Summary of National Report on HABs in Japan

Yasuwo Fukuyo[1], Kazuhiko Dohi[2], Osamu Matsuda[3] and Hitoshi Kikawada[4]

[1]Asian Natural Environmental Science Center, The University of Tokyo, 1-1-1 Yayoi, Bunkyo, Tokyo 113-8657 Japan
ufukuyo@mail.ecc.u-tokyo.ac.jp

[2]METOCEAN ENVIRONMET INC., 2-2-2, Hayabuchi, Tsuzuki, Yokohama 224-0025, Japan
E-mail: dohi@notes.metocean.co.jp

[3]Graduate School of Biosphere Sciences, Hiroshima University, 6-8-13 Hachihonmatsu-Minami, Higashi-Hiroshima 739-0144, Japan, E-mail: matsuda036@go3.enjoy.ne.jp

[4]Northwest Pacific Region Environmental Cooperation Center, 5-5 Ushijimashinmachi, Toyama City, Toyama, 930-0856, Japan, E-mail: kikawada@npec.or.jp

1. Introduction

Harmful Algal Blooms (HABs) encompass “red tides” and “toxin producing plankton blooms”. They often occur in coastal waters where aquaculture activities are extensively operated. Although only a few case of serious damage by these HABs to fishery industry and public health has been reported in NOWPAP region of Japan so far, it is anticipated that such damage may be occurring in wider areas along with the utilization of coastal area. To avoid and manage these problems, close coordination and cooperation among scientists, managers in local government, and fishery folks is necessary. This report shows a summary of current condition of HAB occurrence in NOWPAP region of Japan. Through this report it is expected to share a common platform for development of research and mitigation measures.

2. Situation of HAB Occurrence

2.1. Red Tides

Figure 1 shows the location of red tide monitoring stations conducted by prefectural governments in the NOWPAP region and red tide events recorded in these stations between 1998 and 2003, except the western Kyushu station where red tide causative species appeared in 1999 are listed. The results reveal that red tide events were more common in the western part than in the northern part of the NOWPAP region. Harmful flagellates that have recently caused red tides along the Honshu or Hokkaido coasts include *Heterocapsa circularisquama*, *Gymnodinium mikimotoi* (=*Karenia mikimotoi*), *Chattonella antiqua* and *Cochlodinium polykrikoides*.

Figure 2 shows red tide events in the northern Kyushu in 2002. Most of them occurred in embayment and semi-enclosed coastal waters. During 1998 and 2002, 150 cases of red tide were recorded in Kyushu area. A total of 32 species, most of which were either dinoflagellates or diatoms, was reported to make red tides in the Kyushu coastal area. Five frequently observed species were *G. mikimotoi* (23 events), *Noctiluca scintillans* (23 events), *Heterosigma akashiwo* (19 events), *Mesodinium rubrum* (16 events), and *Skeletonema costatum* (15 events). Among the 150 cases 19 events associated with mass mortality of fish and shellfish, resulting in economic loss for the fishing industry. These species were *C. polykrikoides, G. mikimotoi, H. akashiwo, H. circularisquama,* and *N. scintillans.* The highest exonomic loss equivalent to more than 740 million yen (ca. 7 million US$) was recorded due to a red tide by *C. polykrikoides* in Imari Bay in August 1999.

In order to reduce red tides, Japanese central and local governments have made efforts to control land-based inputs of pollutants into the sea by implementing effluent control, public education, improvement of sewage systems, and enforcement of effluent standards for COD, nitrogen and phosphorous. Clay-spraying in fishery and aquaculture grounds is employed for reactive measures against red tides in some areas of Kyushu.

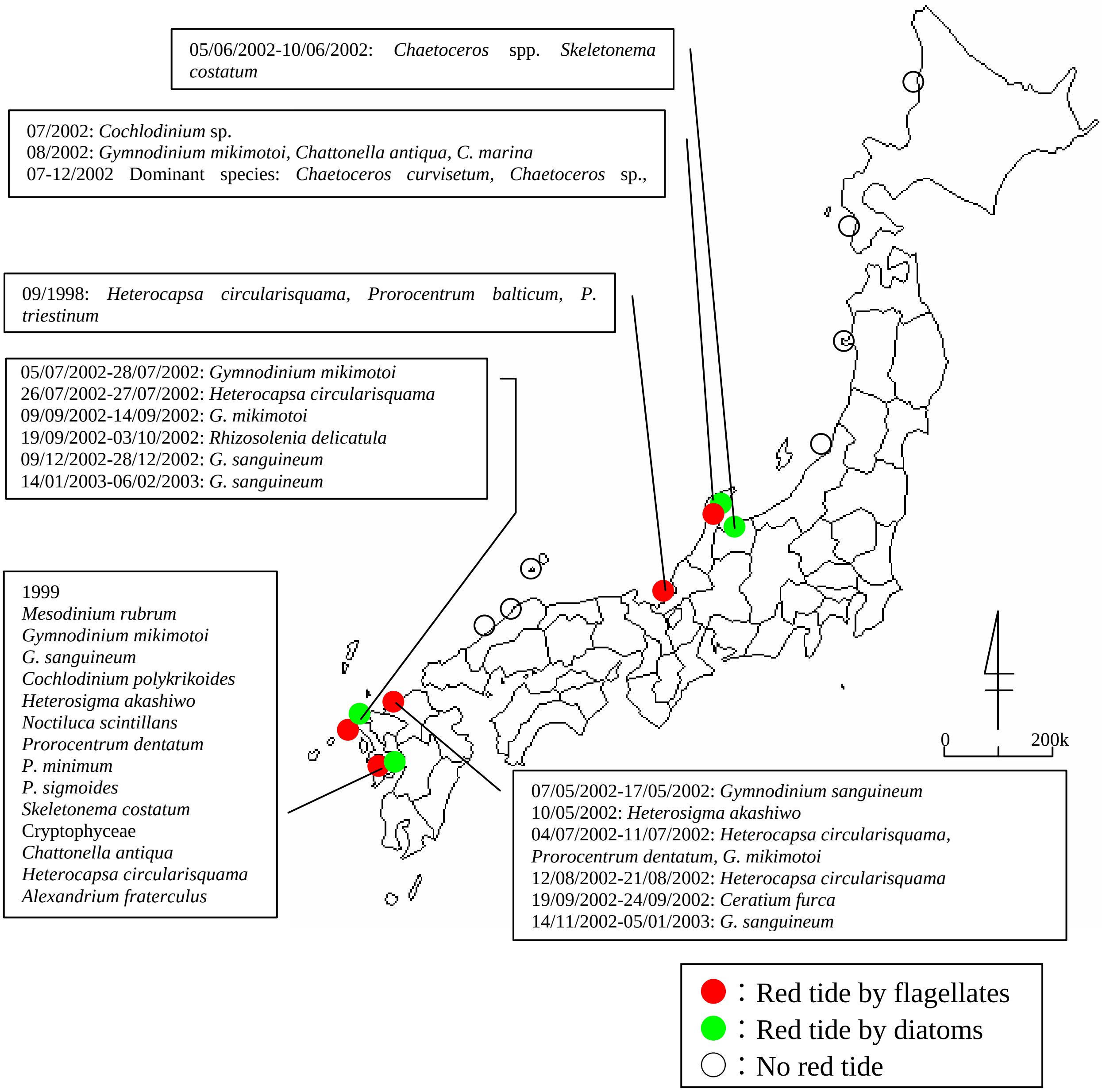
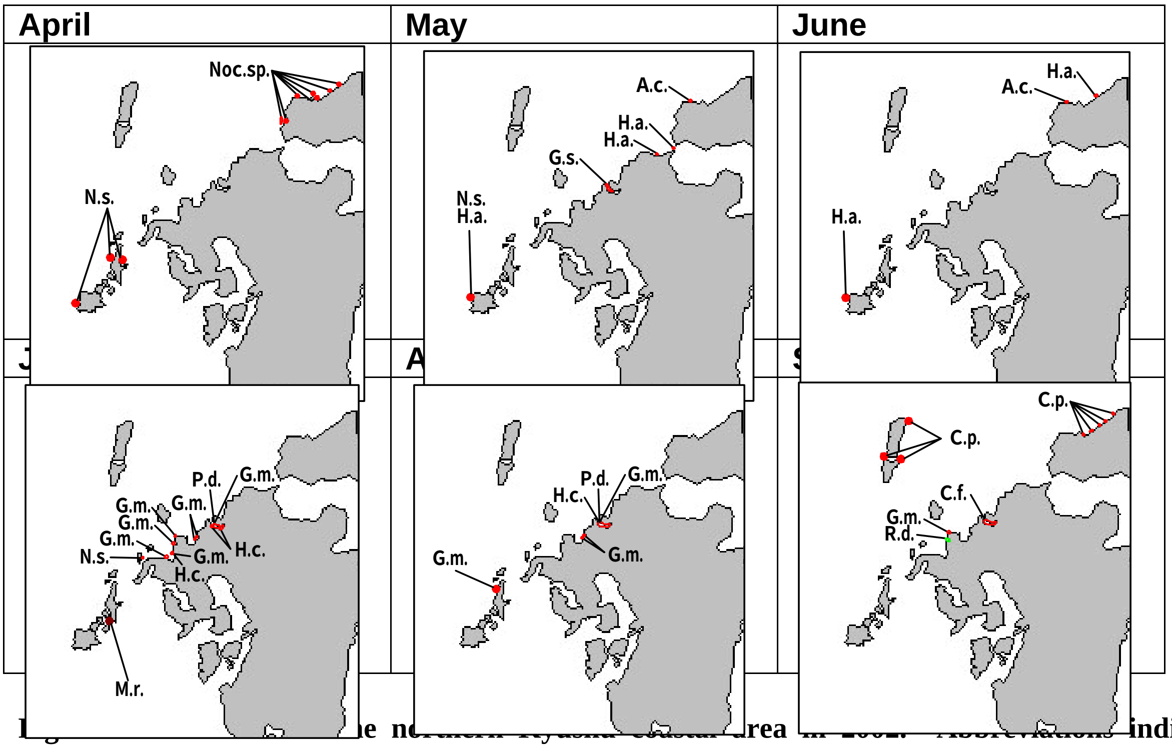


Figure 1 Red tides and their causative species observed at monitoring stations located in the NOWPAP region during 1998-2003

Source: Annual reports of fishery laboratories of prefectural governments



...e n... ...area ... indicate following causative species; N.s: *Noctiluca scintillans,* Noc.sp.: *Noctiluca* sp., H.a.: *Heterosigma akashiwo,* G.s.: *Gymnodinium saguineu,* A.c.: *Alexandrium catenella,* M.r.: *Mesodinium rubrum,* G.m.: *Gymnodinium mikimotoi*, H.c.: *Heterocapsa circularisquama*, P.d.: *Prorocentrum dentatum,* R.d.: *Rhizosolenia delicatula*, C.f: *Ceratium furca*, C.p.: *Cochlodinium polykrikoides*

Source: Annual reports of fishery laboratories of prefectural governments

2.2 Toxin-producing Plankton

Most common shellfish toxins originated from toxin-producing plankton in Japan are those responsible for Paralytic Shellfish Poisoning (PSP) and Diarrhetic Shellfish Poisoning (DSP), which have been reported in Japan since 1976. Species known to cause these poisoning include *Alexandrium tamarense A. tamiyavanichii*, *A. catenella* and *Gymnodinium catenatum* for PSP, and *Dinophysis fortii* and *D. acuminate* for DSP.

Figure 3 shows the Japanese coastal area where PSP have been detected through monitoring by prefectural governments. There was no PSP toxin contamination in shellfish in the NOWPAP region until 1987. But it became gradually widespread in the northern, southern and western areas of the Sea of Japan after 1988. The poisoned species are the Mediterranean blue mussel, Japanese oyster and noble scallop. DSP toxin contamination was first observed in the northern NOWPAP region of Japan in 1976. Although it rarely appeared in western Japan in the 1980s, the main area of DSP events is in the northern NOWPAP region of Japan (Figure 3). Scallop is the typical poisoned species.

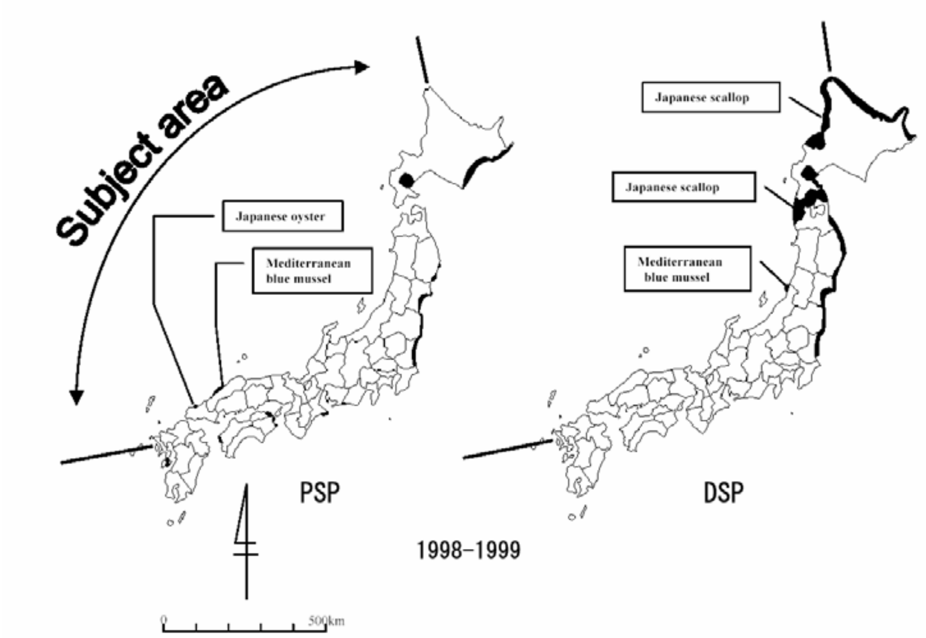


Figure 3　Areas having experienced voluntary control due to PSP and DSP contamination in Japan in 1998 and 1999.　"Subject area" indicates NOWPAP region.

Source: Japan Fisheries Resource Conservation Association (JFRCA), 'Monitoring Report on Shellfish Poisoning in Japanese Fishery Products', 1999-2000

Around 900 people have suffered from PSP and DSP in Japan since 1976, including several casualties from PSP. The oldest records of PSP and DSP poisoning were reported in 1948 and 1976, respectively. Careful monitoring of PSP and DSP toxins in shellfish, and voluntary shipping and marketing control have resulted in no fatalities since 1980. A total of 20 cases of voluntary control by high level of PSP toxins were reported during 1978-1999. Most cases had duration of 2-4 months. There were a total of 64 cases of DSP induced voluntary control of shellfish shipping during 1978-1999. The duration of the shipping inhibition by DSP was generally longer than by PSP. Twenty-six out of 64 cases stopped shellfish shipping for 5 months or longer.

Monitoring of shellfish toxicity is mandatory for the central and local governments, and is the only substantial mitigation measure applied to shellfish production. Monitoring is or should be conducted at least twice a week during the high risk period. Shipping of harvested shellfish should be voluntarily prohibited when the results exceed the quarantine limit (PSP: 4 MU/g, DSP: 0.05 MU/g).

3. Suggested Activity for the NOWPAP Region

Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC) has established the "*Cochlodinium* Corresponding Group (CCG)" to counter problems with *Cochlodinium* blooms. The Group should continue to provide useful information on *Cochlodinium* so to assist the policy makers in the decision making process.

ICO/WESTPAC of UNESCO will establish Training Trough Research Project (TTR) for characterization of HAB species including *Cochlodinium* in late 2005. It is expected that the CCG of NOWPAP/CEARAC will work cooperatively with the WESTPAC TTR to cope with *Cochlodinium* and to exchange information on the species and related activities.

Using the experience and technology of Japan, NOWPAP/CEARAC will enhance capability of monitoring on pollution and establishment of prevention policies about human land based activity.