Annex VI-1

Draft National Report on HAB in China

(Submitted in the Second Meeting of NOWPAP WG3)

Ⅰ INTRODUCTION

The microscopic planktonic algae are the main primary producers in the marine ecosystem. They are critical food for filter feeding bivalve shellfish, such as oysters, mussels, scallops, clams, as well as the larvae of commercially important crustaceans and finfish. Microalgae play a very important role in marine food webs. In normal cases, the proliferation of planktonic algae is beneficial for aquaculture and wild fisheries operations. However, in some cases, algal blooms caused by toxic or harmful algal species can have a negative effect, causing heavy losses to aquaculture, the fisheries industry and tourism operations, and having major environmental and human health impacts. Hallegraeff (1993) noted that among the 5000 species of extant marine phytoplankton, some 300 species can at times occur in such high numbers that they obviously discolour the surface of the sea (so-called ‘red tides’), while only 40 or so species have the capacity to produce potent toxins that can find their way through fish and shellfish to humans.

1. Definition of red tide in China

Harmful algal blooms (HABs) were called red tides in the past because of the intense (often reddish) discolouration of the seawater by the pigments in the algae involved. However, the term red tide is too general: it includes dense accumulations of phytoplankton species which can visibly discolour the seawater but have no harmful effects, and it excludes many other blooms which cause negative effects at very low density without any associated water discoloration. In spite of the name, red tides are often not red, and are seldom associated with tides, and in some cases there are no negative effects.

“Harmful algal blooms” (or HABs) is the term now used widely to describe blooms which have negative effects. They take many forms and have equally diverse effects, but they always have harmful or toxic effects. These effects involve different toxins produced by the algae resulting in fish and other marine animal kills, as well as more general environmental effects.

Traditionally, Chinese are used to the term of “red tides” to describe any marine phytoplankton events, both water discolourations and harmful or toxic events. For the scientific communities in China, HABs is widely used. HABs in this report, therefore, encompass both harmful or toxic blooms and harmless red tides.

2. Present situation of HABs in China

For many years, HABs have had a severe economic impact on shellfish and finfish resources, public health, and the aquatic environment throughout the coastal regions of China. It is now evident that the magnitude, frequency and geographic extent of these occurrences have increased significantly over the last several decades. This phenomenon affects China, as a developing countries that rely heavily on coastal fisheries and mariculture for their food supply and economics.

Fish kills are the main economic effect caused by HABs. In China. Some algal species can seriously damage fish gills, either mechanically or through production of hemolytic and hemagglutinating substances. Wild fish stocks have the ability to move away from bloom areas, whereas caged fish are absolutely exposed to such noxious algal blooms.

In recent China, a long-term bloom caused one million Chinese dollars worth of aquaculture product losses in Bohai Bay in 1989 (Qi *et al*, 1993). A massive fish kill and PSP toxicity cases were also recorded in Tolo Harbour (Lam et Yip, 1989) and various parts of Hong Kong waters (Lam et al, 1987). In 1998, an historical record bloom affected Hong Kong and other nearby South China waters (Lu and Hodgkiss, 1999). Almost all caged fishes were killed by the bloom, resulting in estimated direct losses of HK$315 million in Hong Kong plus over HK$20 million in nearby South China waters.

In 2003, the national sea waters witnessed altogether 119 cases of marine red tides, added up area about 14.55 thousand square kilometers. Compared to that of 2002, either events or affected areas are increased (Table 1).

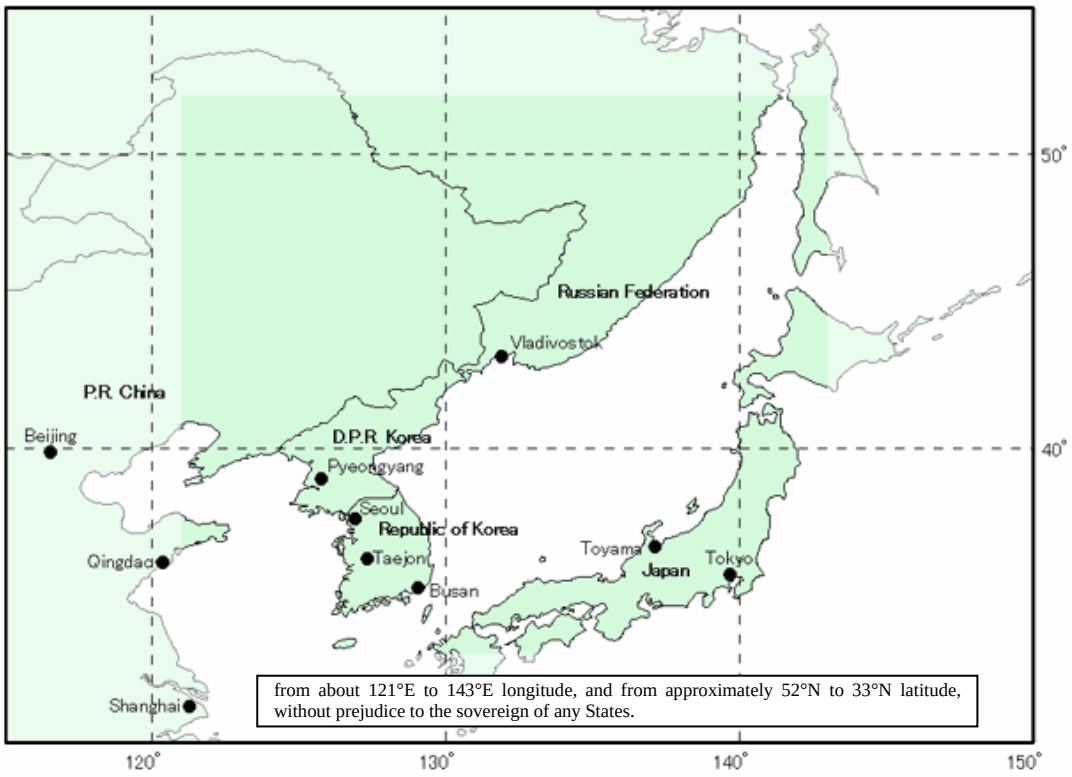
Table 1 Contrast of marine red tide events in Chinese coastal waters in 2002-2003 (adapted from SOA)

Sea Areas	Number of Red Tide Events		Added up areas (km^2)	
	2002 年	2003 年	2002 年	2003 年
Yellow Sea	3	5	310	410
Bohai Sea	14	12	300	460
East China Sea	51	86	9 000	12 990
South China Sea	11	16	540	690
Total	79	119	10 150	14 550

3. Marine and coastal environment of NOWPAP region in China

NOWPAP regions in China are Bohai Sea and Yellow Sea. The Yellow Sea is located between the China and Korea. It is connected to the East China Sea to the south. It has a maximum depth of 152 m. The length approximately 1,000 km, greatest width 700 km; area 466,200 sq km. Huge quantities of sediment are discharged into the Bohai Gulf by the Yellow River in China. It receives the Huang He (Yellow River) and Chang Jiang (Yangtze River), which transport yellow mud (derived from the soil known as loess, which was originally wind-blown from central Asia) down into the shallow waters (average depth 44 m).

The Bohai Sea is a enclosed interior sea located at 37° 07′ ~41° N and 117° 35′ ~122° 15′ . It connected with the Yellow Sea on the east via the Bohai Strait. The line linking Laotieshan of the Liaoning Peninsula and the Cape of Penglai on the north coast of the Shandong Peninsula is the boundary between the Bohai and Yellow seas. The Bohai Sea covers an area of 77284 km^2 and has a continental coastline of 2668 km long. With an average water depth of 18 m and a maximum of 85 m, it has over half of its sea area shallower than 20 m. Located in the northern temperate zone, the Bohai Sea is neither extremely hot in summer nor severely cold in winter. Here, the multi-year mean air temperature is 10.7℃， the precipitation 500~600 mm and the seawater salinity 30.



Geographic coverage of the NOWPAP Region

Geographic coverage of Yellow Sea and Bohai Sea

Ⅱ DATA AND INFORMATION USED

Data and information used for the report are mainly from published literatures and materials.

Red tide study and monitoring in China are relatively later compared to other coastal countries. The earlier red tide data and information was from fishmen's observation and few research projects. So the earlier data is discontinuous and not completed.

Red tide monitoring program is conducted by State Oceanic Administration (SOA). The monitoring program started from late 1980, and the monitoring network is still under construction. Late on, some local government in coastal areas have their own monitoring programs focused on mariculture waters. SOA has issued "Year Report of Chinese Marine Environmental Quality" since 1990, and some coastal provincial government have also issued their local Year Report since 2001. Red tide data was published in these reports.

There are also many scientific projects on red tides working on different coastal areas. These projects focused on red tide occurrences, mechanisms, species diversity, toxicity, and mitigation. The published literatures are one of the main data and information of this reports.

Table 2 Situation of Red Tide Occurrence in Yellow Sea and Bohai Sea， China

Event No.	Location (name of the sea area) *1	Approximate Area suffered (km2)	Type of HAB Red tide or Toxic	Duration dd/mm/yy -dd/mm/yy	Causative species	Max. cell density cells/L	Mitigation Activity and effectiveness	Damage	
								Fishery resources*2	Human health*3
1	LaizhouBay	1/3 Bay area	Red tide	18/6/1990					
2	Jiaozhou Bay	80 000	Red tide	26/6/1990					
3	Baidaihe,Hebei	110		28/6/1990-4/7/1990					
4	West Laizhou Bay	10	Red tide	19/8/1990-20/8/1990					
5	LaizhouBay	1200	Red tide	26/8/1990					
6	LaizhouBay	1000	Red tide	30/8/1990					
7	North LaizhouBay		Red tide	1/9/1990					
8	Liaodong Bay	100	Red tide	4/7/1991-12/7/1991	Noctiluca scintillans	4.9×10^7	none		
9	Jiaozhou Bay		Red tide	April, 1992					
10	East Qingdao	1200	Red tide	12/5/1992					
11	37°38′06″N，120°06′01″E		Red tide	6/6/1995	Noctiluca scintillans				
12	Penglai, Bohai	1	Red tide	13/4/1997-14/4/1997					
13	Bohai Bay	3	Red tide	28/6/1997					
14	Yantai, Bohai	100	Toxic	August, 1998				30 millium RMB Fishery losses	
15	Bohai Sea	5000	toxic	16/8/1998-19/9/1998	Ceratium furca，Dinophysis ovata	1.25×10^9		120 millium RMB Fishery losses	DSP detected
16	Yantai, Bohai	170		15/8/1998-10/9/1998	Gymnodinium sanguineum			Shellfish death	
17	Bohai Sea	6300		13/7/1999					
18	Liaodong Bay, Bohai	350		9/7/2000-15/7/2000	Noctiluca scintillans				
19	Bohai Bay	1040		23/7/2000					
20	North Wentuozhi Island, Bohai	217		13/8/2000					
21	West Changxin Island, Bohai	44		13/8/1/2000					
22	East Zhuanghe, Yellow Sea	827		2/8/2000					
23	Southeast Qikou	180		20/7/2000-21/7/2000					
24	Beidaihe, Tianjing	3		23/7/2000					

25	Tanggu, Tianjing	134		25/7/2000					
26	Jiaozhou Bay	2		20/7/2000-23/7/2000	Noctiluca scintillans				
27	Jiaozhou Bay	20		7/7/2001-12/7/2001	Mesodinium rubrum				
28	Yingkou, Liaodong Bay	360		15/7/2001-16/7/2001	Noctiluca scintillans				
29	Bayuquan, Liaodong Bay	770		12/8/2001-23/8/2001	Leptocylindrus danicus				
30	Yalujiang Estuary	1100		24/8/2001-14/9/2001	Eucampia zoodiacus, Chaetoceros socialis				
31	Liao River Estuary	130		25/8/2001-26/8/2001	Navicula sp.				
32	Bayuquan, Liaodong Bay	100		27/8/2001-30/8/2001	Mesodinium rubrum, Eucampia zoodiacus				
33	Jingtang Habour, Tangshan	15		17/6/2002-27/6/2002	Noctiluca scintillans ,Gymnodinium sp				
34	Qinghuang dao Bay	8		25/7/2002	Chattonella marina				
35	East Liaodong Bay	10		28/5/2003	Noctiluca scintillans				
36	Dandong waters, Yellow Sea	30		June 2003					
37	Dalian Bay	15		July 2003	Heterosigma akashiwo				
38	Qinghuang dao	70		25/4/2003-26/4/2003	Noctiluca scintillans				
39	Luanhe, Qinghuang dao	12		21/6/2003	Noctiluca scintillans				
40	Dagu Harbour, Tianjing	100		1/7/2003-8/7/2003	Noctiluca scintillans				
41	Yellow River Estuary	1850		11/8/2004-18/8/2004	Phaeocystis sp。				
42	Central Bohai Bay	3200		12/8/2004-18/8/2004	Kerania mikimotoi				
43	Jingshitan，Dalian ，Yellow Sea			6/9/2004	Chattonella antiqua				
44	Jingshitan，Dalian ，Yellow Sea			25/9/2004	Alexandrium catenella				

Table 3 Red Tide Causative Species in Yellow Sea and Bohai Waters

Species	Red tide events
Noctiluca scintillans	
Skeletonema costatum	
Ceratium furca	
Prorocentrum micans	
Prorocentrum minimum	
Heterosigma akashiwo	
Chattonella marina	
Chattonella antiqua	
Kerania mikimotoi	
Phaeocystis sp。	
Gymnodinium sp。	
Dinophysis ovata	
Gymnodinium sanguineum	
Leptocylindrus danicus	
Eucampia zoodiacus	
Chaetocerus socialis	
Navicula sp.	
Alexandrium catenella	
Mesodinium rubrum,	

Fig.2 The Key Red Tide Monitoring Zone in Coastal China

Fig 3 High frequency areas of red tide occurrences in China coastal Waters