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POSSIBLE OCCURRENCE OF TOXIC AND HARMFUL PHYTOPLANKTON IN LEMBAR BAY, LOMBOK, INDONESIA

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ABSTRACT

Harmful Algal Bloom (HAB) incidences in Indonesian waters were increasingly occurred from time to time. Extensive and continous studies in this field are needed to be done in more areas in the country. This objective of this present survey were to determine the occurrence of potential toxic and harmful marine microalgae in Lombok, to reveal the diversity of marine microalgae found in the area, and to give some information on the occurrence of HAB phytoplankton in Lombok island. Plankton samples were taken from six stations in Lembar bay, Lombok on February, 2007. This survey found 23 marine microalgae species and two of those were potentially harmful and toxic, namely *Dinophysis caudata* and *Gymnodinium catenatum*. Four species, such as *Ceratium* spp, *Dinophysis miles*, *Prorocentrum gracile*, and *P. micans*, were noted to be harmful though so far no report on adverse effect caused by these microalgae in the area. Diatom *Chaetoceros* spp were the most abundant phytoplankton in almost all of the sampling areas and followed by *Ceratium furca* and *Protoperidinium* sp.

Keywords: HAB, Lombok island, *Dinophysis caudata*, *Gymnodinium catenatum*.

INTRODUCTION

Indonesia has 81,000 km of coastal length that is prone to many adverse effects in this area. One of the important phenomena need to be understood well in the area was the increase of cases in term of blooming of marine phytoplankton that usually give rise to affect not only marine environment, but also human health and marine-related businesses. Such a phenomenon is well known as Harmful Algal Bloom (HAB), but formerly known as red tide (Hallegraeff, 1995).

Many marine microalgae were reported to be responsible for the impact happened after HAB outbreak occurred in an area. Those microalgae were capable either to produce toxins and the toxins may accumulate in the muscle of marine organisms through food chain (with human being as the "last" target at the tip of the pyramid) or to damage marine ecosystems when the huge number of marine microalgae cells block the penetration of sunlight, kill fish, foul water column, etc. (Anderson, 2004).

Indonesian waters are prone to HAB outbreaks and some cases were reported else where (Sidharta, 2005; Damar, 2003; Wiadnyana *et al.* 1996; Adnan, 1989). The latest HAB outbreak was reported to happpen in Tabanan beach, Bali that took vast number of fishes killed and tourists were cancelled their trip to the beach (Anonymous, 2007).

Therefore the study on marine microalgae occurrence and regular monitoring are important factors to minimize the adverse impact of HAB in this country. In addition to that, there was no published report on HAB outbreak in Lombok island and its adjacent areas. The objective of this present research are: 1) to determine the occurrence of potential toxic and harmful marine microalgae in Lombok, 2) to reveal the diversity of marine microalgae found in the area, and 3) to up date information on the occurrence of HAB phytoplankton in Lombok (as well as in Indonesian waters).

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MATERIALS AND METHODS

Sea water samples were taken from Lembar Bay, Lombok on 15 February 2007 (Fig. 1). Plankton samples were collected utilizing plankton net and placed in small bottle. In addition to that, environmental parameters such as salinity, pH, temperature, depth, and transparency were also measured. Samples were observed using light microscope Olympus™ type CH-2. Plankton samples were put into the Sedgewick-Rafter counting plate and then observed under the microscope. Marine microalgae found in the counting plate were counted for individual species and were identified based on their morphology as well as their characteristics and then compared to the existing identification books such as Allen and Cupp (1935), Tomas (1997), and Faust and Gulledge (2002).

RESULTS

This present research found 23 marine microalgae species (Table 1). Those 23 microalgae were examined and determined based on the existing work and books. These 23 species were divided into two groups namely dinoflagellates and diatoms. Thirteen species were belonged to dinoflagellate group and the rest were belonged to diatom.

Diatom species such as *Bacteriastrum* sp, *Nitszchia* sp, *Pleurosigma* sp, *Thalassionema javanicum*, *T. nitszchioides*, and *Odontella* sp were found in relatively low number of cells

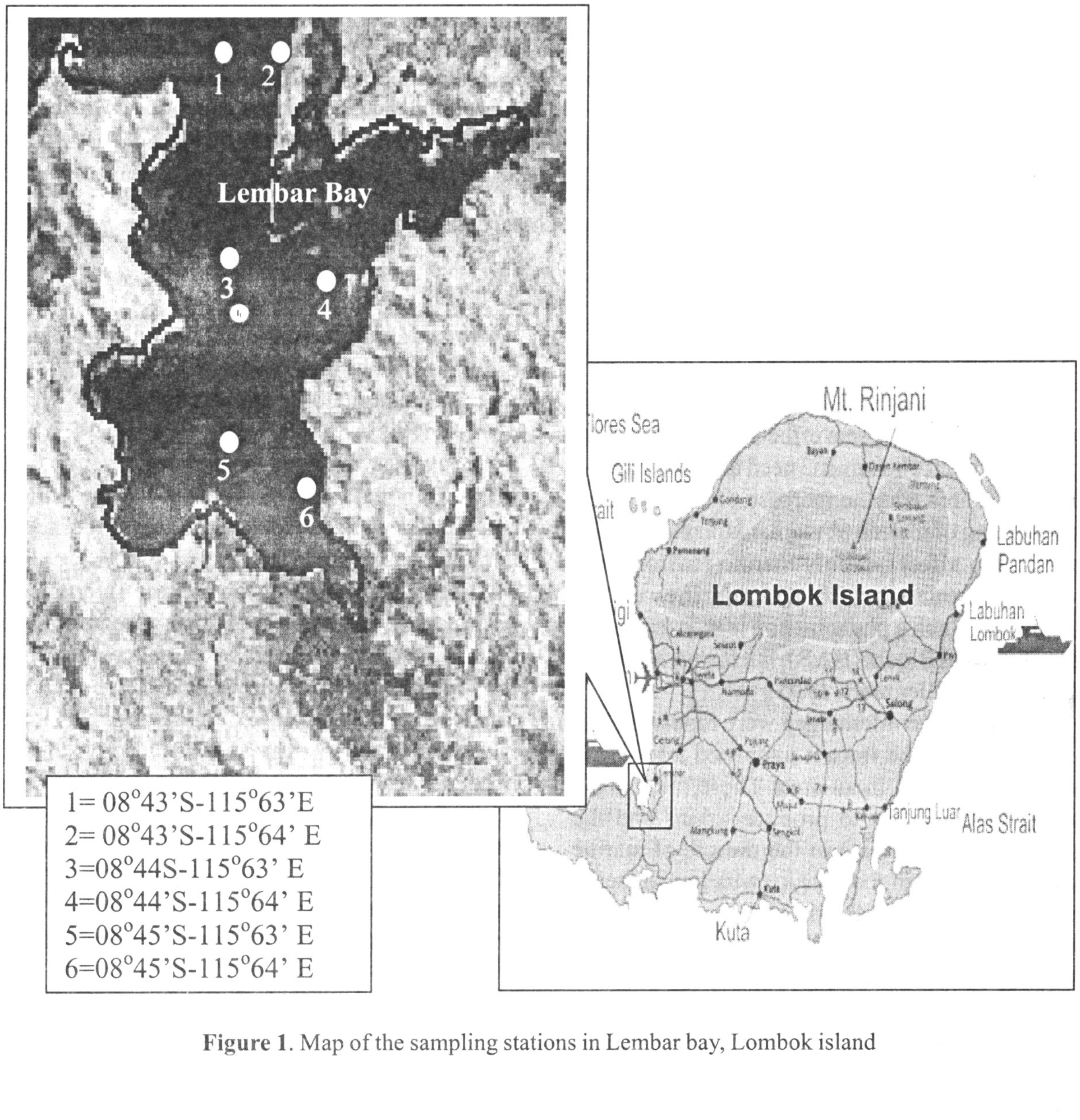

Figure 1. Map of the sampling stations in Lembar bay, Lombok island

Table 1. Overall marine microalgae observed in the water samples

+ : present, - : absent

No.	Marine microalgae	Stations					
		1	2	3	4	5	6
Dinoflagellate							
1.	*Dinophysis caudate*	+	+	+	+	+	+
2.	*Dinophysis miles*	-	+	+	-	+	+
3.	*Gymnodinium catenatum*	-	+	-	+	+	-
4.	*Prorocentrum gracile*	+	+	-	+	+	+
5.	*Prorocentrum micans*	+	+	+	+	+	+
6.	*Protoperidinium conicum*	+	+	+	+	+	+
7.	*Protoperidinium divergens*	+	+	+	+	+	-
8.	*Protoperidinium leonis*	+	+	+	+	+	+
9.	*Protoperidinium pellucidum*	-	+	+	+	-	+
10.	*Ceratium furca*	+	+	+	+	+	+
11.	*Ceratium fusus*	+	-	+	-	+	+
12.	*Ceratium trichoceros*	-	+	-	+	-	+
13.	*Ceratium tripos*	-	-	+	-	+	-
Diatoms							
14.	*Bacteriastrum* sp	-	+	+	-	-	-
15.	*Chaetoceros affinis*	-	+	+	+	+	+
16.	*Chaetoceros* sp	+	+	+	+	+	+
17.	*Coscinodiscus* sp	+	+	+	+	+	+
18.	*Thalassiosira* sp	+	-	+	+	+	-
19.	*Nitszchia* sp	+	+	+	+	+	+
20.	*Pleurosigma* sp	-	-	+	+	-	+
21.	*Thalassionema javanicum*	+	-	-	+	-	-
22.	*Thalassionema nitzschioides*	-	+	+	+	-	+
23.	*Odontella* sp	-	-	-	+	+	-

(Table 2). *Bacteriastrum* sp, *Odontella* sp, and *T. javanicum* were the species with low frequency of occurrence, i.e. only in two stations of the area of study, while *Pleurosigma* sp was found in 3 stations.

DISCUSSIONS

Among the dinoflagellate group, *Dinophysis caudata* was known to be toxic and harmful microalgae. This species was known to be able to produce dinophysis toxin and can cause Diarrhetic Shellfish Poisoning (DSP) worldwide (Altamirano *et al.*, 2004). As indicated in its name, the symptomps of DSP are as follows: gastrointestinal distress, nausea, vomiting, and diarrhea (Quilliam and Wright, 1995). Hence, such symptomps were very common to be misunderstood by medical practitioners, which were very similar to the adverse effect of bad sanitation in remote areas in the country. Praseno (1981) reported the bloom of *D. caudata* in Jakarta bay. Since then no more report on the bloom of this species in Indonesian waters.

Gymnodinium catenatum was also known as toxic and harmful, since this species might cause Paralytic Shellfish Poisoning (PSP) and produce saxitoxin (STX). This species, however, was found in a very few number i.e. 1×10^3 cells.L^{-1}. In addition, this species might become a problem in the area if no regular monitoring planned. The occurrence of *G. catenatum* in the area of study still need to be verified, because this species was considered as temperate and not common in the tropics (Steidinger and Tangen, 1997).

Ahyadi and Sidharta (2005) reported the occurrence of *Gymnodinium* sp in Bali-Lombok strait during the INSTANT cruise held. Fukuyo *et al.* (1993) confirmed that the same species occurred in Manila Bay, which is located in the tropical region. One possible explanation was that this species be brought into the area of study by ship's ballast water (Hallegraeff, 1995).

Table 2. Number of cells.L^{-1} (x 10^3) of phytoplankton collected at the sampling sites

No.	Marine microalgae	Stations					
		1	2	3	4	5	6
Dinoflagellate							
1.	*Dinophysis caudate*	9	2	7	5	3	4
2.	*Dinophysis miles*	0	2	5	0	5	5
3.	*Gymnodinium catenatum*	0	1	0	1	1	0
4.	*Prorocentrum gracile*	11	5	0	18	7	13
5.	*Prorocentrum micans*	4	6	4	4	5	6
6.	*Protoperidinium conicum*	61	67	188	78	76	89
7.	*Protoperidinium divergens*	8	53	33	15	36	0
8.	*Protoperidinium leonis*	14	31	23	12	11	24
9.	*Protoperidinium pellucidum*	0	3	4	5	0	3
10.	*Ceratium furca*	90	240	75	115	86	98
11.	*Ceratium fusus*	2	0	1	0	2	1
12.	*Ceratium trichoceros*	0	2	0	2	0	1
13.	*Ceratium tripos*	0	0	2	0	2	0
Diatoms							
14.	*Bacteriastrum* sp	0	1	1	0	0	0
15.	*Chaetoceros affinis*	0	3	5	4	6	5
16.	*Chaetoceros* sp	21	320	98	125	76	87
17.	*Coscinodiscus* sp	12	22	14	16	23	17
18.	*Thalassiosira* sp	5	0	6	7	6	0
19.	*Nitszchia* sp	130	55	88	79	90	99
20.	*Pleurosigma* sp	0	0	3	4	0	4
21.	*Thalassionema javanicum*	2	0	0	2	0	0
22.	*Thalassionema nitzschioides*	0	10	12	13	0	11
23.	*Odontella* sp	0	0	0	1	1	0

Two genera, *Ceratium* and *Protoperidinium*, shared the same number of species i.e. four species. *Ceratium furca* was non-toxic microalga, but it has been reported to be responsible for the mass mortality of blue-fin tuna at Baja, California (Orellana-Cepeda *et al.* 2004). *C. furca* could produce un-ionized ammonia with the concentration as high as 1 mg.L^{-1} and such a concentration was enough to caused rapid mortality in the tuna pens, while *C. fusus* was also reported to be able to harm invertebrate larvae though with an unknown mechanism (Taylor *et al.* 1995).

Two members of *Prorocentrum* namely *P. gracile* and *P. micans* were also known as common red tide marine microalgae in many areas (Orellana-Cepeda *et al.*, 2004). The two were non-toxin producers, however these two species were still potentially harmful, because they might affect other marine biota when they were in very high number of cells.

There was no toxic diatom species found, but there were still some noxious species occurred such as *Coscinodiscus* sp that was able to produce mucus and may clog the fish gills (Altamirano *et al.*, 2004). *Chaetoceros affinis* and *Chaetoceros* sp that have thick and hard spines were able to damage fish branchia (Altamirano *et al.*, 2004). Both *Chaetoceros* species were very potential to cause harmful effect to some marine organisms, especially fish, when their number of cells reached 2 x 10^7 cells.L^{-1}. Furthermore, *Chaetoceros* spp were the most abundant microalgae found in the water samples in the area. This finding was in accordance with the survey done earlier in southern Java seas and Indian ocean by Sutomo (2003).

Thalassiosira sp, in contrast, known as a useful diatom species in marine food chain, because this species was eaten by some zooplankton species (Orellana-Cepeda *et al.*, 2004). Thus, the presence of this species could help to maintain the health condition of the marine ecosystem by alleviating the secondary production.

To conclude, this present research found some HAB member species in Lembar bay, Lombok.

Some of them are really serious threat due to their ability to produce HAB toxins, i.e. *Dinophysis* spp and *Gymnodinium catenatum*. However, further research and monitoring still need to be done to verify those harmful species in the area.

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