Use of Korean HAB data for the joint ICES/PICES HAE-DAT database

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I. Introduction

II. Briefs – HABs monitoring system

III. HABs & nutrients data collection

IV. Data compilation & analysis

V. HABs in 1988 in Korea

VI. Recommendations
Introduction of Korean HABs Monitoring system
## Major HABs Monitoring Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Area</th>
<th>Frequency</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Tide</td>
<td>South, Eastern coast</td>
<td>daily, weekly, monthly</td>
<td>phytoplankton</td>
</tr>
<tr>
<td>Shellfish poisoning</td>
<td>South, Eastern coast</td>
<td>weekly, monthly</td>
<td>PSP, DSP, ASP</td>
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<tr>
<td>Environment quality</td>
<td>All coast</td>
<td>Seasonal</td>
<td>Biotic and abiotic factors</td>
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<tr>
<td>Ocean dynamics</td>
<td>Korean waters</td>
<td>bimonthly</td>
<td>Physical, chemical and biological</td>
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</table>
## Korean HABs Monitoring System

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<tr>
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<tbody>
<tr>
<td>Facilities</td>
<td>Ship cruise</td>
<td>Ship cruise</td>
<td>Ship cruise</td>
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<td></td>
<td>Coast patrol</td>
<td>Coast patrol</td>
<td>Coast patrol</td>
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<td></td>
<td></td>
<td>Remote sense</td>
<td>Aircrafts</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Remote sense</td>
</tr>
<tr>
<td>Surveillance</td>
<td>Partial area</td>
<td>Widespread in South Sea</td>
<td>Widespread overall coast</td>
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<tr>
<td>area</td>
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<tr>
<td>Surveillance</td>
<td>Monthly</td>
<td>Biweekly/monthly</td>
<td>Daily, weekly, monthly</td>
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<td>terms</td>
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</tbody>
</table>
The Monitoring of Marine Environment and HABs

Oceanographic observation 300 points
Environmental observation 300 points
HABs observation (●) 160 points
Present Korean HABs Monitoring System
- Focused on Cochlodinium blooms

- **Precautionary Monitoring**: Less than 300 cells/ml
  - 5 susceptible areas to initiate the bloom
  - To begin in June till the first bloom at the density of more than 300 cells/ml

- **Regular Monitoring** (over 300 cells/ml)
  - Regular Cruise: weekly, biweekly at 70 stations from Mar. to Nov.
  - Emergent Cruise: daily observation in Cochlodinium blooms area

www.nfrdi.re.kr
Procedures of HABs data production
HABs & nutrients data collection

Harmful phytoplankton taxonomy
Shellfish poisoning data
Nutrients
Use of Korean HAB data for the joint ICES/PICES HAE-DAT database
List of phytoplankton identified

1. Sampling date, place, volume, and depth
2. Project title, name of research vessel
3. Methods of enumeration, counting plate,
4. concentration ratio, counting volume
Target Area for the Monitoring of Shellfish Toxin in Korea
## Current Shellfish Toxin Monitoring Portfolio in Korea

<table>
<thead>
<tr>
<th></th>
<th>Prevailing season</th>
<th>Occurring area</th>
<th>Starting year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PSP</strong></td>
<td>From March to May</td>
<td>South coast (Jinhea Bay and adjacent area)</td>
<td>Since 1980</td>
</tr>
<tr>
<td><strong>DSP</strong></td>
<td>Sporadic</td>
<td>Not specified</td>
<td>Since 1995</td>
</tr>
<tr>
<td><strong>ASP</strong></td>
<td>Sporadic</td>
<td>Not specified</td>
<td>Since 1995</td>
</tr>
</tbody>
</table>
Number of Sampling Station and Monitoring Frequency

- **Number of sampling station**
  - PSP : 55 stations
  - DSP : 15 stations
  - ASP : 40 stations

- **Frequency of shellfish toxin**
  - Once a month : All the year round
  - Every week : Toxic season (Usually Mar. to May)

- **Monitoring target shellfish species**
  - Blue mussel (*Mytilus edulis*), oyster (*Crassostrea gigas*), ark-shell (*Scapharca broughtonii*), short necked clam (*Ruditapes philippinarum*) and etc.
Detection Methods for Shellfish Toxins

- Paralytic shellfish poisoning (PSP)
  - Mouse bioassay
- Diarrhetic shellfish poisoning (DSP)
  - Mouse bioassay and HPLC
- Amnesic shellfish poisoning (ASP)
  - HPLC
Environmental Monitoring to Assess Eutrophic Level

- Offshore: 40, coastal area: 256
Sampling period: Seasonal survey
- Offshore: Summer

Result service: Website and reports
Scientific committee: Annual meeting

Eutrophic level by COD (2002)
## Monitor components for Korean marine environment

<table>
<thead>
<tr>
<th>Monitoring requirement</th>
<th>Required monitoring components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEAWATER</strong> (21 factors)</td>
<td></td>
</tr>
<tr>
<td>General items</td>
<td>SST, Salinity, pH, DO, COD, TN, TP, NO2 - N, NO3 - N, NH4 - N, PO4 - P, SS, Oil &amp; Grease, Clearness</td>
</tr>
<tr>
<td>Trace metal</td>
<td>Cu, Pb, Zn, Cd, Cr⁺⁶, total Hg, As, CN</td>
</tr>
<tr>
<td>Organic contaminants</td>
<td>PCBs, TBT</td>
</tr>
<tr>
<td><strong>SEDIMENT</strong> (12 factors)</td>
<td></td>
</tr>
<tr>
<td>General items</td>
<td>Particle size, IL, AVS, COD</td>
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<tr>
<td>Trace metal</td>
<td>Cu, Pb, Zn, Cd, Cr⁺⁶, total Hg, As, CN</td>
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<tr>
<td>Organic contaminants</td>
<td>PCBs, TBT, Pesticides, PAHs, PCDDs/DFs</td>
</tr>
<tr>
<td><strong>ORGANISM</strong> (15 factors)</td>
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<tr>
<td>General items</td>
<td>Chl a</td>
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<tr>
<td>Trace metal</td>
<td>Cu, Pb, Zn, Cd, Cr⁺⁶, total Hg, As, CN</td>
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<tr>
<td>Organic contaminants</td>
<td>PCBs, TBT, Pesticides, PAHs, PCDDs/DFs</td>
</tr>
</tbody>
</table>
Eutrophic level COD in Aug. 2001
Compilation of oceanographic and meteorological data and information

Remote sensing data
Aerial observation
Water movement and currents
Meteorological information
Marine Remote Sensing System (NFRDI, KOREA)

Fig. Marine remote sensing system of NFRDI, Korea
Real-time Satellite Oceanographic Information

NOAA Sea Surface Temperature

OCM Chl. a concentration
적조 항공감시 (’98. 9월)
Red tide monitoring using aircraft.
South coast of Korea, Sept. 1998

김시를 끝내고 귀환 (’98. 9월)
Return office after aerial monitoring.
Suyong heliport, Sept. 1998
1995년도 적조

*Cochlodinium polykrikoides blooms*
Drifting Buoys’ Movement

estimate the direction and elapsed dates of the HABs movement

Fig. Drifting buoy trajectories in Korean Waters.
Use of Korean HAB data for the joint ICES/PICES HAE-DAT database
Use of Korean HAB data for the joint ICES/PICES HAE-DAT database
HABs data analysis and dissemination to all stakeholders

Forecasting
Service by paper documents & on-line
적조상황실
HABs Monitoring & Prediction System

All available data/information

Considering the various factors

Movement & Expansion factors

Density variation factors

Analysis

Prediction & Forecasting

Fisher
Other user Communities
ARS
Internet Services
Any Fax.
Mass media

HABs situation

Real-time oceanographic information

Drifting Buoys

Model application

Tidal Currents

Wind data

Sunshine, Air temp.

Vessel Watch

Helicopter

Remote Sensing

Fisherman Notice
## Real time HABs Service

<table>
<thead>
<tr>
<th>Services</th>
<th>Available channels</th>
<th>Destinations</th>
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</thead>
<tbody>
<tr>
<td>Easy Fax.</td>
<td>TV, Radio, Newspaper</td>
<td>Aquaculturists, fisherman, administratives, fish consumers, journalists, fisheries shareholders</td>
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<tr>
<td>ARS</td>
<td>12 lines since 6 May 1996</td>
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<td>Internet access</td>
<td><a href="http://www.nfrdi.re.kr">http://www.nfrdi.re.kr</a></td>
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</table>
Use of Korean HAB data for the joint ICES/PICES HAE-DAT database
Fig. Home page of Korea Oceanographic Data Center (KODC)
Korean HABs in 1998 & recent trends
Annual distribution in the periods of HABs in Korean coastal waters since 1978.

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<thead>
<tr>
<th>Year</th>
<th>30</th>
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: Cochlodinium
Annual Changes of the Area Affected by the *C. polykrikoides* Blooms in Korean Waters.
Fig. Year to year variations of the movement of HABs. Red circles and numbers denote the first outbreak area and the elapsed dates respectively.
# Two decadal progress of *Cochlodinium* blooms in Korean Waters

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Spatial distribution</td>
<td>Partial area Jinhae Bay</td>
<td>South Sea to Kijang in East Sea</td>
<td>Widespread overall coast</td>
</tr>
<tr>
<td>Highest density (cell/ml)</td>
<td>Less than 8,700</td>
<td>Less than 25,000</td>
<td>Up to 48,000</td>
</tr>
<tr>
<td>Persistency</td>
<td>10 days</td>
<td>20 days</td>
<td>Up to 62 days</td>
</tr>
</tbody>
</table>
The characteristics of 1998 *Cochlodinium* blooms in Korean waters

◆ Typical scale in spatial
  - Good example
  - magnitude, density, and persistency

  • Periods: 25 Aug. – 22. Sep. (34 days)
  • High density: 20,000 cells/ml
  • Spatial distribution: South Sea
1 - GENERAL INFORMATION

Please note: NOT all information requested on this form is required. Some respondents may choose to stop at the end of the first page, but others may wish to add detailed bloom information, as requested on page 2. Any information you provide is of value.

Indicate the nature of the reported harmful event:

<table>
<thead>
<tr>
<th>Water discoloration</th>
<th>Mass mortalities</th>
<th>Has this event occurred before in this location?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Yes  No If yes, comments:</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Associated syndrome</th>
<th>Unexplained toxicity</th>
<th>Has any toxicity been detected?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSP DSP ASP AZP NSP CFP Other:</td>
<td>Yes  No If yes, comments:</td>
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</table>

If intoxications occurred, please indicate the species implicated in the transmission of toxins (Transvector):

Additional comments:

Is this report the outcome of a monitoring programme? Yes  No

If yes, which programme(s)?

Has this event occurred before in this location? Yes  No If yes, comments:

Individual(s) to contact (name, address, e-mail, web page, etc.):

2 - LOCATION AND DATE

<table>
<thead>
<tr>
<th>Location (if a single site)</th>
<th>Latitude: ° N ° S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longitude: ° E ° W</td>
</tr>
</tbody>
</table>
PICES HAE-DAT

- General information
  - nature, toxin/toxicity, monitoring/history, contact point
- Locations and date
  - Location, date, quarantine level
- Microalgae
  - Species identification, co-occurring species, Chlorophyll
- Environmental conditions
  - Weather, physical parameters, current, nutrients, max. °C
- Toxin assay information
  - Target species, detection methods, economic loss, measures taken
<table>
<thead>
<tr>
<th>Items</th>
<th>Red tides</th>
<th>Shellfish poisoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Locations and date</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Microalgae</td>
<td>Dominant species, Surface chlorophyll</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>Monitor weekly, daily</td>
<td>Temperature</td>
</tr>
<tr>
<td>Toxin assay information</td>
<td>Economic loss</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Make monitoring and research effective, predictive and mitigative

Benefit from building common data resources among PICES nations

Central tasks are:
- ascertain the data base process
- identify the difficulties in delivery
- assess web-based window
- further modification to encompass Pacific
Recommendations

- It needs to segment the NOWPAP area
- It needs specified format for red tide and PSP events.
- Data format can cover successional changes of the blooms
- It needs to cover multi-lingual HABs data
- Should develop to cover both delayed and real-time mode
HAE-DAT 해역구분

유해적조 발생해역도

Zone-1

Zone-2

Zone-3
Data exchange, communication network, and databank

Production
Analysis
Compilation

QA/QC
-reliable
-compatible

NODC
PICES(HAE-DAT)
Let PICES HAE-DAT Network Work soon.
Thank you

Nong-ak: farmer's dance
If we harm the environment, it will harm us in return.
Let Asian HABs Monitoring Network Work soon.