in tropical waters of the ocean. Yet unlike the tropics, in the Mediterranean Sea there are large differences between winter and summer saturation levels (carbonate ion concentration). Combined effects from other peculiarities, including different marine ecosystems and intense anthropogenic pressures, necessitate distinct initiatives to study Mediterranean Sea acidification. For the Mediterranean Sea there is little scientific information on the likely effects of ocean acidification on marine food webs, fisheries and aquaculture species. However many of the taxonomic groups of organisms present in the Mediterranean are also found elsewhere where many of the ocean acidification studies are currently focussed [1].Our approach has been to first assess the current state of knowledge of the impacts of ocean acidification on seafoods and specifically for the Mediterranean, including potential indirect effects through disruption of food webs, and in combination with the effects of co-contaminants and increasing temperatures. Then we use this assessment to interpret biological and ecological impacts in the context of projected future acidification of the Mediterranean. We then present some macro-economic assessment of the value of Mediterranean seafoods at the regional and national scale to determine what is potentially at threat economically from ocean acidification in the future. By undertaking this preliminary cross-disciplinary study of the economic significance of ocean acidification for Mediterranean seafoods we have also better evaluated the inadequacies of the economic and scientific data for the Mediterranean that is currently available for such a purpose. We have also proposed what is needed to better assess the economic costs and risks, with a prioritisation of the requirements for new information to reduce the uncertainties in such an analysis. Ocean acidification is a recently identified phenomenon and the scientific assessment of its impacts on seafoods and underpinning biodiversity is still in its infancy, particularly for the Mediterranean. Its tentative nature has constrained the precision of our socio-economic analyses. However, the scale of potential losses has been better clarified and detailed for Mediterranean countries, for the groups of seafoods that are currently identified as more at risk from OA. Moreover, the following questions have been better shaped through our collaborative analyses to indicate where the needs for further research and consideration lie, viz: i) the higher alkalinity of Mediterranean water mitigates the rate at which it will acidify, however the biological responses of organisms that have also evolved under these conditions need to be assessed experimentally, to discern the degree of their vulnerability, ii) such experimental assessments need to be undertaken within the ranges of pH values that are projected to occur, with longer-term exposures, and for those species that have been identified as of particular economic value for individual countries, iii) particular countries are also identified as being pre-disposed to greater socio-economic impact of OA due to both the value of calcifiers in their seafood production coupled with the narrow species base of their seafood industries, iv) assessment of the potential scale of socio-economic impacts of OA and the equity of their distributions among the Mediterranean countries, that represent a very broad range in their states of economic development. By its diversity among member states in their level of economic development and the resilience of their economies, the Mediterranean offers the unique opportunity to investigate the different scales of socio-economic impacts among countries of OA [2].

References

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