Investigation of plankton assemblage in Magam Ruhunupura Mahinda Rajapaksa Port, Hambantota

D. G. T. C. Balawardhana and P. B. T. P. Kumara*

Department of Oceanography and Marine Geology, University of Ruhuna, Sri Lanka

Abstract

Ruhunupura Mahinda Rajapaksa (MRMR) Port is located in a strategic location between Europe and far East. Hence, there is a risk of introducing non-indigenous plankton species when cargo ships arrive at harbor. Baseline information on existing plankton assemblage is a prerequisite to determine introduction of non- indigenous species in future since MRMR port is a newly constructed port. The present study was carried out to investigate existing plankton composition within the port and adjacent marine environment. Three replicates of phytoplankton and zooplankton samples (N=3) were collected in 14 sampling locations using 30µm mesh and 100µmmesh respectively. Shannon-Weiner diversity index (H□) and Simpson's index (D) was used to calculate the species diversity. Environmental parameters such as Temperature, pH, Salinity, Conductivity, Turbidity, nitrate and orthophosphate concentration were measured using standard methods. During the survey 101 phytoplankton species were identified and *Thalassionema sp, Rhizosolenia* sp, and *Chaetoceros sp* were dominated whereas 48 zooplankton species were identified and *Calanus sp, Eucalanus sp, Paracalanus sp, Brachionus sp, Sapphirina sp,* nauplii larvae of Barnacles, and fish larvae were dominated. Highest diversity of phytoplankton (H'= 2.657) and zooplankton (H'= 2.465) were recorded in the outer harbor (station 14) and wharf pile (station 4) respectively. Several species such as *Ceratium furca, Chaetoceros* sp., *Thalassiosira* sp., *Rhizosolenia* sp. and *Protoperidinium* sp.which are known to form harmful algal blooms were also observed in this study.

Keywords: Plankton assemblage, Non-indigenous species, MRMR port, Algal bloom

Corresponding author: terneypradeep@yahoo.co.uk

Introduction

Non-indigenous plants and animals are now recognized as one of the most serious threats to the ecology of biological systems worldwide (Alexandrov, B. and Berlinsky, N.,2005).These non-indigenous species can be invasive to introduced environment causing interruptions to human activities and eco-system balance. Shipping is responsible for 69% of marine organisms' introduction through ballast water and hull fouling. Commercial ports act as hubs for the introduction of alien marine species. As a result of shipping movements, repairs and construction activities in ports there is a favourable conditions for the establishments of new species.

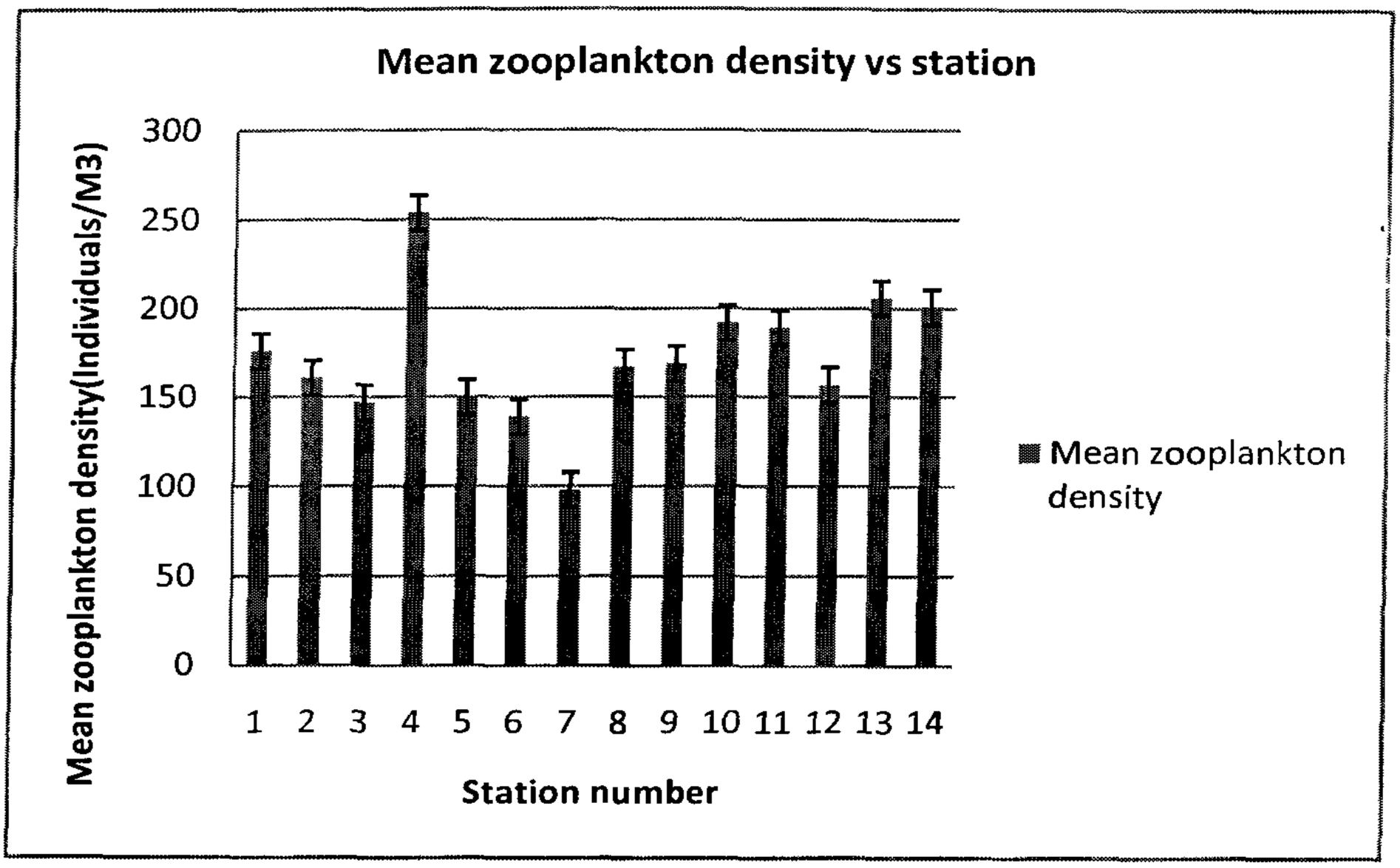
Magam Ruhunupura Mahinda Rajapaksa (MRMR) port has been constructed near to the international shipping line nearly 100 ships bypass daily during the voyage between Europe and the Far East, necessitating the carrying of a large quantity of fuel and supplies for the journey. Though it is still under construction, upon completion, the port will cover 4,000 acres of land and will accommodate 33 vessels at any given time making it the largest port and gradually become a container trans-shipment hub in South Asia. Hence, this maritime environment will definitely vulnerable to the introduction of non-indigenous species. Hence, it is inevitable to carry out an environmental monitoring within this port premises. Not only baseline information about existing marine organisms should be identified for future references.

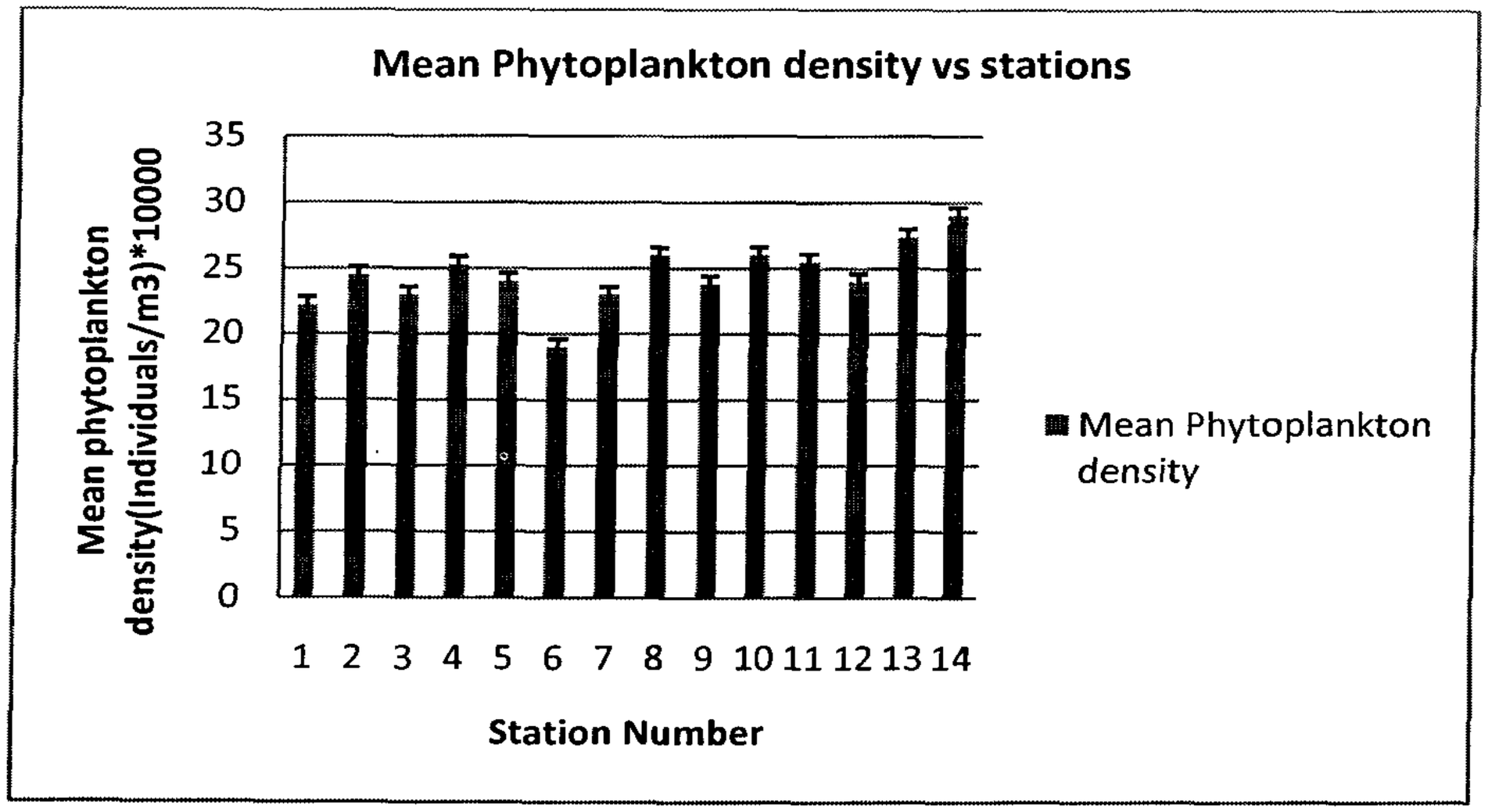
The objective of this study was to gather baseline information about both phytoplankton and zooplankton assemblage within port environment and adjacent coastal environment. Standard CRIMP protocol was followed as the guideline for the study since it is valid for the port surveys in tropical and temperate countries.

Materials and Method

Phytoplankton samples were collected by using 30 µm mesh size plankton net vertically and horizontally. 3 replicated samples were collected in 14 sampling stations and samples were placed in clean bottles with tightly fitting screw caps and preserved using acid Lugol's Iodine solution (0.25-0.5cm^3/100cm^3). Zooplankton samples were collected horizontally and vertically using a 100µm net and flow rate was recorded using a digital flow meter. As phytoplankton sampling 3 replicated samples were collected in same sampling stations and samples were preserved with 5% Formaldehyde. Preserved phytoplankton and zooplankton samples were identified up to genus or species level (Conway *et al.*, 2003; Perry, 2003; Newell and Newell, 1963). Cell density and composition and diversity were estimated from counting number of phytoplankton and zooplankton cells using a Sedgwick rafter cell under a light microscope with the magnification of 10*10. In addition to that water quality parameters such as temperature, pH, Salinity, Conductivity, dissolved oxygen were recorded 0.5m, 3m and 7m depth using standard water quality meter. In addition to that Nitrate and orthophosphate were measured using standard methods.

Results





Discussion

The highest species composition of phytoplankton was recorded in station 14(outer harbour). This can be due to high water circulation and favourable environmental condition. The highest species composition of zooplankton was near to oil pier. Lowest species composition of zooplankton was recorded in station 7(near to temporary bank).

This can be due to disturbance to the area by construction activities. Apart from that turbidity of the station 7 was quite high. The mostly abundant groups of zooplankton were arthropods and ichthiyoplanktons. There is a significant difference of turbidity and conductivity in stations near to temporary bank and near to dredge. This can be due to construction activities

Cheatoceros species, *Rhizosolenia* species, *Thalassionema*species are the species that algal blooms can be formed.*Pseudo- Nitzschia seriata* species produce neurotoxin called as domoic acid, a toxin which is responsible for the amnesic shellfish poisoning in human. In addition to that *Ceratium* species and *Protopteridinum* sp. were recorded in 9 stations out of 14 stations. Zooplankton species such as *Calanus* sp., *Paracalanus* sp, *Pseudocalanus elongates* species have recorded in Colombo harbour environment also. During the study period there was no ballast water discharging to port environment. Hence, these species can be naturally inhabited in this environment. But, these species also recorded as species which form harmful algal blooms. According to the study larval stages of invasive species previously found in Sri Lanka were not recorded. But, in future as a consequence of development of port activities non-indigenous species can be inoculated to this environment through ballast water and hull fouling. With the human activities favourable environment can be created for their establishment. Hence, there is a high potential to over-growth of existing organisms also.

Conclusion

During the survey in MRMR port environment 101 species of phytoplankton and 48 species of zooplankton were identified. From phytoplankton species cheatoceros species are the mostly present species in most of the stations. The highest species composition of phytoplankton was recorded in station 14(outer harbor).The highest species composition of zooplankton was near to oil pier.

References

- Alexandrov, B. and Berlinsky, N. (2005). Introduced species in the Black Sea: the role of ballast water at Odessa Port, Ukraine. Retrieved on the 05.06.2013 from the http://www.unige.ch/sciences/near/pdf/Alexandrov and Berlinsky2005.pdf
- Chandrasekera, W. U. and Fernando, M. A. S. T. (2009). Accidental introduction of alien plankton into the Sri Lankan coastal zone through ballast water of cargo ships. Sri Lanka Journal of Aquatic Sciences, 14, 87-103.

- Conway D. VP., White R. G., Hugues-Dit-Ciles J., Gallienne C. P. and Robins D. B. (2003). Guide to the coastal and surface zooplankton of the South-Western Indian Ocean. (15), Marine Biological Association of the United Kingdom.

- Newell,G.E. and Newell, R.C. (1963). Marine plankton, A practical guide, Hutchinson Educational LTD, London, 165-230pp

- Perry, R. (2003). A guide to the Marine plankton of Southern California, 3rd edition. pp. 1-23. Marine Science Centre. Retrieved on the 22.05.2013 from http://www.msc.ucla.edu/oceanglobe