Testing the ICES Harmful Algal Event Meta-database to Archive Data from the West Coast of Canada

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Goal:

• To develop a common harmful algal bloom (HAB) data resource among PICES nations

Approach:

• Test utility of report forms designed for the ICES Harmful Algal Event meta-database for data of the west coast of Canada.
Outline

• Description of West coast of Canada data base
• Harmful Algal Event (HAE) report entry
• Problems/difficulties encountered
  – What is an event?
  – How to divide the BC coastline into areas?
  – Others
Sources of data on West Coast of Canada

• Plankton monitoring program at fish farm sites
  – Focus on HAB species likely to kill salmon
  – It has been discontinued (1999 - 2003)
  – Data has been entered in ICES-HAE database

• Shellfish biotoxin monitoring
  – There are 15 years of data (1989 to present)
  – We entered data from 2003 for the west coast of Canada.
Monitoring of Marine toxins in shellfish – West Coast of Canada

- It is carried out by the Canadian Food Inspection Agency
- ~600 sites are monitored along the BC coast. Data are not GIS referenced, rather shellfish toxin data are recorded for a region, not for a specific site
- Mussels are the sentinel species for monitoring
- Monitoring includes: PSP, ASP, and recently DSP monitoring on a limited basis
- Stable, well-documented methodologies
- Data is available upon request and digitized
Shellfish Monitoring Sites

- Heavily concentrated in southern B.C.
  - Easier to get to
  - Where most of the people and industry are
Sampling Frequency

- Samples are withdrawn from 70 sentinel sites south of Cape Caution
  - every 2 weeks from Nov- April 30
  - weekly from May 1-end of Oct.

- Samples of other species and other locations are taken when required.
Limitations

- Monitoring sites are not evenly distributed but mainly concentrated in southern B.C.
- Monitoring is not even among locations
- Database is on marine toxins in shellfish only
- At present, there is no monitoring program of phytoplankton and environmental parameters
Harmful algal Event (HAE) Report Entry

• We entered data from 2003 because it is the most recent complete year.

• What is an event?
  – We used the definition of harmful events as “biotoxin accumulation in seafood above levels considered safe for human consumption”
Regulatory Limits

• The regulatory action limit for PSP is 80 micrograms per 100 grams of the edible portion.
• For ASP it is 20 ppm.
• If these levels are exceeded, the area is closed for harvesting. The area may be reopened when 3 consecutive tests in at least 14 days are below the regulatory value.

… Of course any detectable toxin indicates a bloom, either happening or in the past.
There were a total of 3204 records of shellfish monitoring at 178 sites in BC in 2003.
There were 2398 records of ASP monitoring.

Of these, 31 ASP records were >0, and none were above the regulatory limits.
PSP records

- There were 3204 records of PSP monitoring
- 671 PSP records were >0 µg/100 gm
- Of those records, 148 records were over the regulatory limit.
- Area 14 (Baynes Sound, south of Courtenay) is historically low in PSP events.
HAE Report

• Part 1: General information
  – Only seafood toxin monitored
  – Shellfish only
  – We entered all records over the regulatory limit: 126 events of PSP and no event of ASP for the year 2003
Section 1. General Information

Constant entries are:

- Country: Canada
- Region: West coast
- Year: 2003
- Seafood toxin, affecting shellfish, no unexplained toxicity, reported as an outcome of the CFIA monitoring programme, and contact information
Section 1. General Information

Variable entries are:

- Range of toxicity (ug/100 gm meat)
- Associated syndrome
Section 1. General Information

Problem encountered:

Has this event occurred before in this location?

- We are only reporting one year’s data, so could not comment on annual trends.
Section 2. Location and Date

Location:

• The BC Coast, including its many islands and inlets, has 27,000 km of coastline. If the coastline were divided into 100 - 200 km sections, there would be 270 - 135 areas.

• The shellfish monitoring database is already divided into 48 areas and further divided into 650 subareas used for fisheries management.

• We decided to use those areas with some minor modifications since it was impractical to divide the BC coast into 100-200 km sections.

• Thus, the West coast was divided into 28 areas
HAE areas - West of Canada

Adaptation of DFO Fisheries management area locations

- The offshore areas were eliminated (19)
- The northern Queen Charlotte island areas were divided into nine areas (rather than 2 areas and 107 subareas)
- Some areas in the south coast were grouped together (23 areas rather than 29)
Section 2: Location and Date

- Names of area taken from DFO Fisheries management areas
- Latitude and longitude in decimal format of the area reported in the database, negative values are west.
- HAE Area code: our HAB area codes were used.

<table>
<thead>
<tr>
<th>Location and Date</th>
<th>Latitude:</th>
<th>52.309° N</th>
<th>9° S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longitude:</td>
<td>-128.024° W</td>
<td></td>
</tr>
<tr>
<td>General location information</td>
<td>Name of the area:</td>
<td>Prince Island, Hunter Island</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Region:</td>
<td>British Columbia</td>
<td></td>
</tr>
<tr>
<td>Additional location information</td>
<td>HAE Area code:</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Date of detection of quarantine levels (dd/mm/yy)</td>
<td>Detection date:</td>
<td>17/10/2003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date:</td>
<td>17/10/2003</td>
<td></td>
</tr>
<tr>
<td>Additional information (i.e., start and end date of the bloom):</td>
<td>same location had levels above the regulatory action limit during the time period of 17/10/2003 - 22/10/2004</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 2. Location and Date

Date:
- Date of detection = date of the record.
- Final date was more difficult to determine. We decided to make a note in the additional information section when high levels had been detected in the area within ~4 weeks.

<table>
<thead>
<tr>
<th>Location (if a single site)</th>
<th>Latitude:</th>
<th>52.309° N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longitude:</td>
<td>-128.024° W</td>
</tr>
</tbody>
</table>

General location information:
- Name of the area: Prince Island, Hunter Island
- Region: British Columbia
- HAE Area code: 7

Additional location information (i.e., length of covered shoreline or aerial coverage of bloom, ecosystem type, etc.):

Date of detection of quarantine levels (dd/mm/yy):
- Detection date: 17/10/2003
- Final date: 17/10/2003

Additional information (i.e., start and end date of the bloom):
- same location had levels above the regulatory action limit during the time period of 17/10/2003 - 22/10/2004
HAE Report

• Section 3: Microalgae
  – No information available

• Section 4: Environmental conditions
  – No information available
Section 5: Toxin assay information

- The species of shellfish, type of toxin, concentration, and type of assay entries were straightforward.

<table>
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<tr>
<th>Species containing the toxin</th>
<th>Toxin type</th>
<th>Toxin details</th>
<th>Max. Concentration (specify units)</th>
<th>Assay type</th>
<th>Use of a kit (if yes, what type of kit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FZ SEA MUSSELS</td>
<td>PSP</td>
<td>saxitoxins</td>
<td>350 ug/100gm meat</td>
<td>mouse bioassay</td>
<td>Yes  ❌ No</td>
</tr>
</tbody>
</table>

**ADDITIONAL INFORMATION** (e.g. positive animal assay, chemical details, analytical methods, etc.): AOAC Official Method mouse bioassay

**ECONOMIC LOSSES** (production value, direct loss, indirect loss...):

**MANAGEMENT DECISION:** PSP >80 ug/100 gm meat always results in closure

**ADDITIONAL HARMFUL EFFECT INFORMATION:**
**Section 5: Toxin assay information**

- Additional Information section: we refer to the AOAC protocol  
- Economic losses cannot be assessed from the database information  
- Management Decision section: levels reported are always above regulatory limit

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### 5 - TOXIN ASSAY INFORMATION

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**MANAGEMENT DECISION: PSP >80 ug/100 gm meat always results in closure**

**ADDITIONAL HARMFUL EFFECT INFORMATION:**
Summary

• We filled an HAE form for all records over the regulatory limit for 2003: 126 events of PSP and no event of ASP

• The main problems/uncertainties encountered were in determining:
  – What is an event?
  – Location: What is the best way to divide the BC coast?
  – Duration: How to determine how long an event lasted?
What is an event?

• By defining an “event” as those records above the regulatory limit, we did not include those records where toxin was detectable at lower levels.

• But..., any detectable toxin indicates a bloom, either happening or in the past.
Location: What is the best way to divide the BC coast?

• Because the west coast of Canada includes many islands and inlets, it was not practical to divide the coastline into 100 - 200 km sections.

• Instead, we defined 28 areas based on existing fisheries management areas in BC.

• These areas are used to report data from the shellfish monitoring program.
Duration: How to determine how long an event lasted?

- Where there were data from several sites in one area over the same time period, the data was sometimes very variable.
- It was difficult to determine how long an event lasted. We decided to make a note in the additional information section when high levels had been detected in the area within 4 weeks.
General concerns:

- The data available for the west coast of Canada have very limited usefulness for scientific purposes.
- It is not possible to put together the broad picture of the relationship between biological, physical and chemical factors that influence the development and spreading of blooms in this region.
- These data do not allow inter-comparison of HAB species composition and the magnitude of environmental and economic impacts with data from other PICES nations.
Sample Analysis

- Determination of PSP (saxitoxins) is by mouse bioassay using the standard AOAC method.
- Determination of ASP (domoic acid) is by HPLC.
Sample Analysis

- Mussels are the sentinel species for monitoring. They are hung in mesh bags in harvest areas; samples are withdrawn from 70 sentinel sites south of Cape Caution every 2 weeks from Nov-April 30, then weekly from May 1-end of October. Samples of other species and other locations are taken when required.
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