PICES/IOC Workshop on "Harmful algal blooms - Harmonization of data"

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Dr. Vera Trainer is the Program Manager of the Marine Biotoxin group at the Northwest Fisheries Science Center. Current research activities include refinement of analytical methods for both marine toxin and toxigenic species detection, assessment of environmental conditions that influence toxic bloom development, and understanding how shellfish cope with toxins in their environment. She is the co-principal investigator on a regional Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) research project that will study Pseudo-nitzschia blooms off the WA coast over the next 5 years. Vera is also the lead investigator of the Olympic Region Harmful Algal Bloom (ORHAB) project, a regional monitoring effort involving federal, state and local agencies, coastal tribes, and academic institutions. She received her B.S. in Biology from Indiana University of Pennsylvania, and both her M.S. in Biological Oceanography, and Ph.D. in Biochemistry and Molecular Biology at the University of Miami, with postgraduate studies in the pharmacology department at the University of Washington. Vera was a member of the PICES WG 15 on Ecology of harmful algal blooms (HABs) *and now co-chairs the new PICES Section on HABs.*

The understanding of the environmental factors contributing to harmful algal bloom (HAB) events is limited by our access to comparative data from similar coastlines worldwide. A free flow of information to all interested investigators is vital in planning experiments, analyzing relevant data and modeling HABs, and the eventual development of a predictive capability to forecast HAB events in Pacific coastal regions. Such future forecasting to protect coastal fisheries in all PICES member countries will not be possible without the knowledge of, and access to, the relevant biological, chemical and physical factors which have influence on bloom development. However, the historical data sets available for analysis of coastal HAB events are widely dispersed among the various agencies responsible for monitoring biotoxin events. These data exist in various degrees of processing, quality assurance, and public availability, and much of the available data (*e.g.* phytoplankton assemblage characteristics) are in forms that are difficult to use effectively. In order to address these problems facing PICES member nations, two PICES groups, the Working Group 15 on *Ecology of harmful algal blooms in the North Pacific* and Technical Committee on Data Exchange, together with the Intergovernmental Oceanographic Commission (IOC) of UNESCO, co-sponsored a 1.5-day workshop on HAB data harmonization in conjunction with the PICES Twelfth Annual Meeting in Seoul. The workshop was held October 10-11, 2003, and convened by Drs. Vera Trainer (NWFSC, U.S.A.) and Hee-Dong Jeong (NFRDI, Korea). A major goal of the workshop was to determine how national- and community-level data on harmful algal blooms and red tides could be shared among PICES member countries. The workshop was attended by more than 20 scientists from 7 countries.

At the workshop, Henrik Enevoldsen presented the IOC/ICES database for the North Atlantic, termed the Harmful Algae Events Database or HAE-DAT. The main purpose of creating HAE-DAT is to develop an international structure for data storage that allows easy integration of data, efficient search tools, and the possibility of conducting data analysis. This database does not share raw (primary) data and only includes harmful events that cause economic or agricultural loss and human illness. Problems that must be overcome in a harmful algae database comprise:

- Some events are very difficult to compile in a common database;
- Some data are not accessible to the public;
- Data types are sometimes not comparable; and
- Compilation of the database is very resource intensive.

HAE-DAT currently runs under the MS Access 97 programming routine (scheduled for replacement in the near future) and includes the general (location and date, microalgae type, environment and harmful effects) and complementary information about harmful algal blooms. HAE-DAT maps of HAB occurrences (see Fig. 1 as example) are not yet linked automatically to the database, although this is anticipated to occur over the next year. Decadal maps are prepared by IFREMER in France. The information plotted includes the presence of toxins or observations of mortalities (regardless of levels of toxicity). Blooms of potentially toxic species have been omitted. In the future, ICES delegates will divide their countries into HAE regions to overcome data sensitivity issues.

Our ambition is that HAE-DAT will eventually become a global database and will incorporate information on North America and Europe (including the Mediterranean Sea region), IOS ANCA (Caribbean), IOC FANCSA (South America), the North Africa network, and PICES, thereby establishing worldwide system for sharing biological data.

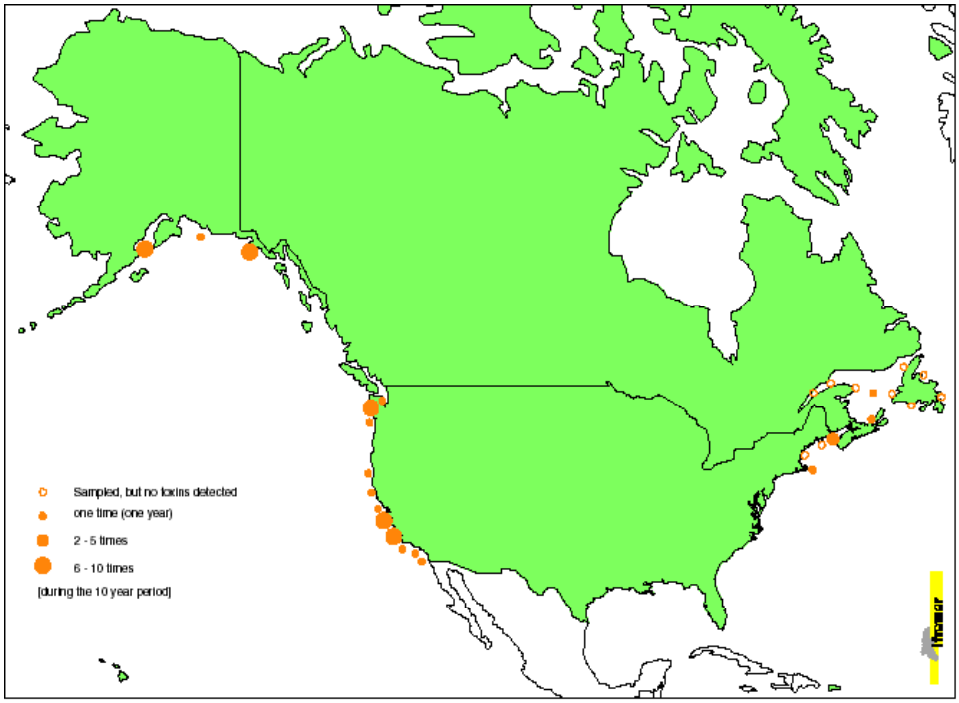

Fig. 1 An example of a HAE-DAT map showing ASP toxin occurrence in North America, in 1990-1999. This picture is available from the HAE-DAT website (http://ioc.unesco.org/hab/data33.htm). A goal of the HAB Section is to strive towards creating such maps and their corresponding relational data for all PICES member countries.

Information on HAB data collection and data management was presented by each PICES member country. The following problems with data sharing were identified during these presentations and following discussion:

- Data are collected by managers and are not always accessible to researchers;
- Different countries have different definitions of what constitutes a harmful algal bloom (*e.g.*, in China and Japan "red tides" are defined as those algal blooms that attain sufficient densities to discolor water, but do not necessarily produce a toxin, while in Canada and the United States these algal blooms are not normally considered harmful);
- Different toxins are monitored in different countries (*e.g.*, whereas both DSP and PSP toxins are routinely monitored in Japan, in Canada or the western United States shellfish are only monitored for PSP and ASP toxins);
- Data are not always GIS referenced, rather shellfish closures are recorded for a region, not for a specific site;
- Shellfish monitoring is intense in some areas of coastline and in some countries, but not in others (*e.g.*, in Russia, although HAB species are identified, there is currently no routine monitoring of toxins);
- Data are site specific (*e.g.*, most shellfish monitoring in western Canada occurs in the southern regions where commercial shellfish and fish farms are concentrated); and
- Data available from offshore research cruises indicating high toxin concentrations or elevated cell abundance estimates may not result in any significant coastal impact. Should such data be included in an "events" database?

At the workshop, all PICES member countries unanimously decided to adopt the IOC/ICES database for a one-year trial period. This database will now be called the HAE-DAT joint database to reflect the fact that PICES is actively using it. It was agreed that:

- Each country will enter one year's HAB data in the database using the year of their choice;
- Each country will decide which data to enter, or in other words, will decide what constitutes a "problem" HAB in their country;
- Each country will define "regions" for their data entry that could include exact locations or more general areas (*e.g.* prefectures in Japan). This will allow issues of data sensitivity to be overcome;
- Each country will decide on a point person to oversee data entry into HAE-DAT during the next year; and
- For the next PICES Annual Meeting (October 2004, Honolulu, U.S.A.), each country will complete a "report card" describing what worked within the database, types of data that were difficult to deliver (data access issues, etc.), and the overall usefulness of the database.

The workshop participants unanimously recommended to convene a 1-day follow-up workshop on "Developing a North Pacific HAB data resource", co-sponsored by IOC and PICES, at PICES XIII in Honolulu. The primary goal of this workshop will be to provide an interim "report card" on the use of the HAE-DAT database. The central tasks include: (i) to ascertain how well the database process worked; (ii) to identify any difficulties in data delivery from member nations; (iii) to assess the effectiveness of the interactive web-based window to the developing resource; and (iv) to determine if further modifications are needed to encompass unique aspects of Pacific Rim marine resources.

The proposal was approved by the PICES Governing Council, and the workshop will be organized by a new PICES Section on *Harmful Algal Blooms*. This section was established under the MEQ (Marine Environmental Quality) Committee with the following Terms of Reference:

1) To develop and implement annual bloom reporting procedures that can be consistent with ICES procedures and therefore incorporated into HAE-DAT. This will be important in assessing impacts of HAB events and as a research tool to look at patterns that will lead to prediction capability.
2) To exchange national reports of HAB incidents and development in order to inform Section members of new toxins, new developments, and new approaches. Both toxin producing and non-toxic (but harmful) algal species should be included.
3) To focus on specific needs for scientific advice among PICES member countries by identifying topics of interest, and providing syntheses of the available scientific information on those selected topics. Example topics for discussion and syntheses might include:
   a. Mitigation practices to reduce the impact of HABs;
   b. Numerical model development of HAB initiation and transport for predictions and forecasts;
   c. Relationship between oceanographic processes and HAB formation (*e.g.*, How the physics of nutrients, trace metals tie into bloom formation);
   d. Organism identification using molecular biological techniques;
   e. Discussion of possible changes to certain monitoring techniques (*e.g.*, cell numbers vs. toxin levels);
   f. Species introductions including issues of anthropogenic sources (*e.g.* ballast water) or natural systems (*e.g.*, species range extension).
4) To develop, together with TCODE, a metadatabase that describes HAB monitoring and research efforts in each PICES member country.
5) To support the harmonization of methods for identifying HAB species. This could include inter-calibration workshops co-sponsored by PICES and ICES and future capacity building efforts.
6) To develop early warning systems for the detection of HABs. This could include discussion of ocean observing systems and techniques.
7) To educate the community (managers, students) about HAB organisms. For example, an in-depth study of selected HAB species (top ten) could include information about physiology, taxonomy, etc.

The HAB Section will be co-chaired by Drs. Vera L. Trainer (U.S.A.) and Hak-Gyoon Kim (Korea) and will carry on future work on PICES HAB data sharing.