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BLOOMS OF *COCHLODINIUM POLYKRIKOIDES* AT AL MAMZAR LAGOON OF DUBAI

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ABSTRACT

Intensive blooms of *Cochlodinium polykrikoides* caused in nature and affected tourism in the Al Mamzar lagoon of Dubai. The marine ichthyotoxic dinoflagellate *Cochlodinium polykrikoides* algal bloom was noticed at Al Mamzar lagoon on 13th to 16th March, 2016, which was rusty brown in color, no incidents such as foul odor or fish kill was observed in this area. Surface algal bloom samples were collected and using l lit. Clean polyethylene bottles for population estimation and preserved in acidified Lugols iodine solution and transferred to the Marine Laboratory for identification. The impact of the bloom was observed more (0.2 km^2) on 13th march and the density of the bloom became much less covering smaller area. These kinds of HABs may have serious impacts on the health and dwelling of wild and marine organisms. However, during this incidence huge numbers of dead ctenophorea (Jelly fish) molluscan forms and other marine organisms were reported and some of the coastal birds were observed to have sickness and dizziness due to the algal blooms.

INTRODUCTION

The marine ichthyotoxic dinoflagellate *Cochlodinium polykrikoides* is one of several taxa responsible for the ecologically and economically important phenomenon known as harmful algal blooms (HABs), commonly referred to as ''red tides''. First described from Puerto Rico in the Caribbean by Margalef (1961), the geographic distribution of *C. polykrikoides* is widespread, and populations have been documented in tropical and warm-temperate waters around the world, including the Caribbean Sea, eastern and western Pacific Ocean, the eastern Atlantic Ocean, Indian Ocean, and Mediterranean Sea (Kudela, *et al*., 2008; Matsuoka, *et al*., 2008). *C. polykrikoides* appeared in August 2008 in the Oman Sea, extended into the Arabian Gulf and formed a large-scale red-tide of long duration from August 2008 to April 2009 accompanied with huge mass mortalities of marine nekton and benthic organisms. Despite the widespread occurrence of this species in the Pacific, Atlantic, and Indian Oceans, only a few studies of its ecophysiology have been conducted in the Oman Sea and the Persian Gulf (Matsuoka, *et al*., 2008). Ballast water has been suggested as a possible mechanism for introducing this species region by Richlen, *et al*., 2010.

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In the present case, investigations to assess the impacts on the marine ecosystem and public health from the algal bloom (*Cochlodinium polykrikoides)* was carried out by Environment Department of Dubai Municipality.

METHODS OF SAMPLE COLLECTION AND ANALYSES

Phytoplankton bloom samples were collected at two locations (25°18'17.13" N 55°21'15.66" E and 25°18'9.74" N 55°21'24.62" E) on 13th, 14th, 15th and 16th March 2016 from surface algal bloom samples were collected and using l lit. clean polyethylene bottles for population estimation and preserved in acidified Lugols iodine solution and transferred to the Marine Field Research Laboratory in Al Jaddaf. From the above concentrated bloom samples 1ml was taken on a Sedge-wick Rafter cell for counting and analyses under a binocular research Leica inverted microscope (model: DMI1) with attached camera (Leica, Eclipse 50i with 10X to 100X magnification). Identification of phytoplankton was carried out using phytoplankton identification manuals, research article and books (Richlen, *et al*., 2010; UNESCO., 1978 and Tomas, 1997).

RESULTS

Laboratory analyses confirmed that the discoloration of Al Mamzar lagoon was due to the blooming of Dinoflagellate – *Cochlodinium polykrikoides* with a cell density of 54,800 cells/ml, 44,800 cells/ml, 15,800 cells/ml and 4,800 cells/ml were recorded on 13th, 14th, 15th and 16th March, 2016 respectively (Fig.1). *Cochlodinium polykrikoides* which is the

bloom causing Phylum; Dinoflagellata, Class; Dinophyceae, Family; Gymnodiniaceae in this case. This harmful blooms caused marine organisms huge numbers of dead ctenophorea (Jelly fish), shellfish and other marine organisms were reported and some of the coastal birds were observed to have sickness and dizziness due to the algal blooms.

Fig. 1 *Cochlodinium polykrikoides* blooms at Al Mamzar Lagoon

DISCUSSION

Media reports on the chronology of the 2008–2009 bloom suggest that the *Cochlodinium ploykrikoides* bloom affecting (appeared for the first time) the Arabian Gulf may have originated in the Gulf of Oman and was subsequently transported into the Arabian Gulf though the Strait of Hormuz. It is regional circulation regimes clearly suggest an allochthonous origin of at least some taxa that originate in the Gulf of Oman and are adverted into the Arabian Gulf by Dorgham, *et al*., 1987. The mechanistic processes that were involved in the *Cochlodinium* bloom initiation and spread are not known, but may relate to physical forcing factors such as the Arabian Sea's reversing monsoon system that drive convective mixing, resulting in the upward transport of nutrients in the northern Arabian Sea. Nutrient enrichment was also suggested as an important factor that contributed to the 2001 epizootic in Kuwait Bay by Glibert, *et al*., 2002. The coastal waters of the Arabian Gulf have been exposed to a variety of environmental pressures and pollutants, including pollution from oil operations; industrial and domestic wastewater inputs such as treated and untreated sewage, desalination effluents, wastewater from fertilizer plants (e.g., urea), oil refinery outfalls; and land runoff from agricultural operations (Sheppard, *et al*., 1992). The recently developed fish aquaculture industry in the region represents an additional source of nutrient enrichment to coastal waters, though the number of farms is presently quite small. In addition to anthropogenic eutrophication, nutrient regeneration and decomposition of the algal bloom likely contributed to the size of the available nutrient pool; given the immense size and duration of the bloom coupled with low flushing rates in the Gulf, this nutrient flux may have helped to maintain and propagate the bloom. As eutrophic conditions have been implicated in *Cochlodinium* blooms elsewhere, the potential stimulation of the 2008–2009 Arabian Gulf bloom by anthropogenic nutrient enrichment and/or nutrient regeneration clearly warrants further investigation (Ahn, *et al*., 2006; Anton, *et al*., 2008). To our knowledge, this is infrequently HAB event associated with *C. polykrikoides* in this region. Conclusion it is likely that the development of the bloom of *C. polykrikoides* in the coastal waters of Mamzar lagoon was likely facilitated by the mesoscale forcing towards the coastal region-driven reversal of raining periods, while the occurrence and persistence of high densities of *C. polykrikoides* was significantly influenced by an elevated nutrient load and warmer than normal temperatures. We speculate that the progression of this regional event began with stronger than normal upwelling from the rainy along the Dubai coast. This was likely followed by discharge of warm coastal plume water from the region, and together with nutrient discharge (which included enrichment of PO_4), the *C. polykrikoides* cells were able to grow rapidly and accumulate along in the region. This study supports the growing conclusion that increasing numbers of blooms of *C. polykrikoides* are associated with nutrient loading, and the diversity of nutritional mechanisms appears to allow them to not only establish under conditions of high nutrient loads, but to be sustained for long periods of time. There is much yet to be understood, however, with regard to the long-term, large-scale patterns of phytoplankton change in the area, and specifically when and why *C. polykrikoides* can displace *N. scintillans* as the major bloom former of this region and the sources of nutrients that support these blooms, as well as the differential factors leading to growth of one dominant species over another.

In the current area of concern at Al Mamzar lagoon, storm water discharge outfall nearby the beach may be the cause of the bloom. This area is considered as a hotspot and is monitored to keep a close watch on the changes taking place around it. There have been many colored discharges (red, brown, white and black) from the storm water discharge outfall in the past with reason not yet known as the source is unknown.

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