

Annex VI

Report of NOWPAP WG3 (HAB) Intersessional Activity

1. Overview of activities of WG3

According to a workplan with approval of the 2nd CEARAC FPM, NOWPAP WG3 has conducted the following activities:

- (1) Compiling of Reports on HABs for the NOWPAP Region
- (2) Establishment of HAB Reference Database
- (3) Activities of *Cochlodinium* Corresponding Group (CCG)

For the Activity (1), WG3 and CEARAC have made National Report on HABs in each country and Integrated Report in the NOWPAP Region. These reports will help us understand situation of HABs in the NOWPAP Region. For the Activity (2), HAB Reference Database was established in order to obtain information on HABs in the NOWPAP Region easily and efficiently. WG3 organized CCG to collect information on the most concerned HAB species in this region (Activity (3)). As the results of CCG activities, *Cochlodinium* Homepage and its pamphlet have been made. The detail explanations of these activities will be made in the following chapters.

2. Compiling of Reports on HABs for the NOWPAP Region

2.1. National Reports on HABs

2.1.1 Concept of National Reports

National Report gives basis for creating common understanding by reporting present situation of Harmful Algal Blooms (HAB) in each country. Such common understanding forms a starting point of the discussion about monitoring, assessment, and policy concerning HAB for marine environmental conservation in the NOWPAP Region, which is the final goal of NOWPAP WG3. National Report is prepared by each country of NOWPAP. Each country is responsible for its contents. The major contents shall be applied fields of monitoring of HAB and its results, which help understand problems and activities about HAB in the NOWPAP Region.

2.1.2 Contents of National Reports

Table 1 shows contents which were suggested in the past WG3 Meetings based on the National Report Guideline. The contents of each chapter shall be prepared by taking account of the following points of concern as well as contributing to NOWPAP activity.

Table 1. Contents of National Report suggested in the WG3 Meetings

<p>I. INTRODUCTION</p> <ul style="list-style-type: none"> - Definition of red tide in each country shall be described. - General explanation of present situation of HAB in each country shall be made. - General description of characteristics of marine and coastal environment of the NOWPAP Region in each country shall be made. <p>II. USED DATA AND INFORMATION</p> <ul style="list-style-type: none"> - Data and information used for the report shall be explained. It is important to understand how to obtain data and information and what data sources are used in order to evaluate the quality of the report. <p>III. RESULT</p> <ul style="list-style-type: none"> - The contents of chapters are made by following the guideline, which was proposed in the 1st WG3 Meeting in 2003 and revised in the 2nd WG3 Meeting in 2004. <ol style="list-style-type: none"> 1. Situation of HAB Occurrence <ul style="list-style-type: none"> - This chapter introduces situation of HAB based on the table in the guideline. 2. Information of Monitoring <ul style="list-style-type: none"> - Monitoring activities in each country are described based on the guideline. 3. Progress of Researches and Studies to Cope with HAB <ul style="list-style-type: none"> - Present researches and studies about HAB in each country are introduced. - Topics suggested by the guideline are causative species, toxicity analysis, mechanism of occurrence, and mitigation measures. 4. Publications including newly obtained information <ul style="list-style-type: none"> - New information about HAB is introduced. - The CEARAC secretariat 's recommending structure (sections) of this chapter is made based on the categories of HAB Reference Database, which are "Occurrence and Monitoring", "Mechanism and Environment" "Physiology", "Taxonomy", "Mitigation and Management", and "Others". 5. Training Activity to Cope with HAB <ul style="list-style-type: none"> - Based on the guideline, training activities related to each county are described. 6. National Priority for Future Activities to Cope with HAB <ul style="list-style-type: none"> - Activities concerning HAB, which each country is implementing, are described. 7. Suggested Activities for NOWPAP Region <ul style="list-style-type: none"> - Activities for HAB in the NOWPAP Region are suggested. - Future activities for WG3 are suggested.

2.2. Integrated Report on HABs for the NOWPAP Region

2.1.1 Concept of Integrated Report

The objectives of Integrate Report on HABs for the NOWPAP Region are to provide and to share information on the status of HAB in the NOWPAP Region, and to address issues to be tackled through CEARAC activities. To this end, common HAB issues in the NOWPAP Region will be identified. Integrated Report has been made based on National Reports sent by NOWPAP Focal Points. Therefore, Integrated Report shows broader perspectives of HAB issues in the whole NOWPAP Region.

2.2.2 Contents of Integrated Report

The draft table of contents of Integrated Report is shown in Table 2. The contents of Integrated Report have been discussed in the 2nd WG3 Meeting in fall 2004 and in an unofficial meeting in summer 2005. Regional consultants hired by CEARAC will prepare Integrated Report. CEARAC, NOWPAP WG3 members, and CEARAC FPM share responsibilities of the contents.

Table 2. Contents of Integrated Report proposed in the 2nd WG3 Meeting

1. Introduction

- Purpose of Integrated Report is described.
- Geographical, oceanographic, and ecological characteristics of the NOWPAP Region are described.
- General information of NOWPAP countries is described. (human population, fishery, national interests, etc)
- Definitions of words are explained.

2. Situation of HAB Occurrence

Based on Chapter 1 of National Reports from each country, overall status on HAB in the NOWPAP Region is described. In addition, common issues in the region will be identified and stated.

2.1 Present Situation of HAB in the NOWPAP Region

- 1) Location of HAB Occurrence

2) Approximate Areas of HAB

3) Duration

4) Causative Species

5) Cell Density

6) Type(s) of HAB

7) Mitigation Measures

8) Damage(s) due to HAB

2.2 Common issues on HAB in the NOWPAP Region

3. Information of Monitoring of HAB

Based on Chapter 2 of National Reports, overall status of monitoring in the NOWPAP Region is described. In addition, common issues in the region will be identified and stated.

3.1 Monitoring activities in the NOWPAP Region

3.2 Common issues on Monitoring activities in the NOWPAP Region

4. Researches and Studies to Cope with HAB

Based on Chapter 3 and 4 of National Reports, important studies, on-going researches, and new findings about HAB are summarized in order to share the knowledge of HAB in the NOWPAP Region.

5. Training Activity to Cope with HAB

Based on Chapter 5 of National Reports, overall status of training activities in the NOWPAP Region is described. In addition, common issues in the region will be identified and stated.

5.1 Training Activities in the NOWPAP Region

5.2 Common issues on Training activities in the NOWPAP Region

6. Suggested Activities for HAB in the NOWPAP Region

Based on Chapter 6 and 7 of National Reports, national activities in each country for HAB are described. Activities for HAB in the NOWPAP Region are suggested.

6.1 National Activities to Cope with HAB

6.2 Suggested Activities for HAB in the NOWPAP Region

2.2.3. Schedules

Draft Integrated Report will be discussed in the 3rd CEARAC FPM in September 2005. Integrated Report will be issued at the end of 2005.

3. Establishment of HAB Reference Database

HAB Reference Database was opened in April 2005. It is now available at the following URL on the CEARAC website.

URL: <https://cearac.nowpap.org/hab-web/hab-ref-db/>

CEARAC expected the database to be used mostly by researchers and government officers in order to investigate information on HABs in the NOWPAP Region efficiently. Appendix 6-1 shows how to use the HAB Reference Database.

3.1. Purpose of Database development

The purpose of HAB Reference Database is to establish a focal storage of information and reference materials (papers, reports, data, etc.) which can be used as resources for scientific analyses on red tide and HAB.

It is hoped that this database will promote further studies on red tide and HAB in the NOWPAP Region, by helping WG3 experts and researchers in each country to deepen their understanding and analyses on HAB issues. Also, it is anticipated that the study results will play an important role in making recommendations to policy makers, and in providing information to citizens.

3.2. Expected uses of the database (Significance of the database)

3.2.1. Search for the location of the reference

Location of Information where materials are included can be searched by HAB Reference Database. The result of the search will show the Title, Author, and Location of the reference. If further details are needed, the original document can be obtained by contacting the appropriated organization.

3.2.2. Exploitation of Research Areas

For every person who is dedicated to researches on HAB, what themes have been studied and being studied are always an interesting topic. As already mentioned, HAB Reference Database enables these people search for references by "Year of Publication", "Categories", and "Species". By specifying the "Year of Publication", the hottest theme(s) of a year can be confirmed.

If a person is just starting to get involved in HAB studies, he can search for an unexploited area and themes by the database. For someone who has already had some experiences with (a) certain topic(s), it is possible to see how much study has been or

has not been done in other countries in the NOWPAP area, and that information can be used effectively for his own research.

3.2.3. Understanding Status of HAB studies and Taking Necessary Measures

The database is constructed as joint efforts of the four NOWPAP member countries. The amount of information on certain study area or on certain species correspond with indicates that of researches vigorously studied in those countries. In case of plotting this information on a map, it would explain the overall status of HAB studies in the NOWPAP area. The information can be used effectively to facilitate discussions and reciprocal visits among experts in the NOWPAP Members.

Issues which are currently observed only in one part of the NOWPAP area may also arise in other countries in the future. The information obtained from the database will be of great help for every country in considering what necessary measures need to be taken in order to prevent or tackle these future possibilities.

3.3. Contents of Database

3.3.1 Status of data collection

Members of Secretariat and WG3 from each country have worked in collecting references to be stored in the database and data input. Table 3 shows the status of documents which were categorized and stored in the database.

Table 3. Status of the number of reference information in the database

(As of April, 2005)

	Japan	Korea	China	Russia	Total
The Number of reference information in the database	359	440	275	76	1150

3.3.2. Categorization of reference information

WG3 agreed to classify the collected reference materials into the following 6 categories: (1) Occurrence and Monitoring; (2) Mechanism and Environment; (3) Physiology; (4) Taxonomy; (5) Mitigation and Management; and (6) Others. Table 4 is the summary of the categories defined above. The first 5 categories are chosen as the most basic ones, and “others” is added in case a new category of information is introduced in the future. When information on a certain area is accumulated under “others” category, a new database category can be added for it. A new category, “Toxin-Producing Plankton” will be introduced in the future.

Table 4. Explanation of Category for scientific publications

Category	Explanation of Category
Occurrence and Monitoring	<ul style="list-style-type: none"> • Information on HAB occurrence (location, duration, etc.) • Monitoring of natural plankton population (mass, cyst, dormant cell, resting cell, mortality, etc.) • Monitoring activity on red tide and shellfish toxins (PSP, DSP, damage, etc.) • Plankton enumeration technique, etc
Mechanism and Environment	<ul style="list-style-type: none"> • Mechanism of HAB initiation (nutrient, cyst germination, cyst formation, etc. • Mechanism of toxin production and accumulation • Environmental condition related to HAB (precipitation, radiation, etc.) • Inter-species relationship involving HAB species and algicidal organism (growth inhibition, algicidal bacteria, etc.) • Antifungal/antivirus metabolites, etc.
Physiology	<ul style="list-style-type: none"> • Plankton physiology and ecophysiology (sperm formation, intracellular bacteria, etc.) • Growth rate measurement (nutrient requirement, etc) • Histology (histological analysis, etc.) • Toxin production (axenic culture, etc.), etc
Taxonomy	<ul style="list-style-type: none"> • Morphology of plankton species (species-specific DNA probe, ultrastructure, etc.) • Molecular biological species identification (monoclonal antibody, etc.) • Cyst identification • DNA sequencing, etc.
Mitigation and Management	<ul style="list-style-type: none"> • Economic loss of HAB (Death en mass of cultured fish and bivalves, etc.) • Numerical simulation on HAB dispersion • Prediction method for HAB occurrence • Countermeasures against HAB (algicidal bacteria, algicidal virus, clay spraying, etc.), etc.
Others	<ul style="list-style-type: none"> • Toxin chemistry (HPLC, toxin composition, structural analysis of toxic substance, etc.) • Effect on fish, shellfish, and mouse (oxygen radicals, etc.) • Pathology of fish/shellfish • Enumeration technique for bacteria • Distribution of cyst, etc.

Note) Terms which is closely related to the explanation in bullets are written in brackets. These terms are also used in publication title and in contents. They can also be the Keyword to be used when searching the reference using "Word(s) in Title".

4. Activities of *Cochlodinium* Corresponding Group (CCG)

4.1. Purpose of the activities of CCG

Cochlodinium is one of the concerned species in the NOWPAP Region. Especially the damages of coastal fisheries caused by this species are reported in Korea and Japan. However, our understanding of *Cochlodinium* is insufficient to make policies against it. Therefore, NOWPAP Working Group 3 (WG3) agreed to organize *Cochlodinium* Corresponding Group (CCG) so as to make a set of information on *Cochlodinium*, and to help policy makers concerning coastal fisheries.

4.2. Organization of CCG

The First Meeting of WG3 elected the following experts of HAB as co-leaders of CCG:

- Dr. Hak-Gyoon Kim (Pukyong National University, Korea)
- Dr. Yasuwo Fukuyo (Asian Natural Environmental Science Center, The University of Tokyo, Japan)

The members of CCG are shown in Table 5. Scientists of CCG were recommended by WG3 experts. Chinese WG3 experts are not on the list.

Table 5. Members of CCG

Name	Country	Organization
Dr. Songhui LU	China	Jinan University
Dr. Yasuwo FUKUYO (Group Leader)	Japan	The University of Tokyo, Asian Natural Environmental Science Center
Mr. Haruyoshi TAKAYAMA	Japan	Hiroshima Fisheries Experimental Station
Dr. Kazumi MATSUOKA	Japan	Nagasaki University
Dr. Yasunori WATANABE	Japan	National Research Institute of Fisheries and Environment of Inland Sea, Fisheries Research Agency
Dr. Hak Gyoon KIM (Group Leader)	Korea	Pukyong National University
Dr. Chang Kyu LEE	Korea	Marine Harmful Organisms Research Team, NFRDI
Dr. Kyoung Ho AN	Korea	Aquaculture Environment Institute, NFRDI
Dr. Wol Ae LIM	Korea	Marine Harmful Organisms Research Team, NFRDI
Dr. Tatiana ORLOVA	Russia	Institute of Marine Biology, Far Eastern Branch of Russian Academy of Sciences
Dr. Marina SELINA	Russia	Institute of Marine Biology, Far Eastern Branch of Russian Academy of Sciences

4.3 Procedure of group meetings

Internet is the main tool for the CCG group meetings in order to reduce extra tasks and meeting costs. The CCG members exchange correspondences with their ideas and information for CCG through Internet. All the members will be registered in a mailing list that CEARAC makes for CCG. The subjects to be discussed are proposed by the co-leaders (Dr. Fukuyo and Dr. Kim) and the CEARAC secretariat. The group activities are also discussed in WG3 Meeting and Focal Points Meeting (FPM).

4.4 Outputs of the activities of CCG

The outputs of the CCG activities, which CEARAC secretariat planned, are to make homepage and a pamphlet about *Cochlodinium*.

4.4.1. *Cochlodinium* Homepage

With the result of the CCG activities, the group made a homepage which briefly introduces *Cochlodinium* to the public concerning with environmental problems. The homepage includes pictures of *Cochlodinium*, explanations of the species, and information of its damage to fishery, and so on. Pictures and information for the website of *Cochlodinium* are provided by the CCG members. This homepage is loaded on the CEARAC website (<https://cearac.nowpap.org/cochlo-web/en/>). The detailed explanations of the homepage are shown in Appendix 6-2.

4.4.2. *Cochlodinium* Pamphlet

This pamphlet will be made based on *Cochlodinium* Homepage and issued by the end of 2005 in order to advertise NOWPAP CEARAC activities and *Cochlodinium* homepage, and to provide basic information on *Cochlodinium* to students, NGOs, and people who are interested in marine environment to learn this species. The detailed explanations of the pamphlet are shown in Appendix 6-4.

5. Other related activities

5.1 First International Workshop on HAB in the Northwest Pacific Region

Thanks to cooperation of WG3 experts, the 1st International Workshop on HAB in the Northwest Pacific Region was held on June 30 and July 1 2005 in Toyama, Japan. Almost 30 experts of HAB from the NOWPAP Members participated in the workshop and discussed the situation, monitoring systems, causative species and mitigation measures of HAB in the NOWPAP Region and its related areas. CEARAC and WG3 gathered a wide variety of information on HABs and will utilize the collected information for the future work of WG3.

Appendix 6-1 Brief Explanation of HAB Reference Database

1. Outline

Figure 6-1-1 shows the constructed HAB Reference Database. Search operation is to be done on the left frame, while its result is shown on the right frame.

HAB Reference Database

[Country]
A country that the subject of the publication is made.
Example 1: A country where a HAB event occurred.
Example 2: A country where a research on the topic of a publication was conducted.
How to use: Choose an appropriate country, if any, from the pull-down menu.

[Year]
Year of publication.
How to use: Type the year (e.g. 2000) or duration (e.g. 1990 ~ 2000, 1990 -, ~ 2000) to search, if any.

[Category]
Type of content.
How to use: Choose an interested category from the pull-down menu, if any.

Respective categories include topics as shown in a table below. Possible keywords found in literature are also listed up in the table.

Category	Explanation of Category
Occurrence and Monitoring	<ul style="list-style-type: none"> Information on HAB occurrence (location, duration, etc.) Monitoring on natural plankton population (mass, cyst, dormant cell, resting cell, mortality, etc.) Monitoring activity on red tide and shellfish toxins (PSP, DSP, damage, etc.) Plankton enumeration technique, etc.
Mechanism and Environment	<ul style="list-style-type: none"> Mechanism of HAB initiation (nutrient, cyst germination, cyst formation, etc.) Mechanism of toxin production and accumulation Environmental condition related to HAB (precipitation, radiation, etc.) Inter-species relationship involving HAB species and algalicidal organism (growth inhibition, algalicidal bacteria, etc.) Antifungal/antivirus metabolites, etc.
Physiology	<ul style="list-style-type: none"> Plankton physiology and ecophysiology (spore formation, intracellular bacteria, etc.) Growth rate measurement (nutrient requirement, etc.) Histology (histological analysis, etc.) Toxin production (axenic culture, etc.), etc.
Taxonomy	<ul style="list-style-type: none"> Morphology of plankton species (species-specific DNA probe, ultrastructure, etc.) Molecular biological species identification (monoclonal antibody, etc.) Cyst identification DNA sequencing, etc.
Mitigation and Management	<ul style="list-style-type: none"> Economic loss of HAB (Death on mass of cultured fish and bivalves, etc.) Numerical simulation on HAB dispersion Prediction method for HAB occurrence Countermeasures against HAB (algalicidal bacteria, algalicidal virus, clay spraying, etc.), etc.
Others	<ul style="list-style-type: none"> Toxin chemistry (HPLC, toxin composition, structural analysis of toxic substance, etc.) Effect on fish, shellfish, and mouse (oxygen radicals, etc.) Pathology of fish/shellfish Enumeration technique for bacteria Distribution of cyst, etc.

*Terms which are closely related to the explanation in bullets are written in brackets. These terms are also used in publication title and in contents. They can also be the keyword to be used when searching the reference using "Word(s) in Title".

In addition, HAB Reference Database has picked-up the species names of the target plankton of each study. This will help you search your concerned information on certain plankton species.

[Organism]
Name of a genus or a species to search.
How to use: Choose a genus from pull-down menu for the genus list. Then choose a species option from pull-down menu. Choosing spp. means to search all species of the pre-set genus. "And/Or" search is applicable.

[Surname(s) of Author]
Surname(s) to search from Authors of the publication.
How to use: Type surname(s) to search. "And" search is applicable.

[Word(s) in Title]
Word(s) to search from title of the publication.
How to use: Type word(s) to search. "And" search is applicable.

[Display per page]
Number of publications displayed per page at once.
How to use: Choose appropriately from the pull-down menu.

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Figure A6-1-1 an overall structure of HAB Reference Database

2. Explanation of search categories

2.1. Country

“Country” means a country where a certain organization (e.g. laboratory, university, etc.) in which the head author of a publication belongs to. Authors who studied abroad and later started working at a laboratory in their home countries after graduation might be categorized into several countries. Choose a country name from the list as shown in Figure A6-1-2.

The screenshot shows the HAB Reference Database search interface. On the left, there is a sidebar with search filters: Country (a dropdown menu with options like China, Japan, Korea, Russia), Genus (multiple dropdowns), and Word(s) in Title (a text input field). Below these are buttons for 'Search' and 'Reset'. The main content area is titled 'HAB Reference Database' and contains a table explaining the search categories. The table has two columns: 'Category' and 'Explanation of Category'. The categories listed are Occurrence and Monitoring, Mechanism and Environment, Physiology, Taxonomy, Mitigation and Management, and Others. Each category has a list of specific topics or keywords. Below the table, there is a note about terms used in brackets and a section for 'In addition, HAB Reference Database has picked-up the species names of the target plankton of each study. This will help you search your concerned information on certain plankton species.' followed by instructions for searching by Organism, Surname(s) of Author, Word(s) in Title, and Display per page.

Category	Explanation of Category
Occurrence and Monitoring	<ul style="list-style-type: none"> Information on HAB occurrence (location, duration, etc.) Monitoring on natural plankton population (mass, cyst, dormant cell, resting cell, mortality, etc.) Monitoring activity on red tide and shellfish toxins (PSP, DSP, damage, etc.) Plankton enumeration technique, etc.
Mechanism and Environment	<ul style="list-style-type: none"> Mechanism of HAB initiation (nutrient, cyst germination, cyst formation, etc.) Mechanism of toxin production and accumulation Environmental condition related to HAB (precipitation, radiation, etc.) Inter-species relationship involving HAB species and algalicidal organism (growth inhibition, algalicidal bacteria, etc.) Antifungal/antivirus metabolites, etc.
Physiology	<ul style="list-style-type: none"> Plankton physiology and ecophysiology (spore formation, intracellular bacteria, etc.) Growth rate measurement (nutrient requirement, etc.) Histology (histological analysis, etc.) Toxin production (axenic culture, etc.), etc.
Taxonomy	<ul style="list-style-type: none"> Morphology of plankton species (species-specific DNA probe, ultrastructure, etc.) Molecular biological species identification (monoclonal antibody, etc.) Cyst identification DNA sequencing, etc.
Mitigation and Management	<ul style="list-style-type: none"> Economic loss of HAB (Death on mass of cultured fish and bivalves, etc.) Numerical simulation on HAB dispersion Prediction method for HAB occurrence Countermeasures against HAB (algalicidal bacteria, algalicidal virus, clay spraying, etc.), etc.
Others	<ul style="list-style-type: none"> Toxin chemistry (HPLC, toxin composition, structural analysis of toxic substance, etc.) Effect on fish, shellfish, and mouse (oxygen radicals, etc.) Pathology of fish/shellfish Enumeration technique for bacteria Distribution of cyst, etc.

*Terms which is closely related to the explanation in bullets are written in brackets. These terms are also used in publication title and in contents. They can also be the Keyword to be used when searching the reference using "Word(s) in Title"

In addition, HAB Reference Database has picked-up the species names of the target plankton of each study. This will help you search your concerned information on certain plankton species.

[Organism]
Name of a genus or a species to search
How to use: Choose a genus from pull-down menu for the genus list. Then choose a species spelled from pull-down menu. Choosing spp. means to search all species of the pre-set genus. "And/Or" search is applicable.

[Surname(s) of Author]
Surname(s) to search from Authors of the publication
How to use: Type surname(s) to search "And" search is applicable.

[Word(s) in Title]
Word(s) to search from title of the publication
How to use: Type word(s) to search "And" search is applicable.

[Display per page]
Number of publications displayed per page at once
How to use: Choose appropriately from the pull-down menu.

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Figure A6-1-2 Search method of HAB Reference Database (Country)

2.2. Year

“Year” means the year of publication for each reference.

Operating Instruction: Type the year of publication. You can also search for materials with approximate publishing year; type the beginning and/or the end year of the target duration. When this box is left blank, all materials stored in the database will be the objects for your search.

2.3. Category

“Category” shows a field of each material’s content. Some materials are categorized into several categories.

Operating Instruction: Choose a category from the list as shown in Figure A6-1-3.

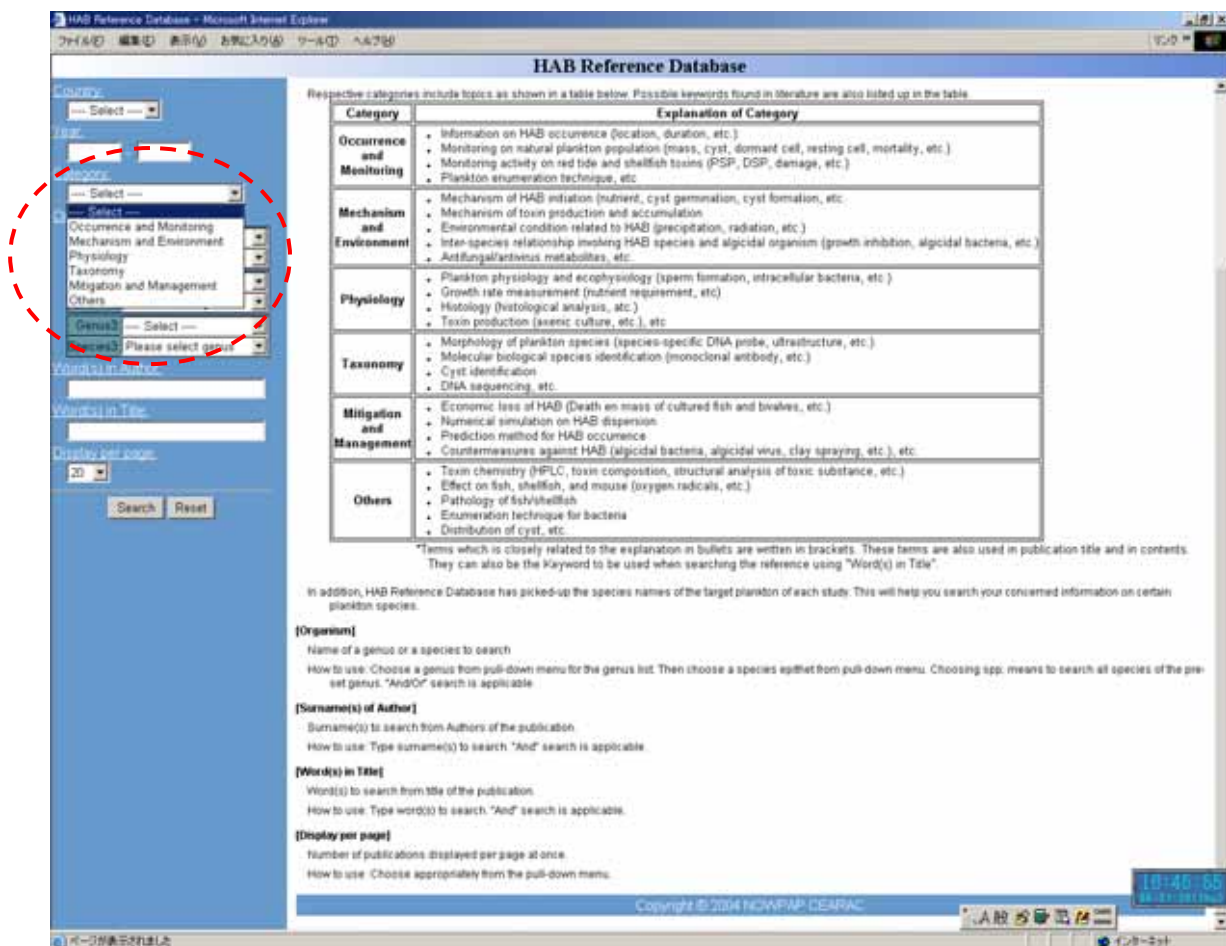


Figure A6-1-3 Search method of HAB Reference Database (Category)

2.4. Organism

“Organism” shows a name of biological species referred in the documents. Search results may not include materials with synonyms.

Operating Instruction: Choose a genus from the “genus list” (as shown in Figure A6-1-4), and all the species in that genus will appear in the “species list”. Then choose a species from the “species list”.

When you choose “spp.” in the species list, all species belonging to the chosen genus will become the target for your search. Species and genus searches are limited to the ones on the list. “And/Or” search is also possible.

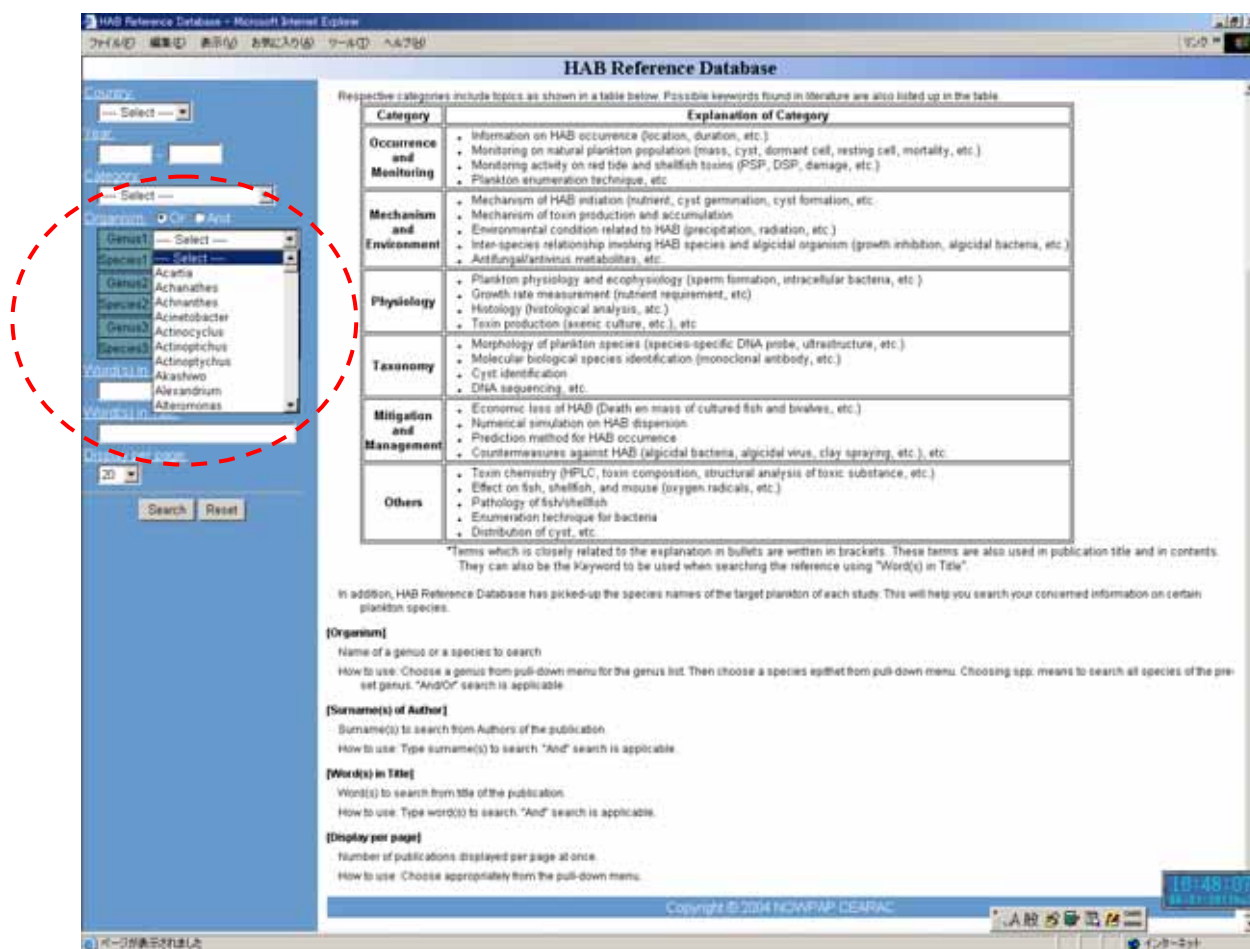


Figure A6-1-4 Search method of HAB Reference Database (Organism-1)



Operating Instruction: Type a part of author's surname. If you want to search for collaborated works, put "spaces" between surnames.

Operating Instruction: Type word(s) (a part of a title) to search. If you want to search for more than two keywords, put “spaces” between words.

2.7. Display per page

“Display per page” shows the number of references displayed per page.

Operating Instruction: Choose a number of references to be shown on one page from the list as shown in Figure A6-1-6. When not all of the references are shown on one page, you can see the rest of the references by clicking “next” button on the research result frame.

HAB Reference Database

Respective categories include topics as shown in a table below. Possible keywords found in literature are also listed up in the table.

Category	Explanation of Category
Occurrence and Monitoring	<ul style="list-style-type: none"> Information on HAB occurrence (location, duration, etc.) Monitoring on natural plankton population (mass, cyst, dormant cell, resting cell, mortality, etc.) Monitoring activity on red tide and shellfish toxins (PSP, DSP, damage, etc.) Plankton enumeration technique, etc.
Mechanism and Environment	<ul style="list-style-type: none"> Mechanism of HAB initiation (nutrient, cyst germination, cyst formation, etc.) Mechanism of toxin production and accumulation Environmental condition related to HAB (precipitation, radiation, etc.) Inter-species relationship involving HAB species and algalicidal organism (growth inhibition, algalicidal bacteria, etc.) Antifungal/antivirus metabolites, etc.
Physiology	<ul style="list-style-type: none"> Plankton physiology and ecophysiology (sperm formation, intracellular bacteria, etc.) Growth rate measurement (nutrient requirement, etc.) Histology (histological analysis, etc.) Toxin production (axenic culture, etc.), etc.
Taxonomy	<ul style="list-style-type: none"> Morphology of plankton species (species-specific DNA probe, ultrastructure, etc.) Molecular biological species identification (monoclonal antibody, etc.) Cyst identification DNA sequencing, etc.
Mitigation and Management	<ul style="list-style-type: none"> Economic loss of HAB (Death on mass of cultured fish and bivalves, etc.) Numerical simulation on HAB dispersion Prediction method for HAB occurrence Countermeasures against HAB (algalicidal bacteria, algalicidal virus, clay spraying, etc.), etc.
Others	<ul style="list-style-type: none"> Toxin chemistry (HPLC, toxin composition, structural analysis of toxic substance, etc.) Effect on fish, shellfish, and mouse (oxygen radicals, etc.) Pathology of fish/shellfish Enumeration technique for bacteria Distribution of cyst, etc.

*Terms which is closely related to the explanation in bullets are written in brackets. These terms are also used in publication title and in contents. They can also be the Keyword to be used when searching the reference using "Word(s) in Title"

In addition, HAB Reference Database has picked-up the species names of the target plankton of each study. This will help you search your concerned information on certain plankton species.

[Organism]
Name of a genus or a species to search
How to use: Choose a genus from pull-down menu for the genus list. Then choose a species splitted from pull-down menu. Choosing spp. means to search all species of the pre-set genus. "And/OR" search is applicable.

[Surname(s) of Author]
Surname(s) to search from Authors of the publication
How to use: Type surname(s) to search "And" search is applicable.

[Word(s) in Title]
Word(s) to search from title of the publication
How to use: Type word(s) to search "And" search is applicable.

[Display per page]
Number of publications displayed per page at once
How to use: Choose appropriately from the pull-down menu.

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Figure A6-1-6 Search method of HAB Reference Database (Display per page)

2.8. Search and Reset

By clicking the “Search” button after filling the research categories, your search will begin and results will be shown on the right frame. By clicking the “Reset” button, you can clear your search condition.

Appendix 6-2 *Cochlodinium* Homepage

Start of homepage : Homepage is expected to be ready in September 2005.

Expected users : Students, NGOs, Researchers

URL : <https://cearac.nowpap.org/cochlo-web/en/>

Contents :

(1) Entrance page

The following is the entrance page of the *Cochlodinium* Home Page. English and Japanese versions are available. Animation is used to make the page visually attractive. Other language versions will also be accessible from this page, if prepared.



Figure A6-2-1. “Welcome to *Cochlodinium* Home Page” Entrance page

(2) “Cochlo” top page

The “Cochlo” top page includes:

- Brief description and a photo of *Cochlodinium polykrikoides*,

- Background on why CEARAC is targeting its research activities on *C. polykrikoides*,
- Definition of the NOWPAP region (i.e. areas where the CEARAC survey and the research are focused).

On the homepage, *C. polykrikoides* is abbreviated as "Cochlo". This is to familiarize students and the general public with this species.

The menu list is constantly displayed on the left side of the page. Through the menu list, viewers can instantly access Entrance, Top Page, Biology, Red Tide, Glossary, Links and Bibliography pages.

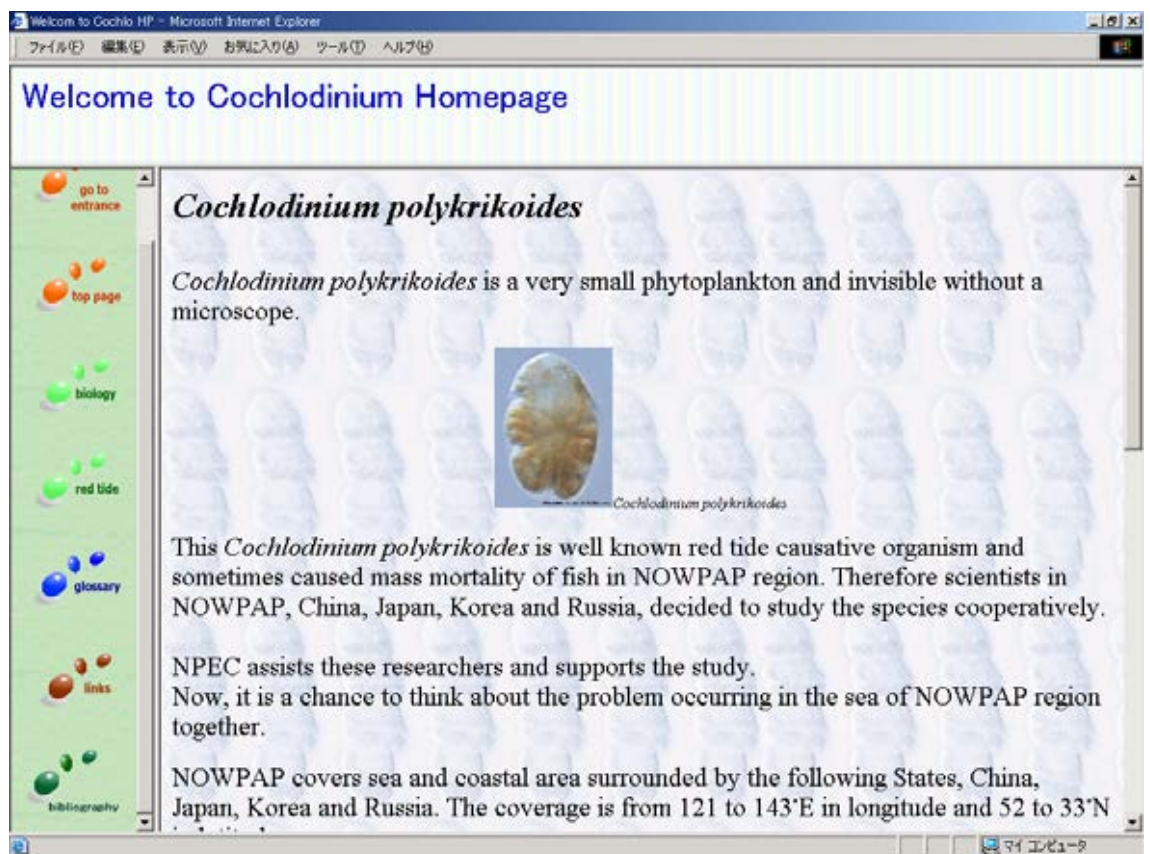


Figure A6-2-2. "Cochlo" top page

(3) "Cochlo" biology page

On the "Cochlo" biology page, the biology and ecology of *Cochlodinium* are explained with photos and simple tables / figures. Topics include: (1) morphology, (2) life cycle, (3) taxonomy, (4) global distribution and (5) suitable growth condition.

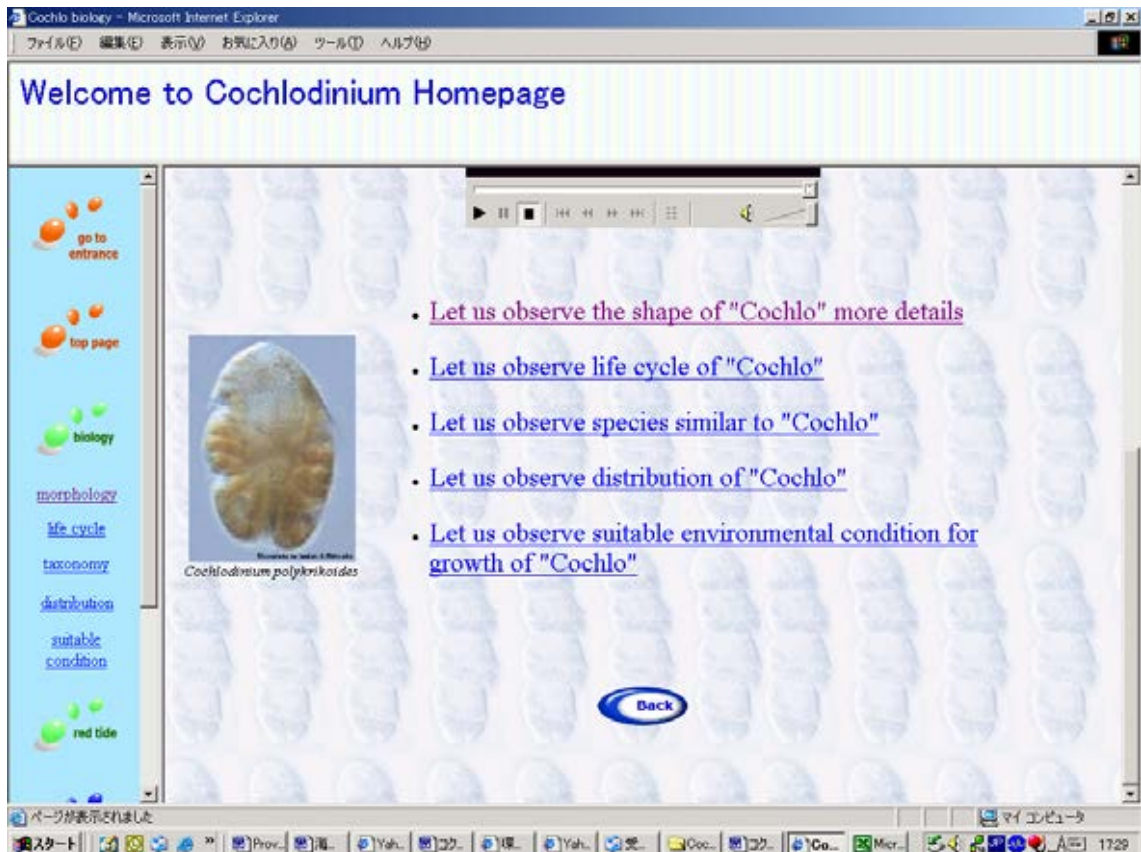


Figure A6-2-3. "Cochlo" biology page

(4) “Cochlo” red tide page

On the “Cochlo” red tide page, information on *Cochlodinium* red tide is explained with photos and simple tables / figures. Topics include: (1) color, (2) location of occurrence, (3) damage situation, (4) expansion mechanism, (5) triggering factor and (6) countermeasures.

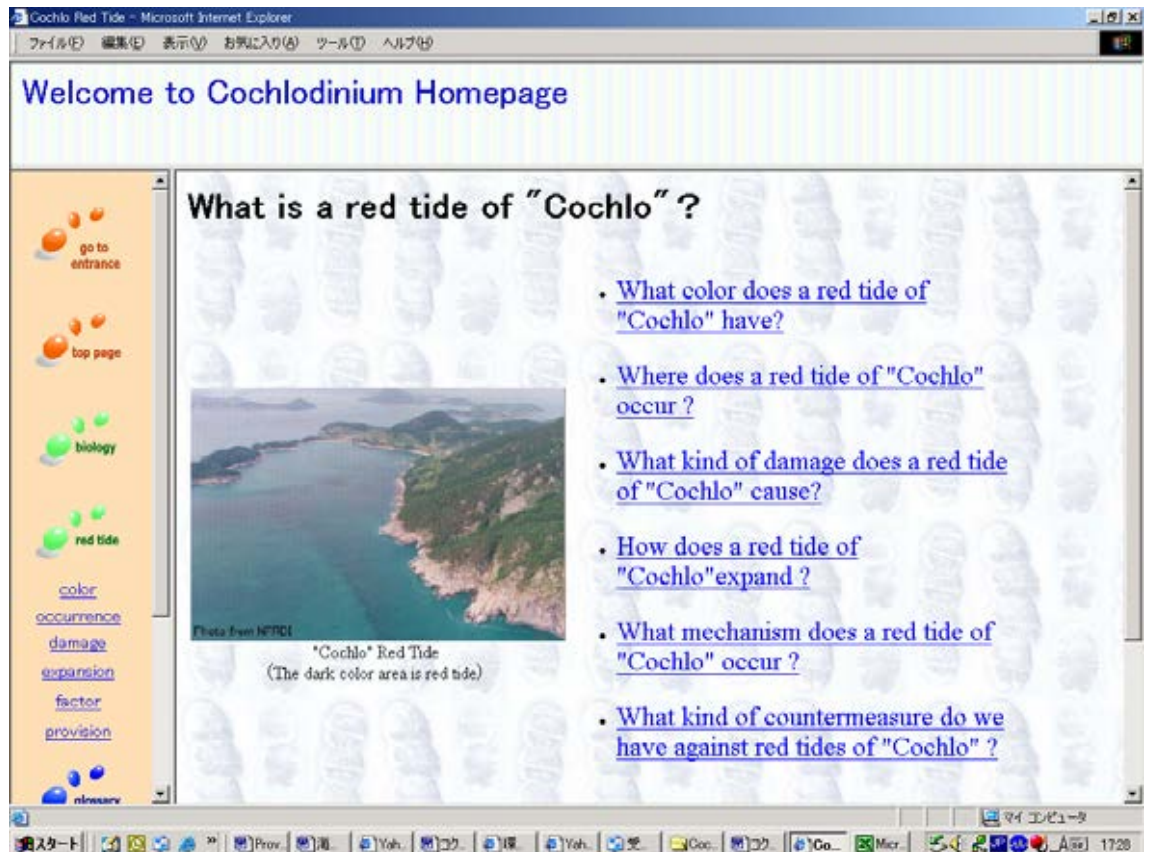


Figure A6-2-4. "Cochlo" red tide page

(5) Glossary

On the glossary page, the technical terms used in the homepage are explained. The terms are described in a simple and clear manner, so that viewers can easily understand.

Dinoflagellate	Unicellular algae with two dissimilar flagella, some of them overlapping cellulose plates called the theca.
Nutrients	A substance that is needed to keep plankton alive and to help it to grow, that include ammonia , nitrites, orthophosphates, and silicate.
Plankton	The weakly swimming but mostly drifting small organisms that inhabit the water column.
Phytoplankton	Phytoplankton are free floating flora which convert inorganic compounds into complex organic compounds. This process of primary productivity supports the pelagic food-chain.
Protist	A heterogeneous group of living things, comprising those eukaryotes which are neither animals, plants, or fungi.
Red Tide	Red tide is a term used to describe all phenomena which the water is discolored by high algal biomass or concentration of algae. Color of red tides is reddish-brown, brown, green, yellowish, bluish green and white.
Salinity	The dry weight of salts per kilogram of sea water (The practical definition of salinity is based on the conductivity of a sample of sea water in comparison with that of a standard solution of KCl.).

(6) Links

The links page lists the websites that are related to HAB, or websites that may be useful in understanding environmental problems in the NOWPAP Region.

Linked websites include:

- sites dealing with biology and taxonomy of *Cochlodinium*, HAB and dinoflagellate,
- homepages of fishery research institutes
- homepages of international organizations related to NOWPAP

Refer to Appendix 1 for the web addresses of the links.

(7) Bibliography

Materials used in preparing this web site are listed in the bibliography.

Future activities :

- Update of contents

If new information relevant to *Cochlodinium* is obtained, it will be added into the homepage.

- Addition of other language version

Currently, only English and Japanese versions are available. If the WG3 and CCG members wish to include their native language versions, the member is required to submit translated versions of the texts (CERAC will assist the members on this work).

Appendix 6-3 Links

- Northwest Pacific Region Environmental Cooperation Center (NPEC)
<http://www.npec.or.jp/index2.html>
- The Special Monitoring & Coastal Environmental Assessment Regional Activity Centre (CEARAC)
<http://cearac.nowpap.org/>
- The Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region
<http://cearac.nowpap.org/nowpap/index.html>
- Protist Information Servern
<http://130.158.208.53/WWW/index.html>
- Welcome to the world of Dinoflagellates
<http://bio2.sci.hokudai.ac.jp/Dinohome/Eng-Documentation.html>
- Atlas of Dinoflagellates (HAB Related Photograph)
<http://dinos.anesc.u-tokyo.ac.jp/>
- Phytopia Special Topics
<http://www.bigelow.org/phytopia/>
- IOC Taxonomic Reference List of Toxic Plankton Algae
<http://www.bi.ku.dk/ioc/default.asp>
- NOAA project to forecast HABs for a given region
<http://www.csc.noaa.gov/crs/habf/index.html>
- The National Office for Marine Biotoxins and Harmful Algal Blooms (Woods Hole)
<http://www.whoi.edu/science/B/redtide/>
- dino scope
http://www.bio.usyd.edu.au/Protsvil/dinoscope_front.htm

National Research Institution in NOWPAP region

Japan

- National Research Institute of Fisheries and Environment of Inland Sea, Fisheries Research Agency (FEIS)
<http://www.nnf.affrc.go.jp/eng/eindex.html>
- Japan Fisheries Resource Conservation Association
<http://www.fish-jfrca.jp/index.html>

Korea

- National Fisheries Research and Development Institute (NFRDI)
<http://www.nfrda.re.kr/>
- Korea Oceanographic Data Center (KODC)
<http://www.nfrda.re.kr/kodc/>
- Korea Ocean Research and Development Institute (KORDI)
<http://www.kordi.re.kr/>

Russia

- National Oceanographic Data Center
http://www.meteo.ru/nodc/index_e.html
- Pacific Oceanological Institute (POI)
<http://www.pacificinfo.ru/en/>

China

- State Oceanic Administration
<http://www.soa.gov.cn/>
- China Oceanic Information Network
<http://www.coi.gov.cn/eindex.html>

International Organization

- GEOHAB (Global Ecology and Oceanography of Harmful Algal Blooms)
<http://ioc.unesco.org/hab/GEOHAB.htm>
- IOC (International Oceanographic Commission)
<http://ioc.unesco.org/iocweb/index.php>
- IMO (International Maritime Organization)
<http://www.imo.org/home.asp>
- IPHAB (IOC Intergovernmental Panel on Harmful Algal Blooms)
<http://ioc.unesco.org/hab/act2.htm>
- PICES (North Pacific Marine Science Organization)
<http://pices.int/>
- SCOR (Scientific Committee on Oceanic Research)
<http://www.jhu.edu/~scor/>
- UNESCO (United Nations Educational Scientific and Cultural Organization)
http://portal.unesco.org/en/ev.php-URL_ID=15006&URL_DO=DO_TOPIC&URL_SECTION=201.html

Appendix 6-4 Proposal of *Cochlodinium* Pamphlet

The secretariat of CEARAC proposes the contents of “Cochlodinium pamphlet” in Table A5-3-1. This pamphlet will be made based on *Cochlodinium* Homepage and issued by the end of 2005. There is basic information about *Cochlodinium* for students, NGOs, and people who are interested in marine environment to learn this species.

The size and volume of this pamphlet are A4-size (210×297mm) and 6-pages respectively. The language used in it is English. 500 copies will be prepared.

Table A6-4-1 Proposed Contents of “*Cochlodinium* Pamphlet”

Page	Space	Contents	Pictures and Figures
1	0.7	What is <i>Cochlodinium</i> ? - Brief Explanation of <i>Cochlodinium</i>	- Photomicrographs of <i>Cochlodinium</i> with various optical sections
	0.3	- Brief Explanation of NOWPAP	- Figure of the official area of the NOWPAP Region
2	1	Red tide of <i>Cochlodinium</i> : - Explanation of color and damage caused by the species	- Picture of fish killed - Picture of red tide of <i>Cochlodinium</i>
3	0.5	Occurrence and location of <i>Cochlodinium</i>	- Figure of occurrence and locations of <i>Cochlodinium</i> red tide in Japan and Korea
	0.5	Expansion of <i>Cochlodinium</i> Red tides	
4	1	Introduction of Countermeasures against <i>Cochlodinium</i> red tide	- Pictures of Yellow Clay Spraying
5	1	Morphology of <i>Cochlodinium</i>	- Picture of solitary cell - Picture of chain forming cell (in 4 cells)
6	1	Explanation of NOWPAP and CEARAC - URL of <i>Cochlodinium</i> HP - Request of sending information on HAB - Address of CEARAC - Explanation of NOWPAP, CEARAC, and NPEC	- Figure of NOWPAP Family - Figure of <i>Cochlodinium</i> HP