NOTE ON THE OCCURRENCE OF PHYTOPLANKTON AND ITS RELATION WITH MASS MORTALITY IN THE JAKARTA BAY, MAY AND NOVEMBER 2004

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Abstrak

There were noted two times (May and November 2004), fish mass mortality occurred in the coast of the Jakarta Bay, killing several species of small and big fishes, crustaceans, eels and molluscs. Phytoplankton blooms in the Jakarta Bay is accelerated by the high input of nutrients, which caused eutropication of the Bay water. Analysis of water sample showed in st 1 (Marina coast) showed that phytoplankton abundance was of 2.9 x 10^6 cells/l^-1, the common diatom species recorded at that time were: Skeletonema costatum, Thalassiosira mala, Bacteriastrum varians, Chaetoceros pseudourvisetus, Nitzchia sigma, Coscinodiscus radiatus. Of the which: Skeletonema costatum 1.8 x10^6 cells/l^-1 ; in st. 3 Binaria lake was the most a common diatoms species found in the Jakarta Bay. This species frequently bloom, especially after rainfall, causing no harm to marine life, the second diatoms Thalassiosira mala 2.8 x 10^6 cells/l^-1 (st 4 Carnaval coast), during this decade in more often frequencies. The second largest group was represented by four dinoflagellates species: Prorocentrum micans, Protopteridinium sp., Ceratium furca and Gonyaulax sp., and one species dominated of dinoflagellate Prorocentrum micans 2.3 x 10^6 cells/l^-1 (in the Dadap coast). P. micans is also common species of the Jakarta Bay. Hydrological conditions in May and November 2004 are, temperature 32 – 33 °C, pH 7.76 to 7. 92, Salinity 32 ‰, Dissolved oxygen 3.88 to 4.26 mg/l, Phosphate 0.10 – 0.40 µg-at-P l^-1, Nitrate 0.01 to 0.03 µg-at-N l^-1. The result suggests that phytoplankton distributes in wider areas than expected and monitoring of its occurrence in Indonesian waters is necessary to prevent harmful effects of such bloom.

Keywords: The occurrence of phytoplankton, mass mortality, The Jakarta Bay

1. Introduction

Mass mortalities of fish have been observed 2 times in the Jakarta Bay on 7 May 2004 and November 30 2004. Many statement were made blaming industries, oil spill, or algal blooms for the incident; none of them came up with satisfactory explanation. Oil spill should easily been detected forming oil layers on the sea surface. No signs of this feature were detected, and the killed fish, were not covered by oil. So oil spill was not the factor of mass mortality. Poison may be introduced to the environment through river water or discharged by vessels. Looking at the wide area affected, tons of poison should be dumped to do the damage. This looks impossible, for no industry would release large amounts of poison into river water. Poisons, such as heavy metals, do not have instant impact. Poison produced inside habitat, many phytoplankters, called Harmful Algal (HAB) organisms, have the ability to produce poison that could kill marine biota. HAB organisms have been identified in the Jakarta Bay, such as Pyrodinium bahamense var compressum, Gymnodinium catenatum, G. pulchellum, Dinophysis caudata, Noctiluca scintillans and Pseudo-nitzchia sp. These organisms were not detected during the incident. Data show that the affected marine biota consists of several species of fish, crustaceans and mollusks. Marine biota was killed starting the evening of May 7 until the morning of May and 30 November 2004. The area covered coastal waters between Kamal and Binaria, Ancol. There have been several reports of HAB incidences in Indonesia with human casualities where the major cause is the toxic dinoflagellates Pyrodinium bahamense var. compressum which is responsible for PSP (Paralytic Shellfish Poisoning). Such incidences were reported to occur in Nusa Tenggara [1] and Halmahera [2]. Fish kills are also reported to occur in several areas such as
the Jakarta Bay [3]. HAB organisms in Indonesian waters were reported by Paseno & Wiadnyana [4] and lately Praseno & Sugestiningsih [5] listed and described 35 HAB species in Indonesia, of which 25 species belong to dinoflagellates. Since then intensive monitoring activities were conducted at several locations to study on the geographical distribution. This paper is intented to provide current information on the occurrence of phytoplankton and its reation with mass mortality in the Jakarta Bay.

2. Material and Method

The phytoplankton surveys were carried out in May 2004 and November 2004, in Marina coast, Horison Hotel, Binaria Lake and Carnaval coast at Ancol Coast, the Jakarta Bay (Figure 1). The measurements of environmental parameters, i.e. temperature, salinity, dissolved oxygen, phosphate and nitrate were also done. Plankton samples were collected by horizontal haul at the sea surface using a phytoplankton net equipped with flow meter. All plankton samples were preserved in 4 % formalin. Phosphate and nitrate concentrations were measured by methods described by Strickland and Parson [6]. Salinities were measured using salinometer and water temperatures were obtained from inverse thermometers fitted in Nansen bottles. Dissolved oxygen was measured using Winkler method. Phytoplankton cells were counted under an inverted microscope. The identification of phytoplankton species was done by using some reference books [7-15].

3. Result and Discussion

Algal blooms are common features for Jakarta Bay is accelarated by the high input of nutrients, which caused eutrophication of the Bay water [3], but so far have never caused problems. On May and November 2004, coincided with a green – brown colour discolouration. Phytoplankton concentration of this occurrence from horizontal haul samples was 2.5 – 4.2. x 10^6 cells/l. These values are lower than the in Manila Bay where 7.0 x 10^6 cells l^-1 occurred [16]. Twenty phytoplankton species which consist 12 species of diatoms and 8 species of dinoflagellates were recorded (Figure 2). The most dominant phytoplankton genus are: Chaetoceros, Skeletonema, Thalassiosira and Prorocentrum (Figure 3). Hidrological conditions at sampling sites are, temperature 32 – 33 °C, pH 7.76 to 7. 92, Salinity 32‰, Dissolved oxygen 3.88 to 4.26 mg/l, Phosphate 0.10 – 0.40 µg-at-P l^-1, Nitrate 0,01 to 0.03µg-at-N1^-1 concentration (Figure 4). The relatively high phosphate concentrations during May and November 2004 in all stations, may be due to heavy rainfall and the water of flow. This suggests that climatic and hydrological conditions might play an important role to accelerates the bloom of phytoplankton of the Bay water.

The phytoplankton blooms were recorded in all samples collected during the fish kill in the Jakarta Bay and surrounding areas. The highest bloom occurred in Marina Coast Jakarta Bay on Mei 2004 in st. 1, with the cell number about 1.8 x 10^6 cells/l and was dominated by Skeletonema costatum. Skeletonema costatum is a common diatom species found in the Jakarta Bay. This species frequently bloom, especially after rain falls,
Figure 1. Map of sampling location: 1. Marina coast; 2. Horison Hotel; 3. Binaria Lake; 4. Carnaval coast

Figure 2. Phytoplankton abundance at Ancol in the Jakarta Bay, May – November 2004
causing no harm to marine life. The second diatoms Thalassiosira mala 2.8 x 10^6 cells/l^{-1} only appeared during the last decade in more often frequencies. Bloom of this species may harm molluscs, as was the case in the coastal waters of Chiba Bay of Tokyo, in September 1951 [17].

The dinoflagellate compositions during the survey were 11 species. The total number of cells of dinoflagellate in st. 1 was about 2.8 x 10^6 cells/l^{-1}, with the domination species was Prorocentrum micans (2.3 x 10^6 cells/l^{-1}). This species was found in all areas during the fish killed in Mei 2004. Prorocentrum micans is also a common species of the Jakarta Bay, although never dominated phytoplankton community. This species is known as fish killer. In St Helena Bay, South of Africa blooming of this species, together with other phytoplankters, caused a drop of dissolved oxygen until 0.5 mg/l and caused mortality of 60 tons of spiny lobsters and 1,500 ton of fish [18].

The dinoflagellate cell found in all Ancol Coast on November 2004 was Protoperidinium sp. There were five species found in 50% of area, i.e. Ceratium furca, Protoperidinium sp., Protoperidinium oceanicum, Prorocentrum micans, and Phyrophacus sp. Six other
Figure 4. Nutrient (Phosphate, Nitrate) concentrations at Ancol in the Jakarta Bay, May – November 2004

Dinoflagellate species were found 25% existence of the areas at the Jakarta Bay and surrounding areas. In many cases the bloom of phytoplankton, certain species of phytoplankton algal can grow excessively (blooming) that can discolor seawater and known as red tide. The discolored water, however, is not always red depending on the pigment content of the responsible algal species. If the blooming alga produces toxin it can do harm to other organism such as shellfish, crustacean and fish. Certain species of planktonic algae are known as fish killers as their toxin or the anoxic condition they produce may induce mass fish kill. It can also affect human health if the seafood contaminated with the toxin is eaten by man. Because of this nuisance this algal bloom is known as Harmful Algal Bloom (HAB). There are many species that can cause HAB, but the most common are diatoms, dinoflagellates and blue green algae. HAB is gaining attention as it can affect not only the ecosystem but economy and human health as well.

4. Conclusion

There were noted two times (May and November 2004), fish mass mortality occurred in the coast of the Jakarta Bay, killing several species of small and big fish, crustaceans, eel and molluscs. Phytoplankton blooms in the Jakarta Bay is accelerated by the high input of nutrients, which caused eutrophication of the Bay water. The results suggests that phytoplankton distributes in wider areas than expected and monitoring of its occurrence in Indonesian waters is necessary to prevent harmful effects of such bloom.

Learning from this incident, red tide in the Jakarta bay should be studied in more detail, covering all aspects. Therefore, the need of basic research activities would be necessary to prevent and mitigate economic losses.

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References


