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“Crab Jubilee” subsequent to red tide of *Noctiluca scintillans* along the central Kerala coast (SW coast of India)

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Crab jubilee associated with red tide of *Noctiluca* was observed along the central Kerala coast during the summer monsoon of 2013. There was an unusual shoreward mass movement of blue swimming crab *Portunus pelagicus* throughout the day. Hypoxia caused by red tide of *Noctiluca* in the coastal waters as well as sluggish upwelling by fresh water surfacing during the intense rainfall might be the reason for this unusual coastal phenomenon.

[Keywords: Crab jubilee, Red tide, *Noctiluca scintillans*, Hypoxia, Kerala coast, Southwest coast of India]

“Jubilee” is an unusual phenomenon which brings the demersal fishes and crustacean shoreward from the depths into shallow waters of the shoreline in a depressed or moribund state for several minutes or hours and seldom killed. The term jubilee was first used in the scientific literature by Loesch¹ for describing the sporadic shoreward migration of demersal organisms in Mobile Bay (Gulf of Mexico). He considered the depletion of oxygen as the reason for this phenomenon. Later, May² confirmed the extensive oxygen depletion because of salinity stratification in Mobile Bay, as the cause for the so called jubilee phenomenon. Only very few reports are available on jubilee phenomenon from the world ocean such as, Mobile Bay- Gulf of Mexico^{1,2,3}, Walvis Bay- Southwest Africa⁴ and from Florida coast⁵. There is no published report on jubilee from the Indian EEZ.

An unusual “Crab jubilee” was reported by local fisherfolks and in News paper⁶ from the coastal region of Chettuva to Chavakkad (Central Kerala coast) on 13th July 2013 (Fig. 1 and 2). This was due to the unusual, mass shoreward movement of blue swimming crab *Portunus pelagicus* and was observed throughout the day time till evening. Local fisherfolks were able to harvest the heavy catch of crabs without much effort by using scoop nets and shore seines. More than 4000 kg of crabs were obtained from the

area and along with this bottom dwelling flat fishes (*Cynoglossus* sp.) in considerable amount.



Fig. 1— Study area. Red dot represents the area where the Crab jubilee was observed along the central Kerala coast

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Fig. 2— Fishermen separating the crabs from the shore seines (Inset- *Portunus pelagicus*)

The most suggested causative factor for the jubilee phenomenon was depletion of oxygen (hypoxia/ dead zone). According to May², the jubilee phenomenon along Mobile Bay, Gulf of Mexico was due to oxygen depletion in summer resulted from salinity stratification. In the present study hypoxic conditions were observed along the bottom waters of jubilee area. Search of the possible reason for present hypoxia points to the algal bloom (Red tide) event observed along the coastal waters off Chavakkad four days before this phenomenon. A red tide of *Noctiluca scintillans* (syn. *N. miliaris* Suriray) was observed off Chavakkad (Lat. 10° 23.670 N; Long. 76° 01.295 E) with red surface water discolouration (Fig. 3) and cell density 2.5×10^5 cells L^{-1} during FORV *Sagar Sampada* cruise 315 on 9th July 2013. The bloom was monospecific, spread over an area of 5-10 km length and 3-4 km width. Physico-chemical and biological characteristics of the bloom area were analysed following standard procedures and protocols^{7, 8}. Vertical profiling of parameters, such as temperature, salinity, and density, was done using Conductivity-Temperature-Depth profiler (CTD Seabird 911 plus) for understanding oceanic processes. Sea Surface Temperature (SST) of bloom regions was measured by a bucket thermometer. Qualitative and quantitative analysis of micro algal composition of bloom samples were carried out using a Sedgewick Rafter counting cell under a Nikon Eclipse microscope following standard identification keys⁹.

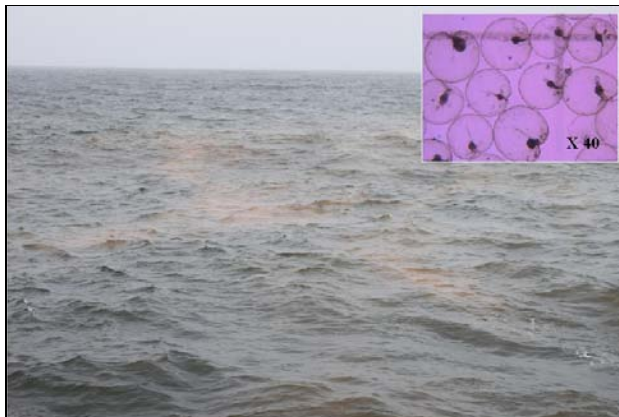


Fig. 3— Red surface water discolouration by *Noctiluca scintillans* bloom (Inset- microphotograph of *N. scintillans* x 40)

With growing influxes of the nutrients (nitrogen and phosphorous) from terrestrial runoff because of heavy southwest monsoon (June-July 2013), the ecology of coastal region began to change. This results in eutrophication, causes increased phytoplankton growth and reproduce more rapidly resulting in algal blooms. Massive algal blooms turned the water red, green or even brown, depriving sunlight to the flora below and depositing a steady stream of decaying organic matter in the bottom. Bacteria on the seabed then consumed greater amounts of oxygen as they feasted on the organic matter and the dead plants, leading to hypoxia on the seafloor, stressing the benthic fauna. From the vertical distribution of dissolved oxygen in the bloom area (Fig. 4), it was observed that the bottom waters are hypoxic with dissolved oxygen concentration of 0.27 ml L^{-1} . Coastal upwelling during summer monsoon also plays a significant role in the development of hypoxia. Along the eastern Arabian Sea during southwest monsoon intense rainfall and subsequent freshwater runoff results in a thin freshwater lens that prevents upwelled waters from surfacing. Moreover the upwelled waters are drawn from the marginally suboxic waters off the shelf break. Thus the sluggish upwelling with poor mixing results in further O_2 depletion of initially low oxygen subsurface waters leading to coastal hypoxia¹⁰. The present crab jubilee and associated shoreward migration of bottom dwelling flat fishes (*Cynoglossus* sp.) can be considered as a consequence of temporally existing hypoxic condition augmented by the red tide of *Noctiluca* in the coastal waters.

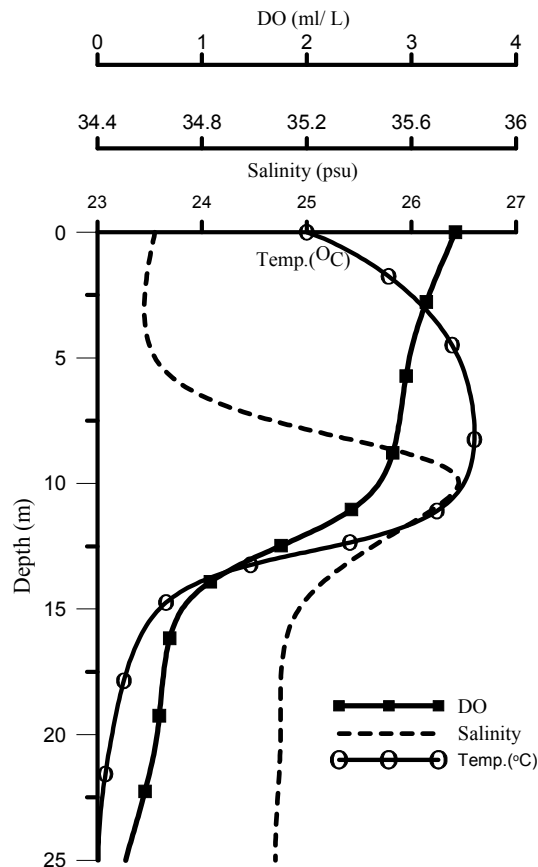


Fig. 4— Vertical profile of temperature, salinity and dissolved oxygen of *Noctiluca* red tide area

Jubilees, once known mostly in the Gulf of Mexico region, now happen in Chesapeake Bay and other areas, wherever coastal dead zones occur¹¹. Dead zones have now been reported from more than 400 systems, affecting a total area of more than 245,000 square kilometers, and are probably a key stressor on marine ecosystems¹². Excessive nutrient input along with terrestrial runoff especially during heavy precipitation results in rapid algal blooms. This increased accumulation of organic matter followed by their decay enhances the probability of coastal hypoxia and related environmental stresses leading to Jubilee like phenomenon.

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