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All the Appendices are the original PPT copies shown during the 8th CEARAC FPM and the Expert Meeting on Assessment of Eutrophication Status and Marine Environment Focusing on Marine Biodiversity, and some descriptions are not matched to documents in this booklet which were revised after the meeting in accordance with the adopted report of the 8th CEARAC FPM.

UNEP

Report on NOWPAP implementation

Xiaodong Zhong
NOWPAP Deputy Coordinator

DINRAC (1)

DINRAC has continuously developed and maintained the following databases (available at the DINRAC website):

- Database on NOWPAP Institutions;
- Database on NOWPAP Experts;
- Database on NOWPAP Coastal and Marine Environmental Geographic Information Systems (GIS) and Remote Sensing (RS) Applications;
- Database on Marine Litter;
- Database on Coastal and Marine Nature Reserves.

Reference Databases on Atmospheric Deposition (AD), River and Direct Inputs (RDI) of contaminants and ICARM have been also established and maintained through cooperation with POMRAC

DINRAC (2)

The 14th NOWPAP IGM approved DINRAC workplan and budget for the 2010-2011 biennium, including the following activities.

- Update of database on coastal and marine nature reserves in the NOWPAP region.
- Update of meta-database on contaminants and nutrients in the NOWPAP region.
- Investigation of alien species and its potential damage in the NOWPAP region (e.g. national reports, regional overview to be published in October 2010).
- Development of visualized DINRAC website.

MERRAC (1)

In 2009, MERRAC had completed the following specific projects:

- Minimum Level of Preparedness (led by China and Russia).
- HNS Response Operation Guidelines (led by China and Russia).
- HNS Database (led by Korea).
- HNS Training Manual (led by Japan).
- Regional Report on HNS Preparedness and Response (led by MERRAC Secretariat).
- Regional Report on Sea-based Marine Litter (led by MERRAC Secretariat).

MERRAC has maintained the following databases, available at the MERRAC website:

- List of oil spill response equipment, institutions and experts in the field of marine pollution preparedness and response.
- List of oil spill accidents over 10 tons.

MERRAC (2)

The 14th NOWPAP IGM approved MERRAC work plan and budget for 2010-11 biennium, including the following activities:

- Expert meeting was organized on 5 September 2010 in conjunction with "Sakhalin Project Forum" and full-scale NOWPAP DELTA oil spill exercise.
- Regional report on HNS preparedness and response.
- Other specific projects on oil and HNS issues.
- Marine litter issues (under RAP MALI).

POMRAC (1)

In 2009, POMRAC had completed the following activities:

- Development of Regional Overview on Integrated Coastal and River Basin Management (ICARM).
- Regional Overview on Atmospheric Deposition Models (ADM) in the NOWPAP Region.
- Regional Overview on River and Direct Inputs (RDI) of Contaminants to the Marine and Coastal Environment in the NOWPAP Region (with Special Emphasis on the Land Based Sources of Pollution).
- POMRAC activities related to RAP MALI (with other RACs).
- Development of Reference Database for ICARM (with assistance of DINRAC).

POMRAC (2)

- POMRAC has also maintained its website, including reference databases developed in cooperation with DINRAC.
- POMRAC experts co-organized a workshop on ICARM during the 2009 East Asian Seas Congress (23-27 November 2009, Manila, Philippines) and co-convened a session with PICES on Marine Spatial Planning (30 October 2009, Jeju, Republic of Korea).

The 14th NOWPAP IGM approved POMRAC workplan and budget for the 2010-2011 biennium, including the following activities:

- Revised Regional Overviews on AD and RDI for the preparation of the second edition of the "State of Marine Environment Report" (with other RACs and three POMRAC working groups).
- Further activities on the preparation of regional programme on ICARM (with other RACs and regional partners) covering many different issues including climate change adaptation, biodiversity conservation, marine spatial planning, ecosystem valuation and application of ecosystem based management.
- Update Reference Data Bases for ICARM, AD and RDI.
- Marine litter (with other RACs).

8th CEARAC FPM, September 2010, Toyama, Japan

Partnerships

NOWPAP RCU and RACs staff have continued actively developing partnerships with many relevant organizations, programmes and projects in the region. Close relations were established and maintained with the following partners (in alphabetical order):

- East Asian Seas Regional Coordinating Unit (EAS/RCU);
- GEF/UNDP/IMO Regional Programme on Partnerships in Environmental Management for the Seas of East Asia (PEMSEA);
- North Pacific Marine Science Organization (PICES);
- UNESCO/IOC Sub-Commission for the Western Pacific (WESTPAC);
- UNDP/GEF Project on the Yellow Sea Large Marine Ecosystem (YSLME).

NOWPAP partners were involved in co-organizing of numerous events, which improved sharing of information, coordination of related activities (e.g., on ICARM, remote sensing applications and other issues) and raising public awareness.

8th CEARAC FPM, September 2010, Toyama, Japan

Public awareness (1)

According to NOWPAP Public Awareness Strategy, the following actions were taken by NOWPAP RCU and RACs:

- NOWPAP homepage and RAC homepages have been maintained and constantly updated. News and information have been posted on the NOWPAP homepage in five languages (English, Chinese, Japanese, Korean and Russian) since 2006. Since August 2009 (when website statistics became available for NOWPAP RCU), average monthly number of pages visited at the NOWPAP website was around 2,000, with visitors from more than 10 countries.
- News about NOWPAP implementation was regularly posted at the partners' websites and introduced in their electronic newsletters (e.g., COBSEA, PEMSEA, WESTPAC, YSLME).
- Information about NOWPAP activities was introduced to UNEP Headquarters (HQ), UNEP ROAP and GPA websites (and is currently available there).

8th CEARAC FPM, September 2010, Toyama, Japan

Public awareness (2)

- Several brochures, leaflets, posters about NOWPAP activities were prepared and widely distributed. In addition to English, local languages were used when appropriate.
- While attending a few global and regional meetings (e.g., East Asian Seas Congress 2009; 11th Global Meeting of Regional Seas) as well as local events, RACs and RCU staff contributed to increasing NOWPAP visibility and attracting public attention to marine environment conservation by introducing the NOWPAP activities.
- RACs and RCU staff also contributed articles to magazines, newspapers and newsletters and delivered lectures and presentations at a local level.

8th CEARAC FPM, September 2010, Toyama, Japan

Resource mobilization and financial support

- According to the NOWPAP Resource Mobilization Strategy, several external funding sources were approached by the NOWPAP RCU and relevant information has been introduced to the RAC Directors and Marine Litter Focal Points.
- In response to NOWPAP RCU request, UNEP Regional Seas Programme (RSP) provided financial support (US$ 15,000) for the performance review of the NOWPAP RCU. UNEP RSP also kindly agreed to support (US$24,000) NOWPAP brainstorming workshop on biodiversity conservation, which was held in Toyama, Japan, on 17 September 2009. In 2010, UNEP RSP provided funds (US$5,000) to hire a consultant to collect information on marine and coastal biodiversity threats in the NOWPAP region.
- Ministry of Foreign Affairs of Japan allocated an earmarked contribution of US$ 52,000 to support the NOWPAP International Coastal Cleanup (ICC) and Workshop in Hirado, Japan held on 26-28 March 2010.

8th CEARAC FPM, September 2010, Toyama, Japan

NOWPAP RAP MALI

Implementation of the NOWPAP RAP MALI and plans for 2010-2011 were discussed at the 14th NOWPAP IGM. After approval in principle by the IGM, details of RAP MALI workplan and budget for 2010-2011 were discussed at a RAP MALI working meeting on 28 March 2010 in Hirado, Japan. After endorsement by a working meeting participants, workplan and budget were circulated among NOWPAP National Focal Points and then approved.

8th CEARAC FPM, September 2010, Toyama, Japan

Development of NOWPAP projects on marine and coastal biodiversity (1)

Brainstorming Workshop on Marine and Coastal Biodiversity (financially supported by UNEP RSP) was organized on 17 September 2009 in order to discuss and prepare project concepts for the consideration and approval by the 14th NOWPAP IGM.

Among several possible projects related to biodiversity (BD) conservation in the NOWPAP region, preferences of most of participants were in the following order:

- Assessment of the current status of BD in the NOWPAP region (so far, no such assessment has been undertaken and current research is mostly national; there were no attempts even to compare "red lists" of threatened species).
- Assessment of climate change impacts and other factors on BD (with understanding that in many cases it's hard to clearly distinguish climate change impacts from other causes).
- Establishing networks of marine protected areas (MPAs), including taking into account typical habitat representation.
- Developing a regional programme to deal with marine invasive species (most participants agreed that such activities are being implemented under the IMO umbrella and there are ongoing projects implemented by PICES and IOC-WESTPAC).

Development of NOWPAP projects on marine and coastal biodiversity (2)

Possible funding sources, implementation arrangements, potential partners and other issues associated with these project concepts were also discussed.

NOWPAP is participating in the UNEP-initiated preparation of a global outlook on marine and coastal biodiversity, contributing regional input. This global outlook is due to be released at the upcoming 10th Conference of the Parties to the Convention on Biological Diversity (CBD COP10) in October 2010 in Nagoya, Japan.

The 14th NOWPAP IGM decided to develop a project proposal using the first concept (Assessment of the current status of BD in the NOWPAP region). The proposal has been developed by NOWPAP RCU and submitted for possible funding to the following donors: Mitsui & Co. Ltd.; Toyota Foundation and Asia-Pacific Network for Global Change Research (APN).

NOWPAP development (1)

Following the decisions of the 14th NOWPAP IGM, RCU and RACs have prepared a draft Medium-term Strategy (MTS) for NOWPAP. The following thematic elements are included in the draft MTS:

- Integrated coastal and river basin management;
- Regular assessments of the state of the marine environment;
- Pollution prevention and reduction;
- Harmful substances and hazardous waste;
- Biodiversity conservation (including alien invasive species);
- Climate change.

The draft NOWPAP MTS will be discussed at the 15th NOWPAP IGM in late 2010.

NOWPAP development (2)

According to the 13th NOWPAP IGM decision, RCU performance review was conducted by Mr. Alan Fox (a consultant hired by UNEP RSP). Mr. Fox report was discussed at the 14th NOWPAP IGM and several suggestions regarding the NOWPAP RCU Terms of Reference (TOR) were made after the meeting. The redrafted RCU TOR will be presented to the 15th NOWPAP IGM for discussion and approval.

NOWPAP development (3)

Another document prepared for the 15th IGM discussion is the proposal on how to improve quality of NOWPAP technical reports.

With the approval of several documents by the 15th NOWPAP IGM (MTS, RCU TOR and procedures to improve quality of NOWPAP technical report), and with regular member states contributions to the NOWPAP Trust Fund, it is expected that NOWPAP will continue its activities aimed at improving and maintaining the state of marine and coastal environment in the NW Pacific.

Thank you!

Report on Implementation and expenditure of CEARAC activities for 2008-2009 and revised workplan and budget of CEARAC activities for 2010-2011

NOWPAP CEARAC
13-15 September 2010

Outline of CEARAC Activities for the 2008-2009 biennium

- Organization of CEARAC 6th and 7th FPMs and 4th WG3 and WG4 Joint Meetings
- CEARAC Projects
  (WG3) - HAB Case Studies
  - HAB Integrated Website
  (WG4) - Educational materials for utilization of RS data for coastal environment conservation
  - 2nd RS Training
  (WG3 and WG4 -joint)
  - Procedures for assessment of eutrophication status
- Intersessional Work
- Cooperation and Coordination
- Publication of CEARAC Newsletters
- CEARAC Activities on RAP MALI

Main Achievements of the 6th FPM

(6-8 March 2008, Toyama, Japan)

- Reported implementation of CEARAC activities in 2007 and expenditure for 2006-2007 biennium
- Reported intersessional activities of NOWPAP WG3(HAB) and WG4(RS)
- Approved the detailed workplan and budget of CEARAC activities for 2008-2009 biennium

Main Achievements of the 7th FPM

(14-15 Sep. 2009, Toyama, Japan)

- Reported the progress of CEARAC activities for 2008-2009 biennium
- Proposed workplan and budget of CEARAC activities for 2010-2011 biennium
- Explained organization of a new meeting- Expert Meeting with experts of HAB, RS, eutrophication and marine biodiversity
- Emphasized further cooperation with other RACs, RCU and NOWPAP partners

Main Achievements of the 4th WG3 and WG4 Joint Meeting

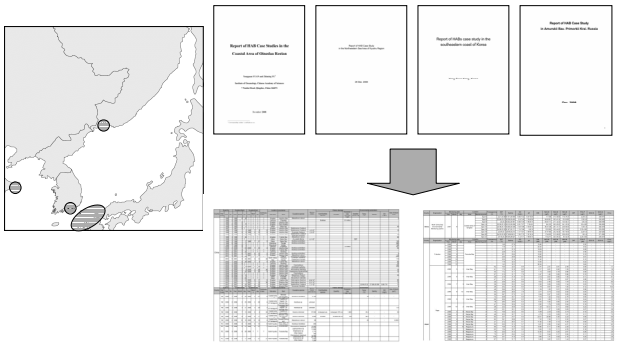
(10-12 September 2008,Toyama, Japan)

- Explained the workplan and budget for the 2008-2009 biennium
- Reviewed the interim progress of respective activities
- WG3: Recommended the CEARAC website be revised to be a new structure
- WG4: Encouraged to work with other relevant organizations such as YSLME and IOC/WESTPAC

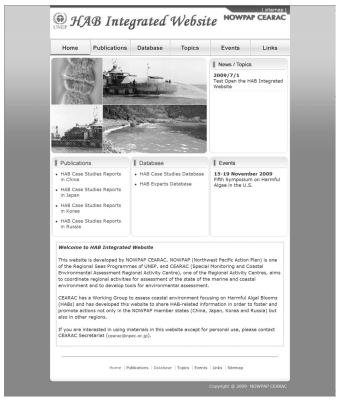
CEARAC Projects

- WG3
  - HAB Case Studies
  - HAB Integrated Website
- WG4
  - Educational materials for utilization of remote sensing data for coastal environment conservation
  - 2nd NOWPAP training course on remote sensing data analysis
- WG3 and WG4 Joint
  - Procedures for assessment of eutrophication

HAB Case Studies

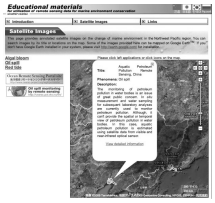


HAB Integrated Website

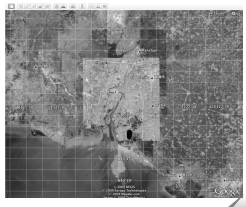


Educational materials for utilization of RS data for coastal environment conservation

Web-based educational materials were developed.
GIS-compatible annotated satellite images concerned with the issues of eutrophication, oil spill and red tides are provided.



Mapping on Google Map



Mapping on Google Earth

2nd RS training on data analysis

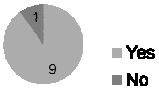
1-5 Nov. 2008 at Cheju National University in Korea
23 trainees and 12 lecturers attended

- Main topics -
RS data analysis for eutrophication, red tide and oil spill

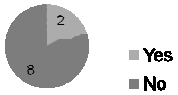
Follow up survey for RS training on data analysis

- Answers: 10/46 (total participants)

Q1. Is your current work/study related to remote sensing?



Q2. Is the knowledge you obtained during the training course useful for your current work/study?



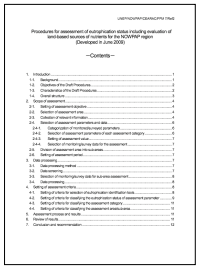
Q3. Did you publish any books or articles in magazines based on the knowledge from the training course?

Q4. Did you have a chance to disseminate/provide obtained skill to your colleagues/classmates?

Q5. did you have a chance to get involved in a new project through communication with peer participants of the training course?

Procedures for assessment of eutrophication status

Draft procedures were developed by the Northwest Pacific Region Environmental Cooperation Center (NPEC) and reviewed and refined by the nominated experts in FY 2008. The procedures were completed in June 2009.

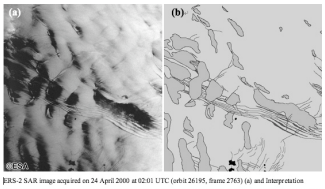


Intersessional Activity

1. Website on Oil spill monitoring by remote sensing

Added many SAR images with annotations.

Added list of new literature related to oil spill monitoring by RS.

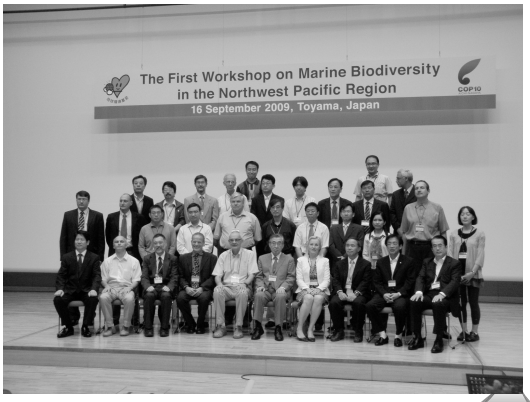


ERS-2 SAR image acquired on 24 April 2000 at 02:01 UTC (orbit 26195, frame 2763) (a) and interpretation scheme showing the location of contrast features on SAR image caused by natural films (green lines), atmospheric gravity waves (blue lines), low wind (gray spots) and oil spills (black spots) (b).

Total area of oil spills:	18.0x10^{6} m^{2}
Assumed thickness of oil spills	0.2 mm
Volume of oil spills	3.6 m^{3}

2. The 1st Workshop on Marine Biodiversity in the Northwest Pacific Region
(16 September 2009, Toyama, Japan)

- Keynote speech
  - How HELCOM works to protect the biodiversity of the Baltic Sea?
  - Development of international marine biodiversity database and its application in the NOWPAP region
- 2 sessions
  1) Current situations of activities and programmes on marine biodiversity in the NOWPAP member states
  2) Data and information on marine biodiversity in the NOWPAP member states
- Discussion : For the development of the new method to assess coastal environment using biodiversity indicators or ecosystem ones



Cooperation and Coordination

1. Participation in NOWPAP Partners' Meetings and Workshops

- NOWPAP IOC/WESTPAC 7th Int'l Scientific Symposium (21-25 May 2008, Kotakinabalu, Malaysia)
- YSLME Regional WS on Assessing Marine Environmental Quality of the Yellow Sea (2-4 June 2008, Shenyang, China)
- PICES 17th Annual Meeting (24 Oct.-2 Nov. 2008, Dalian, China)
- GOCCI PI Workshop (29-30 Oct. Jeju, Korea)
- WS on Marine Environment in the East China Sea and its Sound Future (5-6 December 2008, Fukuoka, Japan)
- PICES workshop on Status and Trends in East Asian Marginal Sea Ecosystems (21-22 April 2009, Busan, Korea)
- PICES International Summer School on Satellite Oceanography for the Earth Environment (25-28 August 2009, Seoul, Korea)
- 11th Global Meeting of the Regional Seas Conventions and Action Plans (5-8 October 2009, Bangkok, Thailand)
- PICES 18th Annual Meeting (23 Oct.-1Nov. 2009, Jeju, Korea)
- East Asian Congress 2009 (23-27 November 2009, Manila, the Philippines)

2. Participation in NOWPAP-related and other RACs' Meetings and Events

- NOWPAP International Coastal Cleanup (ICC)
  (11-12 September 2008, Dalian, China)
  (26-28 September 2008, Vladivostok, Russia)
- Focal Points Meetings of Other RACs

Publication of Newsletter

UNEP

Newsletter from

NOWPAP CEARAC

Northwest Pacific Action Plan
Special Monitoring and Environmental Assessment
Regional Activity Center

Steady Development of CEARAC Activities

Greetings from the Director of CEARAC, Hidetomo Yamaguchi

No. 5
December 2008

Voice from the Partners

Marine Biodiversity Conservation by the Convention on Biological Diversity

Jihyun Lee, Environmental Affairs Officer, Secretariat of the Convention on Biological Diversity/UNEP

Convention on Biological Diversity

The Convention on Biological Diversity (CBD)
Launched at the Earth Summit in Rio de Janeiro in 1992, the Convention on Biological Diversity (CBD) is an international treaty for the conservation and sustainable use of biodiversity and the equitable sharing of the benefits from the utilization of genetic resources. With 192 members, the CBD has near-universal participation among countries committed to preserving life on Earth. The CBD seeks to address all threats to biodiversity and ecosystem services, including threats from climate change, through scientific assessments, the development of tools, incentives and processes, the transfer of

HELCOM shares its long experience in the protection of a regional sea, the Baltic Sea

Maria Laamanen, Professional Secretary of HELCOM

The Helsinki Commission (HELCOM) has worked since 1974 to protect the marine environment of the Baltic Sea from all sources of pollution. Governments of all coastal countries of the Baltic Sea are signatories to the Convention on the Protection of the Marine Environment of the Baltic Sea Area and they all participate in the work of HELCOM.

In November 2007, ministers for the environment and high-level representatives of the HELCOM parties adopted an ambitious action plan, the HELCOM Baltic Sea Action Plan (HELCOM BSAP), to radically reduce pollution to the Baltic Sea and reverse its degradation by 2021. The HELCOM BSAP is a first ever attempt by a regional sea convention to incorporate the ecosystem-based approach into the protection of the marine environment. With the Baltic Sea Action Plan, the Baltic Sea countries adopted a full management the biodiversity of the Baltic Sea.

monitoring, the Baltic Sea countries are able to produce indicator-based assessments. These assessments also supply the latest available information to support policy-making, including recommendations on whether further protective measures are needed. The integrated thematic assessment of eutrophication was published in 2000. It indicated that the eutrophication status of all but 15 areas out of 189 was not acceptable even though the external loads of nutrients to the Baltic Sea have had a decreasing trend since the beginning of the 1980s. Based on the eutrophication targets and

Activities on RAP MALI

- **Development of public awareness materials**
- **Compilation and harmonization of marine litter monitoring data on beaches**
- **Interpretation of results of marine litter monitoring on beaches**
- **Development of technical materials and introduction of best practices on solid waste management**

Final expenditure of CEARAC for 2008-2009 biennium(1/4)

Activity	Time	Planned Budget in US$	Expenditure In US$
Organization of 6th FPM	Mar. 2008		
- organizing the meeting		16,000	15,381
- publishing the meeting report		2,000	2,535
Organization of 7th FPM	Sep. 2009		
- organizing the meeting		16,000	18,760
- publishing the meeting report		2,000	2,873
Organization of 4th WG3 and WG4 Joint Meeting	Sep. 2008		
- organizing the meeting		25,000	21,046
- publishing the meeting report		6,000	4,974
WG3 (HAB)	Throughout 2008 & 2009		
- HAB case studies		10,000	10,000
- HAB Integrated Website		10,000	10,000

Final expenditure of CEARAC for 2008-2009 biennium(2/4)

Activity	Time	Planned Budget in US$	Expenditure In US$
WG4(RS)	Throughout 2008 & 2009		
- Educational materials for utilization of RS data for marine environment conservation		10,000	9,000
- 2nd RS Training		15,000	14,515
WG3 and WG4(Joint)	Throughout 2008 & 2009		
- Procedure for assessment of eutrophication status including evaluation of land based sources of nutrient for the NOWPAP Region		10,000	9,000
Intersessional work	Throughout 2008 & 2009		
- Website on oil spill monitoring by remote sensing		2,000	2,000
- Preparing documents for 7th FPM		4,000	0

Final expenditure of CEARAC for 2008-2009 biennium(3/4)

Activity	Time	Planned Budget in US$	Expenditure In US$
Cooperation and Coordination of CEARAC activities	Throughout 2008 & 2009		
- 2008		4,000	3,422
- 2009		4,000	15,320
Publication of CEARAC Newsletter	Autumn 2008 & 2009		
- Fifth issue		2,000	(total)
- Sixth issue		2,000	4,704
Sub-total		140,000	144,530

Final expenditure of CEARAC For 2008-2009 biennium(4/4)

Activity	Time	Planned Budget in US$	Expenditure in US$
CEARAC activities on RAP MALI	Throughout 2008 & 2009		
- Develop public awareness materials		2,500	3,108
- Compile and harmonize marine litter monitoring data on beaches		4,000	0
- Interpret results of marine litter monitoring on beaches		4,000	0
- Develop technical materials and introduce best practices on solid waste management, including removal of marine litter on beaches		in-kind	2,862
Sub-total		10,500	5,970
TOTAL		150,500	150,500

Outline of CEARAC Activities for the 2010-2011 biennium

- Organization of CEARAC 8th & 9th FPM and Expert Meetings
- Maintenance of CEARAC Websites
- CEARAC Projects
  - Development of the new marine assessment method on marine biodiversity
  - Implementation of the assessment of eutrophication status
  - Updating the Integrated Report on HAB and RS
  - Organization of the 3rd RS Training
- Cooperation and Coordination
- Publication of Newsletters

Organization of 8th & 9th FPM and Expert Meeting

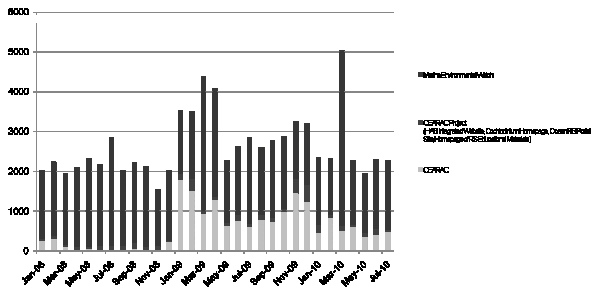
- CEARAC 8th FPM back-to-back with Expert Meeting on assessment of eutrophication and marine biodiversity
  (13-15 September 2010)
- CEARAC 9th FPM back-to-back with Expert Meeting
  (September 2011)

Maintenance of Websites

WG3 - **HAB Integrated Website**
- ***Cochlodinium* Homepage**

WG4 - **RS Portal Site**
- **Homepage of RS Educational Materials**
- **Website on Oil Spill Monitoring by RS**

Number of CEARAC website visitors

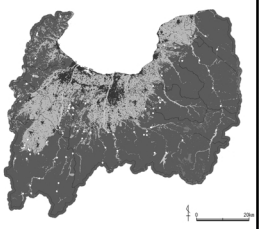


CEARAC Projects

1. **Development of a new marine assessment method focusing on marine biodiversity**
2. **Implementation of the assessment of eutrophication status by the NOWPAP member states**
3. **Updating the Integrated Report on HAB and RS**
4. **Organization of the 3rd NOWPAP Training Course on Remote Sensing Data Analysis**

1. Development of a new marine assessment method focusing on marine biodiversity

-Pilot Study in Toyama Bay to test the methodology for assessment focusing on marine biodiversity

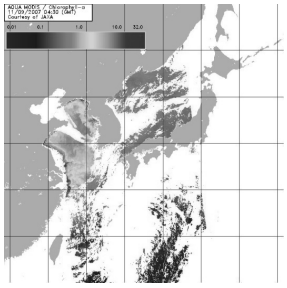


-Development of a draft assessment method for the NOWPAP region

2. Implementation of the assessment of eutrophication status by the NOWPAP member states

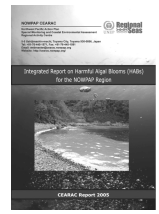
Areas to conduct assessment of eutrophication status in each NOWPAP member state

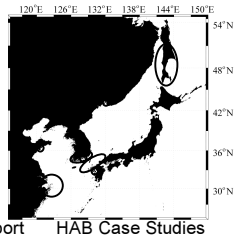
- Yangtze River Estuary and adjacent area, China
- North Kyusyu island, Japan
- Jinhae Bay, Korea
- Peter the Great Bay, Russia



3-1. Updating the Integrated Report on HAB

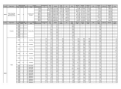
In 2005 In 2010-2011



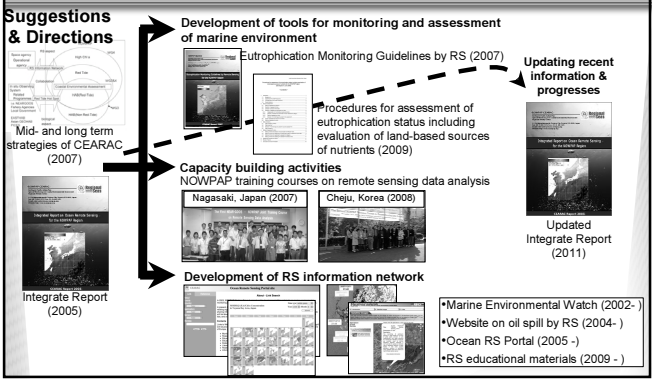


Updated Integrated Report on HABs for the NOWPAP region

HAB Integrated Report HAB Case Studies



3-2. Updating the Integrated Report on Ocean RS



4. Organization of the 3rd NOWPAP Training Course on Remote Sensing Data Analysis

- Follow-on of the 1st and 2nd RS Training Course on Data Analysis

Lecture

Hand-on exercises

Cooperation and Coordination (FY2010)

- 2nd Yellow Sea Regional Science Conference (24-26 February, Xiamen, China)
- 2010 NOWPAP International Coastal Cleanup (ICC) and Workshop on Marine Litter Management (26-28 March, Hirado, Japan)
- 13th NEAR-GOOS Coordinating Committee Meeting (8-10 April, Vladivostok, Russia)
- International Symposium – Climate Change Effects on Fish and Fisheries (25-26 April, Sendai, Japan)

- 8th Intergovernmental Session IOC Sub-Commission
  (10-13 May, Bali, Indonesia)
- 8th POMRAC FPM
  (26-27 May, Busan, Korea)
- 13th MERRAC FPM
  (8-11 June, Taejeon, Korea)

- 2010 NOWPAP ICC in Korea
  (1-2 October, Jeju, Korea)
- Marine Biodiversity Forum in the Northwest Pacific Region
  (16 October, Toyama, Japan)
- COP10 Side Event
  (18-29, October, Nagoya-Aichi, Japan)
- PICES 2010 Annual Meeting
  (22-31 October, Portland, USA)
- 2nd International Conference on Global Change and the Environment in Asia and Pacific (GCEAP): Inland Waters and Coastal Environment
  (28-29 October, Hong Kong, China)
- 15th NOWPAP IGM
  (16-18 November, Moscow, Russia)

Publication of Newsletters

- 7th Issue (autumn 2010)
- 8th Issue (autumn 2011)

CEARAC activities on RAP MALI

- Revise "Marine Litter Guidelines for Tourists and Tour Operators in Marine and Coastal Areas"
- Update the pamphlet "Current Situation on marine litter in the NOWPAP region"
- Compile and harmonize marine litter monitoring data on beaches and submit collected data to DINRAC
- Provide information on best practice to reduce marine litter generation from land-based sources

Revised workplan and budget of CEARAC for the 2010-2011 biennium

Activity	Planned Budget (US$)			Tentative Time
	2010	2011	Total	
Organization of CEARAC FPM back to back with Expert Meeting	27,000	27,000	54,000	Sep. 2010 Sep. 2011
Maintenance of Websites (WG3) ➢ Updating HAB Integrated Website ➢ Development of the website in languages of NOWPAP member states (WG4) ➢ Updating Ocean Remote Sensing Portal Site ➢ Updating Website on the Remote Sensing Educational Materials	3,000	2,000	5,000	Throughout 2010-2011

Activity	Planned Budget (US$)			Tentative Time
	2010	2011	Total	
Specific Projects ➢ New marine assessment method focusing on marine biodiversity ➢ Implementation of the assessment of eutrophication status by the NOWPAP member states ➢ Updating the Integrated Report on HAB ➢ Updating the Integrated Report on RS ➢ 3rd NOWPAP Training Course on RS Data Analysis	In-kind 12,000 8,000	In-kind 4,000 2,000 4,000 10,000	40,000 + In-kind	Throughout 2010-2011
Cooperation and Coordination of CEARAC activities	2,000	2,000	4,000	
Publication of Newsletter(7th& 8th)	2,000	2,000	4,000	autumn
Sub-Total	54,000	53,000	107,000	

Activity	Planned Budget (US$)			Tentative Time
	2010	2011	Total	
CEARAC Activities on RAP MALI				
➢ Revise "Marine Litter Guidelines for Tourists and Tour Operators in Marine and Coastal Areas"			5,000	Throughout 2010-2011
➢ Update the pamphlet "Current situation on marine litter in the NOWPAP region"			2,500	
➢ Compile and harmonize marine litter monitoring data on beaches and submit collected data to DINRAC			In-kind	
➢ Provide information on best practices to reduce marine litter generation from land-based sources			3,000	
Sub-Total			10,500	
Grand Total			117,500	

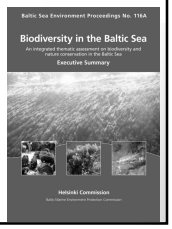
A new marine assessment method focusing on marine biodiversity

CEARAC
14-15 September, 2009

Background

CEARAC developed the common procedures for assessment of eutrophication status for the NOWPAP region in June 2009.

Eutrophication, biodiversity, hazardous substances and maritime activities etc. give negative influences to the marine environment.



Background

The 7th CEARAC FPM and the 14th NOWPAP IGM approved that CEARAC implements the activity for developing the new marine environment assessment method focusing on marine biodiversity.

Point of this activity is to assess the marine environment, not to assess the species and biodiversity in the NOWPAP region.

Objectives

- To coordinate with biodiversity experts on the methodology for assessing marine environment by using indicators related to marine biodiversity

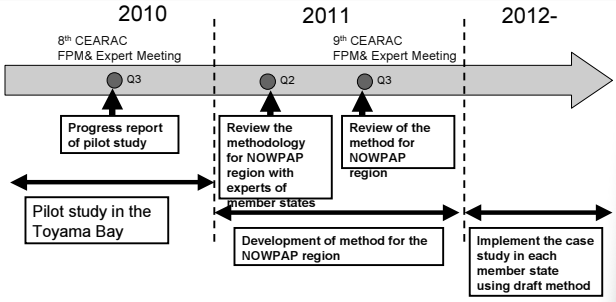
- To develop a draft assessment method for sharing among the NOWPAP member states

Main Tasks

(1)To discuss the methodology to assess the marine environment for conservation of marine life

(2)To develop a draft assessment method in order to implement case studies in each member state

5. Schedule



Expected outcome

- Comprehensive marine environment assessment using common procedure of assessment for eutrophication status and assessment method focusing marine biodiversity

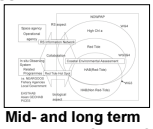
Report of implementation of the assessment of eutrophication status by the NOWPAP member states

CEARAC

September 13, 2010

1. Background

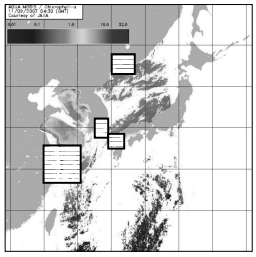
Suggestions & Directions



Mid- and long term strategies of CEARAC (2007)

Procedures for assessment of eutrophication status including evaluation of land-based sources of nutrients (Common Procedures, 2009)

Selected areas for eutrophication assessm



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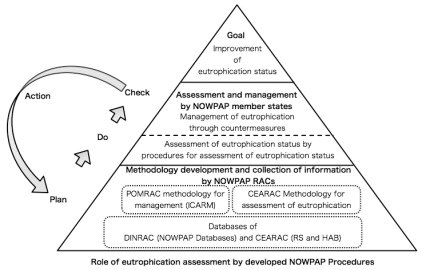
2. Objective

to apply the Common Procedures and to apply the suggested methodology for assessment of eutrophication status in the selected sea areas in the NOWPAP member states



Role of eutrophication assessment by developed NOWPAP Procedures

3

3. Main tasks

Each NOWPAP member state will be required to conduct an assessment of the eutrophication status in their selected sea areas based on the Common Procedures.

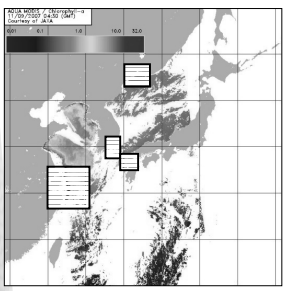
Main tasks of the nominated experts will be;

- **Division of sub area in each selected area**
- **Collection of relevant information**
- **Selection of assessment parameter and data**
- **Setting of assessment period**
- **Data processing**
- **Setting of assessment criterias**
- **Preparation of a report on assessment results**
- **Review of the Integrated report**

4

Selected areas and nominated experts

Selection of area for assessment



Selected areas	Nominated experts
Yangtze River Estuary and adjacent area, China	Dr. Zhiming YU, Chinese Academy of Science, Institute of Oceanology
Northwest Kyusyu sea area, Japan	NPEC with consultant
Jinhae Bay, Korea	Dr. Youngtae Park, South-east Sea fisheries Research Institute, NFRDI
Peter the Great Bay, Russia	Dr. Pavel Tishchenko, Hydrochmistry Laboratory, Department of the Ocean Geochemistry and Ecology, POI

5

Draft table of contents on eutrophcation assessment in each selected area

Executive summary

1. Introduction

2. Results of eutrophication assessment in the selected sea areas
 2.1. Scope of Assessment
  2.1.1Selection of assessment area
  2.1.2Collection of relevant information
  2.1.3Division of assessment area into sub-areas (if necessary)
  2.1.4Selection of assessment parameters

2.2. Data processing
 2.2.1 Organization of collected data
 2.2.2 Screening and sorting of data into sub-areas
 2.2.3 Preparation of data sets for assessment

6

Draft table of contents on eutrophcation assessment in each selected area

2.3. Setting of assessment criteria
2.3.1 Setting of identification criteria of the assessment data
2.3.2 Setting of classification criteria of the assessment parameters
2.3.3 Classification criteria of the assessment categories
2.3.4 Classification criteria of the assessment area/sub-areas

2.4. Assessment process and results
2.4.1 Division of assessment areas and assessment categories
2.4.2 Assessment results in each sub-area

2.5. Summary

7

Draft table of contents on eutrophcation assessment in each selected area

3. Comparison of assessment results in the selected areas in each NOWPAP state

3.1. Similarities and differences in each selected areas

3.2. Comparison of assessment criteria
3.2.1 Similarities and differences in assessment data
3.2.2 Similarities and differences in assessment parameters
3.2.3 Similarities and differences in classification criteria of assessment categories
3.2.4 Similarities and differences in classification criteria of assessment area/sub-areas

3.3. Comparison of assessment results of each selected area

4. Overall conclusions and recommendations

8

4. Expected outcomes

The obtained assessment results from each NOWPAP member state will be compiled as an integrated report on assessment of eutrophication status for the NOWPAP region, <u>hoping that it will provide essential information for proper management of the marine and coastal environment</u> in the NOWPAP region.

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5. Potential partners

Sharing obtained assessment results with group or organization dealing with coastal area management

Alliance with NOWPAP RACs, local governments and other relevant organizations is essential

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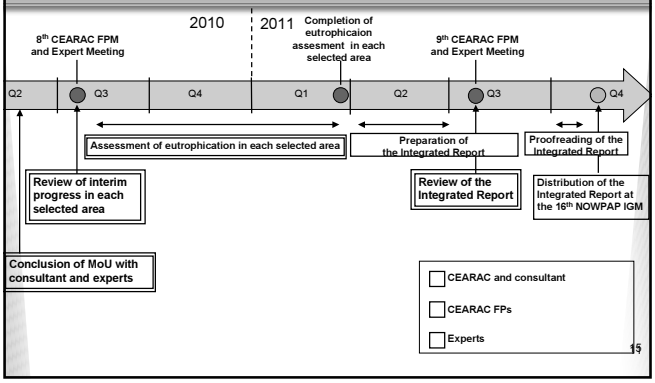
5. Schedule



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6. Budget

Contract	Timing	Output	To be completed	Counterpart	Budget(US$)
Implementation of eutrophication assessment in each NOWPAP member state	2010 Q2	Results of eutrophication assessment in each NOWPAP member state	2010 Q4	Expert or organization in China	3,000
				Consultant in Japan	3,000
				Expert or organization in Korea	3,000
				Expert or organization in Russia	3,000
Preparation of integrated report on eutrophication assessment for the NOWPAP region	2011 Q1	Integrated report on eutrophication assessment for the NOWPAP region	2011 Q3	Consultant	4,000
Total	10,000				16,000

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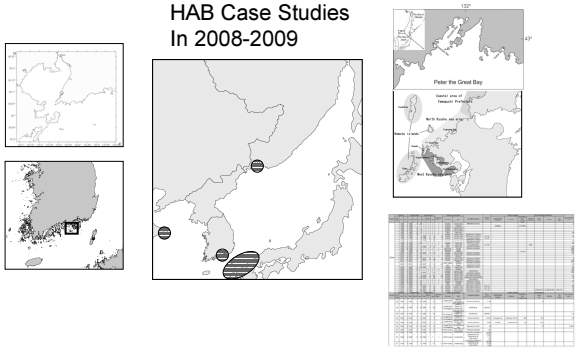
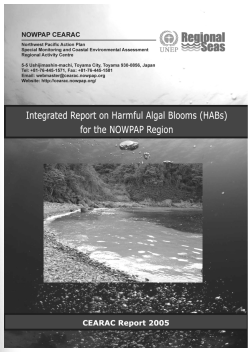
Updating the Integrated Report on HAB for the NOWPAP Region based on the HAB Case Studies

CEARAC
13 September 2010

1. Background



Background



In CEARAC mid- and long-term strategies, it is stated that HAB Integrated Report (2005) will be reviewed and updated in the 2010-2011 biennium.

Based on the HAB Case Studies, the HAB information and other related information can be updated regularly.

2. Objective

(1) To expand the target sea areas in order to enhance information sharing among the member states

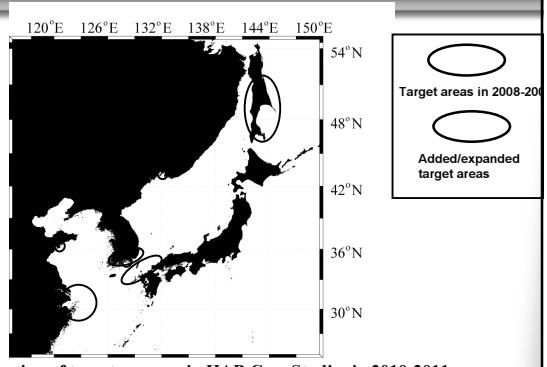
(2) To summarize the situation on HAB in the NOWPAP region for the next five years 2006-2010 after the 1st publication (2005)

(3)To introduce the study on remote sensing and molecular genetic technologies in the NOWPAP region

3. Main Tasks

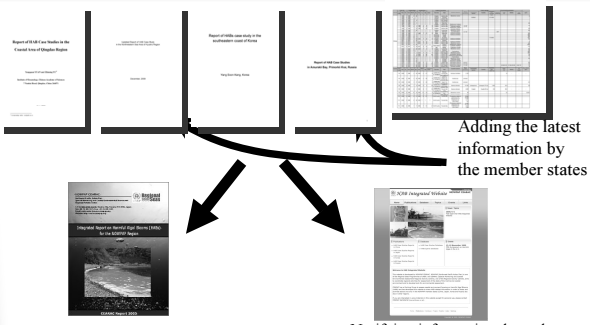
- ***Selection of additional target sea areas for HAB Case Study in the 2010-2011 biennium***
- **Revising the HAB Case Study Report by adding latest information and submitted data with the common format**
- **Updating the Integrated Report on HABs for the NOWPAP region**

Target sea areas in 2010-2011



Location of target sea area in HAB Case Studies in 2010-2011

Submission of revised HAB Case Study Report and the common format



The provisional contents of the updated Integrated Report

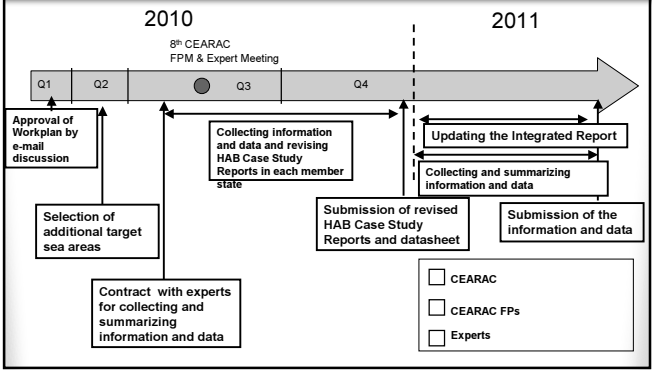
1. Introduction
   1.1 Definition
   1.2 Natural environment of the NOWPAPA region
   1.3 Social environment of the NOWPAPA region
2. HAB occurrence
   2.1 Current HAB occurrences in the NOWPAP region
3. Information on HAB monitoring
   3.1 Monitoring activities in the NOWPAP region
   3.2 Common issues on monitoring activities in NOWPAPA region
4. Challenging studies to cope with HABs
   4.1 Remote sensing techniques
   4.2 Molecular genetic techniques
5. Capacity building to cope with HABs

Appendices

4. Expected Outcome

- **Updated report will contribute to enhance HAB-related information sharing**
- **Regular update will be useful for understanding of on-going situations**
- **The objectives and the goal stated in mid- and long-term strategies will be achieved**

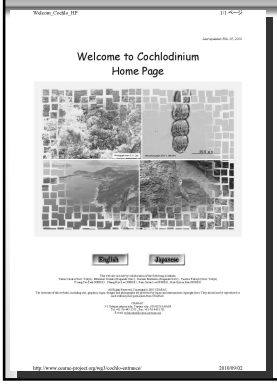
5. Schedule



6. Budget

Task	Conduct	Output	Completion	Contractor	Budget (US$)
Revising the HAB Case Study Report by adding the latest information	2010 Q3-Q4	Revised Case Study Report and Common format sheet	2010 Q4	Expert of China	2,000
				Expert of Japan	2,000
				Expert of Korea	2,000
				Expert of Russia	2,000
Updating the HAB Integrated Report on HABs for the NOWPAP region	2011 Q1	Updated Integrated Report	2011 Q4	Consultant	2,000
Total					10,000

Cochlodinium Website in member states languages



Objective:
To disseminate information to local organizations and fishermen in each member state.

Budget:
500 US$
(Maintenance of CEARAC website)

Schedule (2010):
Oct.: Send text to FPs or expert
Nov.: Submission of translated text
Dec.: Uploading to website

Proposal of workshop on Remote sensing technologies at the PICES 2011 Annual Meeting

Background:

CEARAC has participated in HAB-S Meeting of PICES Annual Meeting as an ex-officio member.

HAB-S begins a series of workshops focusing on a new technologies and methods in HAB detection.

Objective:

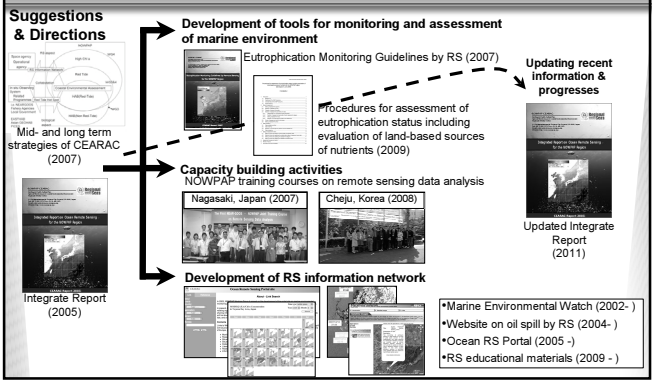
To propose the workshop on “remote sensing technologies and methods in HAB detection” in next PICES Annual Meeting held in Russia

Proposal for updating the Integrated Report on Ocean Remote Sensing for the NOWPAP Region

CEARAC

September 13, 2010

1. Background



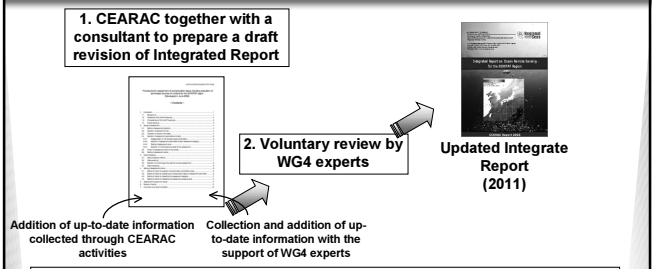
2. Objective

to summerize the recent progress on ocean remote sensing during the last 5 years and provide lastest information for the NOWPAP region.

New applications
New sensors
New algorithms
New publications
Strategies and plans in each member state
Challenges and prospects

3

3. Main tasks



Information to be added;
IOCCG Working Group, IOC/WESTPAC Remote Sensing for Integrated Coastal Area Management, YSLME Ocean Color Project, GEO Water Quality Working Group, ChlroroGIN, etc.

4

Provisional table of contents of the the updated Integrated Report

1. Introduction

2. Status of Remote Sensing utilization in marine environment monitoring

3. Case examples of RS application in marine environmental monitoring

4. Status of Research and Development on remote sensing technology for marine environment

4.1 Sensor and satellite

4.2 Algorithm for geo-physical Parameters

4.3 Validation of geo-physical Parameters

5

Provisional table of contents of the the updated Integrated Report

5. Introduction of latest findings

6. Strategies/Plans for RS related activities

7. Challenges and prospects

8. Suggested activities for NOWPAP Region

9. Summary and recommendations

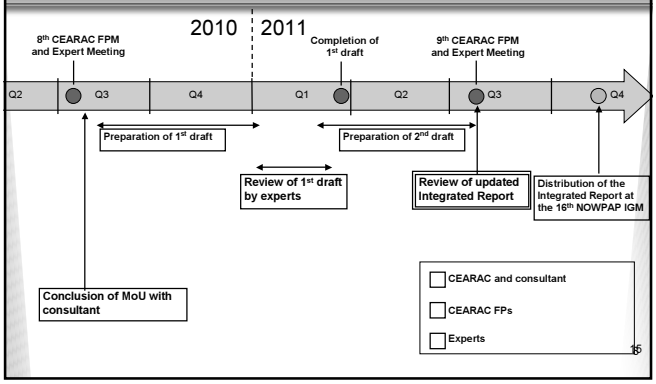
6

4. Expected outcome

to provide up-to-date information on the recent progress and the status of ocean remote sensing for the NOWPAP region and draw on issues to be addressed towards establishment of a collaborative regional monitoring program in NOWPAP.

7

5. Schedule



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6. Budget

4,000 US$ is allocated hire a consultant

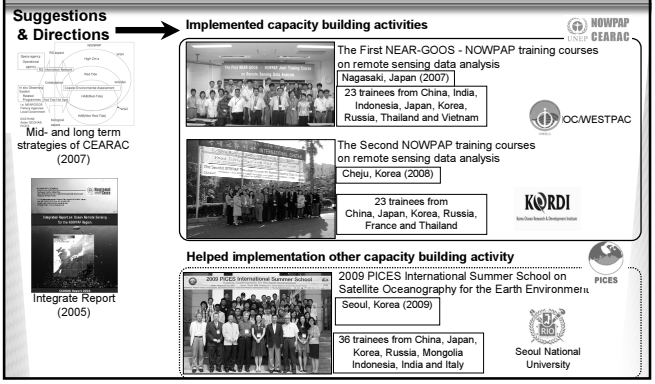
16

Report of preparation status of the 3rd NOWPAP training course on remote sensing data analysis

CEARAC

September 13, 2010

1. Background



2. Objective

to provide opportunities for students, young researchers and coastal managers to help obtain useful skills and knowledge to utilize remote sensing data in monitoring and assessment of the marine environment.

3. Main tasks

Tasks requested to WG4 experts

Review of workplan

Venue, schedule, budg

Review of syllab

Time for each le

Composition of lectures and hands-on practices

Nomination of lecturers

Recommendation of potential trainees

Selection of applicants

4. Potential partnership with other organization

Local host

Pacific Oceanological Institutes of Russian Academy of Science

Supporters

IOC/WESTPAC, PICES …

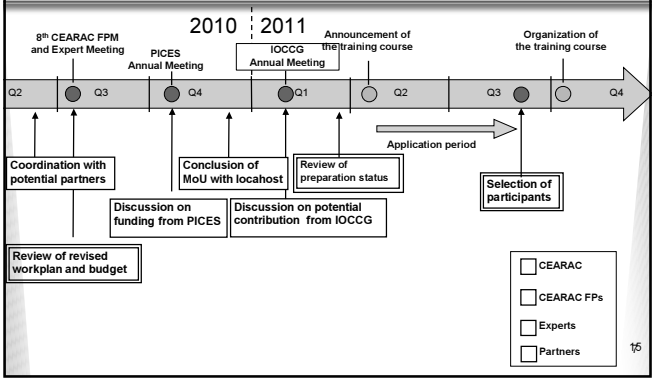
CEARAC will continue to contact other relevant organizations or groups such as IOCCG, YSLME, etc. to obtain more support.

5. Expected outcome

Contribute to capacity building of the NOWPAP member state for utilizing remote sensing data for marine environment conservation.

To obtain useful information to consider future direction of CEARAC activities related to remote sensing through feedbacks from trainees

5. Schedule



6. Budget

10,000 US$ is allocated from NOWPAP Trust Fund.

10,000 US$ is allocated from IOC/WESTPAC.

Contribution from other organization will be further discussed.

CEARAC Marine Litter Activities based on RAP MALI

CEARAC
13-15 September, 2010

Background

Phase I (2006-2007)
Assessment of the regional situation

↓

Phase II (2007)
Preparation of
the Regional Action Plan

↓

Phase III (2008-)
Implementation of activities based on RAP MALI

The goal of RAP MALI is
To improve the quality of the marine and coastal environment of the Northwest Pacific region by adressing the marine litter problem through cooperation and partnerships.

Three objectives
- **To prevent the marine litter input into the marine and coastal environment**
- **To monitor the quantities and distribution of marine litter**
- **To remove existing litter that was already discarded, disposed and abandoned**

Background

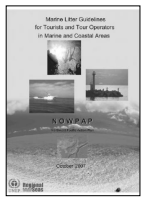
RAP MALI Working Meeting was held in Hirado, Nagasaki on March 2010, and discussed and approved the workplan for the 2010-2011 biennium.

Based on this approval, CEARAC implements marine litter activities in this biennium.

1. Revise "Marine Litter Guidelines for Tourists and Tour Operators in Marine and Coastal Areas"

Objective:
To revise the guidelines published in 2007 by adding specific issues and best practices in this section.

This material will be uploaded to CEARAC marine litter website (http://www.cearac-project.org/MALITA/index.htm)



Budget: US$5,000

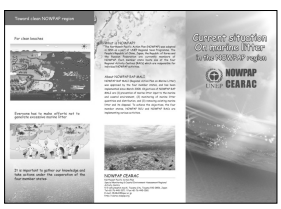
Target date: November 2011

2. Update the pamphlet "Current situation on marine litter in the NOWPAP region"

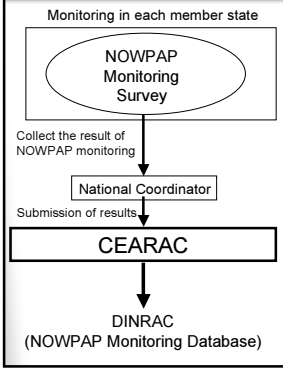
Objective:
To update the pamphlet published in 2009 in order to introduce the current situation of marine litter in the NOWPAP region based on the submitted data from member states.

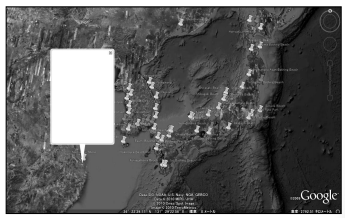
Budget: US$2,500
(printing fee)

Target date: November 2011



3. Compile and harmonize marine litter monitoring data on beaches and submit to DINRAC





Budget: In-kind

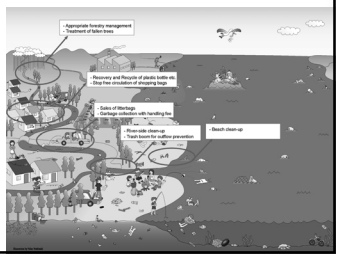
Duration: 2010 - 2011

4. Provide information on best practices to reduce marine litter generation from land-based sources

Objective:
To collect useful information and provide them through CEARAC marine litter website.

Budget: US$3,000

Target date: November 2011

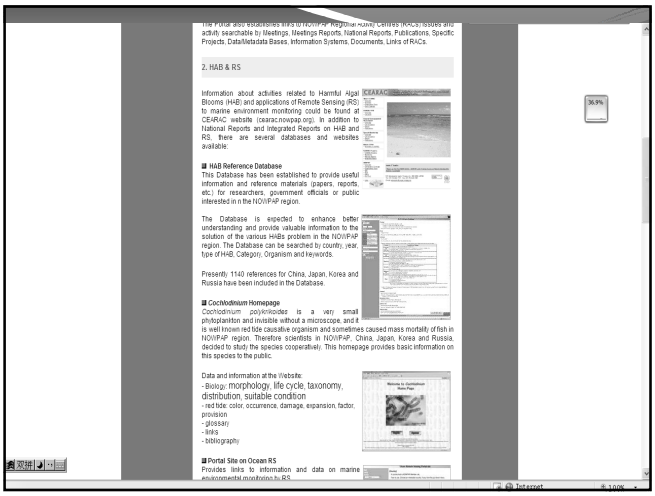


Current and Future Cooperation between CEARAC and DINRAC

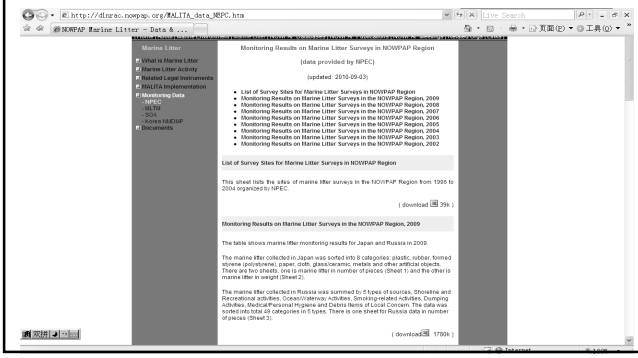
Shang Hongbo
NOWPAP DINRAC
September 12, 2010

1 Regular Update of Links to Latest CEARAC Activities and Outputs

- HAB Reference Database
- Portal Site on Ocean RS
- Marine Environmental Watch Project Homepage
- Website on oil spill monitoring by RS
- etc.



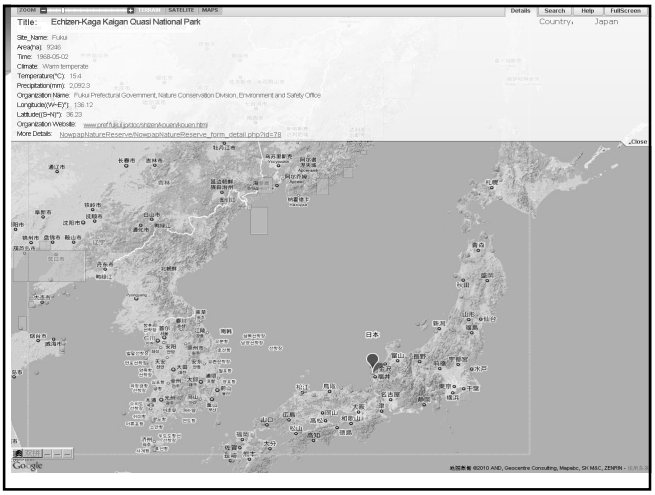
2 Regular update of marine litter data provided by CEARAC



3 Future Cooperation Areas

Database and Information on the following Issues

- Marine Environment Assessment Methods (Biodiversity)
- Marine Environmental Monitoring Methods/Marine Environmental Standards (Marine litter)
- State of Marine Environment (Eutrophication)
- Database of HAB
- Integration of RS Data into the database of concrete marine environmental issues.
- Add links to the Google Earth Visualization of Marine Litter Data (parallel work with the GIS visualization of other Marine environmental data)



NOWPAP MERRAC

Northwest Pacific Action Plan
Marine Environmental Emergency Preparedness and Response
Regional Activity Centre
Website - http://merrac.nowpap.org

UNEP IMO

MERRAC activities and potential co-operation with CEARAC

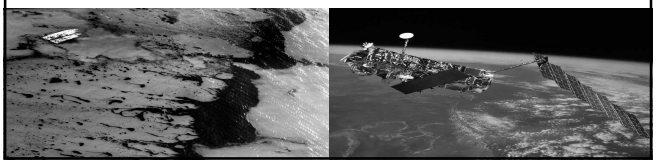
13 September 2010

MERRAC

Seong-Gil KANG, Jeong-Hwan OH
Hyon-Jeong NOH, Hye-Mi LEE

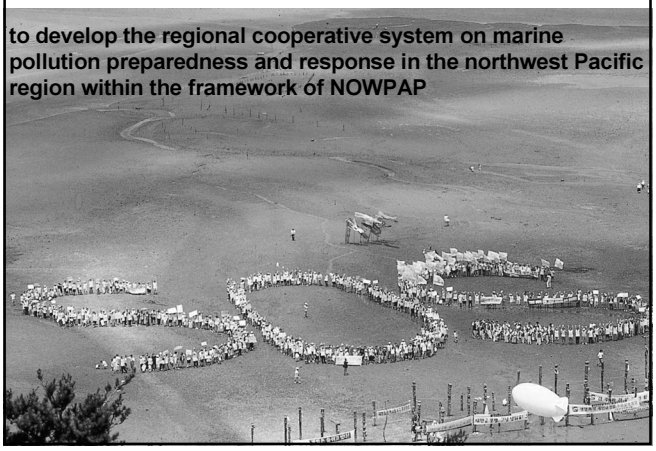
Overview

1. MERRAC's activities
2. Statistics on Oil and HNS spill accidents ('90-'09)
3. Monitoring for oil spill
4. Co-operation between CEARAC and MERRAC
5. Conclusion

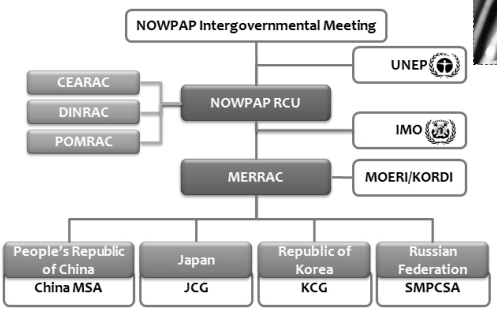


1. MERRAC's activities

to develop the regional cooperative system on marine pollution preparedness and response in the northwest Pacific region within the framework of NOWPAP



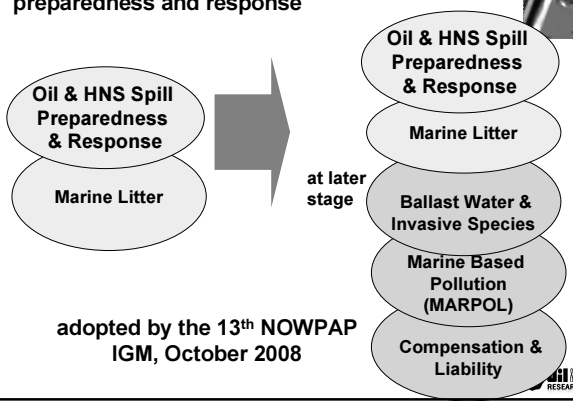
MERRAC's working system



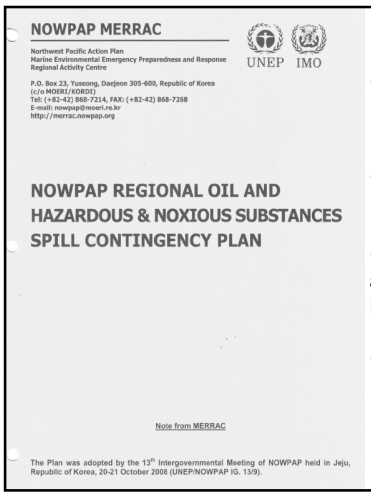
"MERRAC is operating the system of National Focal Point for MERRAC, who is nominated by each country and is responsible for the marine pollution preparedness and response in the respective NOWPAP Members"

Scope for MERRAC's activities

on regional cooperation in marine pollution preparedness and response



adopted by the 13th NOWPAP IGM, October 2008

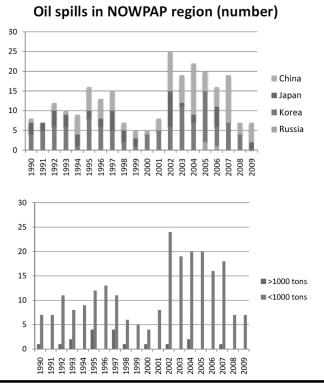


NOWPAP RCP

- **Adopted** originally in 2003 by China, Japan, Korea & Russia (only for oil spill)
- **HNS has been added to this existing oil RCP**
- **The revised RCP has adopted at the 13th NOWPAP IGM**
- **Came into effect of the NOWPAP Regional Oil and HNS Spill Contingency Plan**

2. Statistics on Oil Spill Accidents ('90-'09)

<Number of oil spill>

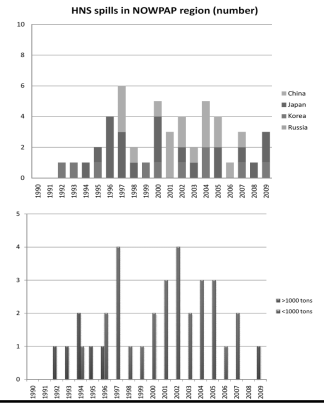


- The oil accident over 10 tons occurred in NOWPAP Members during 2009 year are as follows:

1) China - Oil: 5 cases
2) Japan - Oil: 2 cases
3) Korea - Oil: 0 case
4) Russia - Oil: 0 case,

Statistics on HNS Spill Accidents ('90-'09)

<Number of HNS spill>



- The HNS accident over 10 tons occurred in NOWPAP Members during 2009 year are as follows:

1) China - HNS: 0 case
2) Japan - HNS: 2 cases
3) Korea - HNS: 1 case
4) Russia - HNS: 0 case,

Activation of the Plan against Hebei Spirit oil spill incident

- **As the request of the Korean Government, NOWPAP members provided the sorbents**
  - China: About 56 tons of the sorbents were shipped
    - New Golden Bridge 5: Incheon port from Qingdao port (12. 15)
    - Haibaio 24: Daesan port from Shanghai port (12. 16)
  - Japan: 10 tons of sorbents provided free of charge via air and dispatched the 7 experts for technical advice

3. Monitoring for oil spill

- Importance of monitoring for oil spill

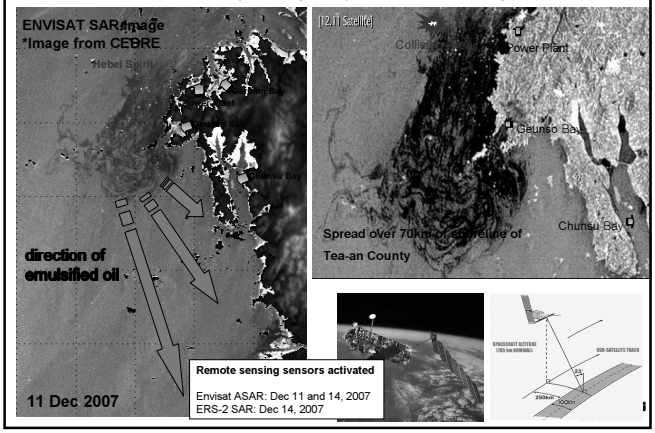
- Regular surveillance against illicit discharge
- For prompt and efficient response by identifying behavior, size and thickness of spilled oil
- To minimize damage to the local ecosystem by responding before oil reaches the coastal and sensitive areas
- Necessity of continued monitoring for rapid recovery of local ecosystem and community damaged by spill incident

Monitoring methods for oil spill

- Aerial Surveillance (by helicopters or fixed wing aircraft)
- Most convenient means for assessing oil pollution
- Possibility of unreliable and inaccurate report, as done by person not specifically trained
- *Satellite monitoring* (by remote sensing)
- Detection can be carried out regardless of distance, weather and light condition
- Slick can be accurately recorded on charts/maps
- Early detection of oil spill, estimate of size and volumes, prediction movement of the slick, and damage assessment and identification of the polluters

Case study utilizing *Satellite Monitoring*

Detection of spreading oil by *Satellite Monitoring*

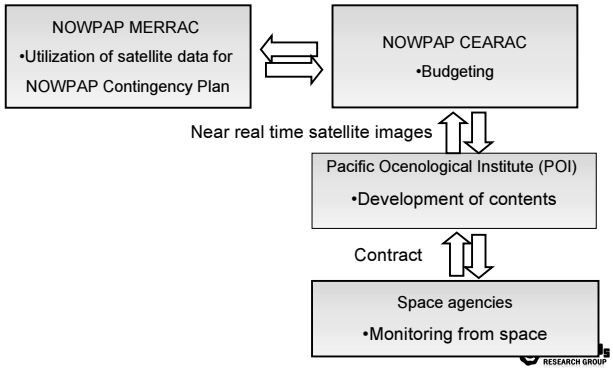


4. Co-operation between CEARAC and MERRAC

- Joint project between CEARAC & MERRAC

- Under discussion on project "*Satellite radar monitoring of oil spills in the Northwest Pacific*"
- Aiming for Joint online service of near real-time monitoring of oil spill in NOWPAP region through modification of NOWPAP CEARAC website "Oil spill monitoring by remote sensing"
- Expected to contribute to detection of oil spills, estimate of the polluted areas and oil volumes when oil spill occurred in NOWPAP region through joint project with MERRAC

Cooperative structure for implementation of *Satellite Monitoring*



5. Conclusion

- MERRAC has successfully implemented the designated activities regarding oil and HNS spill and sea-based marine litter with special support by NOWPAP member states, IMO, UNEP and NOWPAP RCU
- CEARAC has carried out project on oil spill monitoring by remote sensing, and near real-time monitoring data will be very beneficial for oil spill response occurred in NOWPAP region
- MERRAC will continuously co-operate with CEARAC not only for right and timely response but also for sharing information with member states on spreading oil and damage utilizing satellite monitoring in case of major oil spill


Save Our Sea
against marine pollution
- Thank you -
Hebei Spirit incident
Dalian Port incident

NOWPAP POMRAC
Northwest Pacific Action Plan UNEP
Pollution Monitoring Regional Activity Centre
Website – http://pomrac.dvo.ru
http://pomrac.nowpap.org

Proposal of POMRAC for cooperation with CEARAC (2010-2011)

Kachur Anatoly
Director NOWPAP POMRAC

Pollution Monitoring Regional Activity Center (POMRAC) of UNEP Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP) was established according to the decision of the NOWPAP Fourth Intergovernmental Meeting (Beijing, China, April 6-7 1999) on the basis of the Pacific Geographical Institute of the Far Eastern Branch of Russian Academy of Sciences (Vladivostok, Russia).

From 2000 POMRAC was responsible for two working groups: WG 1 - Atmospheric Deposition of contaminants into the marine and coastal environment; and WG 2 – River and Direct Inputs of contaminants into the marine and coastal environment.

In accordance with decisions of the 10th NOWPAP IGM, POMRAC should focus on activities related to Integrated Coastal Area and River Basin Management which include land-based sources of pollution.

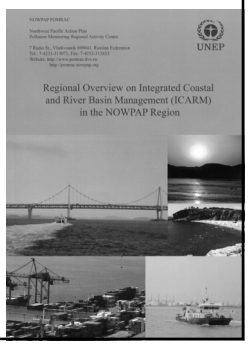
All activities related to Integrated Coastal Area and River Basin Management should be implemented in close collaboration with other NOWPAP RACs.

During 2008-2009 was developed Regional Overview on ICARM (RO ICARM)

In this document was collected and compiled existing ICARM methodologies being used by NOWPAP member states.

In the National reports and Regional Overview, existing ICARM issues were identified and systematically analyzed. Opportunities or positive conditions for development were likewise diagnosed.

Although ICARM has significantly improved both the human and natural dimensions in the NOWPAP region, much still needs to be done. Hence, recommendations have been forwarded to address better national priorities, as well as international (transboundary) issues.



According to the Action Plan adopted in 1994 and the decisions of recent Intergovernmental Meetings, NOWPAP member states agreed to apply the principles of integrated coastal and river basin management (ICARM) to many of priority environmental issues, including climate change adaptation and biodiversity conservation.

Therefore, the following thematic elements are suggested for NOWPAP medium-term strategy :

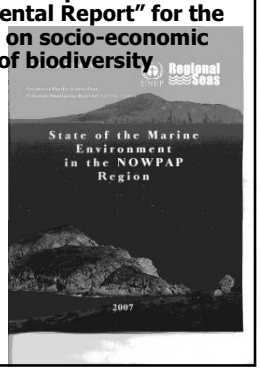
- Integrated coastal and river basin management;
- Regular assessments of the state of the marine environment;
- Pollution prevention and reduction;
- Harmful substances and hazardous waste;
- Biodiversity conservation (including alien invasive species);
- Climate change.

Table 1. Suggested thematic elements of NOWPAP medium-term strategy 2011-2015

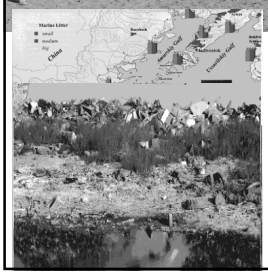
Thematic elements	Possible activities	Implementing agents
1. Integrated coastal and river basin management, ICARM ***(Objectives III and IV of the Action Plan)***	**Analysis of the best ICARM practices in member states (it is very complexes work and we couldn't made it in RO ICARM)** **Projects related to: ecosystem valuation; marine spatial planning; ecosystem-based management; marine protected areas** **Recommendations on applying ICARM principles to biodiversity conservation and climate change adaptation**	**POMRAC** **DINRAC** **CEARAC** **MERRAC** **Experts from member states**

- Preparation of National reports for regional overview on applications of ecosystem valuation, marine spatial planning and ecosystem-based management in the NOWPAP member states.
- Main part of RO must be analysis of situation in NOWPAP countries (mostly on the territory related to NOWPAP region), identification of existing ICARM issues. Examples of existing schemes of land-use management (or functional zoning) in coastal areas and river basins on examples of case study areas and singling out international (transboundary) issues, priorities and alternatives of problem solving.

The second activity will be prepare and publish the Second "State of Marine Environmental Report" for the NOWPAP Region (with more focus on socio-economic issues, climate change and issues of biodiversity conservation)

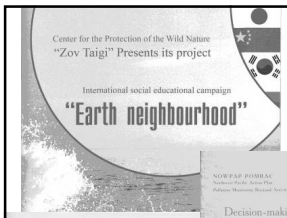


F. POMRAC activities related to Implementation of NOWPAP Regional Action Plan on Marine Litter

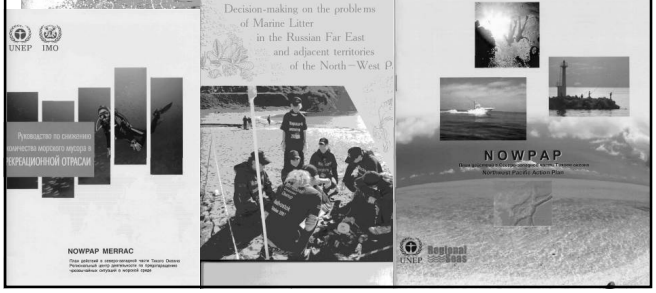


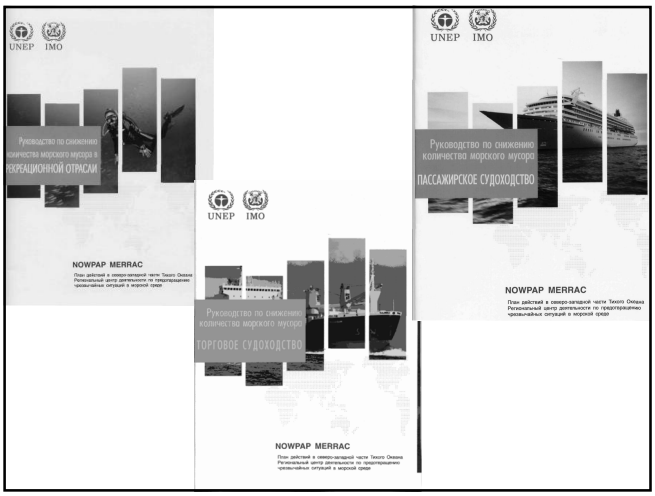
Activities of RAP MaLi: Increase public awareness about marine litter problem by developing and distributing promotional materials	POMRAC in cooperation with RACs, RCU

Budget: US$ 8,000 ,



During 2008-2009 translated developed in MERRAC and CEARAC brochures, prepared and published other articles, brochure and booklets on Russian and English





NEAR-GOOS

Report on NEAR-GOOS Regional Real Time Data Base(RRTDB)

http://goos.kishou.go.jp/

Japan Meteorological Agency

8th NOWPAP CEARAC Focal Points Meeting and the Expert Meeting on assessment of eutrophication and marine biodiversity (13-15 September 2010, Toyama, Japan)

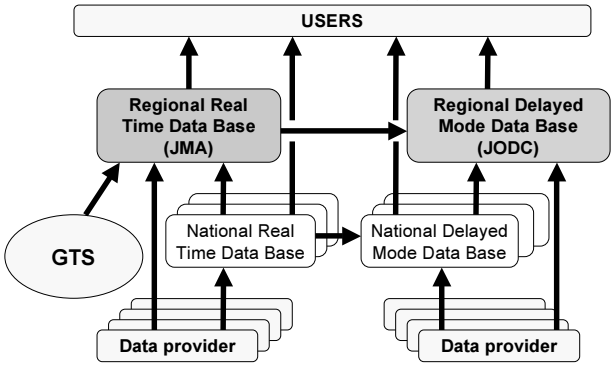
NEAR-GOOS

Outline

- About NEAR-GOOS data system
- Reform of RRTDB Web Page
  - Improved accessibility
  - Improved picture contents
- Contents of RRTDB

NEAR-GOOS

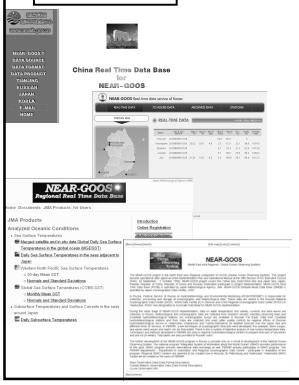
NEAR-GOOS data system



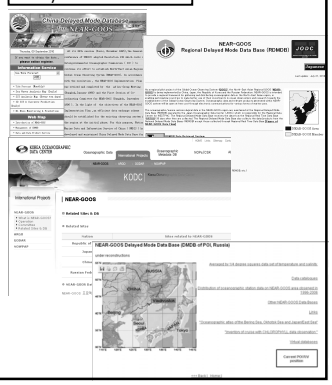
NEAR-GOOS

Data bases of each country

Real time database



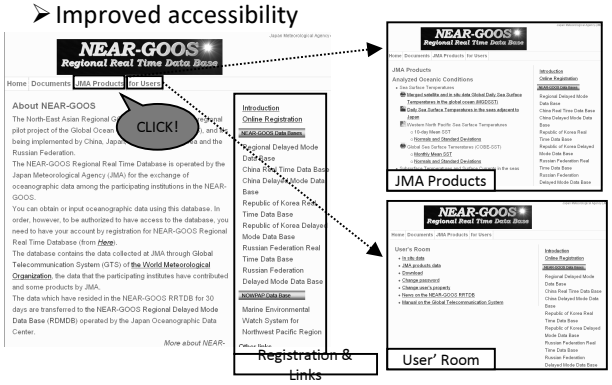
Delayed mode database



NEAR-GOOS

Reform of RRTDB Web Page

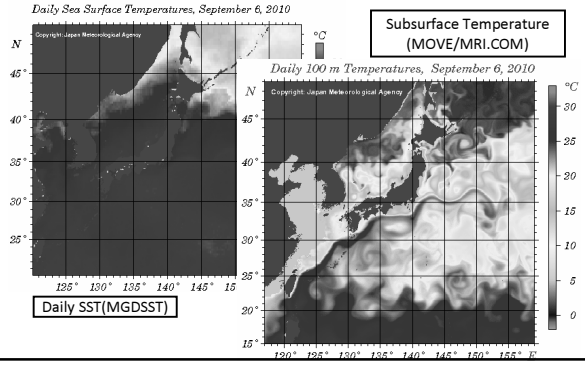
- Improved accessibility



NEAR-GOOS

Reform of RRTDB Web Page

- Improved picture contents



NEAR-GOOS

Contents of RRTDB

Description of data Source Type	Source	Data Type
1) GTS Reports (FM13 SHIP, FM18 BUOY, FM62 TRACKOB, FM63 BATHY, FM64 TESAC)	GTS	in situ data
2) Data provided by users (Sea Water Temperature observations)	JAFIC	in situ data
3) Decoded Data (Temperatures and Winds, of upper 1, 2)	GTS/ JAFIC	in situ data
4) GTSPP (quality controlled Temperatures and Salinities)	GTSPP	in situ data
5) JMA Products		
Daily Sea Surface Temperatures (MGDSST: Global, Regional)		
10 day mean SST (MGDSST and others: Northwestern Pacific)		
Monthly Mean SST (COBESST: Global)		
Daily and Monthly Subsurface Temperatures and Surface Currents (Assimilation Model-MOVE/MRI.COM: Regional)	JMA	Analyzed GPVs and charts
Monthly Mean Pacific Subsurface Temperatures (OI)		
5 Day mean Sea Surface Heights (Jason; Pacific) temporally non-active, since Feb 2009		
Sea Ice concentrations (north-east Asian marginal seas)		
6) Observations by JMA Research Vessels	JMA	Charts

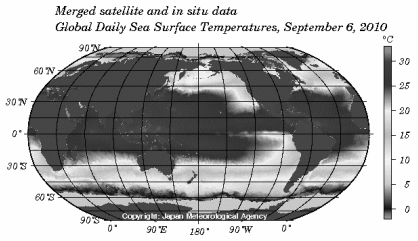
NEAR-GOOS

Thank you for your attention

NEAR-GOOS

JMA products of RRTDB

- MGDSST

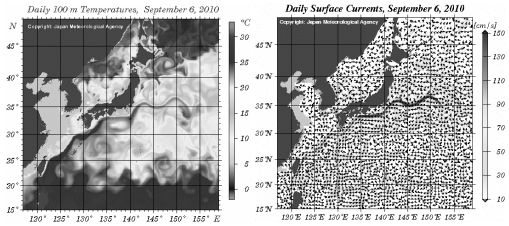


Global SST with 1/4 degree grid
Daily & monthly data is available

NEAR-GOOS

JMA products of RRTDB

- MOVE/MRI.COM

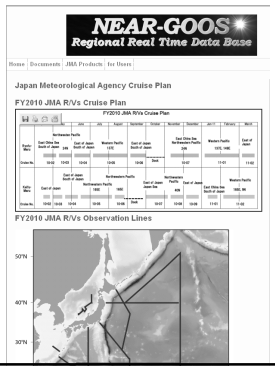


Subsurface Temperature & sea surface current with 1/10 degree grid
(Subs. T at the depths of 50m, 100 m, 200 m and 400 m)
Daily & monthly(Subs. T only) data is available
Only around Japan(from 117E to 159E between 15N and 49N)

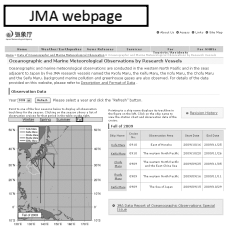
NEAR-GOOS

JMA products of RRTDB

- JMA R/V observations



JMA webpage



Temperature
Salinity
Dissolved Oxygen
Nutrient
Subsurface Current
Greenhouse gas

Etc …

Assessment of eutrophication status by the NOWPAP member states

NOWPAP CEARAC

14 September, 2010
The expert meeting on assessment of eutrophication status and marine biodiversity

Schedule for assessment of eutrophication status by the NOWPAP member states

- March 2011
  - Completion of eutrophication assessment in each selected area
- March to July 2011
  - Preparation of Integrated Report
- August to October 2011
  - Review and revision of Integrated report by experts and CEARAC FPs
- Q4 2011
  - Publication and distribution of Integrated Report

Points of discussion for preliminary eutrophication assessment by remote sensing

- How do we reflect the result of preliminary eutrophication assessment to the Integrated Report?
- Is the preliminary assessment in each selected areas necessary?
- Who will conduct validation of satellite Chl-a data in each selected areas?

Points of discussion for eutrophication assessment in each selected area

- Why will the algorithm difference result in different result? (Dr. Matsuda)
  - In turbid water, estimation of Chl-a is overestimated. There is no much available light for photosynthesis in turbid water such as Yantze River mouth. Another criteria other than Chl-a is needed? (Dr. Ishizaka)
  - Chl-a is higher in offshore than nearshore in Yangtze River discharge (Dr. Chai)
  - MERIS on ENVISAT better estimates Chl-a in near shore and worth comparison (Dr. Mitnik)

Points of discussion for eutrophication assessment in each selected area

- How do set reference condition for each parameter and scientific reason behind?
- How do we share in situ data for comparison of assessment results in each selected area?
- How do we validate the result of preliminary eutrophication assessment by remote sensing in each selected areas?
- How do we link the obtained assessment results to management actions?

Preliminary assessment of eutrophication status by remote sensing in the Northwest Pacific region

Genki Terauchi[*1], Ryo Tsujimoto[*1] and Joji Ishizaka[*2]
1.Northwest Pacific Environmental Cooperation Center
2.Hydrospheric Atmospheric Research Center, Nagoya University

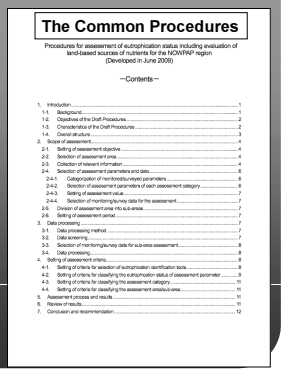
CEARAC Expert Meeting Sep 14, 2010 Toyama, Japan

Outline

- 1. Background
  - Procedures for assessment of eutrophication status including evaluation of land-based sources for nutrients for the NOWPAP region (June, 2009)
- 2. Ideas behind the preliminary eutrophication assessment by remote sensing
- 3. Data and method
- 4. Result of preliminary assessment in Toyama Bay
- 5. Application of the preliminary assessment approach in other part of Northwest Pacific region
- 6. Conclusion

1. Background

- Procedures for assessment of eutrophication status including evaluation of land-based sources for nutrients for the NOWPAP region (June, 2009)
- Developed with experts of HAB and Ocean Remote sensing, referring to experiences in European countries such as HELCOM and OSPAR
- Available on CEARAC Website at http://cearac.nowpap.org/


The Common Procedures

Procedures for assessment of eutrophication status including evaluation of land-based sources of nutrients for the NOWPAP region (Developed in June 2009)

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2. Ideas behind - Strength and weakness in satellite and in situ based monitoring

Means of observation	Strength	Weaknesses
Satellite Remote Sensing **Preliminary Assessment for screening**	•Wider area and higher temporal coverage •Free data access over the Internet •Objectively detect relative change	•Low accuracy in estimation of Chl-a in coastal area •No data obtained under cloud •Data is available only at sea surface
Ship board measurement **Holistic Assessment**	•Obtain data under sea surface •Can obtain actual measured value	•Data represent only point of information •Analysis of Chl-a need expertise •Costly

2. Ideas behind Concept of methodology

- Objective
  - To detect potential eutrophic area only with satellite derived Chlorophyll-a concentration (satellite Chl-a)

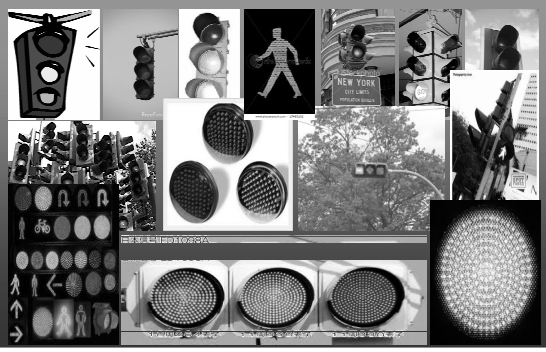
Preliminary Assessment

Detection of potential eutrophic areas by satellite Chl-a

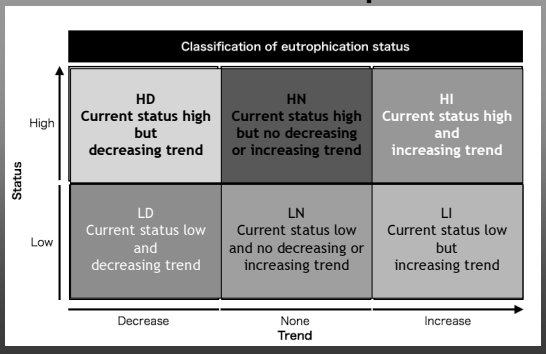
Holistic Assessment

Detailed assessment in the detected potential eutrophic areas with the Common Procedures

2. Ideas behind Simplifying environmental signals



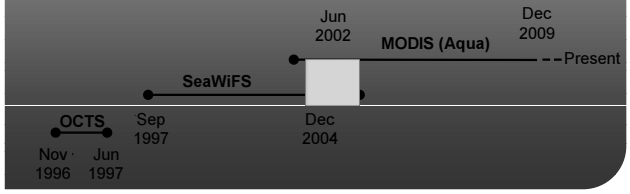
2. Ideas-behind Classification of Eutrophication



Classification base on the Common Procedures (NOWPAP CEARAC, 2009)

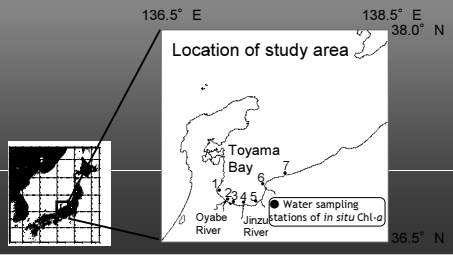
3. Data used : satellite data

Sensor	NASDA (JAXA) OCTS on ADEOS NASA SeaWiFS on Orbview 2 NASA MODIS on Aqua
Algorithm	R2009 NASA standard datasets
Duration	13 Years from Jan 1997 to Dec 2009
Data	Monthly composite
Area	Toyama Bay (36.5 to 38ºN, 136.5 to 138.5ºE)

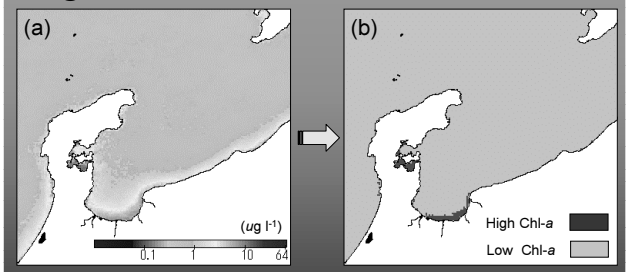


3. Data used : *in situ* data

River discharge	Daily river discharge in the Oyabe and Jinzu Rivers
Total Nitrogen and Phosphate	TN and TP in the Oyabe and Jinzu Rivers (monthly observed from 1986 to 2005 and quarterly from 2006 to 2008)
In situ Chl-a	Ship observed data at 2km offshore from April1997 to Dec 2009

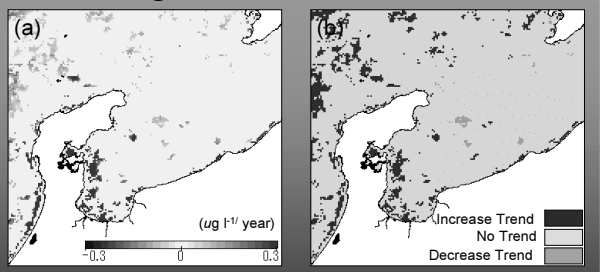


3. Methods - High and Low Chl-*a* area



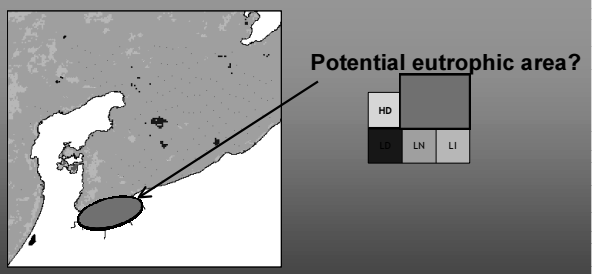
Detection of High and Low Chl-*a* area in Toyama Bay. (a)13-years overall mean of satellite Chl-*a*. (b) High and Low Chl-*a* area determined by the Chl-*a* level more than 5 *ug* l^{-1} referring to the Medium Chl-*a* condition (>5, <20 *ug* l^{-1}) of Bricker *et al.* (2003).

3. Methods Detecting interannual Chl-*a* trend

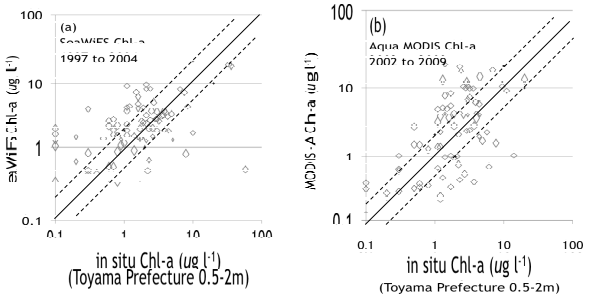


13-years of satellite Chl-*a* trend.
(a) The trend of annual Chl-*a* max in monthly mean Chl-*a* and its

4. Results- Preliminary assessment of eutrophication in Toyama Bay

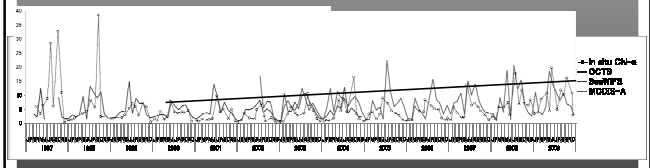


4. Results -Validation of satellite Chl-*a* with in situ Chl-*a*



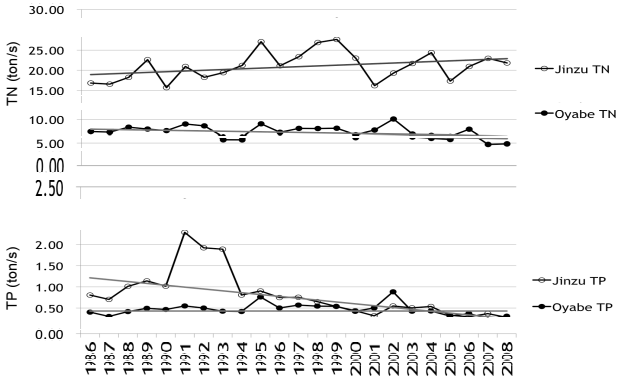
Comparison of satellite and *in situ* Chl-*a* during the studied period.
(a) SeaWiFS Chl-a from 1997 to 2004 and (b) MODIS-A Chl-a from 2002 to 2009 were compared with *in situ* Chl-*a* obtained at 7 water sampling stations located 2km offshore.

4. Results – Interannual change of satellite and in situ Chl-*a* in the detected potential eutrophic area

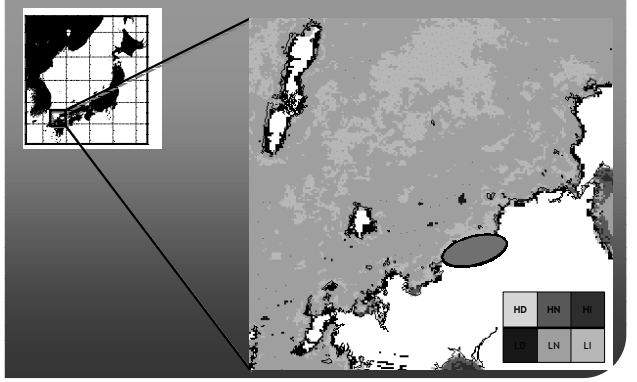


Inter annual change of satellite and in situ Chl-a in the detected potential eutrophic area

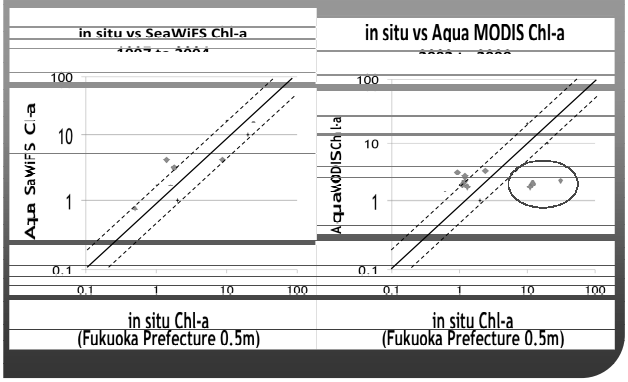
4. Results – Interannual change of annual riverine input of TN and TP



5. Application of the preliminary - assessment in Northwest Kyushu sea area



5. Application of the preliminary assessment in Northwest Sea area



5. Application of the preliminary assessment in Northwest Pacific region

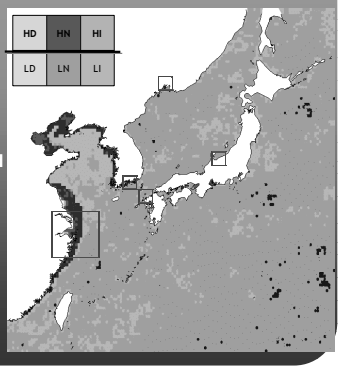
Tunings required

#1. Reference condition to determine High and Low Chl-a

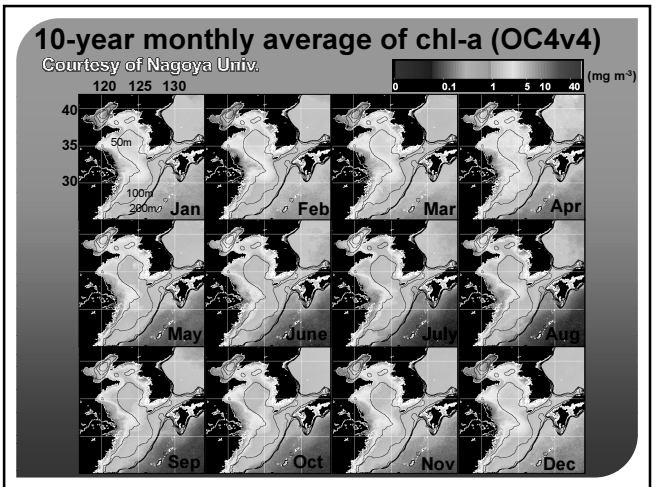
What is appropriate Chl-a amount to maintain balance food web?

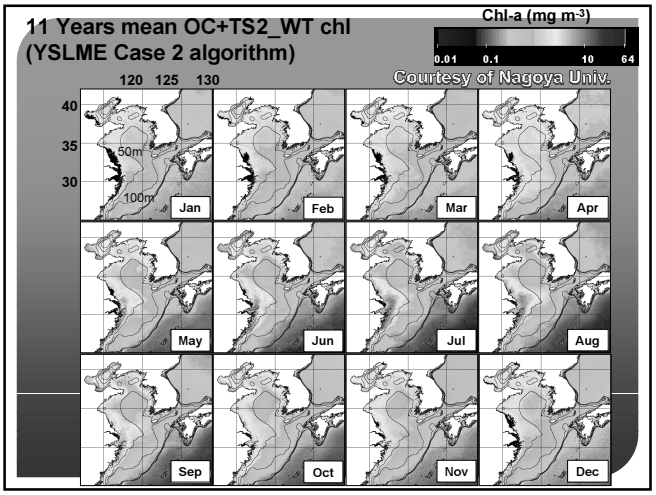
#2. Reliability of satellite Chl-a

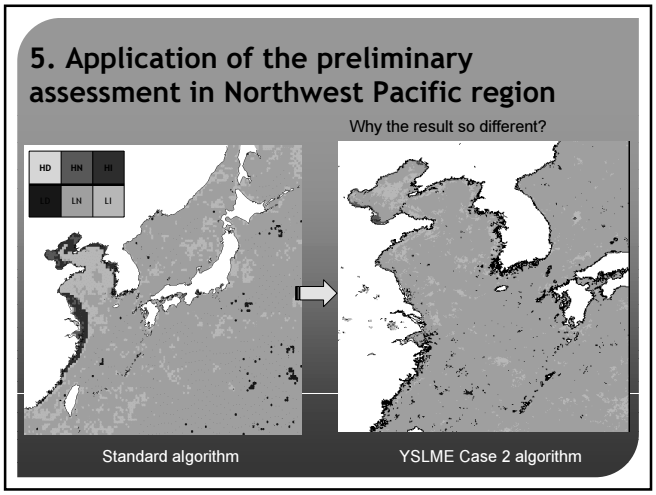
Is the standard satellite data accurate enough?



10-year monthly average of chl-a (OC4v4)







6. Conclusion

- Preliminary assessment of eutrophication by satellite
  - Usefulness was validated in Toyama Bay
- Application to the suggested methodology to the other areas
  - Things to be tuned
    - Reference Chl-*a* condition
    - Algorithms for case II water
      - Collaboration with YSLME
    - Consistency between sensors

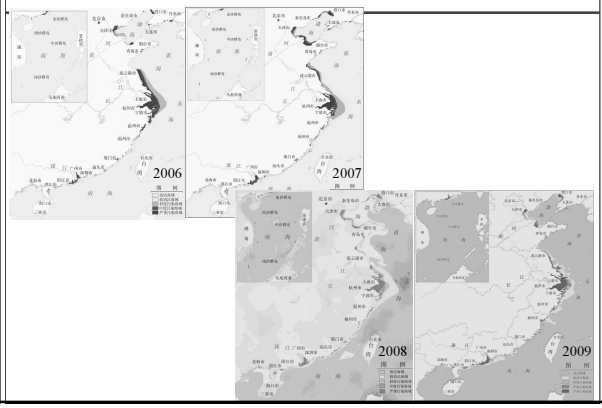
Progress report on a preliminary assessment of eutrophication status in Changjiang (Yangtze) River Estuary and adjacent area, China

Zhiming YU and Chao Chai
Institute of Oceanology, Chinese Academy of Sciences

CONTENT

- Scope of Assessment
- Data processing
- Setting of assessment criteria
- Assessment process and results
- Summary

1. Scope of Assessment



1. Scope of Assessment

1.1 Selection of assessment area

◆Pollution in the Changjiang River estuary is the most serious in coastal area of China .

◆ The main pollutants in this estuary are inorganic nitrogen, soluble reactive phosphorus and petroleum.

1. Scope of Assessment

1.1 Selection of assessment area

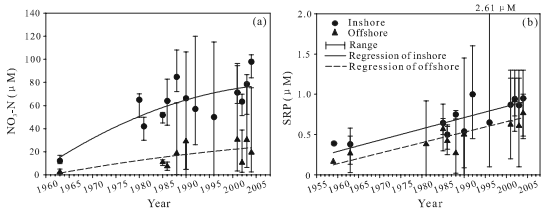
◆The Changjiang River Estuary is the largest estuary in China.

◆The Changjiang River's basin is characterized by many industrial and urban centers, especially along its lower reaches and the estuary.

1. Scope of Assessment

1.1 Selection of assessment area

Nitrogen and phosphorus increased both inshore and offshore from the 1960s to 2004.

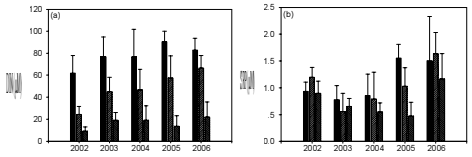


Mean concentrations and range of (a) nitrate, (b) SRP

1. Scope of Assessment

1.1 Selection of assessment area

The mean of DIN and SRP was 60~100 μM and 1~1.5 μM respectively in the upper estuary in November 2002~2006.

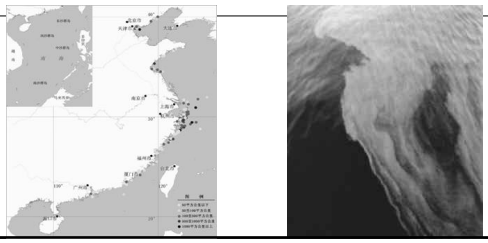


DIN and SRP in November 2002~2006

1. Scope of Assessment

1.1 Selection of assessment area

- **Noxious algal blooms have been of more frequent occurrence in the Changjiang River Estuary.**
- **The most algal blooms happened in this estuary.**

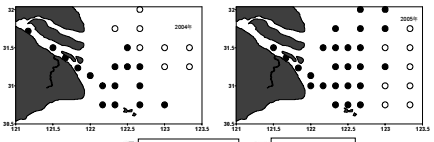


1. Scope of Assessment

1.1 Selection of assessment area

Eutrophication indices:

$$E = \frac{COD \times DIN \times DIP \times 10^6}{a}$$



○ oligotrophic ● eutrophic

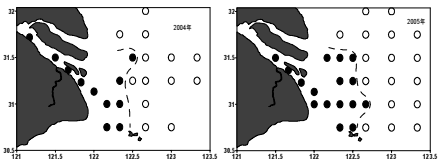
Results indicated that eutrophication grade decreased from coastal to offshore area in this estuary.

1. Scope of Assessment

1.1 Selection of assessment area

Trophic quality indices:

$$NQI = \frac{COD}{COD_0} + \frac{DIN}{DIN_0} + \frac{DIP}{DIP_0} + \frac{Chla}{Chla_0}$$



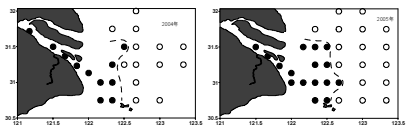
○ oligotrophic ◑ mesotrophic ● eutrophic

1. Scope of Assessment

1.1 Selection of assessment area

Fuzzy synthesis evaluation and artificial neural network evaluation:

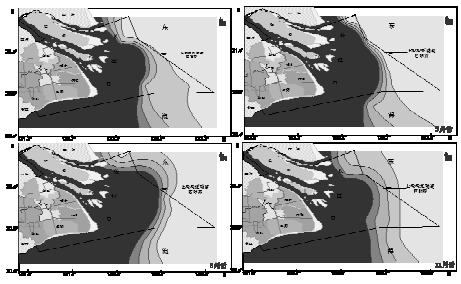
Parametes	COD (mg/L)	DIN (mg/L)	PO_4-P (mg/L)	Chla (μg/L)	DO (mg/L)
oligotrophic	2	0.20	0.015	1	6
mesotrophic	3	0.30	0.030	3	5
eutrophic	4	0.40	0.045	5	4



○ oligotrophic ◑ mesotrophic ● eutrophic

1. Scope of Assessment

1.1 Selection of assessment area



■Appropriate assessment method is very important

1. Scope of Assessment

1.2 Collection of relevant information

1.2.1 Information on the assessment area that is necessary and relevant to eutrophication assessment

- **Bulletin of Marine Environmental Quality of Shanghai**
- **Bulletin of Marine Environmental Quality of China**
- **Bulletin of Marine disaster of China**
- **Report on the state of the fishery eco-environmental in China**
- **Report on water resource of Changjiang River basin**
- **Changjiang sediment bulletin**
- **Published references and data**
- **Results from related research projects**

1. Scope of Assessment

1.2 Collection of relevant information

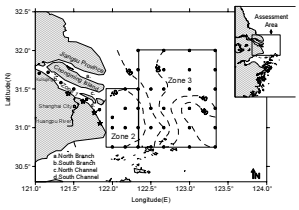
1.2.2 Eutrophication related information/data from organizations

Survey area	Governing organization	Aim	Survey period	Survey frequency
China coastal water	State Oceanic Administration	Survey and assessment of marine environmental quality	1990~2009	Annually
China coastal water	State Oceanic Administration	Survey and assessment of marine disaster	1990~2009	Annuall
Changjiang River Estuary	Shanghai Oceanic Administration	Survey and assessment of marine environmental quality	2001~2006	Annually
Marine fishery waters and key inland fishery waters in China	Ministry of Agriculture, Ministry of Environmental Protection	Survey and assessment of Marine fishery waters and key inland fishery waters	1900~2007	Annually
Changjiang basin	Ministry of Water Resources	Survey of water resource	1999~2006	Annually
Changjiang River	Ministry of Water Resources	Survey of water and sediment discharges	2000~2007	Annually
Changjiang River Estuary	Chinese Academy of Sciences	Survey and assessment of eutrophication	2003~	Quarterly

1. Scope of Assessment

1.3 Division of assessment area into sub-areas

- **Zone 1 is the turbid zone with salinity < 3 psu;**
- **Zone 2 is characterized by turbidity maximum and intermediate salinity (< 25 psu);**
- **Zone 3 has low turbidity with suspended particulate matter < 10 mg l-1**



1. Scope of Assessment

1.4 Selection of assessment parameters

1.4.1 Categorization of monitored parameters

- **Category I: Parameters that indicate status of water quality**
- **Category II: Parameters that indicate direct effects of eutrophication**
- **Category III: Parameters that indicate indirect effects of eutrophication**

1. Scope of Assessment

1.4 Selection of assessment parameters

1.4.2 Selection of assessment parameters of each assessment category

Category	Assessment parameter
Status of water quality	DIN
	SRP
	COD
Direct effects of eutrophication	Chlorophyll a concentration
	Percentage of dinoflagellate cell density
	Macroalgae
Indirect effects of eutrophication	Nuisance and toxic blooms
	DO in bottom water

1. Scope of Assessment

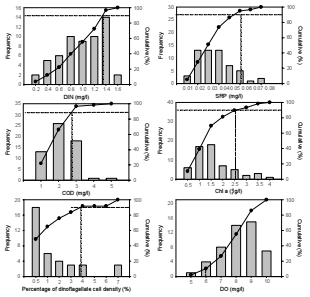
1.4 Selection of assessment parameters

1.4.3 Setting the assessment values

- **The evaluation concentrations used have been the annual or quarterly percentile 90 values for DIN, SRP, COD, Chla, percentage of dinoflagellate cell density and annual or quarterly percentile 10 values for DO.**
- **Macroalgae and nuisance and toxic blooms were identified by occurrence or non-occurrence annually.**

2. Data processing

2.1 Organization of collected data



The percentile values for parameters in a sub-area of Changjiang River estuary

2. Data processing

2.2 Preparation of data sets for assessment

✓The concentration, spatial coverage, and occurrence frequency of parameters were prepared beforehand.

✓Spatial coverage was determined by calculating the ratio of area where the evaluation concentration was higher than thresholds to the whole estuary area.

✓Frequency of occurrence included episodic (conditions occur randomly), periodic (conditions occur annually or predictably) and persistent (conditions occur continually throughout the year). Therefore,

3. Setting of assessment criteria

3.1 Setting of identification criteria of the assessment data

Category	Assessment parameter	Assessment value	Identification tools		
			Comparison	Occurrence	Trend
I	DIN	Annual percentile 90 values	√		√
	SRP	Annual percentile 90 values	√		√
	COD	Annual percentile 90 values	√		√
II	Chlorophyll a	Annual percentile 90 values	√		√
	Percentage of dinoflagellate cell density	Annual percentile 90 values	√		√
	Macroalgae	Annual occurrences		√	√
III	Nuisance and toxic blooms	Annual occurrences		√	√
	DO in bottom water	Annual percentile 10 values	√		√

3. Setting of assessment criteria

3.2 Setting of classification criteria of the assessment parameters

Thresholds and ranges of assessment parameters

Parameters		**Class**				
		Good	**Fair**	**Poor**	**Bad**	**Very bad**
Water quality	**DIN(mg l^{-1})**	**≤0.2**	**>0.2, ≤0.3**	**>0.3, ≤0.4**	**>0.4, ≤0.5**	**>0.5**
	SRP(mg l^{-1})	**≤0.015**	**>0.015, ≤0.03**	**>0.03, ≤0.045**	**>0.045**	
	COD(mg l^{-1})	**≤2**	**>2, ≤3**	**>3, ≤4**	**>4, ≤5**	**>5**
Ecological response	**Chl *a*(μ g l^{-1})**	**≤1**	**>1, ≤3**	**>3, ≤5**	**>5**	
	Percentage of dinoflagellate cell density (%)	**≤1**	**>1, ≤10**	**>10, ≤20**	**>20**	
	DO(mg l^{-1})	**>5**	**>2, ≤5**	**>0, ≤2**	**0**	

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

3.3.1 Assessment of water quality state

Water quality parameters	Concentration	Spatial coverage(%)	Frequency	Value
DIN	>0.5 mg l-1	50–100	Persistent, periodic, episodic	1
		25–50	Persistent, periodic	1
		25–50	Episodic	0.75
		10–25, 0–10	Persistent, periodic	0.75
		10–25, 0–10	Episodic	0.5
		Unknown	Any frequency	0.75
	>0.4, ≤0.5	50–100	Persistent, periodic, episodic	0.75
	mg l-1	25–50	Persistent, periodic	0.75
		25–50	Episodic	0.5
		10–25, 0–10	Persistent, periodic	0.5
		10–25, 0–10	Episodic	0.25
		Unknown	Any frequency	0.5
	>0.3, ≤0.4	50–100	Persistent, periodic, episodic	0.5
	mg l-1	25–50	Persistent, periodic	0.5
		25–50	Episodic	0.25
		10–25, 0–10	Persistent, periodic	0.25
		10–25, 0–10	Episodic	0
		Unknown	Any frequency	0.25
	>0.2, ≤0.3	50–100	Persistent, periodic, episodic	0.25
	mg l-1	25–50	Persistent, periodic	0.25
		10–25, 0–10	Persistent, periodic	0
		25–50, 10–25, 0–10	Episodic	0
		Unknown	Any frequency	0
	≤0.2 mg l-1	Any spatial coverage	Any frequency	0
	Unknown	Unknown	Unknown	Not included in calculation

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

The level of the water quality state for the whole estuary (L) was determined by calculating the area average-weighted value of the three parameters.

$$L = \frac{1}{p}\sum_{1}^{p}[\sum_{1}^{n}(\frac{A_z}{A_E}V)]$$

A_Z is the surface area of each zone;
A_E is the total estuarine surface area;
V is the value at each zone;
n is the number of estuarine zones;
p is number of parameters.

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

3.3.1 Assessment of water quality state

Categories used to classify water quality state

Level of water quality state	Class
≤0.2	1
>0.2, ≤0.4	2
>0.4, ≤0.6	3
>0.6, ≤0.8	4
>0.8, ≤1	5

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

3.3.2 Assessment of direct and indirect response

Indirect response parameters	Thresholds and ranges	Spatial coverage (%)	Frequency	Value
DO	0 mg l^{-1}	50–100	Persistent, periodic, episodic	1
		25–50	Persistent, periodic	1
		25–50	Episodic	0.75
		10–25,0–10	Persistent, periodic	0.75
		10–25,0–10	Episodic	0.5
		Unknown	Any frequency	0.75
	>0, ≤2 mg l^{-1}	50–100	Persistent, periodic, episodic	0.75
		25–50	Persistent, periodic	0.75
		25–50	Episodic	0.5
		10–25,0–10	Persistent, periodic	0.5
		10–25,0–10	Episodic	0.25
		Unknown	Any frequency	0.5
	>2, ≤5 mg l^{-1}	50–100	Persistent, periodic, episodic	0.5
		25–50	Persistent, periodic	0.5
		25–50	Episodic	0.25
		10–25,0–10	Persistent, periodic	0.25
		10–25,0–10	Episodic	0
		Unknown	Any frequency	0.25
	>5 mg l^{-1}	Any spatial coverage	Any frequency	0
	Unknown	Unknown	Unknown	Not included in calculation

Indirect response parameters	Problems	Duration time	Frequency	Value
Nuisance and toxic blooms	Observed	Weeks to month	Persistent, periodic	1
		Weeks to month	Episodic	0.75
		Several days to one week	Persistent, periodic	0.75
		Several days to one week	Episodic	0.5
		One day	Persistent, periodic	0.5
		One day	Episodic	0.25
		Unknown	Any frequency	0.75
	Unobserved			0
	Unknown	Unknown	Unknown	Not included in calculation

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

3.3.2 Assessment of direct and indirect response

◆Level of direct response: by calculating the average values of the three parameters and level for the whole estuary was determined by calculating the area average-weighted value of the two parameters (Eq. (1)).
◆Level of indirect response: by choosing the higher value of the two parameters and .
◆Each zone or the whole estuary was then assigned a category for direct and indirect response according to their levels.

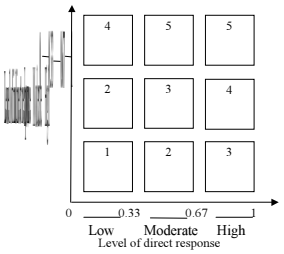
Categories used to classify direct and indirect response

Level of direct and indirect response	Class
<0.33	Low
≥0.33, <0.67	Moderate
≥0.67, ≤1	High

3. Setting of assessment criteria

3.3 Classification criteria of the assessment categories

3.3.2 Assessment of direct and indirect response



3.4 Classification criteria of the assessment area/sub-areas

Class of water quality state	Class of ecological response	Overall eutrophication grade
1	1	1
1	2	2
1	3	3
1	4	4
1	5	4
2	1	1
2	2	2
2	3	3
2	4	4
2	5	5
3	1	2
3	2	2
3	3	3
3	4	4
3	5	5
4	1	3
4	2	3
4	3	4
4	4	4
4	5	5
5	1	3
5	2	3
5	3	4
5	4	5
5	5	5

4. Assessment process and results

4.1 Division of assessment areas and assessment categories

4.1.2 Assessment categories----- Assessment of water quality

Value of water quality parameters

Parameters	Zone 1 and 2				Zone 3			
	Evaluation concentration (mg l^{-1})	Spatial coverage (%)	Frequency	Value	Evaluation concentration (mg l^{-1})	Spatial coverage (%)	Frequency	Value
DIN	1.29	84	Persistent	1	0.44	6	Periodic	0.5
SRP	0.056	23	Periodic	0.75	0.038	21	Periodic	0.5
COD	2.7	22	Persistent	0	1.6	Any	Any	0

4. Assessment process and results

4.1 Division of assessment areas and assessment categories

4.1.2 Assessment categories----- Assessment of water quality

Level and class of water quality state in each zone and the whole estuary

Zone	Level of water quality	Rank of water quality
Zone 1 and 2	0.58	3
Zone 3	0.33	2
The whole estuary	0.42	3

4. Assessment process and results

4.1 Division of assessment areas and assessment categories

4.1.2 Assessment categories ---- Assessment of ecological response

Parameter values of Chl *a*, Percentage of dinoflagellate cell density and DO

Parameters	Zone 1 and 2				Zone 3			
	Evaluation concentration or value	Spatial coverage (%)	Frequency	Value	Evaluation concentration or value	Spatial coverage (%)	Frequency	Value
Chl *a* (μ g l^{-1})	2.5	61	Persistent	0.5	5.2	11	Periodic	0.75
Percentage of dinoflagellate cell density (%)	3.8	35	Persistent	0.5	45	24	Periodic	0.75
DO (mg l^{-1})	6	Any	Any	0	5.4	Any	Any	0

4. Assessment process and results

4.1 Division of assessment areas and assessment categories

4.1.2 Assessment categories ---- Assessment of ecological response

Parameter values of nuisance and toxic blooms

Zone 1 and 2				Zone 3			
Problems	Duration time	Frequency	Value	Problems	Duration time	Frequency	Value
Observed	One day	Episodic	0.25	Observed	Several days	Periodic	0.75

4. Assessment process and results

4.1 Division of assessment areas and assessment categories

4.1.2 Assessment categories ---- Assessment of ecological response

Level and class of ecological response in each zone and the whole estuary

Zone	Level of direct response	Level of indirect response	Rank of ecological response
Zone 1 and 2	0.5	0.25	2
Zone 3	0.75	0.75	5
The whole estuary	0.67	0.58	4

4. Assessment process and results

4.2 Assessment results in each sub-area

Overall eutrophication grade in the each zone and whole estuary

Zone	Rank of water quality	Rank of eological response	Grade of overall eutrophication
Zone 1 and 2	3	2	2
Zone 3	2	5	5
The whole estuary	3	4	4

Summary

- An integrated methodology for assessment of eutrophication in the Changjiang River estuary (Assessment of Changjiang River Estuary Trophic Status，ACRETS) based on multi-parameters of water quality and ecological response was described.
- Based on the historical, present data and National Sea Water Quality Standard of China, the thresholds of parameters were set.
- A logic stepwise decision method was used and the overall eutrophication grade was ranked 1 to 5 in the following order: very good, good, moderate, poor or bad.
- Eutrophication in the whole estuary was poor in 2006.

Assessment of Changjiang River Estuary Trophic Status，ACRETS

Report of interim result of eutrophication assessment from Japan : Case study in northwest Kyushu sea area

Ryo Tsujimoto[1], Genki Terauchi[1,2] and Joji Ishizaka[3]
[1] Northwest Pacific Region Environmental Cooperation Center
[2] NOWPAP CEARAC
[3] Hydrospheric Atmospheric Research Center, Nagoya University

Outline

I. Categorization of parameters
II. Selection of assessment parameters
III. Division of assessment area into sub-areas
IV. Setting of assessment criteria
V. Status analysis
VI. Trend analysis
VII. Results of assessment in Hakata Bay, Kyushu sea area and Toyama Bay

Objectives

I. The secondary (holistic) assessment using the *in situ* data sets based on the "Common Procedures".
II. Assessment of Hakata Bay in the northwest Kyushu sea area and Toyama Bay.

Categorization of parameters

Category I	Parameters that indicate degree of nutrient enrichment
Category II	Parameters that indicate direct effects of nutrient enrichment
Category III	Parameters that indicate indirect effects of nutrient enrichment
Category IV	Parameters that indicate other possible effects of nutrient enrichment

Category I parameters used in this case study

Assessment parameters	
Nutrient loads	Riverine input of TN
	Riverine input of TP
	Sewage plant input of TN
	Sewage plant input of TP
Nutrient concentrations	TN concentration
	TP concentration
Winter nutrient concentrations and ratio	Winter DIN concentration
	Winter DIP concentration
	Winter N/P ratio (DIN/DIP)

Category II parameters used in this case study

Assessment parameters	
Chlorophyll-a	Annual mean of chlorophyll-a
	Annual maximum of chlorophyll-a
Phytoplankton	Red tide events (diatom species)
	Red tide events (dinoflagellate species)

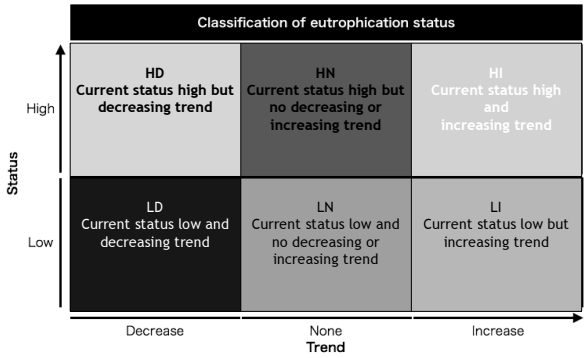
Category III parameters used in this case study

Assessment parameters	
Oxygen	Dissolved Oxygen (DO)
Organic carbon / organic matter	Chemical Oxygen Demand (COD)

Category IV parameters used in this case study

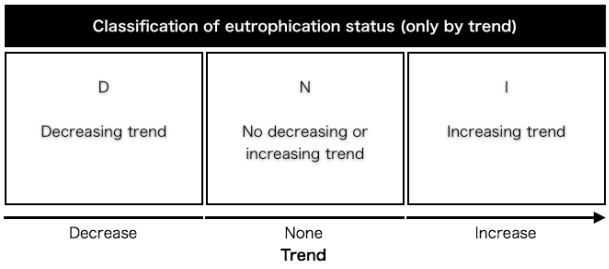
Assessment parameters	
Plankton	Red-tide events (*Noctiluca* sp.)
Algal toxins (Shellfish poisoning)	Food poisoning

Classification of eutrophication assessment



Classification base on the Common Procedures (NOWPAP CEARAC, 2009)

Classification of eutrophication status (only by trend)



Used only for the parameters that no status information can be obtained (e.g. riverine input of TN and TP.)

Seawater quality standards in Japan (Category I)

Assessment parameter	Environmental quality standards		Standards of fisheries water	
TN	0.2 mg/L 0.3 mg/L 0.6 mg/L 1.0 mg/L	Class I Class II Class III Class IV	0.3 mg/L 0.6 mg/L 1.0 mg/L	Class 1 Class 2 Class 3
TP	0.02 mg/L 0.03 mg/L 0.05 mg/L 0.09 mg/L	Class I Class II Class III Class IV	0.03 mg/L 0.05 mg/L 0.09 mg/L	Class 1 Class 2 Class 3

Seawater quality standards in Japan (Category I)

Assessment parameter	Environmental quality standards		Standards of fisheries water	
Winter DIN	None		0.07 - 0.1 mg/L	Minimum concentration for seaweed *Nori* culture
Winter DIP	None		0.007 - 0.014 mg/L	〃

Seawater quality standards in Japan (Category III)

Assessment parameter	Environmental quality standards		Standards of fisheries water	
DO	7.5 mg/L 5 mg/L 2 mg/L	Class A Class B Class C	6 mg/L	All area
COD	2 mg/L 3 mg/L 8 mg/L (based on COD_{Mn})	Class A Class B Class C	1 mg/L 2 mg/L (based on COD_{OH}*)	All area Applied in the seaweed *Nori* culture area and enclosed bay

* $COD_{OH} \fallingdotseq 0.6 \times COD_{Mn}$

Reference concentrations in the Category I used in this study

Assessment parameter	Identification criteria	Remarks
TN	0.3 mg/L	Environmental quality standard class II
TP	0.03 mg/L	Environmental quality standard class II

Reference concentration in the Category I used in this study

Environmental quality standards for DIN and DIP in the seawater are not set in Japan. Thus, reference concentration was calculated from the relationships TN and DIN, TP and DIP in winter, respectively.

Assessment parameter	Identification criteria	Remarks
Winter DIN	0.169 mg/L	Reference concentration was calculated from the relationship between TN and DIN in winter.
Winter DIP	0.010 mg/L	Reference concentration was calculated from the relationship between TP and DIP in winter.
DIN/DIP	16	Redfield ratio (C:N:P=106:16:1)

Reference concentration in the Category II used in this study

Assessment parameter	Identification criteria	Remarks
Annual maximum of chlorophyll-*a*	20 μg/L	Bricker *et al.* (2003)
Annual mean of chlorophyll-*a*	5 μg/L	Bricker *et al.* (2003)

Bricker, S. B., J. G. Ferreira and T. Simas (2003) An integrated methodology for assessment of estuarine trophic status. Ecological Modelling, 169, 39-60.

Classification of eutrophic condition by chlorophyll-*a* concentration level

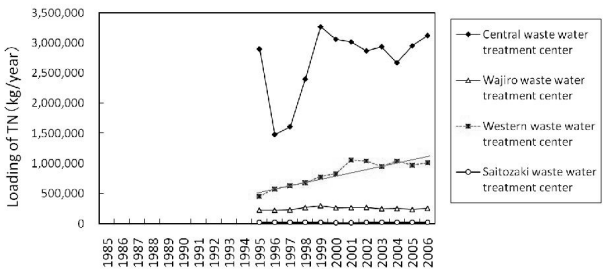
Hypereutrophic	>60 μg/L
High	>20, ≤60 μg/L
Medium	>5, ≤20 μg/L
Low	>0, ≤5 μg/L

Bricker, S. B., J. G. Ferreira and T. Simas (2003)
An integrated methodology for assessment of estuarine trophic status.
Ecological Modelling, 169, 39-60.

Reference concentration in the Category III used in this study

Assessment parameter	Identification criteria	Remarks
Dissolved oxygen	6.0 mg/L	Standard of fisheries water
Chemical oxygen demand	3.0 mg/L	Environmental quality standard class B

Detecting trend of annual values



- We recommend to use a non-parametric Mann-Kendall test for detecting trend in time series of annual data.
- The number of annual value is requested more than 10 years.
- Significance in trend is estimated under 5% probability.
- MAKESENS excel template is available for detecting trend.

MAKESENS

Salmi, T. A. Maatta, P. Anttila, T. Ruoho-Airota and T. Amnell (2002) Detecting trends of annual values of atmospheric pollutants by the Mann-Kendall test and Sen's slope estimate. Copyright Finnish meteorological Institute

Trend statistics can be calculated by annual data in MAKESENS. Copy and paste from Excel worksheet is also available.

ANNUAL DATA
Sewage plant inprt of TN
Hakata Bay, Northewest Kyusyu, Japan
CALCULATE TREND STATISTICS

Number of time series in the calculation:	4			
Number of annual values in the calculation:	13	13	13	13
Select the FIRST YEAR of the calculation:	1995	1995	1995	1995
Select the LAST YEAR of the calculation:	2007	2007	2007	2007

Year	Central waste water treatment center	Wajiro waste water treatment center	Western waste water treatment center	Saitozaki waste water treatment center
1985				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995	2900144	223440	458260	22713
1996	1482199	220835	577753	22431
1997	1611595	226113	632260	20371
1998	2402878	265169	684698	19977
1999	3269351	297911	777997	20391
2000	3061895	262916	829382	13086
2001	3018545	264301	1056598	14033
2002	2869988	269251	1042448	19579
2003	2938984	247237	955445	22263
2004	2671899	249857	1044740	22171
2005	2952056	234229	974124	21709
2006	3124422	253825	1015461	22856
2007	3153549	248494	1037348	23119

Trend analysis using MAKESENS

TREND STATISTICS
Sewage plant inprt of TN
Hakata Bay, Northewest Kyusyu, Japan

				Mann-Kendall trend		Sen's slope estimate	
Time series	First year	Last Year	n	Test Z	Signific.	Q	B
Central waste water treatment center	*1995*	*2007*	*13*	1.77	+	55176.725	1939661.05
Wajiro waste water treatment center	*1995*	*2007*	*13*	0.43		1207.700	226910.70
Western waste water treatment center	*1995*	*2007*	*13*	3.11	**	51019.818	21440.36
Saitozaki waste water treatment center	*1995*	*2007*	*13*	0.79		205.667	17903.00

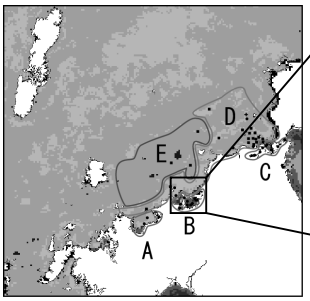
Equation of the lines:
f(year) = Q*(year-firstDataYear) + B
FirstDataYear= 1995

Q: trend
B: intercept
Test Z: A positive (negative) value indicate upward (downward) trend.
Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}$ $p < 0.1$ and blank greater than 0.1

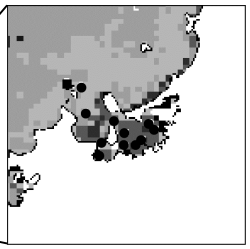
Preliminary eutrophication assessment in the northwest Kyushu sea area, Japan

☆Sub-area B (Hakata Bay) was detected HN and HI by satellite monitoring.

Northwest Kyushu sea area



Sub-area B (Hakata Bay)



A: Karatsu Bay, B: Hakata Bay, C: Dokai Bay and Kanmon Straits, D: intermediate area and E: Offshore area

Hakata Bay

Area: 134.2 km^2

Width of bay mouth: 7.7 km

Max. depth: 23 m

Fukuoka City is the most urbanized in Kyusyu.

Population is 2 millions in this area.

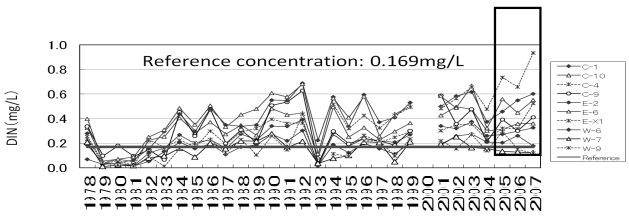
Water quality was monitored in 12 rivers inflow in Hakata Bay.

Four sewage plants (●) directly discharge the waste water.

Satellite image from "Daichi" JAXA (Apr., 2008)

Category I

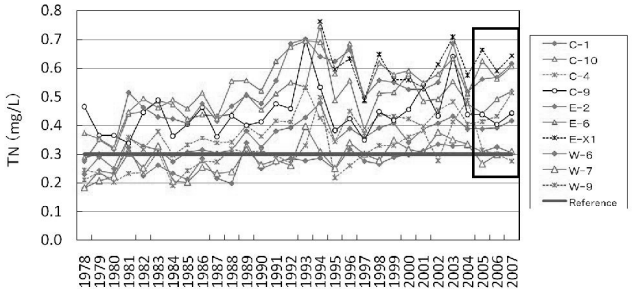
Changes of winter DIN in seawater



Trend was detected by the Mann-Kendall test. Red line showed increase trend, black is no trend and blue is decrease trend.
Status was represented by the averages in recent 3 years in each stations.
"One out - All out" principle was applied in this case study.
For instance, only one station is over the reference concentration, this area will become high status.
8 of 10 stations showed increase trend and no trend was detected in 2 stations (C-9 and W-7) . 9 of 10 stations showed high status and 1 station showed low status (W-7).

Category I

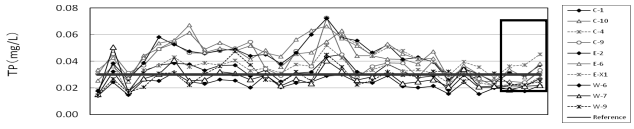
Change of TN in seawater



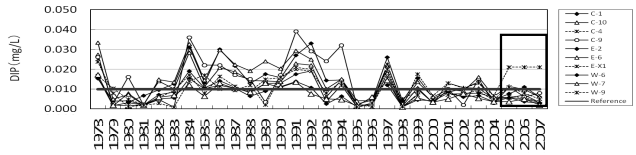
8 of 10 stations showed increase trend and no trend was detected in 2 stations (C-9 and E-X1) . 9 of 10 stations showed high status and 1 station showed low status (W-7).

Category I

Changes of TP in seawater

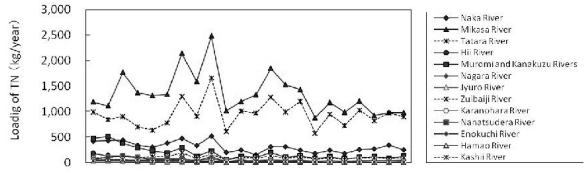


Changes of DIP in seawater

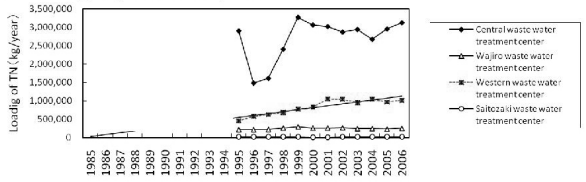


Category I

Riverine input of TN

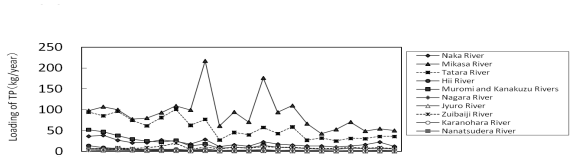


Sewage plant input of TN

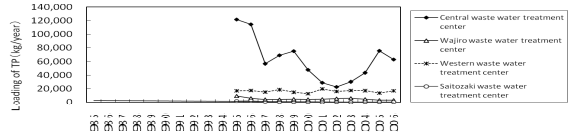


Category I

Riverine input of TP

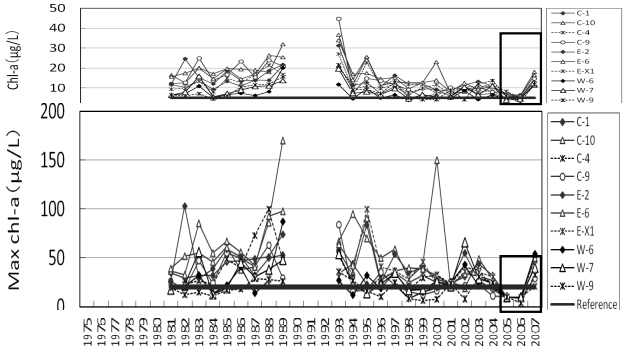


Sewage plant input of TP



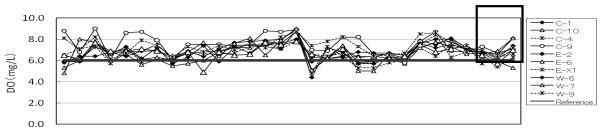
Category II

Changes of annual mean of chlorophyll-*a*

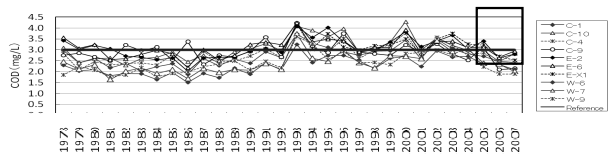


Category III

Changes of dissolved oxygen (DO)

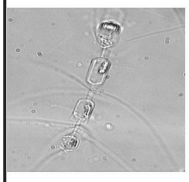


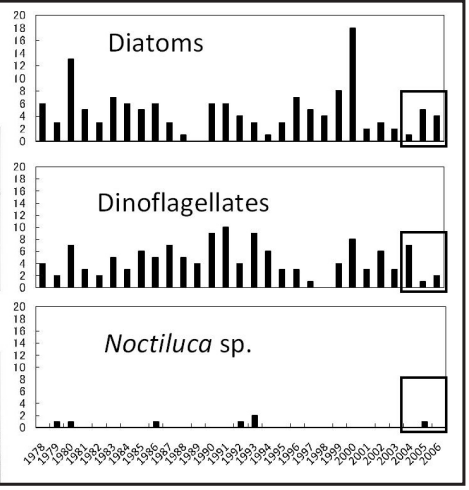
Changes of chemical oxygen demand (COD)



Category II

Red tide events





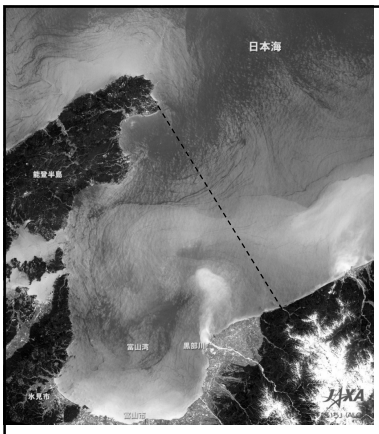
Category IV

Identification of eutrophication status in Hakata Bay

Categories	Assessment parameters	Comparison	Occurrence	Trend	Parameter identification	Category identification
I	①Riverine input of TN	×	×	N	N	HI
	②Riverine input of TP	×	×	N	N	
	③Sewage plant input of TN	×	×	I	I	
	④Sewage plant input of TP	×	×	N	N	
	⑤TN concentration	H	×	I	HI	
	⑥TP concentration	H	×	D	HD	
	⑦Winter DIN concentration	H	×	I	HI	
	⑧Winter DIP concentration	H	×	N	HN	
	⑨Winter DIN/DIP ratio	H	×	I	HI	
II	⑩Annual maximum of chlorophyll-a	L	×	N	LN	HN
	⑪Annual mean of chlorophyll-a	H	×	N	HN	
	⑫Red tide events (diatom sp.)	×	H	N	HN	
	⑬Red tide events (dinoflagellate sp.)	×	H	N	HN	
III	⑭Dissolved oxygen (DO)	H	×	N	HN	HN
	⑮Chemical oxygen demand (COD)	H	×	N	HN	
IV	⑯Red tide events (*Noctiluca* sp.)	×	H	N	HN	HN
	⑰Shell fish poisoning incidents	×	L	N	LN	

Assessment of sub-area B (Hakata Bay)

Categories	Evaluation
I: degree of nutrient enrichment	Increase trend was detected in the sewage plant input of TN. TN and winter DIN were over reference concentration in Hakata Bay. However, decrease trend was detected in riverine and sewage plant inputs of TP.
II: direct effects of nutrient enrichment	Annual mean chlorophyll-a showed decrease or no trend but high status condition. Red tides consist of diatom and dinoflagellate species were occurred almost of the year. These conditions represent eutophication symptom.
III: indirect effects of nutrient enrichment	COD showed increase trend and high status in Hakata Bay.
IV: other possible effects of nutrient enrichment	*Noctiluca* sp. red tide was scare. Shellfish poisoning was not seen in this area.



River plumes were observed in the innermost of the bay.

Toyama Bay

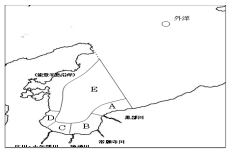
Area: 2120 km^2

Max. depth: 1250 m

Volume: 1280 km^3

Satellite image

from "Daichi" JAXA (May, 2006)



Identification of eutrophication status in Toyama Bay, sub-area B

Assessment parameters	Comparison	Occurrence	Trend	Parameter identification	Category identification
①Riverine input of TN	×	×	I	I	HN
②Riverine input of TP	×	×	D	D	
③TN concentration	L	×	N	LN	
④TP concentration	L	×	N	LN	
⑤Winter DIN concentration	H	×	N	HN	
⑥Winter DIP concentration	L	×	N	LN	
⑦Winter DIN/DIP ratio	×	×	N	N	
⑧Annual maximum of chlorophyll-a	L	×	N	LN	HN
⑨Annual mean of chlorophyll-a	H	×	N	HN	
⑩Red tide events (diatom sp.)	×	L	N	LN	
⑪Red tide events (dinoflagellate sp.)	×	L	N	LN	
⑫Dissolved oxygen (DO)	H	×	D	LI	LI
⑬Abnormal fish kills	×	L	N	LN	
⑭Chemical oxygen demand (COD)	L	×	I	LI	
⑮Red tide events (*Noctiluca* sp.)	×	L	N	LN	LN
⑯Shell fish poisoning incidents	×	L	N	LN	

Assessment of Toyama Bay, sub-area B

Categories	Evaluation
I: degree of nutrient enrichment	Increase trend was detected in the TN input from the Jinzu River. Winter DIN was high concentration.
II: direct effects of nutrient enrichment	Annual mean chlorophyll-a was over 5 μg/L in recent 3 years. Red tides consist of diatoms and dinoflagellate were not observed.
III: indirect effects of nutrient enrichment	DO is satisfied criteria but decrease trend. COD is also satisfied criteria but increase trend.
IV: other possible effects of nutrient enrichment	Red tides consist of *Noctiluca* sp. were not observed. Shellfish poisoning incident was not occurred.

Interrmin Report on the Assessment of Eutrophication Status of Jinhay Bay in Korea

Youngtae PARK and Changkyu LEE

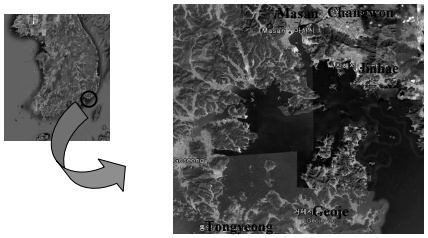
Southeast Sea Fisheries Research Institute,
NFRDI, Korea

Jinhae Bay

- Jinhae Bay, located in the south eastern part of Korea, is a semi-closed inner bay with excellent topographical conditions for marine life.
- As a result, it has become a spawning and breeding ground for mariculture resources such as ark shell, *akagai*, mussel, oyster, flounder and sea beam, over the last few decades.
- However, the water quality of Masan bay, adjacent to Jinhae bay, has been seriously eutrophicated by the rampant discharge of domestic and industrial sewage resulting in massive algal blooms from early 1980s.
-The water quality of Jinhae bay has been improved with showing remarkable decrease of nutrient loading since Korean government designated Masan bay as a special marine management area in 1982 under the revision of Korea Marine Pollution Prevention Law.

Characteristics of Jinhae Bay

Geographical Features

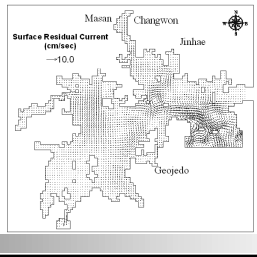


- Jinhae bay is a semi-closed coastal area with 35km in length, 25km in width and 10~20m of water depth.
- Most of the polluted water from five major cities with 40 rivers or streams are discharged into Jinhae bay. Particularly, Masan bay plays an important role as a nutrient reservior because of its locality as a mouth part of Jinhae bay.

Characteristics of Jinhae Bay

Oceanographic Features

- Average tidal range: about 1.3m.
- The velocity of the maximum tidal current: about 30-40cm/sec (near Gaduk Island)
- The velocity of tidal current: about 20-30cm/sec (middle of bay).
- Average surface residual current speed: about 10cm/sec



Characteristics of Jinhae Bay

Fisheries Features

- No of fisherman surrounding Jinhae Bay: about 32,000 peoples
- Aquaculture area: 11,000ha
- Aquaculture products: 4,300ton(2007)
- Major culturing shellfish (area): oyster, sea squirt, arch shell

Pacific oyster
(*Crassostrea gigas*)

Characteristics of Jinhae Bay

Jinhae bay pictures

Oyster culture farm by hanging system

Cage culture farm for fish

Masan bay

Tongyeong

Intermin Report on Jinhae bay

Collection of relevant information

Long-term monitoring programs in Jinhae bay, Korea

Survey area	Governing organization	Survey title	Aim	Survey period	Main survey parameters	Survey frequency	No. of survey points
Jinhae bay	NFRDI	Coastal environment monitoring program	Conservation of coastal environment	1984-	Temp. Salinity Transpa. Nutrients COD, pH Chl.-a pollutants	4/year	14
		HAB monitoring	HAB warning and prediction to minimize fisheries impact	1979-	Phytoplankton Nutrients Chl.-a, etc.	1/month	15
		Shellfish toxins monitoring	Detection of shellfish toxin for food safety	1992-	PSP ASP DSP	- 1/month - 1-2/week (depending on toxin level)	19

※ NFRDI is responsible for long-term monitoring studies; Contrarily universities and research institutes are conducting short-term and intensive studies relating to environment and ecosystem in Jinhae bay.

Used Assessment parameters

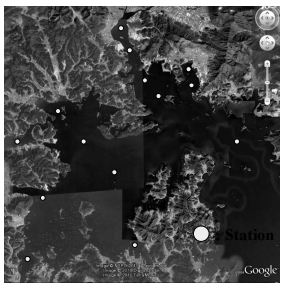
Category		Assessment parameter	
I	Degree of nutrient enrichment	Riverine input(T-N, T-P)	-
		Total nitrogen/Total phosphorus (T-N, T-P)	2002-
		Winter (DIN/DIP) concentration	1997-
		Winter N/P ratio (DIN/DIP)	1997-
II	Direct effects of nutrient enrichment	Chlorophyll-a concentration (field data)	2000-
		Chlorophyll-a concentration (remote sensing data)	Not applicable (low resolution)
		Ratio of area with high Chlorophyll-a concentration (remote sensing data) to the total area	Not applicable (low resolution)
		Red –tide events (diatom species)	1981-
III	Indirect effects of nutrient enrichment	Dissolved oxygen (DO)	1997-
		Abnormal fish kill incidents	1981-
		Chemical oxygen demand (COD)	1997-
IV	Other possible effects of nutrient enrichment	Shellfish poisoning incidents	1980-

Results

Coastal environment monitoring program

Sellection of assessment parameters and data

- Responsible Agency : NFRDI
- Monitoring period/frequency: 1984~/4 times per year (Jan., May, Aug., Nov.)
- Number of stations : 14 stations



Portal site for coastal environment monitoring in NFRDI

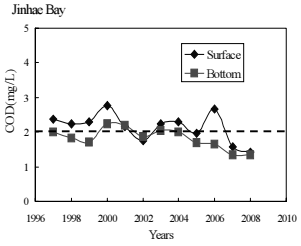
Standardization of seawater based on water quality in Korea

Grade	pH	COD (mg/L)	Dissolved oxygen (mg/L)	Coliform bacteria (MPN/100mL)	TN (mg/L)	TP (mg/L)
I	7.8-8.3	under 1	Over 7.5	Under1000	Under0.3	Under0.03
II	6.5-8.5	under 2	Over5	under1000	Under0.6	Under0.05
III	6.5-8.5	under4	over2		Under1.0	Under0.09

I : Aquaculture (red sea-bream etc), sea bathing
II: Aquaculture except for I level water, marine leisure sports
III: Industrial water, shipping

Long term variations

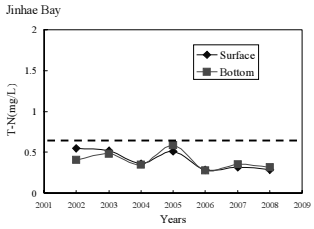
Variation of COD level in Jinhae bay for 12 years



- Overall, COD level in Jinhae Bay decreased since 2000.
- Water quality level of Jinhae bay shows grade II (1-2.5mg/L) based on Korean standardization

Long term variations

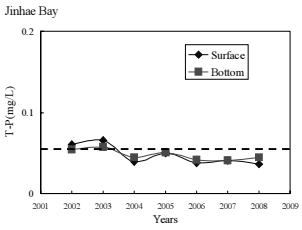
Variation of T-N level in the Jinhae bay for 8 years



- T-N also decreased in Jinhae bay with showing less than 0.6mg/L

Long term variations

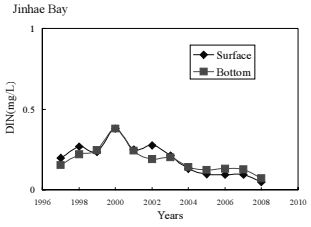
Variation of T-P concentration in Jinhae bay for 8 years



- T-P also decreased in Jinhae bay.
- Hence, Jinhae bay with grade II water quality by Korean standardization is feasible for aquaculture site

Long term variations

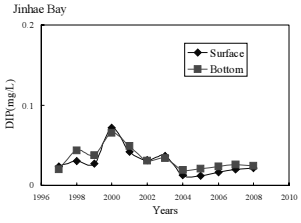
Variation of DIN level in Jinhae bay for 12 years



- DIN level in Jinhae Bay(0.09-0.4 mg/L) gradually decreased since 2000

Long term variations

Variation of DIP level in Jinhae bay for 12 years

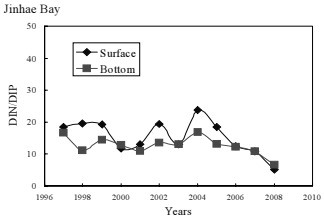


- DIP level in Jinhae Bay (0.01-0.04 mg/L) gradually decreased since 2000

.

Long term variations

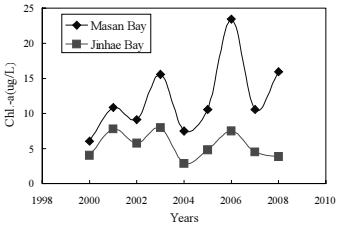
Variation of DIP/DIN ratio in Jinhae bay for 12 years



- N/P ratio in Jinhae Bay decreased since 2004 ranging 5-23.

Long term variations

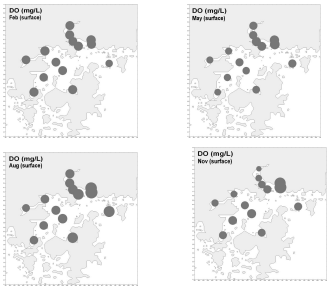
Variation of Chl.-a level in the Jinhae bay



- Chl.-a concentration in Jinhae bay showed fluctuation with less than 7.5ug/L since year 2000.

Long term variations

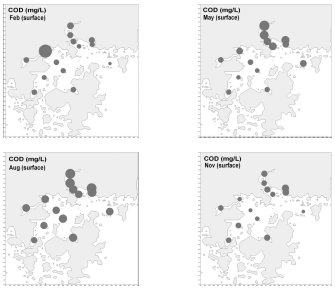
Seasonal and spatial distribution of DO level



- The range of DO level showed 5-11mg/L without remarkable changes depending on season and location

Long term variations

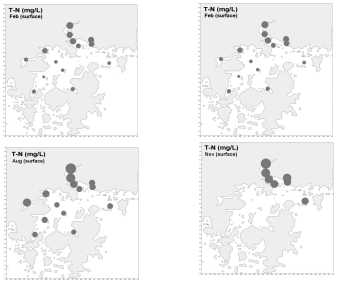
Seasonal and spatial distribution of COD level



- COD level ranged 1-2.5mg/L with showing higher level in summer.

Long term variations

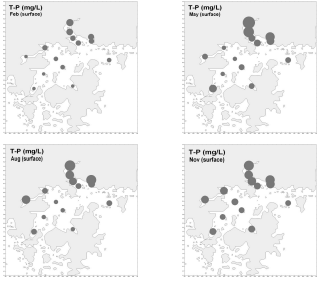
Seasonal and spatial distribution of T-N level



- T-N ranged 0.2-0.5mg/L with showing higher level, particularly, in summer season

Long term variations

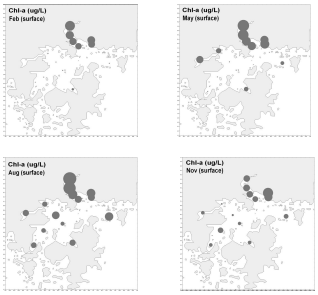
Seasonal and spatial distribution of T-P level



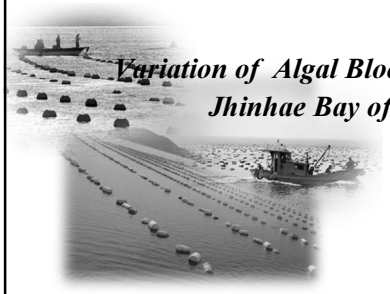
- T-P ranged 0.02-0.06mg/L with showing higher level in winter season.

Long term variations

Seasonal and spatial distribution of Chl.-a level



- Chl.-a ranged 3-7.5ug/L with showing higher level in summer season.



Variation of Algal Blooms in Masan-Jhinhae Bay of Korea

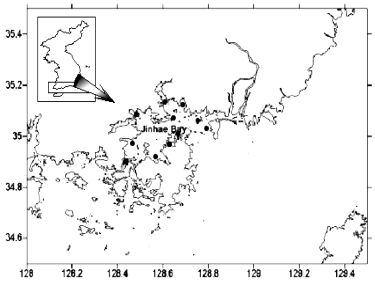
Long term variations

Materials and Methods

- Field survey
  - **Sampling sites: 11 stations (monthly base since 1981)**
  - **Parameter : composition of phytoplankton, abundance,** chlorophyll a, nutrient, hydrographical data
- Compiled data
  - **Annual report of HABs by NFRDI**
  - **Annual report of coastal environment monitoring by NFRDI**

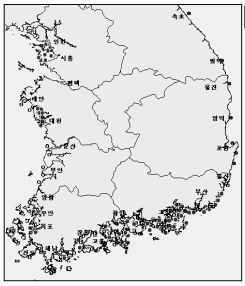
Long term variations

Sampling sites in Jinhae Bay



Long term variations

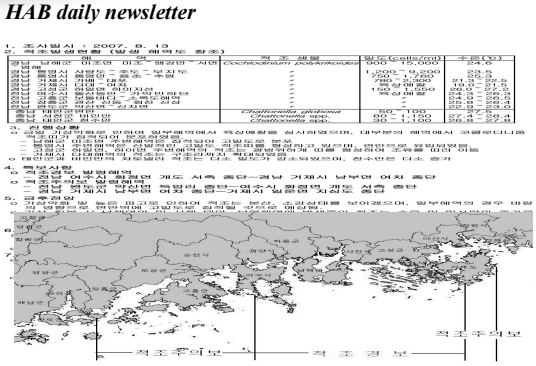
HABs monitoring system



organization	Method	Period	Area
National Fisheries Research & Development Institute	Vessel	Feb.- Nov. (1 time/ month)	77 stations
Local Government	Watch, vessel	Apr.-Oct. (2 times /week)	92 outpost
National Maritime police Agency	Helicopter	Outbreak of HAB (as occasion demands)	all coasts

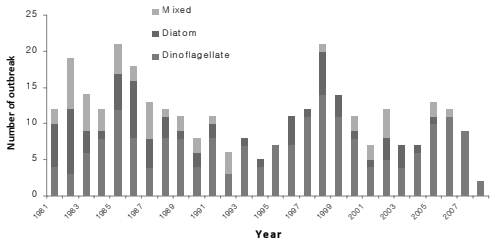
Long term variations

HAB daily newsletter



Long term variations

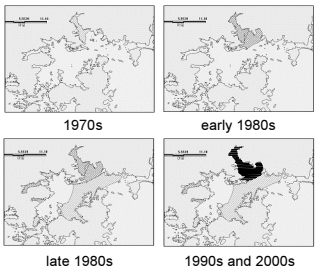
Number of redtide events in Jinhae bay since 1981



- Overall, HAB events has decreased since late 1990s.
- Diatom was relatively dominant in 1980s but flagellates replaced thereafter

Long term variations

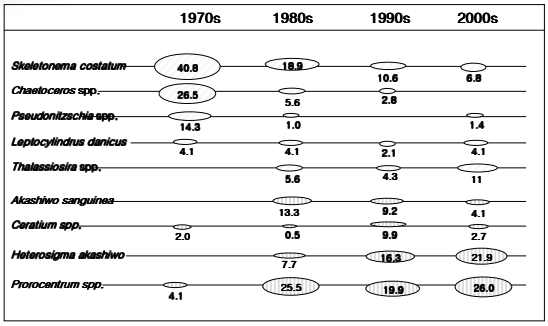
Spatial distribution of redtide in Jinhae Bay



- In 1970s, red-tide was concentrated only in Masan Bay, but it spread to wide range of Jinhae bay since late of 1980s

Long term variations

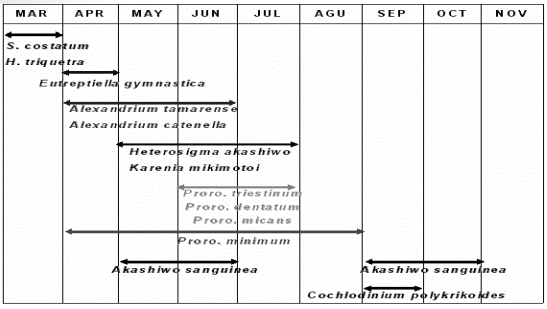
Decadal succession of redtide causative organism in Jinhae Bay



- *S. costatum* was dominant species in 1970s, but flagellate bloom has been dominant since 1980s

Long term variations

Seasonal species succession of dinoflagllates in Jinhae Bay



Long term variations

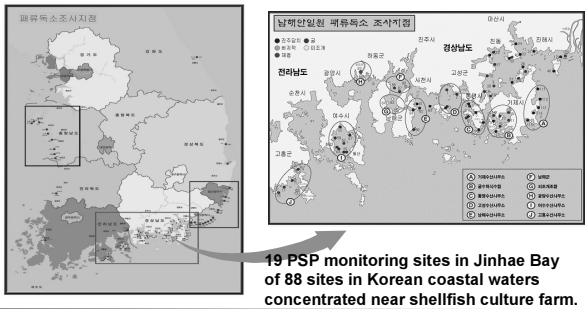
Decadal changes of redtide characteristics in Jinhae Bay

	1970s	1980s	1990s and 2000s
Blooming season	summer	Mar.-Nov.	Year round
Dominant species	diatom	Diatom & Flagellate	Flagellate
Duration	≤ 1 week	1-2 weeks	1-2 weeks

Monitoring of Shellfish Poisoning

Long term variations

Monitoring sites of Shellfish Poisoning in Korean coastal waters



19 PSP monitoring sites in Jinhae Bay of 88 sites in Korean coastal waters concentrated near shellfish culture farm.

Long term variations

PSP

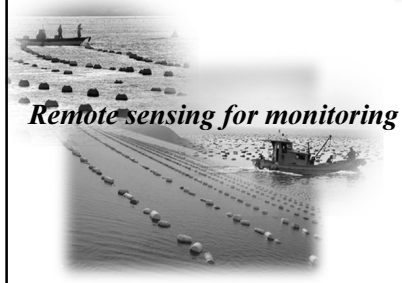
- Monitoring period: year round (from Jan. to Dec.) since 1992
- Monitoring frequency: once a month
  once a week when toxin is detected
  twice a week when toxin level exceed 40 ug/100g meat
- Abundant season: spring (April-June) and fall (October)
- Regulatory limit for shellfish harvest banning: over 80 ug/100g meat
- Harvest banning records: almost every year since 2000

ASP

- Monitoring period: year round
- Monitoring frequency: once a month
- Abundant season: year round
- Regulatory limit for shellfish harvest banning: 20 ug/g meat
  * No records for shellfish harvest banning

DSP

- Monitoring period: year round
- Monitoring frequency: once a month
- Abundant season: from spring to early summer
- Regulatory limit for shellfish harvest banning: 0.5MU
  * No records for shellfish harvest banning



Remote sensing for monitoring of eutrophication

Eutrophication monitoring with satellite image

Year	Event No.	Duration	Spot	SST, nLw 551, Chl-a
2007	SE-2007-2	2007. 8.17	South Sea of Korea (Sea surface temperature image)	
2007	SE-2007-3	2007. 8.17	South Sea of Korea (nLw 551 image)	
2007	SE-2007-4	2007. 8.17	South Sea of Korea (chlorophyll-a image)	

- MODIS, currently operating, is not applicable for Jinhae Bay due to the limit of low resolution(4km)
- New satellite launched this year with 100m resolution will be directly applicable from next year

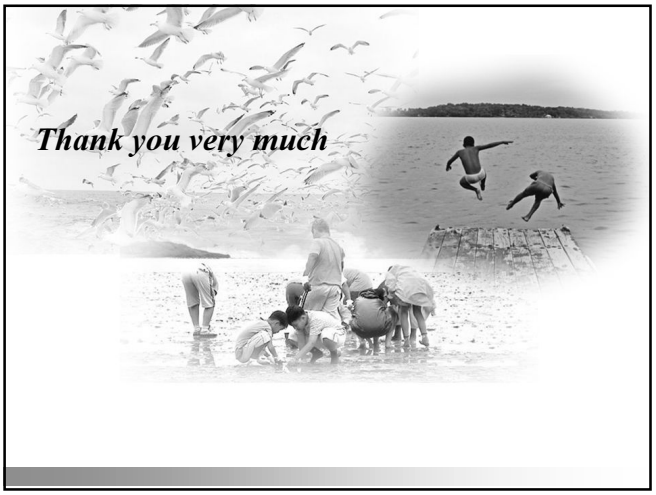
Results

Category	Assessment parameter	Assessment value	Identification tools			Remarks
			Values	Occurrence	Trend	
I	Riverine input (T-N, T-P)	Annual mean	-	-	-	
	Total nitrogen/Total phosphorus (T-N, T-P)	Annual mean	0.2-0.5/ 0.03-0.06	-	Decreasing	
	Winter N/P ratio (DIN/DIP)	Winter mean	5-23	-	Decreasing	
II	Chlorophyll-a concentration (field data)	Annual max. Annual mean	2.9-7.5ug/L	-	No trend	
	Chlorophyll-a concentration (remote sensing data)	Annual max. Annual mean	-	-	-	
	Ratio of area with high Chlorophyll-a concentration (remote sensing data) to the total area	Annual max. Annual mean	-	-	-	
	Red-tide events	Annual occurrences	-	6-23	Decreasing	
III	Dissolved oxygen (DO)	Annual min.	5.0-11.5mg/L	-	No trend	
	Abnormal fish kill incidents	Annual occurrences	-	1	-	
	Chemical oxygen demand(COD)	Annual mean	1.4-2.5mg/L	-	Decreasing	
IV	Red-tide events (Noctiluca sp.)	Annual occurrences	-	-	-	
	Shellfish poisoning incidents	Annual occurrences	-	-	-	

On going works

☐ **Analysis of assessment criteria and data**

- We are now under analysis for the setting of assessment criteria and categorization of eutrophication status to be included in the national report.


Thank you very much

Assessment of eutrophication status including evaluation of land based sources of nutrients for Peter The Great Bay

(Interim Report)

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Vladimir Zvalinsky, viz@poi.dvo.ru
Pacific Oceanological Institute, FEB RAS
Genki Terauchi, CEARAC

Acknowledgment

This work was supported by NOWPAP CEARAC and grant of Russian Science Foundation -08-05-00696-a

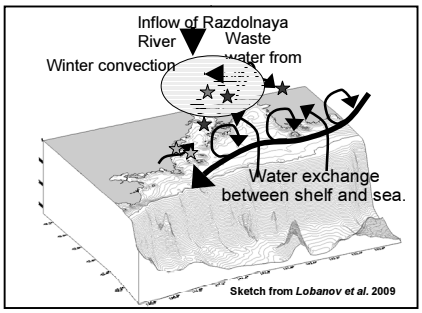
Objective:

The objective of assessment eutrophication status of Peter the Great Bay is to improve management and healthy of coastal environment for NOWPAP member states via sharing information about sources and consequences of eutrophication.

Outline

I. Peculiarities of Peter the Great Bay
II. Scope of assessment
III. Data processing
IV. Setting of assessment criteria
V. Assessment process and results
VI. Review of results
VII. Conclusion and recommendation

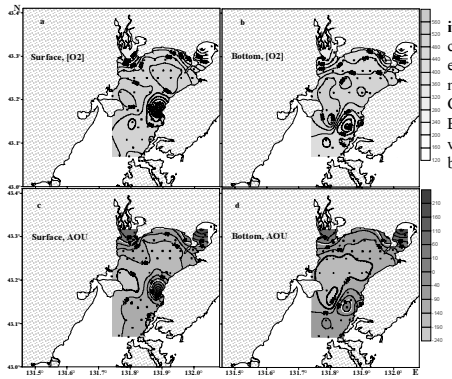
I. Peculiarities of Peter the Great Bay:



i) Steep slope between shelf of Peter the Great Bay and open part of the Sea

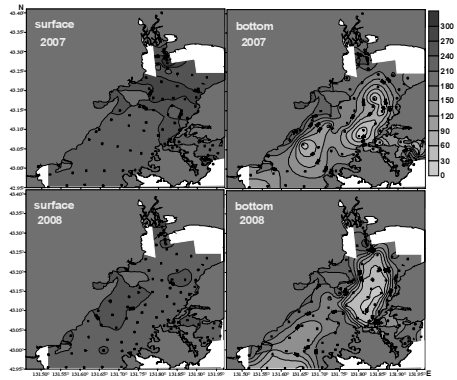
ii) At winter time, due to convection on the slope oxygen-rich Intermediate Water and Bottom Water of the Sea are formed (*Kim K.J., Seung Y.H.* J.Oceanogr., 1999, V.55, p.369-382.; *Kim K.-R. et al.*, Geophys.Res.Lett., 2002, V.29, N8; *Talley et al.*, Geophys. Res. Lett., 2002, V.30, N10)

iii) At fall time due to upwelling Intermediate Water comes up on the shelf of Peter the Grate Bay (Lobanov et al., 2009)



iv) Under winter conditions, due to strong eutrophication of northern part of Peter the Great Bay (Amursky Bay) surface and bottom waters are supersaturated by oxygen.

Fig. 1. Distribution of Oxygen concentration (μmol/kg) in surface (a) and bottom (b) waters and Apparent Oxygen Utilization, AOU (μmol/kg) in surface (c) and bottom (d). Amursky Bay, February-March, 2008.



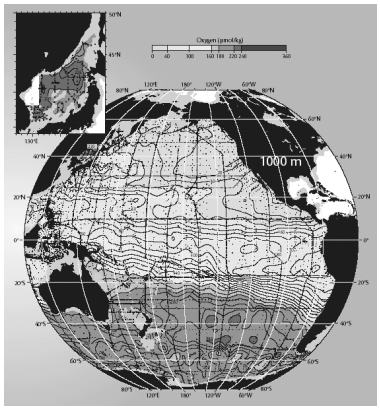
v) Due to strong eutrophication of northern part of Peter the Great Bay (Amursky Bay), bottom water reveals hypoxia events under summer conditions.

Fig. 2. Distribution of oxygen concentration (μmol/kg) in Amursky Bay. August, 2007 (upper panel). August, 2008 (bottom panel).

Result of eutrophication of Amursky Bay under winter conditions are:

a) lot of fishes for animals and people.

Fig. 3 Larga with baby (a) and fishing on ice of Amursky Bay (b).



b) High oxygen concentration in the Sea (purple) indicates more recent ventilation in winter time.

Fig. 4. a) Oxygen (μmol/kg) at 1000 m for the Pacific Ocean and the Sea (*Talley et al.*, 2006).

Result of eutrophication of Amursky Bay under summer conditions is killed fishes.

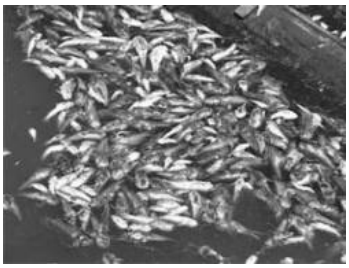


Fig. 5. Killed fishes on coast of Amursky Bay at 14th September 2008. Most part of fishes is Smelt. Photo Vladimir Kolesnikov.

II. Scope of assessment

II.1. Peter the Great Bay reveals strong spatial and seasonal variability of all parameters of ecosystem that causes uncertainty in eutrophication assessment of natural character.

II.2. For minimizing of this type uncertainty studied area was divided on three sub-areas:

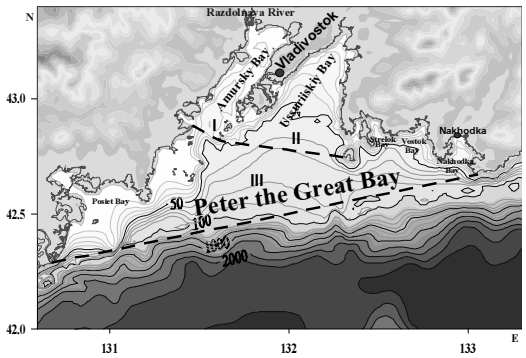
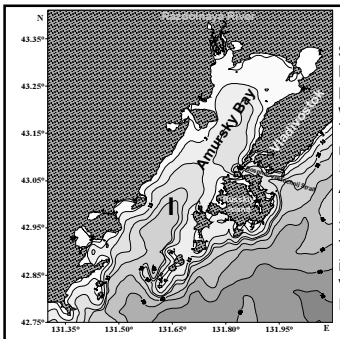


Fig. 6. Subareas of Peter the Great Bay: **I** – Amursky Bay; **II** – Ussuriisky Bay; **III** – open part of Peter the Great Bay.

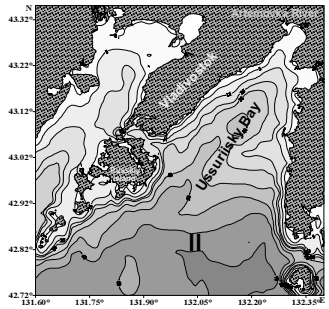
II.3. Relevant information about studied area includes: population, square of area, depth, river runoff, sources of nutrients, locations of main nutrient loads.



Sub-area I, Amursky Bay is semiclosed basin. It is located in the northwestern part of Peter the Great Bay. Its average width is about 15 km, its length is about 70 km and depth varies from 0 up to 53 m (average depth is about 15 m). Square of the bay is about 1000 km^2. Annual river-runoff is about 2.5 km^3. Population around Amursky Bay is 300,000.
There are two main sources of nutrients into Amursky Bay. These are Vladivostok waste waters and Razdolnaya River.

Table 1. Annual fluxes (T/year) of nutrients into Amursky Bay from river runoff and waste waters of Vladivostok

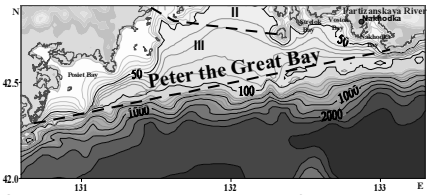
Nutrients	N-inorg	N-tot	P-inorg	P-tot
River runoff	1800	4200	120	450
Vladivostok	700	1150	100	140



Sub-area II, Ussuriisky Bay is open basin. It is located in the northeastern part of Peter the Great Bay. Square of the bay is about 2100 km^2. Depth varies from 0 up to 75 m (average depth is about 35 m). Annual river-runoff is 1 km^3.
There are two main sources of nutrients into (Ussuriisky Bay+Golden Horn Bay). One of them is waste waters from 400,000 peoples Another one is river runoff.

Table 2. Annual fluxes of nutrients into Ussuriisky Bay from river runoff and waste waters (T/year).

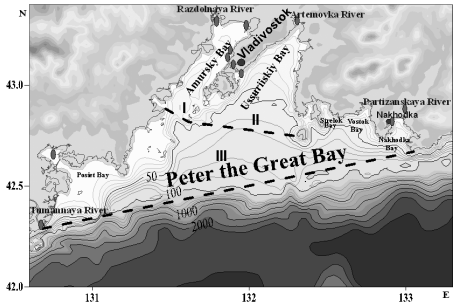
Nutrients	N-inorg	N-tot	P-inorg	P-tot
River runoff	200	400	10	40
Waste waters	950	1600	200	300



Sub-area III, it is south part of Peter the Great Bay. Its square is about 6400 km^2. Depth varies from 0 up to 150 m (average depth is about 70 m). Annual river-runoff is 1.2 km^3. Population around this sub-area is about 200,000.
Distinct feature of this sub-area is intensive exchange between shelf waters of the bay and deep waters of the Sea by downwelling and upwelling processes along steep slope.

Table 3. Annual fluxes of nutrients into south part of Peter the Great Bay (T/year).

Nutrients	N-inorg	N-tot	P-inorg	P-tot
River runoff	250	500	10	40
Waste waters	450	750	100	160



Purple points note local loads of nutrients into Peter the Great Bay.

Square of the bay is about 9500 km^2. Depth varies from 0 up to 150 m (average depth is about 40 m). Annual river-runoff is 4.7 km^3. Population around Peter the Great Bay is about 900,000.

Table 4. Annual fluxes of nutrients into Peter the Great Bay (T/year).

Nutrients	N-inorg	N-tot	P-inorg	P-tot
River runoff	2250	5100	140	530
Waste waters	2100	3500	400	600

II. 4. Selection of assessment parameters and data

No	Category	Parameter	Method
i)	I	NH_4, NO_2, NO_3 PO_4, H_2SiO_3	Grasshoff K., et al., 1983
ii)	II	Chlorophyll a	Koblenz-Mishke, 1983
iii)	III	Oxygen	Grasshoff K., et al., 1983

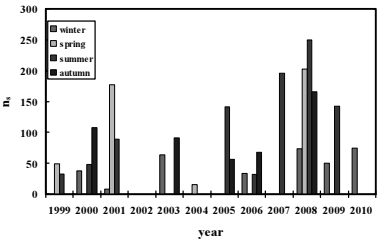


Fig. 7. Level of study of Peter the Great Bay. Number of samples analyzed on assessment parameters during 1999 – 2010.

II.5. General remarks about available data:

1) Available data were collected during oceanographic surveys carried out by POI. Aim of these surveys was not control of water quality.
2) Aim most of surveys was to study hydrochemical state of Amursky Bay (nutrients, dissolved oxygen, carbonate system parameters – pH, Total Alkalinity, Humic Substances).
3) Using our available data we can accurately carry out eutrophication assessment mostly for northwestern part of Peter the Great Bay, it is Amursky Bay and estimate seasonal variability of eutrophication.

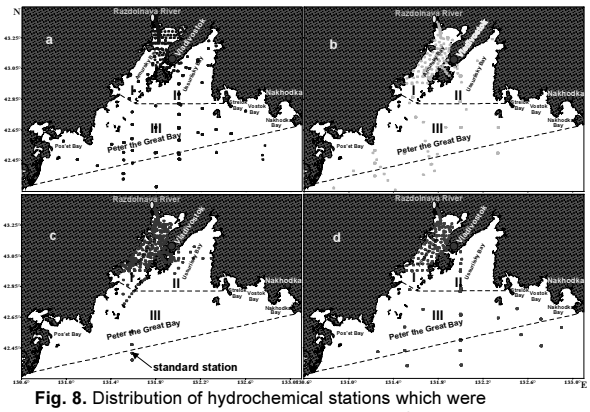
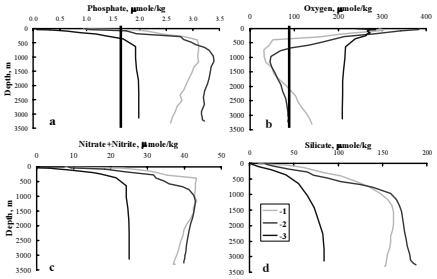


Fig. 8. Distribution of hydrochemical stations which were implemented during 1999 – 2010 in Peter the Great Bay. a – Winter; b – Spring; c –Summer; d – Autumn.

III. Data processing

Values of each assessment parameters have been measured using commonly accepted methods (Grasshoff et al., 1983; Koblenz-Mishke, 1983).
Data set includes values of NH_4, NO_2, NO_3, PO_4, H_2SiO_3, Chlorophyll *a*, and oxygen concentrations along following information: date, time, location (Latitude, Longitude), depth (pressure), in situ temperature, salinity, pH, Total Alkalinity. All measurements were carried out by same scientific group and were crossed checked. Therefore assessment parameters have reliable values.
Data of assessment parameters were collected into excel-file for each survey. Obtained dataset was sorting for each sub-area of Peter the Great Bay.

IV. Setting of assessment criteria



Maximum permissible concentration used in Russia (POMRAC Technical Report N4)

DIN (mg/L)	DIP (mg/L)	DO (mg/L)
9.52	0.05	<3

Fig. 9. Vertical variations of assessment parameters (DIP -a, DO -b, DIN-c, DISi-d) in NW-Pacific -**1 φ=44.49°N, λ= 153.20°E**; Sea of Okhotsk -**2 φ=47.49°N, λ=147.91°E**, the Sea -**3 φ=43.54°N, λ=139.20° E**.

Eutrophication is such enrichment of ecosystem by nutrients that it causes degradation of ecosystem.

Under suitable conditions eutrophication forms dead zones due to oxygen consumption by microbiological decaying of "excess" organic matter. It is generally assumed that aquatic ecosystem start to degradate when oxygen concentration becomes below **2.5 mg/l** (**76 μmol/kg**).

We introduce critical values for assessment parameters (DIN, DIP, DISi, DO) – DIN_c, DIP_c, $DISi_c$ and DO_c within "standard" euphotic layer.
When actual values of assessment parameters higher than DIN_c, DIP_c, $DISi_c$ and lower than DO_c within "standard" euphotic layer, then such environment of ecosystem are identified as high eutrophication status.

Critical values of assessment parameters are following:

1) $DO_c = 76\ \mu mol/kg$

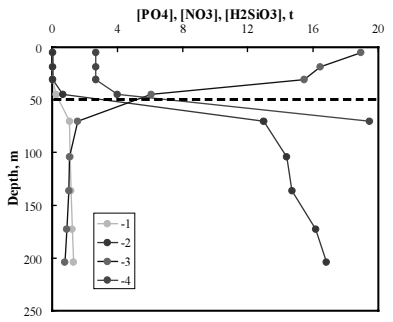
2) $DIN_c/\ \mu mol/kg = \frac{\{[O_2]_{sat} - 76\}\cdot 16}{138}$

3) $DIP_c/\ \mu mol/kg = \frac{[O_2]_{sat} - 76}{138}$

4) $DISi_c/\ \mu mol/kg = \frac{\{[O_2]_{sat} - 76\}\cdot 17}{138}$

Brzezinski M. J.Phyc. 1985. V.21. P.347-357.

Season	Winter	Spring Autumn	Summer
t, °C	0	10	20
S, ‰	33	33	33
DIN_c, umol/kg	32.0	23.5	17.6
DIP_c, umol/kg	2.0	1.5	1.1
$DISi_c$, umol/kg	34.0	24.9	18.7



We consider destribution of assessement parameters within "standard" euphotic layer only

Thick of euphotic layer was accepted **50 m** on "standard" station.

Fig. 10. Vertical distribution of PO_4 (μM) **- 1**, NO_3 (μM) **- 2**, temperature (°C) **- 3** and H_2SiO_3 (μM) **- 4** on station which is accepted as "standard" (42.417° N; 131.588° E).

V. Assessment process and results.

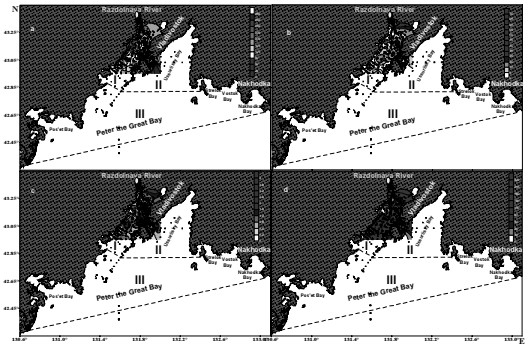


Fig. 11. Distribution of oxygen (μmol/kg) – a, DIN (μM) – b, DIP (μM) – c, DISi (μM) –d in bottom waters of Amursky Bay. August 2007. Red color means hypoxia for oxygen and concentrations of nutrients higher than critical values.

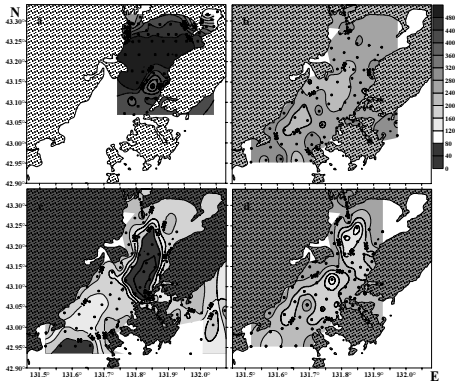


Fig. 12. Seasonal distribution of oxygen in bottom waters in Amursky Bay (μmol/kg). a – Winter, b – Spring, c – Summer, d – Autumn. 2008. Red color means hypoxia.

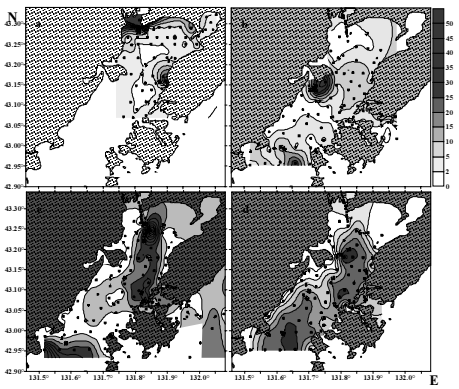


Fig. 13. Seasonal distribution of DIN in bottom waters of Amursky Bay (μmol/kg). a – Winter, b – Spring, c – Summer, d – Autumn 2008. Red color means concentrations of DIN higher than critical values.

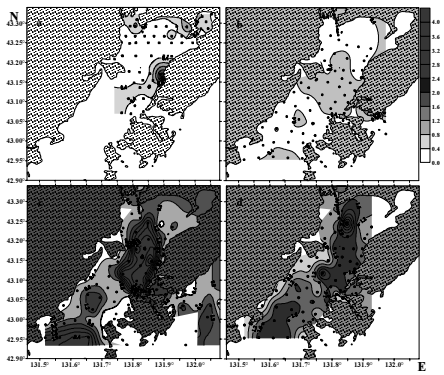


Fig. 14. Seasonal distribution of DIP in bottom waters of Amursky Bay (μmol/kg). a – Winter, b – Spring, c – Summer, d – Autumn. 2008. Red color means concentrations of DIP higher than critical values.

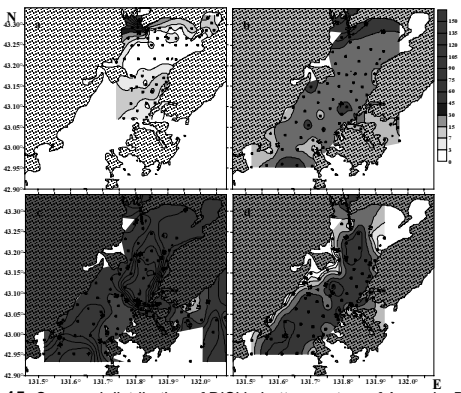
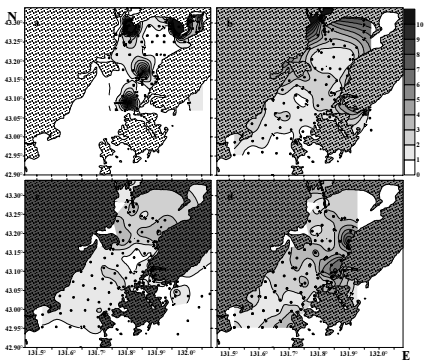


Fig. 15. Seasonal distribution of DISi in bottom waters of Amursky Bay (μmol/kg). a – Winter, b – Spring, c – Summer, d – Autumn. 2008. Red color means concentrations of DISi higher than critical values.



Concentration of chlorophyll as assessment parameter is most questionable parameter because its turnover-time is too short (*Riper D.M. et al.,* Plant Physiol., 1979. V.64. P.49-54.) Therefore Satellite images of chlorophyll is likely more valuable approach.

Fig. 16. Seasonal distribution of chlorophyll *a* in surface waters of Amursky Bay (μmol/kg). a – Winter, b – Spring, c – Summer, d – Autumn. 2008.

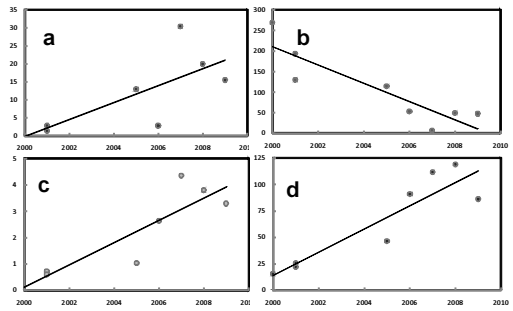


Fig. 17. Detecting trend of assessment parameters (DIN –a; DO – b; DIN – c; DISi – d in μM) at location 43.18 N, 131.80 E (Sub-area I).

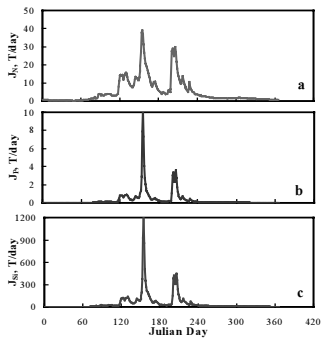
VI. Review of results

There are two type of nutrient sources into Peter the Great Bay:

1) Local are wastewaters of Vladivostok, Ussurijsk, Nakhodka, etc. These sources have almost constant fluxes during year.
2) Diffusive are agriculture fields, atmospheric precipitations. Nutrients from these sources are loaded into Peter the Great Bay by rivers and coastal runoff. Fluxes of these sources have distinct seasonal variability due to seasonal atmospheric precipitation.

Diffusive sources play important role in hypoxia formation whch is considered as result of eutrophication of studied area.

We suggested following scenario of hypoxia formation in the northwestern part of Peter the Great bay (Amursky Bay):



1) Due to heavy atmospheric precipitations at June and July in watershed of Razdolnaya River, high water of the River supplies nutrients and suspension matter on surface of Amursky Bay (**Eutrophication hit**).

Fig. 18. Fluxes of nutrients (a – inorganic nitrogen; b – phosphates; c – silicates) loaded into Amursky Bay by Razdolnaya River as function of Julian Days. (*after Mikhailik et al., 2010, in press*).

2. After settling of suspension matter, diatoms bloom is occurred.

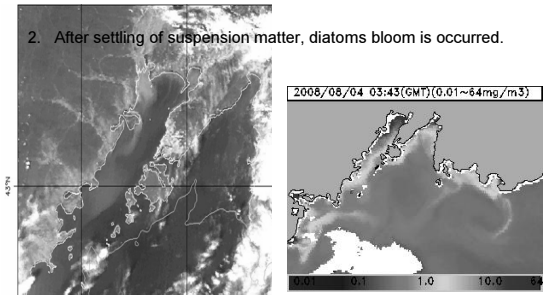
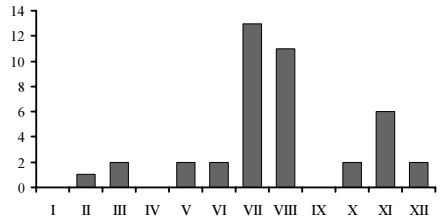


Fig. 19. Ocean color satellite images from MODIS showing high content of suspended material from Razdolnaya River (a) and then high Chl-a concentration (b) in the Amursky Bay in Summer period

Monthly trends of HAB events

During the 17 years between 1991 and 2007, a total 41 bloom events were recorded, in which no any events induce damage or human poisoning.
HAB events occurred most frequently during July-August and October



Number of bloom events by month in Amurskii Bay (1991–2007)

Source: Center of Monitoring of HABs & Biotoxins of the Institute of Marine Biology FEB RAS
http://www.imb.dvo.ru/misc/toxicalgae/index.htm **(Tatiana ORLOVA, IMB, FEB RUS)**

3. Due to short time changes, **zooplankton and fishes are excluded from food chain**, therefore diatoms died and settled on the bottom.

4. Due to heating of surface waters in summertime the strong stratification of water column does not vertical mix waters.

5. Decay of diatoms is going under deficit light conditions for most of the Amursky Bay area because turbidity of waters. Then hypoxia near-bottom waters is occurred due to oxygen consumption by microbiological activity and nutrients are released .

After hypoxia event in summertime, Amursky Bay recoveries due to following physical processes:

1. There are any more no eutrophication hits on the surface water of Amursky Bay because water discharge of Razdolnaya River declines after summertime.

2. Water exchange between open the Sea and Peter the Great Bay is intensified at Autumn and Winter seasons due to upwelling/downwelling processes.

3. Cooling of surface water at Autumn and Winter seasons causes vertical convection and additional vertical mixing.

There are biological processes which help to ecosystem recreation of Amursky Bay.
Most important of these are:

1. Microbiological DENITRIFICATION and ANAMMOX:

DENITRIFICATION:

$$(CH_2O)_{106}(NH_3)_{16}H_3PO_4 + 84.8NO_3^- + 99.8H^+ \rightarrow 106CO_2 + 148.4H_2O + 16NH_4^+ + 42.4N_2 + H_2PO_4^- \quad (1)$$

ANAMMOX:

$$NH_4^+ + NO_2^- \rightarrow N_2 + 2H_2O \quad (2)$$

Both processes decrease eutrophication of the Amursky Bay by ammonium and nitrate ions.

2. High biological productivity of Amursky Bay in winter season which utilizes nutrients due to primary production with **including of zooplankton and fishes into food chain** and suppressing of microbiological activity.

VI. Conclusion and recommendations

Conclusions

1. Distributions of assessment parameters and satellite images of chlorophyll suggest:

a. Northwestern part of Peter the Great Bay (Sub-area I, Amursky Bay) has current eutrophication status as "**High**" and "**Increase**";

b. Most part of sub-area II can be considered as oligotrophic basin excepting Bosfor-Vostochny Strait and estuarine part of Ussuriisky Bay;

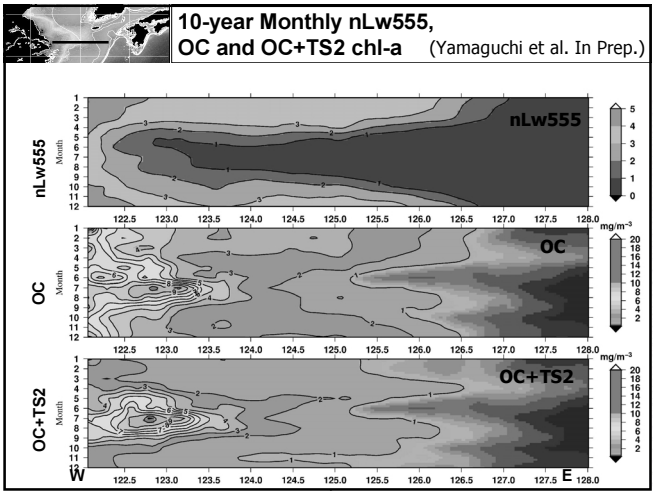
c. At present time, most part of sub-area **III** is oligotrophic basin because it active exchanges with open Sea by water masses.

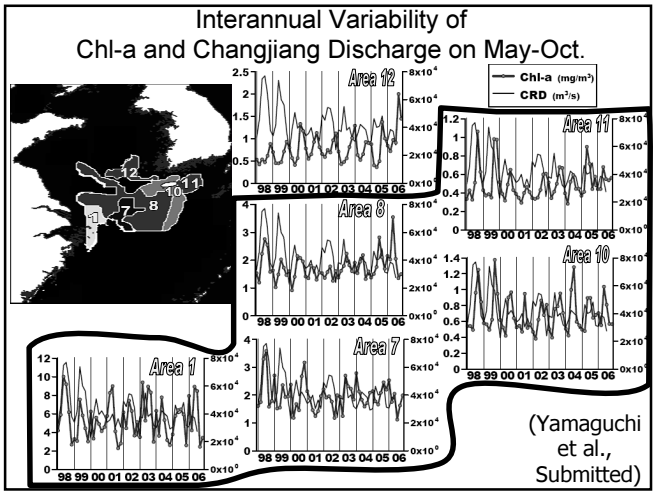
2. Due to poor studying of seasonal and spatial variations of assessment parameters for sub-areas II and III of Peter the Great Bay we cannot recognize any trend in eutrophication status in these sub-areas.

Recommendations

1. To provide monitoring assessment parameters in sites where hypoxia was observed.

2. To provide monitoring assessment parameters estuarine parts of sub-areas II and III because they are terra incognito at present time.





Preliminary Eutrophication Assessment by Remote Sensing

- How do we reflect the result of preliminary eutrophication assessment to the integrated report? – Compare to the in situ assessment and identify the advantage and disadvantage.
- Is the preliminary assessment in each selected areas necessary? – Yes. If it is possible.
- Who will conduct validation of satellite Chl-a data in each selected areas? – CEARAC can help if necessary
- Is Chl-a reasonable parameter in turbid water?
- Cause of trend?

Development of the new marine environmental assessment method focusing on marine biodiversity

Pilot Study in the Toyama Bay

NOWPAP CEARAC

14 September, 2010
The expert meeting on assessment of eutrophication and marine biodiversity

Schedule for development of the assessment method focusing on marine biodiversity

~ March 2011
Pilot Study
Development of the draft methodology for the NOWPAP Region

April 2011~
Review by biodiversity experts and CEARAC FPs

December 2011
Development of the coastal environmental assessment method

2011-2012
Case Study in each member state

Points of Discussion at the Expert Meeting

Pilot study is an experimental approach, and each member state does not have to follow step-by-step procedures when implementing the case study.

This method is to assess coastal environment, not to assess the biodiversity itself.

Points of discussion:
- Existing data and information for possible indicators in each member state
- Potential sea areas for case study implemented in the next biennium
- Assessment criteria

Contents of Pilot Study in Toyama Bay

1. Collecting various information on marine environment
2. Assessment of the current situation of Toyama Bay

3. Designing the desirable future vision of Toyama Bay
   - Survey with questionnaire
   - Interview
   - Council of advisers for designing the desirable future vision of Toyama Bay

4. Assessment of Toyama Bay
5. Discussion on assessment methodology
6. Development of the draft assessment method for the NOWPAP region

Methodology of the assessment in the Toyama Bay Pilot Study

Impact assessment on the influence from land
Achievement assessment on the desirable future vision
→ Comprehensive assessment

	Category I	Category II - III
Assessment of each Indicator	Impact Assessment of each indicator Indicator A: Impact strong Indicator B: Impact moderate Indicator C: impact week	Achievement assessment of each indicator by comparing current status to future vision (target value)
Assessment of each Category	Integrated impact assessment	Integrated achievement assessment
	Comprehensive assessment based on the results of impact assessment and achievement assessment	

Categories and Indicators in Toyama Pilot Study

Category	Indicators
Category I (Background Information)	Population in Toyama Installation rate of sewage system Livestock industry in Toyama Situation of land use Situation of rivers and dams Situation of use of fertilizer
Category II (Information of marine environment)	Change of coast line (Rate of natural coast) Seaweed bed Condition of sea bed Eutrophication Marine pollution by harmful substances Overfishing Invasive species (transfer by ships) Red tide
Category III (Information on species)	Phytoplankton Zooplankton Benthos Diversity of fish catch in Toyama Bay

Designing the desirable future vision of Toyama Bay

The results of questionnaire, interview and council of advisers

How to design the future vision? (target value)

1. Collecting various information on marine environment
2. Assessment of the current situation of Toyama Bay
3. Designing the desirable future vision of Toyama Bay
   - Survey with questionnaire
   - Interview
   - Council of advisers for designing the desirable future vision of Toyama Bay
4. Assessment of Toyama Bay
5. Discussion on assessment methodology
6. Development of the draft assessment method for the NOWPAP region

Outline of Questionnaire

The number of questionees is 230.
They are fishermen, fishery-associated government officers, researchers and general public.

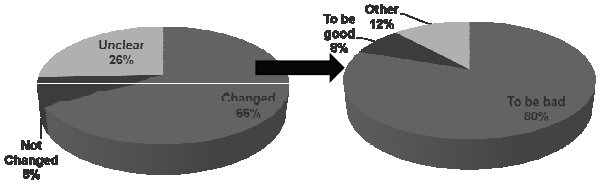
Question;
- Profession of questionees
- Did the environment of Toyama Bay change or not?
- What changed?
- What is the cause?
- What do think of the current situation of Toyama Bay?
- What is your desirable future vision of Toyama Bay?

Results of Questionnaire

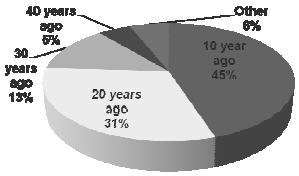
Did the environment of Toyama Bay change or not?

66.5% of questionees think the environment of Toyama Bay changed

80% of questionees who answered "the environment changed" think the change is in a worse way



Continued (When and What changed?)



When did the marine environment in Toyama Bay change?

What Changed?

Living things around coastlines
The number and kinds of living things
The areas of landfill
The situations of shore protection
The situations of sea bed
The areas of seaweed bed
Marine Environment (water temp. etc.)

Reason why the environment of Toyama Bay changed:

- **Climate change**
- **Increase of landfill**
- **Increase of dams**

Continued (Future vision)

- **Natural sand beaches**
  Most of the coast lines in Toyama Bay is protected by cement and placed wave-dissipating blocks
- **Clean water**
  Water quality in the coastal areas of Toyama Bay is in bad condition
- **Wide seaweed bed areas**
  The areas of seaweed bed in Toyama Bay is decreasing
- **Diversity of marine species**
  To keep the current rich fishery resources in Toyama Bay

Questions of interviews

Question 1: What changed in Toyama Bay?

Question 2: What kinds of species decreased or increased?

Question 3: What environmental factors influence the change of marine biodiversity and biomass?

Question 4: What measures do you apply for conservation of marine biodiversity?

Question 5: What is the desirable vision of Toyama Bay?

Results of interview (Q1)

What changed in Toyama Bay?

- **Decrease of shallow sea areas because of the shore protection**
- **The environment of coastal area**
  Decrease of the natural buffer zones of waves
- **Disappearing of sand beaches, and destruction of habitat for goby, shellfish etc.**
- **Decrease of the supply of sand and iron sand from land**


Results of interview (Q2)

What kinds of species decreased or increased?

- Increase of fishes which occur in warm water
- Increase of fish catches of tuna
- Increase of fish catches of Japanese Spanish Mackerel
- Decrease of *sargassum horneri*, *sargassum fulvellum* and brown seaweed
- Decrease of swimming crab and Japanese tiger prawn


Results of interview (Q3)

What environmental factors influence the change of marine biodiversity and biomass?

- **Dams and mountain forests - They relate to supply of water, nutrient and sand**
- **The environment of East China Sea - Spawning grounds for most of the fish caught in Toyama Bay is East China Sea**
- **Sewage systems and agricultural waterway – Concentration of direct discharge in one point and chlorine treatment**
- **Ecosystem**

Results of interview (Q4)

What measures do you apply for conservation of marine biodiversity?

- **Settlement of the base made from oystershells for increasing seaweed beds**
- **Using artificial fish reefs made from recycled wood**
- **The need of conservation of ecosystem**

Results of interview (Q5)

What is the desirable vision of Toyama Bay?

- **To make the ecosystem which has the natural material circle**
- **To control the waste water discharge**
- **To think the marine environment of Toyama Bay based on the security of human life**
- **To maintain the current environment**

Results of Council of advisers

Participants: Researcher, fishermen, NGO, general public (surfers, anglers and divers)

Summary:

- **To maintain the environment in offshore areas**
- **To improve the environment in coastal areas**
- **To apply bank protection work with mitigation approaches**
- **To apply sewerage disposal**
- **To maintain the current fishing style**
- **To develop a system for general public to understand and participate in marine conservation**
- **To enhance public awareness**
- **To have a broader perspective including outer sea areas, whole of NOWPAP region**
- **To increase interest in ocean by general public**

Current situation of Toyama Bay

1. Collecting various information on marine environment
2.Assessment of the current situation of Toyama Bay

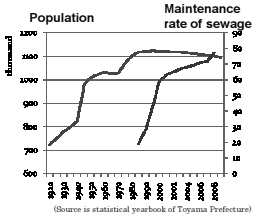
3. Designing the desirable future vision of Toyama Bay
- Survey with questionnaire
- Interview
- Council of advisers for designing the desirable future vision of Toyama Bay

4. Assessment of Toyama Bay
5. Discussion on assessment methodology
6. Development of the draft assessment method for the NOWPAP region

Situation in terrestrial area 1 Category I

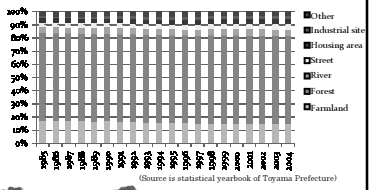
Population

Maintenance rate of sewage



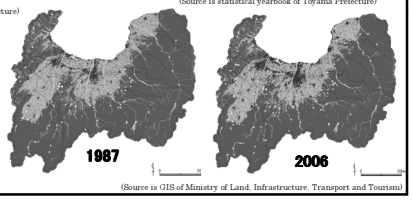
(Source is statistical yearbook of Toyama Prefecture)

Situation of land use



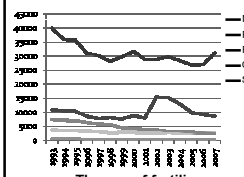
(Source is statistical yearbook of Toyama Prefecture)

Impact to Toyama Bay is smaller than other sea area such as Toky Bay (area of Bay: 380km^2, population in river basin: 29,000 million)



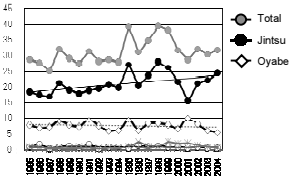
(Source is GIS of Ministry of Land, Infrastructure, Transport and Tourism)

Situation in terrestrial area 2

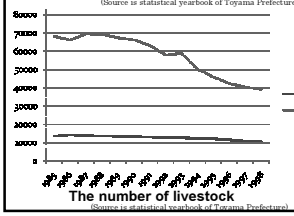


The use of fertilizer

(Source is statistical yearbook of Toyama Prefecture)

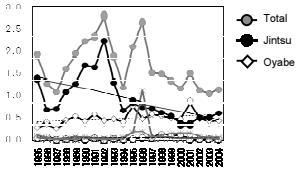


River input of Nitrogen



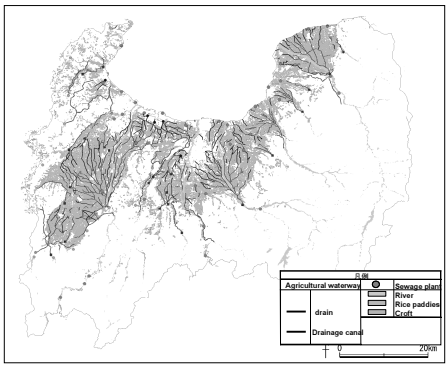
The number of livestock

(Source is statistical yearbook of Toyama Prefecture)



River input of Phosphate

Situation in terrestrial area 3



Agricultural waterway

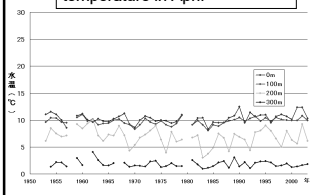
(Source is Ministry of Agriculture, Forestry and Fisheries)

The current situation in Category I

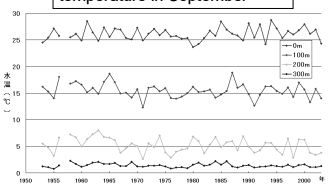
Population in Toyama: small
Maintenance rate of sewage: moderate
Livestock industry in Toyama: small
Situation of land use: small
Situation of rivers and dams: moderate
Situation of use of fertilizer: moderate

Situation in sea area 1 Category II

The annual change of water temperature in April



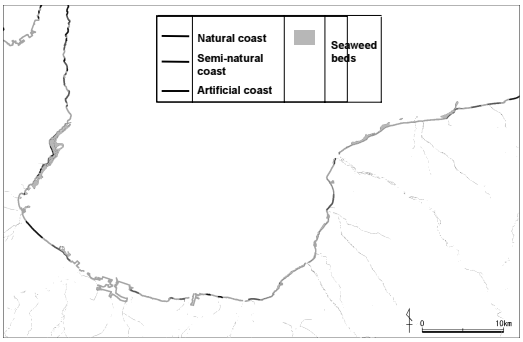
The annual change of water temperature in September



(Source is Fishery Research Institute of Toyama Prefecture)

Situation in sea area 2
Category II

Distribution of seaweed beds and natural coast

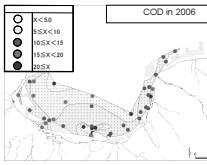


(Source is National Survey on the Natural Environment by Ministry of Environment)

Situation in sea area 3
Category II

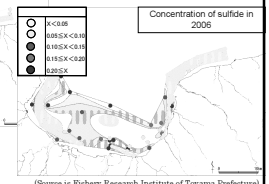
Eutrophication

COD in 2006



Bottom sediment

Concentration of sulfide in 2006

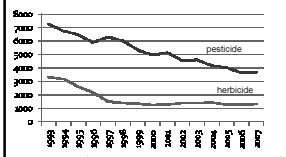


(Source is Fishery Research Institute of Toyama Prefecture)

Subarea	Assessment result	comments
A	LI	Increasing trend in discharge of total nitrate from Kurobe River. Total nitrate in the bay is under the standard level.
B	HI	Increasing trend in discharge of total nitrate from Jinzu River. Nitrate in winter season is high level.
C	HN	High nitrate in winter and no trend
D	LI	Increasing trend of total nitrate and phosphate
E	LI	Increasing of chlorophyll-a

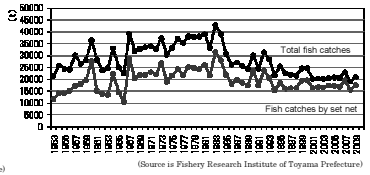
Situation in sea area 4
Category II

The use of pesticide and herbicide



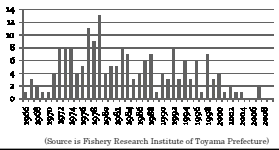
(Source is statistical yearbook of Toyama Prefecture)

Fish catches in Toyama Bay



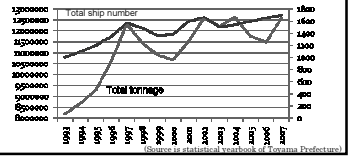
(Source is Fishery Research Institute of Toyama Prefecture)

Number of Red Tide Occurrence



(Source is Fishery Research Institute of Toyama Prefecture)

Situation of foreign vessels



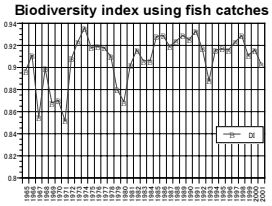
(Source is statistical yearbook of Toyama Prefecture)

The current situation
in Category II

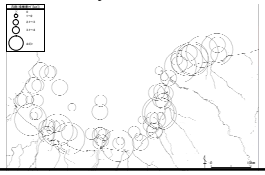
- Coast line: Needs improvement
- Seaweed beds: Needs improvement
- Condition of sea beds: Needs improvement
- Eutrophication: Needs improvement
- Marine pollution by harmful substances: Maintain the current situation
- Overfishing: Maintain the current situation
- Invasive species transferred by foreign ships: Needs more research
- Red tide: Maintain the current situation

Situation of biodiversity 1
Category III

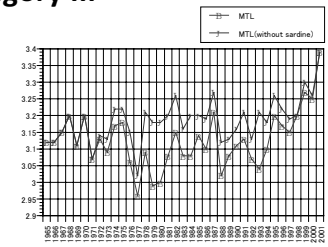
Biodiversity index using fish catches



Biodiversity index of benthos



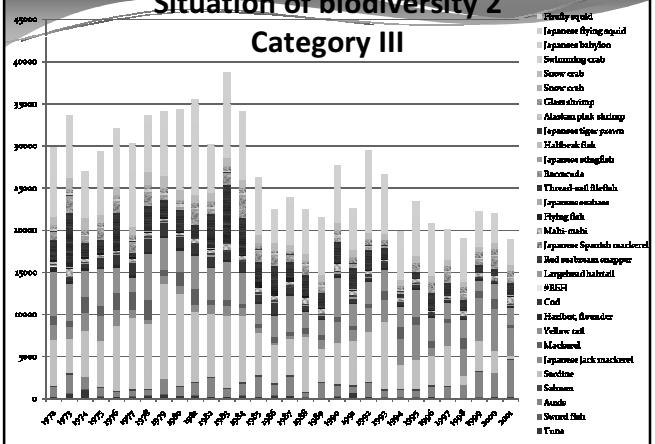
(Source is Fishery Research Institute of Toyama Prefecture)



Marine Trophic Level using fish catches

(Source is statistical yearbook of Toyama Prefecture)

Situation of biodiversity 2
Category III



Fish Catches in Toyama Bay

(Source is statistical yearbook of Toyama Prefecture)

The current situation in Category III

- Phytoplankton: Needs more data and information
- Zooplankton: Needs more data and information
- Benthos: Maintain the current situation
- Fish: Maintain the current situation

Comprehensive assessment

Influence to marine environment from land is small in Toyama Bay.
However, there are some elements which change the situation of the environment. So continued attention to the environment and improvement of the situation is necessary.

About environment in Toyama Bay, eutrophication and high concentration of sulfide are observed in some areas. So their influences to habitat is concerned.

Not visualized in Toyama Bay yet, but change of fishery resources, invasive species by ship transportation and climate change are important issues to keep our eyes on.

Achievement assessment on desirable future vision and development draft methodology for the NOWPAP region