

Completion of the PICES Seafood Safety Project – Indonesia

by Charles Trick, Vera Trainer, Mark Wells and William Cochlan

Since 2007, the PICES Seafood Safety Project has worked to develop a community-based system for the assessment of marine biotoxins that are transferred through the food chain to impact seafood security and community health. While most PICES member countries are protected by a fully-developed, national food inspection plan or by regulation by government health authorities, many more nations are at risk of human illness and death through unregulated shellfish consumption during toxic events. Under our mandate, we focused on seafood that was contaminated with marine toxins derived from periodic outbreaks of harmful algal bloom species (HABs). The outcome of our work has been the development of community-based phytoplankton monitoring networks, connected with two levels of toxin analysis: (1) lateral flow (test-strip) and enzyme-linked immunosorbent (ELISA) assays followed by (2) the traditional, internationally-recognized instrument of toxin verification – the mouse bioassay.

The project is funded by a voluntary contribution from Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF), through the Fisheries Agency of Japan (JFA), and is conducted by the PICES Section on *Ecology of Harmful Algal Blooms in the North Pacific*, with Dr. Vera Trainer, who co-chairs the Section, as the Principal Investigator of this effort. The criteria for country selection in the project were: (1) the magnitude of the HAB problem, (2) the need for training, and (3) the likelihood of sustainability. These were assessed through conversations with individuals at national and regional meetings and by evaluating responses to a specifically designed questionnaire distributed via the IOC (Intergovernmental Oceanographic Commission of UNESCO) network.

After the development, implementation and sustainable success of our training classes in the Philippines (PICES Press, 2009, 17 (2): 5–7) and Guatemala (PICES Press, 2010, 18 (2): 32–35), the final chosen location for implementation of the project was Indonesia. In September 2011, a trio of PICES researchers visited the headquarters of Lembaga Ilmu Pengetahuan Indonesia (LIPI; Indonesian Institute of Sciences) and the Pusat Penelitian Oseanografi (Research Center for Oceanography) in Jakarta, as well as the LIPI facility on Lombok Island to initiate stakeholder discussions. The primary management of Indonesian marine responses is LIPI's responsibility, and they served as our host for facilitating future efforts with both government and academic scientists. Meetings with these researchers confirmed both a solid interest in HABs, and the need for new strategies to minimize the consumption of toxin-tainted marine products.

In February 2012, the PICES team consisting of the authors of this article and Mr. Julian Herndon (San Francisco State University) initiated 10 days of training and mentoring. In the first phase of the seafood training course, we invited two target groups: researchers responsible for the analytical aspects of the nutrient and phytoplankton biomass analysis (critical for the marine monitoring program) and researchers responsible for the analysis of toxins in marine products.

For the first group of 8 researchers, William Cochlan and Julian Herndon gave background lectures on the value of measuring nutrients for ecological and anthropogenic studies, the specific theoretical foundations of analysis, the critical need for quality control and self-evaluation, and a review of standard operating procedures for preparing standards, evaluating methods, and laboratory and environmental safety. The remaining time was spent in intensive 'hands-on' exercises, with lecturers providing trouble-shooting advice and mentoring. The outcome of this intensive 3-day course was a reinvigorated cadre of marine monitoring chemists, and an upgrade in the expectations of their marine monitoring program.

Coincident to the marine chemistry course was an intensive marine biotoxin course that attracted 12 researchers from LIPI and several marine research-focused academic institutions. Mark Wells and Vera Trainer gave a series of lectures on the different marine toxins in Indonesian waters, and the theory behind the analytical approaches to the measuring the toxins. After the theoretical presentations, the class became heavily involved in several practical exercises in the extraction, isolation and confirmation of toxins in shellfish. The participants of both training courses gained considerable expertise in their fields of responsibility and are now able to work as independent scientists on marine environmental chemistry and toxin analysis.

These two training courses were followed by a 2-day lecture series focused on the monitoring of Indonesian waters for HAB species and was attended by 45 people. Using the "Responsible Sentinel Approach" where knowledgeable and trained scientists can then train students and community members to watch for the 'symptoms of change', the PICES team led the class through a series of lectures that covered anthropogenic changes in coastal waters, sampling and measurement, the critical needs for monitoring projects, and the importance of phytoplankton in healthy, coastal ecosystems. The team then focused on HAB recognition and taxonomy, phytoplankton quantification and microscope care. This HABs-centric approach enables the participants to develop an appreciation for the taxonomy of the phyto-



Clockwise from top left: (1) Participants and instructors of the training course in Jakarta, Indonesia; (2) Participants and instructors of the training course in Lombok Island, Indonesia; (3) Julian Herndon (San Francisco State University, USA) demonstrates methods for nutrient analysis; (4) Charles Trick (Western University, Canada) lectures on phytoplankton identification; (5) Students prepare samples for rapid toxin testing; (6) The children who are benefiting from a microscope donated to the Main Center for Mariculture Development, Lampung, Indonesia.

plankton through the initial recognition of the key problem species, and then the expansion to other prevalent, but non-harmful taxa. The participants in this group were primarily academic scientists as well as LIPI and public health researchers. Based on the enthusiastic exchange of questions, they gained considerable understanding of the topic.

The lecture series was followed by a focused workshop for LIPI and academic researchers, including faculty and graduate students from Mataram University, University 45, and Hasanuddin University from the southern islands of Indonesia. A total of 14 individuals participated in a 3-day workshop at the LIPI Mataram Research Station on Lombok Island. The curriculum included an abbreviated series of lectures, considerable 'hands-on' collection and analysis of phytoplankton communities, and measurements of abiotic oceanographic parameters.

Our trip ended with a short visit to the Secretariat of WESTPAC (IOC Sub-Committee for the Western Pacific) to outline the PICES Seafood Safety strategy and discuss linking WESTPAC training with the need for Indonesian aquaculture and mariculture advancement.

The Indonesia training had the same outcome as our previous efforts in the Philippines and Guatemala – an engagement with communities that are concerned with HABs, toxin-contaminated seafood, and the monitoring of coastal resources. By all measures, this has been a very successful enterprise between PICES scientists and the funding body, MAFF (Japan). We have successfully avoided 'helicopter science': and have embedded ourselves into the decision making of three enthusiastic communities to ensure sustainability in current and emerging fisheries while attempting to safeguard the health of their citizenry from HABs.



Dr. Vera Trainer (vera.l.trainer@noaa.gov) is a Program Manager of the Marine Biotoxin group at the Northwest Fisheries Science Center, USA. Her 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. In her spare time Vera climbs mountains.

Dr. Mark Wells (mlwells@maine.edu) is a Professor of Oceanography in the School of Marine Sciences, University of Maine, USA. His current work spans the study of toxin production associated with harmful algal blooms, the interaction of trace metal chemistry with phytoplankton production in coastal and offshore seawaters, and the implementation of nanoscience and engineering concepts into the next generation sensor development for bioactive metals, phytoplankton community composition, and other indicators of ecosystem health.

Dr. Charles Trick (trick@uwo.ca) is the Beryl Ivey Chair for Ecosystem Health at Western University, Canada, a position that emphasizes the merging of science, health/medicine, social and psychological aspects of environmental programs. Since receiving his Ph.D. in Oceanography, Charlie has worked in a variety of different coastal and open ocean projects. He has recently completed a sustainability assessment of the Persian Gulf and continues his research in harmful algal blooms.

Dr. William Cochlan (cochlan@sfsu.edu) is a Senior Research Scientist at Romberg Tiburon Center for Environmental Studies, San Francisco State University, USA. His key research questions revolve around factors that control phytoplankton growth, their nutrition and distribution in the ocean. His research on harmful algal blooms and other phytoplankton covers multiple interactions of light and macro- and micro-nutrients affecting the physiology of marine phytoplankton.