Journal of
Marine Science: Research & Development

Mizrahi, J Marine Sci Res Dev 2021, 11:8

Short Communication Open Access

Physiological Consequences of Oceanic Environmental Variation: Life from a Pelagic Organism's Perspective

Saadya Mizrahi*

Department of Marine Geology, University of Chile, Chile

Introduction

Ecosystems are defined by a complex suite of interactions among organisms and also between organisms and their physical environment; a disturbance to any part may lead to cascading effects throughout the system. Ocean acidification has the potential to disturb marine ecosystems through a variety of pathways. Differential sensitivities will result in ecological winners and losers, as well as temporal and spatial shifts in interactions between species (e.g., shifts in the timing of zooplankton development relative to food availability) leading to changes in predator-prey, competitive, and other food web interactions. There may also be changes in habitat quality and effects on other ecological processes such as nutrient cycling. Many of the physiological changes from ocean acidification are expected to affect key functional groups species or groups of organisms that play a disproportionately important role in ecosystems. These include expected effects on phytoplankton, which serve as the base of marine food webs, and on ecosystem engineers, which create or modify habitat (e.g., corals, oysters, and seagrasses) [1]. Such changes may lead to wholesale shifts in the composition, structure, and function of these systems and ultimately affect the goods and services provided to society. While it is important to understand how ocean acidification will change ocean chemistry and the physiology of marine organisms, as reviewed, what is equally critical is to understand how these effects may scale up to populations, communities, and entire marine ecosystems. Such changes are likely to be difficult to predict, particularly where more than one species or functional group will be affected by ocean acidification. In general, higher trophic levels, including most finfish, will likely be sensitive to ocean acidification through changes in the quantity or composition of the food available, although there may be direct physiological effects on some fish species at high pCO_2. The difficulty in predicting ecosystem change is compounded by other simultaneous stressors occurring in the oceans now (e.g., pollution, overfishing, and nutrient eutrophication) and in association with climate change. For example, it is projected that surface waters will become warmer, the upper water column will become more stratified, and the supply of nutrients from deep waters and from the atmosphere will change as a result of climate change [2]. Whether these changes, in combination with the effects of ocean acidification, will have synergistic, antagonistic, or additive effects is unknown, but multiple stressors are likely to affect marine ecosystems at multiple scales.

Several previous reports have identified marine ecosystems that are most likely to be at risk from ocean acidification. This chapter begins by describing what is known and not known about ecosystem effects of ocean acidification for five vulnerable ecosystems: tropical coral reef, open ocean plankton, coastal, deep sea, and high latitude ecosystems. This is not an exhaustive review of all possible ecological effects, but is instead an overview of the ecosystems that have been identified as most vulnerable to acidification. The chapter looks at examples of high-CO_2 periods in the geologic past for possible information on the ecological response to current acidification. It also examines general principles regarding biodiversity, possible thresholds in ecological systems, and managing ecosystems for change. Some of the most convincing evidence that ocean acidification will affect marine ecosystems comes from warm water coral reefs. Coral reef ecosystems are defined by the large, wave-resistant calcium carbonate structures, or reefs, that are built by reef calcifiers. The structures they build provide food and shelter for a wide variety of marine organisms [3]. There are hundreds of reef-building species; the predominant calcifiers on coral reefs are zooxanthellate corals, which produce hard aragonite skeletons, and calcifying macroalgae, which produce high-Mg calcite and aragonite. These groups produce the bulk of the calcium carbonate that make up the reef structures, which in turn support the high biodiversity of coral reef ecosystems.

Ocean acidification poses a variety of risks to coral reef ecosystems. A critical vulnerability is the potential for ocean acidification to affect the reef structure itself. Acidification may decrease reef growth by reducing calcification rates, reproduction, and recruitment. It may also increase the dissolution or erosion of existing reef structures. Finally, acidification may indirectly result in the mortality of reef-builders.

References

1. Andrews OD, Bindoff NL, Halloran PR, Ilyina T, Le Quere C (2013) Detecting an external influence on recent changes in oceanic oxygen using an optimal fingerprinting method. Biogeosciences 10: 1799-813.
2. Alexander JM, Diez JM, Levine JM (2015) Novel competitors shape species responses to climate change. Nature 525: 515-518.
3. Arnott, SA, Ruxton GD (2002) Sandeel recruitment in the North Sea: demographic, climatic and trophic effects. Mar Ecol Prog Ser 238: 199-210.

***Corresponding author:** Saadya Mizrahi, Department of Marine Geology, University of Chile, Chile; E-mail: saadmizrahi@gmail.com

Received: August 03, 2021; **Accepted:** August 18, 2021; **Published:** August 23, 2021

Citation: Mizrahi S (2021) Physiological Consequences of Oceanic Environmental Variation: Life from a Pelagic Organism's Perspective. J Marine Sci Res Dev 11: 328.