Subthermocline Chlorophyll Maxima in the South China Sea, Area III (Western Philippines)

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ABSTRACT

The subsurface chlorophyll maxima from 31 sampling stations in the South China Sea off Western Philippines were investigated. The extremely low concentration of chlorophyll ranged 0.001-0.104 μg/1 were observed. These values were thought to be a result of serious problem of samples storage for too long at -20°C. Shipboard analysis or improved storage strategy should be considered.

Introduction

Chlorophyll is the principal photosynthetic pigment of phytoplankton in the oceans. Measurement of chlorophyll have been used as indicator of biomass and productivity in marine environment for over 40 years. Low concentration of chlorophyll in oligothrophic ocean at surface water is leas than 0.05 μg/1 while their characteristic maxima ranged 0.1-0.5 μg/1 at depth of 100-150 m. However, chlorophyll rich waters in estuaries, coastal seas, upwelling areas and continental shelf fronts have chlorolhyll concentration in the range of 1-10 μg/1. (Jeffrey and Mantoura, 1997

Primary production in the Gulf of Thailand and East Coast of Peninsular Malaysia in the South China Sea (Area I) was recently carried out by SEAFDEC in 1996. Musikasang *et al.,* (1999) reported that nearshore stations had highest daily primary production at depth of 2-6 meters while offshore stations sbpycnocline maxima were observed at depth of 25-50 m. The value of chlorophyll maxima at this depth is approximately 0.1 μg/1. Snidvongs (1999) studied the distribution and composition of photosynthetic pigments in the South China Sea in the areas off Sabah, Sarawak and Brunei Darussalam in 1997 and reported that subsurface chlorophyll maxima were observed at depth of 50-100 m. in Southeast Asian Waters where depth is deeper than 50 m. He also reported the range of chlorophyll a, b and c observed in the studied area were 0.01-0.77 μg/1, 0.01-0.32 μg/1 and 0.01-0.77 μg/1 respectively. Shamsudin *et al.,* (1988) studied the chlorophyll a content off the Sarawak Waters of the South China Sea during the Matahari Expedition in 1987 and reported that chlorophyll a in the studied area ranged 0.00601-0.2569 μg/1. The subsurface chlorophyll maxima was observed at depth of about 60 m. Ichikawa (1990) reported that in the South China Sea off Sabah, the chlorophyll maxima was observed at depth of about 50 m. with a range of 0.14-0.43 μg/1. and concluded that the chlorophyll concentration in the area is comparable to those of productive North Pacific open waters and Equatorial upwelling waters.

The objective of the present study in to collect information on the distribution of chlorophyll in the South China Sea off Western Philippines and attempt to elucidate the over all chlorophyll distribution in the region in relation to marine fishery resources survey conducted by SEAFDEC member countries.

Material and Methods

Water samples were taken by Van Dorn water sampler at surface, seasanal thermocline (below the mixed layer), chloraphyll maxima depth and subchlorophyll maxima depth. The sampling depth followed ICTD record at each station. The chlorophyll maxima depth for all stations were well below seasonal thermocline depths. The water samples of 2-6 liters were collected and filtered through GF/F filters with diameter of 47 mm. Under vaccum pump not exceeding 150 mm. Hg (vaccum) in the dark place. Then the GF/F filters were kept in glass vials and store at -50°C in the research vessels. After returning to shore laboratory, the filters were kept at -20°C in the freezer until analysis was performed.

For extraction, GF/F filters were cut in a small pieces and grind in a glass hamogenizer with 2 ml DMF (Dimethylformamide) mixed with 0.5 M Ammonium Acetate (Furuya *et al.,* 1998) as the ion paring reagent and keep in refrigerator for ten minutes. Then, the crushed filters were centrifuged and the supernatant were filtered through a 0.2 μm PTFE filter (Sartorius). The mixing and filtaration was done immediately before injection. The 125 μl of the mixture was injected in to a Thermoseparation HPLC systems (a binary gradient pump, autosampler, UV detector, degasser) fitted with a 5 μm HICHROM S50DS (4.6x250mm.) HPLC grades reagents were used for all analysis. The pigment separated were identified on retention time of commercially available pigment (Chls a and b : Sigma U.S.A.). Chlorophyll were quantified by weight from peak area calibrated against that of the standard solution.

Results

Table 1 summarized the result of chlorophyll analysis in this study. The extremely low concentrations reflected that there might be some crucial problems in the analysis. The problems may concerned with water sampling volume, storage of GF/F filter, extraction and analysis by HPLC. Samples were collected during April 7- May 19, 1998. The samples were injected to HPLC on late December 1998. The prolong time for analysis was about 7-8 month. Thus, the GF/F were kept under –20° C for too long as mentioned by UNESCO (Mantoura *et. al.,* 1997) The delay in analysis was due to the malfunction of the HPLC system.

Thus storage of samples during the long cruise must be seriously considered as a drawback for a certain water quality parameter. Shipboard analysis of chlorophyll might the best but if not possible storage in liquid nitrogen is a good alternative.

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Table 1. Results of chlorophyll analysis in this study.

Stations	Chlorophyll-a				Chlorophyll-b			
	A	B	C	D	A	B	C	D
1	NS	-	-	-	NS	-	-	-
2	-	-	-	-	-	-	-	-
3	-	NS	-	-	-	NS	0.002	-
4	-	-	0.001	-	-	NS	0.004	-
5	-	-	-	-	-	-	-	-
6	-	-	0.003	-	-	-	0.002	-
7	-	-	0.002	-	-	-	0.006	-
8	-	-	0.001	-	-	-	0.003	-
9	-	-	-	-	-	-	-	-
10	-	0.002	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
14	-	0.001	0.002	-	-	-	0.007	-
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	0.002	-
19	-	-	-	-	-	-	0.002	-
20	-	-	-	-	-	-	-	-
21	0.001	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	0.005	NS	-	-	0.003	NS
25	-	-	0.008	-	-	-	0.006	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	0.002	-
28	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-
30	0.008	-	0.104	-	-	-	-	-
31	-	-	-	-	-	-	0.041	-

Remark: NS = NO SAMPLE - = NON DETECT
A = SURFACE B = SEASONAL THI
C = CHLOROPLIYLL MAXIMA D = SUBCHLOROH