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PLANKTON DYNAMICS AT EASTERN ARABIAN GULF AND SEA OF OMAN

by

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Abstract

The present study is making part of the collaborative research project entitled "Comparative Analysis and Predictions of Algal Blooms in the Arabian Gulf and the Sea of Oman", between the United Arab Emirates University and Sultan Qaboos University (Grant # G00002684-31S321), in which simultaneous and intensive biweekly plankton and water samples were collected from two opposite coastal stations off the Strait of Hormuz with the aim to study plankton dynamics at the Arabian Gulf and the Sea of Oman and the effect of environmental parameters on their community structures during the period from May 2018 until May 2019. For the Arabian Gulf, samples were collected from Ras Al Khaimah station (RAK), while for the Sea of Oman samples were collected from Sohar station (SOH). Due to the differences of the morphometric as well as the bathymetric features of the two basins, plankton samples and environmental parameters measurements were collected from 6 meters depth at Ras Al Khaimah and from 20 meters depth from the Sea of Oman. However, similar methodologies have been used for sampling collection and analyses. Phytoplankton and zooplankton samples were collected by using 20 µm and 80 µm respectively. Environmental parameters measured in situ (water temperature, Salinity, pH, and dissolved Oxygen) by using multisensory instruments, while nutrient salts concentration (Nitrate- NO₃, Ammonia NH₃, phosphate PO₄), were determined at the designated laboratories using auto analyzer instrument following the approved standard methods. Chlorophyll concentrations at RAK were measured in situ, while at SOH it was extracted from remote sensing data analyses. The obtained results indicated that water temperature at SOH was cooler (maximum 28.7 °C) in summer months than that of RAK (maximum 34.8 °C). Strikingly, the RAK water temperature in winter was cooler than at SOH station. Due to the Sea of Oman direct connection with the Indian Ocean its water salinity was always close to Oceanic salinity (i.e. 36 ppt); while the semi closed and shallow nature of the Arabian Gulf have increased its water salinity up to 41 ppt. It was clear from the nutrients analyses that the concentrations at SOH station was higher than values resulted from the analyses of water samples collected from RAK. Phytoplankton community structure at RAK was mainly composed of Bacillariophyceae and Dinophyceae with Bacillariophyceae dominance (≥90%), along the study period, except in June 2018 where, other groups such as cyanobacteria and Chlorophyceae were representing up to 50% of the community structure. While at SOH, Bacillariophyceae were less dominant during the study period with values ranged between <1 % in August 2018 and April 2019 and between 80% in February 2019 and 10% in May 2019. Both cyanobacteria and Chlorophyceae were alternating the dominance with Bacillariophyceae. Dinophyceae, were sporadically represented, with a maximum of 10% of the community structure occurred during November 2018. At both stations zooplankton was represented by three groups i.e., Calanoids, Cyclopoids and Harpacticoids. At RAK Cyclopoids was dominating the zooplankton community along the study period, while Calanoids was dominating SOH zooplankton community. Harpacticoids was more presented at RAK compared to SOH during the study period. The results also indicated that, although the numbers of phytoplankton community was more diverse (1151 species) at RAK compared to SOH (192 species), the phytoplankton biomass was > 10 folds at SOH compared to RAK station. Indeed, the zooplankton density at SOH was 4 times more than that found at RAK station. Based on the obtained results, the present study also analyzed the relationship between phytoplankton biomass and zooplankton densities during the study period and came to the conclusions that 1- Both phytoplankton and zooplankton communities at the studied stations are not similar in its monthly community structures. 2- The variations between the two basins in environmental parameters are also affecting the species dominance and the monthly community structures of both phytoplankton and zooplankton. 3- Wind stress and its directions over the studied period are controlling the surface water current directions through the Strait of Hormuz which control by its time the movements of planktonic organisms between the two basins 4- At RAK the relationship between phytoplankton and zooplankton is based on grazing of zooplankton on phytoplankton; while at SOH it is mainly based on prey predator interaction, especially with the presence of high densities of fish larvae (especially Sardine and Anchovy), which controlled the zooplankton ability to limit the phytoplankton productivity. Statistical analyses (Principal component Analyses-PCA), has confirmed the negative relationship between phytoplankton and zooplankton at RAK, but it was less able to explain such relationship at SOH station. The present study is the first in its kind to study simultaneously the dynamics of plankton communities at the Arabian Gulf and the Sea of Oman and it could be a baseline for future research.

Keywords: Arabian Gulf, Sea of Oman, Phytoplankton, Zooplankton; Algae bloom; Environmental parameters; Hydrodynamics