Harmful Algae News

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Intergovernmental Oceanographic Commission

Exceptional climate anomalies and northwards expansion of Paralytic Shellfish Poisoning outbreaks in Southern Chile

Harmful Algal Blooms (HAB), in particular recurrent events of the Paralytic Shellfish Poisoning (PSP) agent *Alexandrium catenella,* pose the main threat to aquaculture and public health in Southern Chile [1, 2]. The development of measures to control these events or, at the very least, to minimize their impact requires a detailed understanding of the triggers for bloom initiation [3]. A common factor underlying dinoflagellate bloom initiation, termination and the long-range dispersal of cells in several important HAB species—including *A. catenella*—is the encystment, germination and transport of highly resistant sexual cysts [4]. The absence of large "seedbeds" observed in several studies conducted in the Chilean Island Sea [5, 6] suggested that *A. catenella* blooms are not the result the massive in situ germination events. Therefore, the germination of dispersed cysts and transport of vegetative cells [7], are probably responsible for the intense proliferations observed. Recently, Díaz et al. [6] suggested the inflow of offshore planktonic populations or cysts as a possible mechanism for the development and recurrence of blooms in this area.

In 2016, an exceptional late summer bloom of *A. catenella*—in terms of intensity and geographic extension—was observed in Southern Chile. A remarkable northwards expansion of previously PSP-affected areas, that reached the Valdivian coasts (39°45'S), was observed in the first week of May (Fig. 1). There were 12 cases of human intoxication. This situation led the health authorities to enforce shellfish harvesting closures throughout extensive geographic areas (up to 500 km) causing dramatic socio-economical impacts. This exceptional *A. catenella* bloom was associated with extreme hydroclimatic anomalies, a consequence of the strong El Niño Southern Oscillation (ENSO) recorded in 2015/2016 (Fig. 2). Weakening of wind strength, high positive Sea Surface Temperature (SST, Fig. 3) and negative rainfall anomalies were calculated. The total rainfall in the summer-autumn months preceding the *A. catenella* bloom (January-May) was 253 mm, 60% below the historic mean of 56 years (1961-2016, data not show). A maximum of 2.5 × 10^5 cells L^{-1} in integrated (0-10 m) hose samples was found at the outermost station in Chacao Channel (41°45'S, see Fig. 1) during the last week of April (Fig. 4), coinciding with a peak of 5 × 10^3 µg STX eq. kg^{-1} in PSP toxin levels in Pacific clams (*Gari solida*). Likewise, maximum levels of PSP toxins around 9 × 10^4 µg STX eq. kg^{-1} were recorded at the same time in surf clams (*Mesodesma donacium*) from Cucao beach (Fig. 1), on the open coasts of Chiloé Island, 100 km southwards. From the second week of May onwards, a significant decrease of PSP toxin levels was record-

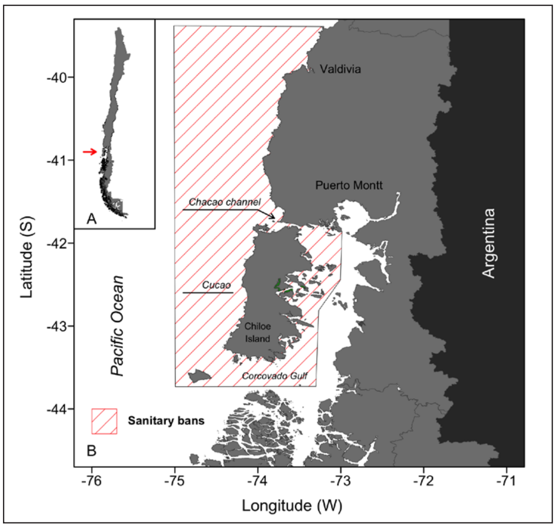

Fig. 1. Map of the study area showing the geographic extension of the shellfish harvesting closures (dashed area) during the PSP outbreak.

Content

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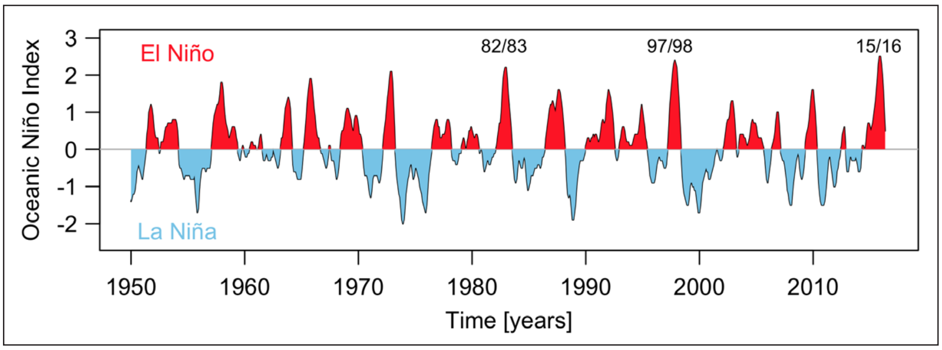

Fig. 2. Evolution of the Oceanic Niño Index (ONI) from 1950 to 2016.

ed, coinciding with the absence of vegetative cells in the water column.

Our results suggest that large-scale atmospheric and oceanographic processes (climatic anomalies) modulated the late summer *A. catenella* bloom observed in southern Chile. Considering that the most affected areas were observed on the open coasts of Los Lagos Region (Chacao channel and Cucao beach), the hypothesis of offshore planktonic populations advected in to the coastal region gains strength. Parameterization of the effect of these climatic anomalies—in terms of intensity and phenology—on the development of massive proliferation *A. catenella* is poorly understood in this area. Therefore, the identification of climatic signals and the development of predictive simulations on oceanographic conditions that might serve as early warning of future *A. catenella* events is a priority for the region.

Acknowledgements

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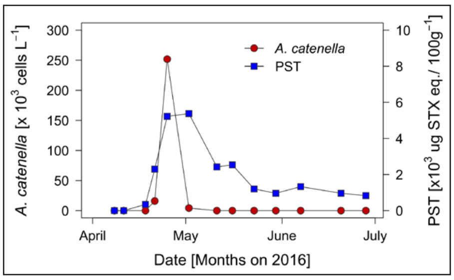

Fig. 4. Weekly changes in Alexandrium catenella *cell densities (red circles) and paralytic shellfish toxins (blue squares) in Chacao Channel, Los Lagos Region.*

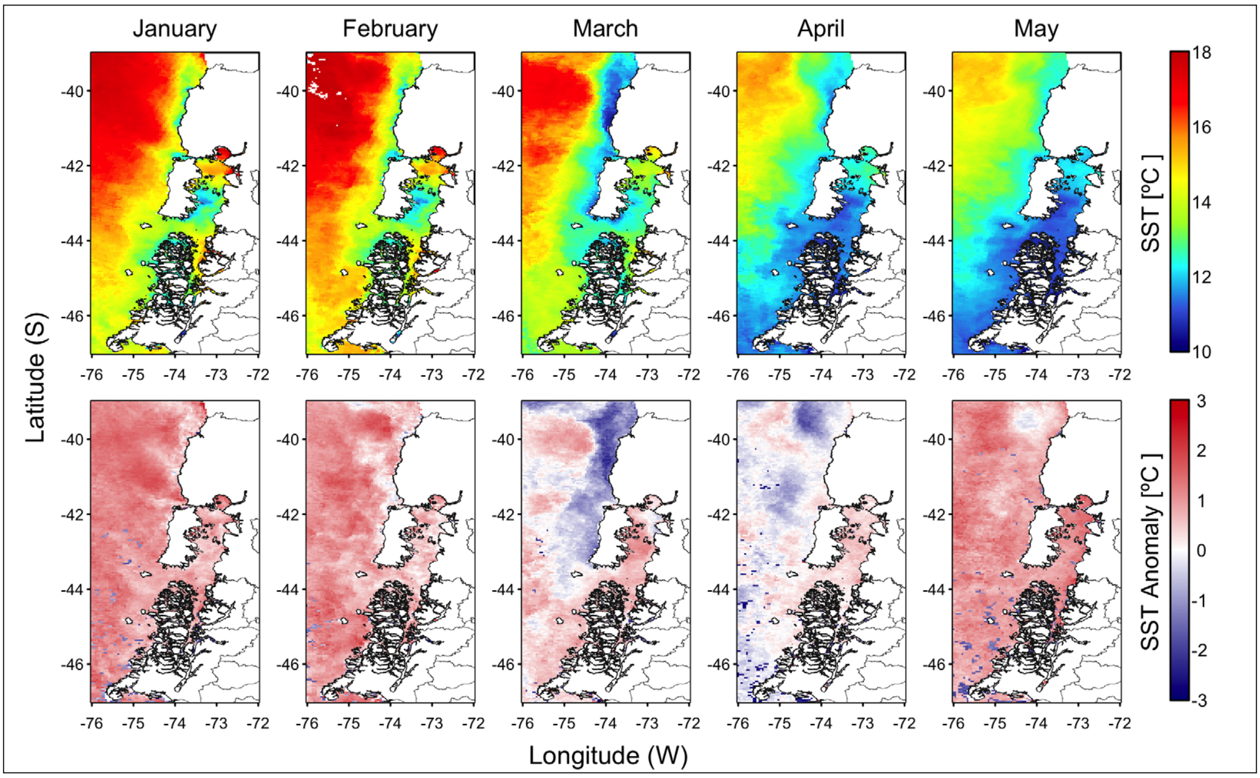

Fig. 4. Monthly Sea Surface Temperature (SST, upper panels) and SST anomalies (lower panels) from January to May. Anomalies were computed with the 2003-2015 monthly means from MODIS images.

Cochlodinium polykrikoides blooms in southern Cuba during anomalous hot dry seasons

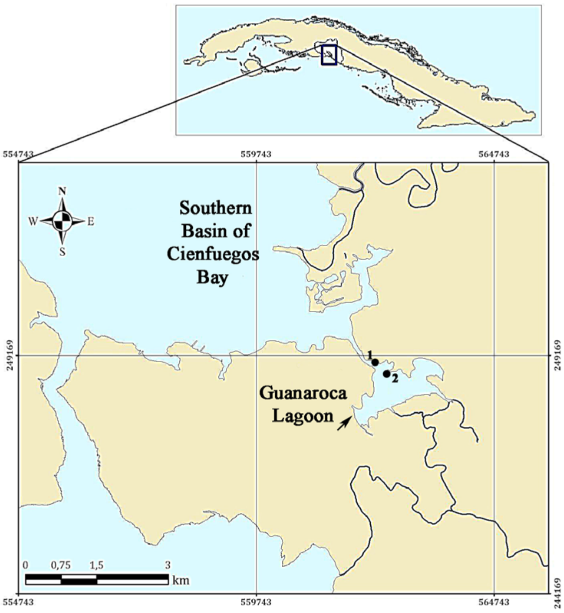

Fig. 1. Study area and sampling stations in Guanaroca Lagoon, southern Cuba (January 2014).

The athecate dinoflagellate *Cochlodinium polykrikoides* is a common marine invertebrate and fish killer in Japan and Korea, but in the last two decades has been reported to cause problems in many other countries including Canada, USA, Pacific Central America, China, Philippines and the Middle East [1].

A bloom of *C. polykrikoides* was identified in mid-January 2014 in Guanaroca Lagoon, southern-central Cuba (Fig. 1). Patches of red water were noted in the lagoon, extending into neighboring areas of the southern basin of Cienfuegos Bay. At the same time, hundreds of juvenile "bocón" fish (*Cetengraulis edentulus*), some oysters and blue crabs appeared dead in the shore areas (Fig. 2).

Guanaroca Lagoon (22°04'N, 80°22'E) is a small (2.2 km^2) shallow (average depth, 1.2 m) estuary fed by the Arimao River. This wetland is on the southwest of the semi-enclosed Bay of Cienfuegos (southern Cuba) and connected to it by a single channel. The area is subject to two main seasons: dry (November -April) and rainy (May-October). The annual mean air temperature is 24.7° C, with the highest (monthly mean 27.0° C) in the rainy season, in June, and the lowest (21.6° C) in January. The lagoon is part of a protected area for the conservation of biodiversity, in particular local and migratory birds, with a great variety of marine fauna including "blue crabs" (*Callinectes sapidus*), "ostión" (*Crassostrea virginica*), mussels and juvenile fish species.

During the bloom event, water samples were collected with a Niskin bottle for temperature, salinity and dissolved oxygen measurements and nutrient analysis (nitrite and phosphate). Phytoplankton samples were settled using 10 ml sedimentation chambers, and cells were counted under a Zeiss (Axiovert 40) inverted microscope.

Specimens collected at Guanaroca Lagoon had the features typical of *C. polykrikoides*, such as rod-like chloroplasts and a narrow sulcus located immediately below the cingulum. A large nucleus and reddish orange pigmented body were located at the epicone. Cells were more or less oval, with a girdle making 1.8–1.9 turns around the cell. The anterior part of the epicone was conical and the hypocone subspherical. The hypocone of the chain's terminal cell was bilobed. Cells within the chain were either spherical or slightly dorso-ventrally depressed, and smaller than single cells. Single cells were 35–45 µm long (41.23 ± 3.54, n=30) and 30–35 µm wide (33.83 ± 2.68, n=30). *C. polykrikoides* specimens in the present study were slightly smaller than the holotype (L: 50 µm) described by Margalef from the neighboring island of Puerto Rico [2]. During the bloom, chains of two (predominant), four and eight cells were observed and single cells were found occasionally.

	Collection sites inside the lagoon	
	1	**2**
Temperature	24,5°C	24,5°C
Salinity	31,3	31,4
pH	8,49	8,60
Dissolved O_2	13,7 mg L^{-1}	21,6 mg L^{-1}
$PO_4{}^{3-}$	1.59 µg L^{-1}	3.78 µg L^{-1}
Total P	31.6 µg L^{-1}	42.1 µg L^{-1}
$NO_2{}^-$	0.303 µg L^{-1}	2.88 µg L^{-1}

Table 1. Some abiotic parameters measured during the C. polykrikoides *bloom in Guanaroca Lagoon (January 2014)*

The *C. polykrikoides* bloom reached a maximal density of 7.4 x 10^7 cells L^{-1}. Environmental conditions (high temperature, salinity and irradiance) were consistent with those previously reported as favourable for this species in Cuba [3]. Nitrite was low; however moderate concentrations of inorganic phosphate and very high of total P, in particular in the more restricted area of the lagoon (Site 2) may have stimulated the bloom development. The high concentration of dissolved oxygen was a good indicator of microalgae overgrowth (Table 1).

The high residence time, salinity and transparency of Cienfuegos Bay waters during the dry season seem to be the key factors behind the development and maintenance of the blooms [4]. Coincidentally, *C. polykrikoides* populations have been observed only during the dry (March, November-December) and early rainy (June) seasons, and are generally restricted to the less eutrophic area (southern basin) of the bay. *Cochlodinium* blooms have not been observed during the rainy period (September), possibly affected by increased river inflow in that season [5]. Temperature was another important environmental factor associated to the *C. polykrikoides* event. The bloom observed in the Guanaroca Lagoon coincided with winter (December-February), with expected average air temperatures between 21 and 22° C. Higher temperatures were recorded during the first days of January and throughout the preceding month (December 2013). This was one of the warmest Decembers (average temperature of 24.4° C) in the Cienfuegos Province since records began with a record number of days (14) with maximum temperatures above 30° C [6].

There is recent evidence of increasing air temperature and drought periods in Cuba associated with the ENSO. 2015 was the warmest of the last 64 years in Cuba with the annual air tem-

Fig. 2. C. polykrikoides *(A) and dead blue crabs (*Callinectes sapidus*) (B) during the bloom in Guanaroca Lagoon (January 2014)*

Fig. 3. A more recent C. polykrikoides *bloom from beaches in Cienfuegos Bay (June 2016). A.* Cochlodinium polykrikoides*. B. Discolorations and foam from* C. polykrikoides *blooms in the beach.*

perature exceeding the historical average of 25.49° C by 1.06° C and 68% of the Cuban territory suffered severe droughts from November 2014 to October 2015, affecting both the dry and rainy season [7]. These extreme weather conditions appeared to stimulate the growth of some dinoflagellates in embayments and restricted coastlines in Cuba. Within the same period (August 2015), a bloom of *Vulcanodinium rugosum* caused acute skin irritation in bathers from Cienfuegos Bay (in prep.), and more recently during the early rainy season (June 2016), another bloom of *C. polykrikoides* was observed in beaches of Cienfuegos Bay without apparent harmful effects (Fig. 3).

Fish-killing blooms of *C. polykrikoides* similar to those from Guanaroca Lagoon/Cienfuegos Bay have been recorded only in one other embayment of south-eastern Cuba (Santiago de Cuba Bay), and always during hot dry periods (April/May 2005 and January 2015) [8-9]. During the 2015, a bloom of *C. polykrikoides* was also recorded in channels of a small marina from Havana, north-western Cuba, in September, without apparent damage to marine life [10].

Acknowledgements

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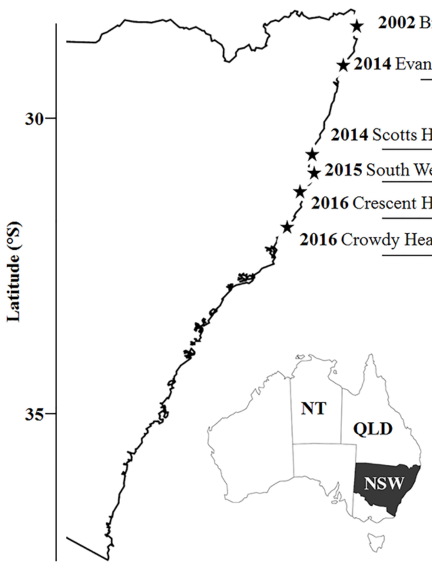
Is Ciguatera moving south in Australia?

Ciguatera Fish Poisoning (CFP) is well-known in tropical regions around the world, including the Pacific. The illness occurs through the consumption of fish that have accumulated naturally occurring ciguatoxins (CTXs) produced by the dinoflagellate genus *Gambierdiscus*. In Australia, there were more than 1,400 documented cases between 1965 and 2010 [1-3], including two fatalities, despite a significant rate of apparent under-reporting. Cases of CFP have occurred principally due to fish caught in tropical Queensland (QLD) and Northern Territory (NT) waters. Spanish mackerel (*Scomberomorus commerson*) is the fish species that has been most commonly involved in Australian CFP cases [4]. CFP is recognised as the most frequent cause of seafood-related illnesses in Australia [3].

During March and April 2016, two outbreaks of CFP were reported from consumption of Spanish mackerel caught in New South Wales (NSW) coastal waters. NSW is the state immediately south of QLD, along which the East Australian current runs in a southerly direction (Fig.1). This marks the third consecutive year since 2014 where CFP has been linked to Spanish mackerel caught in NSW waters. Twenty-four individuals were affected over five separate outbreaks between February 2014 and April 2016. These occurrences appear to be uncharacteristic for the region. A CFP outbreak following consumption of Spanish mackerel caught off Brunswick Heads (Fig. 1) in 2002 was the single recorded case from NSW prior to 2014 [4,5].

Pacific ciguatoxin-1B (P-CTX-1B) is regarded as a potent fish metabolite and is common to ciguatoxic fish sourced from the Pacific region [6]. Following the two CFP outbreaks in NSW during 2014, P-CTX-1B was reported at concentrations between 0.4 and 1 µg kg^{-1} in three of four fish samples (Fig. 1). These results were likely an underestimation of P-CTX-1B due to significant matrix suppression from fish tissue during the analyses [4]. At that time, testing was completed at the Cawthron Institute (New Zealand). Since then, capability to test for CTXs in fish samples has been established in NSW, and supported the 2016 illness investigations. Spanish mackerel fillet samples from the fish implicated in the Crescent Head (two samples, Fig. 1) and Crowdy Head (one sample, Fig. 1) cases were analysed. Following the illness reports, samples were kept frozen prior to analysis. A Thermo Orbitrap liquid chromatography mass spectrometry (LC-MS) system was used to detect P-CTX-1B in the fish samples. The performance of the method is the subject of a manuscript currently in preparation [7]. All samples from the 2016 cases were positive for P-CTX-1B with indicative concentrations of 0.11 and 0.37 µg kg^{-1} (20 kg Spanish mackerel, Crescent Head, Fig. 1) and 0.93 µg kg^{-1} (40 kg Spanish mackerel, Crowdy Head, Fig. 1). It is also highly likely that other CTXs were present in these fish samples, although at the time of analysis only P-CTX-1B was available as reference material.

While traditionally considered as a tropical or sub-tropical disease, CFP has become an emerging issue in locations previously thought to be outside its range of impact. The concentrations of P-CTX-1B in the fish that caused illness in NSW were up to two orders of magnitude higher than the US Food and Drug Administration's action level (0.01 µg kg^{-1} CTX equivalent for Pacif-



	Month	Fish weight (kg)	No of people affected	No. of samples	P-CTX-1B (µg kg^{-1})	Reference
2002 Brunswick Heads	Not confirmed	>10	Not confirmed	n/a	n/a	[5]
2014 Evans Head	February	~10 & ~17	4	3 (not distinguished)	nd, 0.6 & 1	[4]
2014 Scotts Head	March	25.7	9	1	0.4	[4]
2015 South West Rocks	April	~10	4	n/a	n/a	[4]
2016 Crescent Head	April	20	4	2	0.11 & 0.37	This report
2016 Crowdy Head	March	40	3	1	0.93	This report

Fig. 1. Map of coastline of New South Wales (NSW), Australia documenting catch locations of fish associated with ciguatera fish poisoning outbreaks. In all cases, the implicated fish was identified by the fisher as Spanish mackerel (S. commerson). The weight of the fish, number of affected individuals and indicative concentration of P-CTX-1B are reported where available. (Note: n/a = not available, nd = not detected, NT = Northern Territory, QLD = Queensland).

ic CTX) [8]. The illnesses occurred between February and April each year in NSW (Fig 1), coinciding with the peak Spanish mackerel fishing season. There is an apparent southern expansion of the geographic range of CFP along the east coast of Australia (Fig. 1). The catch locations of the fish from the 2014 and 2015 outbreaks were up to 300 km south of the QLD border. The fish from the 2016 cases were caught up to 120 km further south along the eastern seaboard. This highlights an urgent need to further understand the dynamics of CFP in NSW waters.

It has been thought that larger sized (>10 kg) Spanish mackerel specimens were more likely to have detectable levels of CTXs than smaller sized, and this information was conveyed to the fishing community following the outbreaks [9]. There are established commercial fishing bans, including Spanish mackerel of any size in designated QLD locations, due to the risk of CTX-contaminated fish [1,2]. While localised populations exist, Spanish mackerel can migrate several hundred kilometres [5]. Although increased reports of CFP may be a reflection of increased awareness of the disease in NSW, increasing ocean temperatures and an intensification of the East Australian Current [10] could influence the behaviour of Spanish mackerel and CTX-producing *Gambierdiscus* spp. Further research is essential to simultaneously mitigate the risks to consumer health and minimise the impact to the fishing community.

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The CODIMAR launches a bilingual taxonomic guide of marine dinoflagellates

CODIMAR, the Marine Dinoflagellate Collection, Mexico, was established by Consejo Nacional de Ciencia y Tecnología in 2004. CODIMAR has launched a bilingual guide of the taxonomy of marine dinoflagellates. The guide uses file cards and original photographic sheets to illustrate the taxonomic and morphological characteristics of 26 dinoflagellate species that were isolated mainly from the southern Gulf of California and Cuban coastal waters. It also brings together a review of 26 scientific articles that contain information on some strains of CODIMAR. The genera described in the guide are: *Akashiwo*, *Alexandrium*, *Ceratium*, *Cochlodinium*, *Coolia*, *Gymnodinium*, *Lingulodinium*, *Ostreopsis*, *Pentapharsodinium*, *Prorocentrum*, *Protoceratium*, *Pyrodinium*, *Pyrophacus*, *Scrippsiella* and *Vulcanodinium*. Updated information on biological, ecological and geographical distribution aspects, as well as harmful effects and/or toxicity, are also included.

Revenue from the sale of this guide will be used entirely for maintenance and progress of CODIMAR. Contact details and information about how to order the guide are given below.

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***Illustrated taxonomic guide of the Marine Dinoflagellate Collection* (*CODIMAR*) | *Guía taxonómica ilustrada de la Colección de Dinoflagelados Marinos* (*CODIMAR*)**

Lourdes Morquecho-Escamilla, Amada Reyes-Salinas, Yuri B. Okolodkov

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A survey of BHAB assemblages utilizing the artificial substrate method in Rawa Island, Malaysia

Benthic dinoflagellates are marine tychoplanktonic inhabitants on the natural substrates of coral reefs in tropical and subtropical coastal waters. These dinoflagellates are associated with their prefered natural habitats [1,2]. Some of these species are known as bioactive compound producers. The compounds (e.g. ciguatoxin) may accumulate in reef fishes via the food web.

To assess benthic harmful algae (BHAB) assemblages in tropical coral reefs, we selected a fringing reef, Rawa Island, on the east coast of Peninsular Malaysia. The island is an ideal study site due to its abundance and diversity of coral reefs and other tropical marine resources. The fringing reef is covered with various types of hard corals, i.e. staghorn corals, table corals, cabbage corals (Fig. 1). At deeper water, large patches of soft corals (e.g. mushroom corals), sponge and giant clams are found. Nonetheless, some parts of the reefs appear severely disturbed, and coral rubbles there are covered with macrophytes. The co-occurrence of both pristine and disturbed reefs areas around the island makes it an ideal site for comparative studies to investigate the effect of anthropogenic activities on coral reefs and the associated BHAB communities.

Sampling of benthic dinoflagellates at Rawa Island was conducted monthly using the artificial substrate method (Fig. 2) [3,4]. This study focuses on five dinoflagellate genera: *Gambierdiscus*, *Ostreopsis*, *Prorocentrum*, *Coolia*, and *Amphidinium* [2-4]. BHAB species were observed and identified under a light microscope (Fig. 3). *Ostreopsis* spp. were predominant in most samples, with a maximal cell density of 11,000 cells/100 cm^2. This study provides an important baseline data of BHABs in the western Pacific region, in particular on species composition and distribution in relation to their habitat preferences.

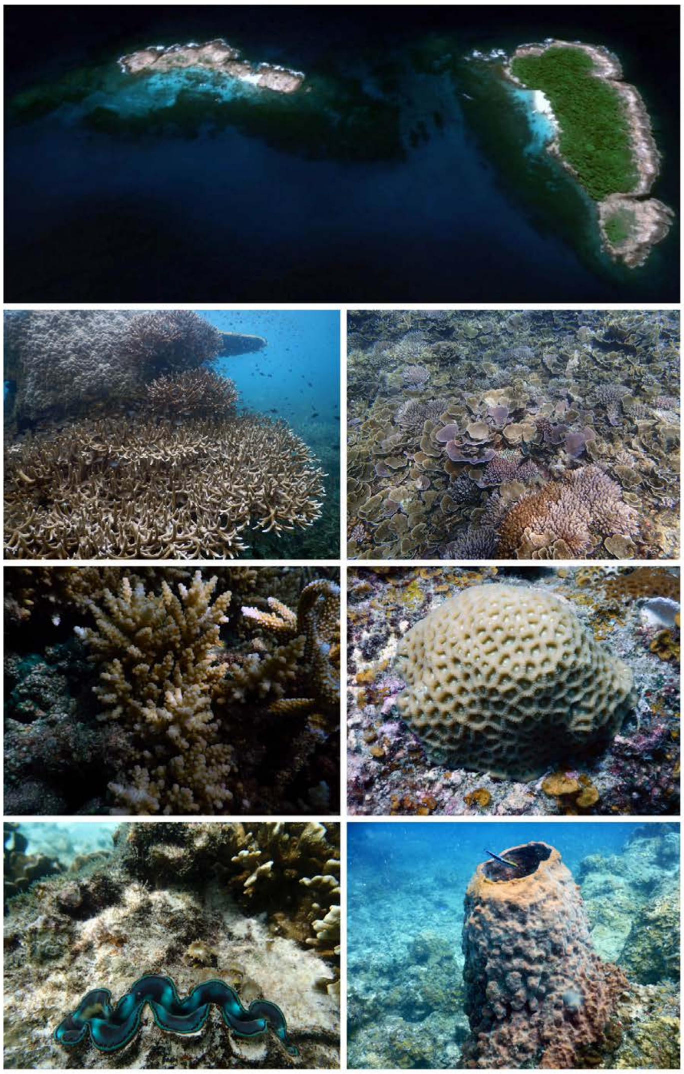

Fig.1. Map of Rawa Island and the common coral communities.

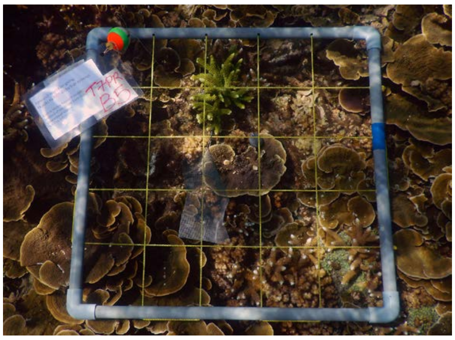

Fig. 2. Artificial substrate deployed underwater.

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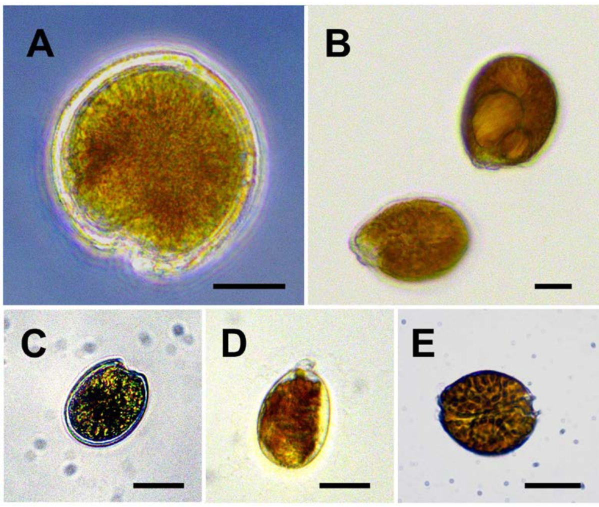

Fig. 3. Benthic dinoflagellates from Rawa Island. (A) Gambierdiscus *sp. (B)* Ostreopsis *sp. (C)* Prorocentrum *sp. (D)* Amphidinium *sp. (E)* Coolia *sp. Scale bars, 20 µm.*

Annual variability of *Prorocentrum lima* and abiotic factors in Chengue Bay, Tayrona National Park, Colombian Caribbean

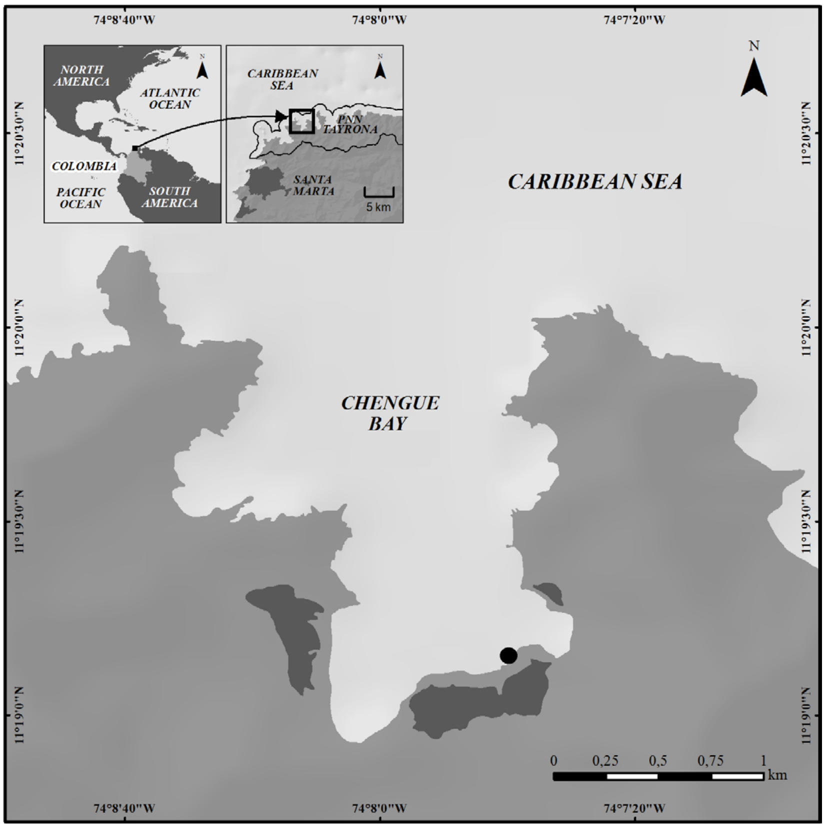

Fig. 1. Study area where samples of Thalassia testudinum *were collected. Chengue Bay (black star), Tayrona National Park, Colombian Caribbean*

Prorocentrum lima is a cosmopolitan species distributed in tropical and temperate seas. This dinoflagellate has been characterized in different regions as a toxin producer (okadaic acid and its analogs) and agent of diarrheic shellfish poisoning [1]. *P. lima* is one of the most abundant and frequent component of the epiphytic dinoflagellate community on the Turtle Grass (*Thalassia testudinium)* in the Caribbean. The objective of this study was to describe the annual variability in population abundance of *P. lima* in Tayrona National Park, Colombian Caribbean, to understand possible patterns related with climate.

Sampling was conducted in Chengue Bay. This bay, part of the Tayrona National Park (Fig. 1), is about 14 km east of the tourist city of Santa Marta (11 ° 18' - 11 ° 20' N and 74 ° 09' - 74 ° 07'W). Chengue Bay occupies an area of approximately 2.5 km^2 with a climate influenced by the two annual seasons: dry from December to April and rainy from May to November, although variations have been reported in recent years. The bay harbors a variety of tropical ecosystems such as mangroves, seagrass beds, coral reefs, soft bottoms and rocky shores [2].

Between January and December 2014, samples of *T. testudinium* were collected every month to analyze dinoflagellates present in the epiphytic community. In the laboratory, microalgae were detached and preserved in formalin. *P. lima* was identified in SEM micrographs. Cell counts were carried out with Sedgewick-Rafter chambers under a Zeiss Primo Star optical microscope. *P. lima* (Fig. 2) was the most frequent and abundant species of the 14 taxa observed. Cell densities ranged from 232 to 15,867 cells g^{-1} ww (wet weight) of *T. testudinum* (Fig. 3), with an average of 3,081 cells g^{-1} ww and maximum values in August and September. These values were lower than the maximal densities recorded by other authors during May 2005 (29,756 cells g^{-1} ww) in a semi-protected reef area of Veracruz, Gulf of Mexico [3], but higher than those observed in the coastal area of the Yucatán Peninsula (max. of approximately 1,100 cells g^{-1} ww of *T. testudinum*) in April 2013 [4].

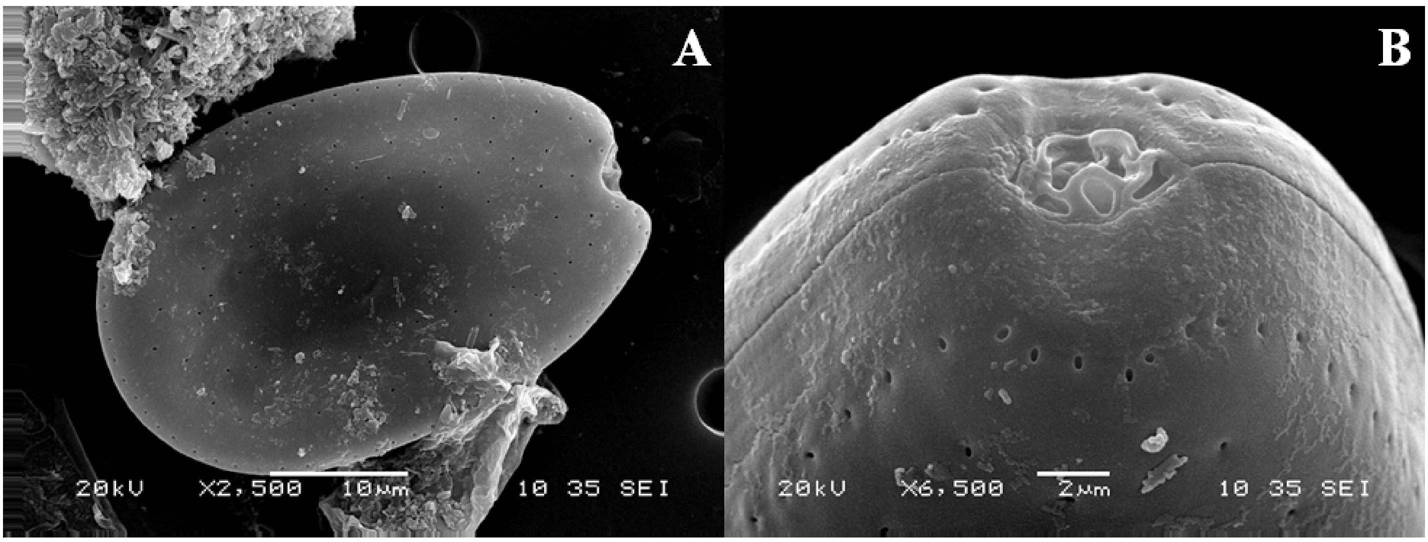

Fig. 2. SEM images of Prorocentrum lima*. A. Ventral view, with pore pattern and* B. Periflagellar *area with intercalary band and suture view*

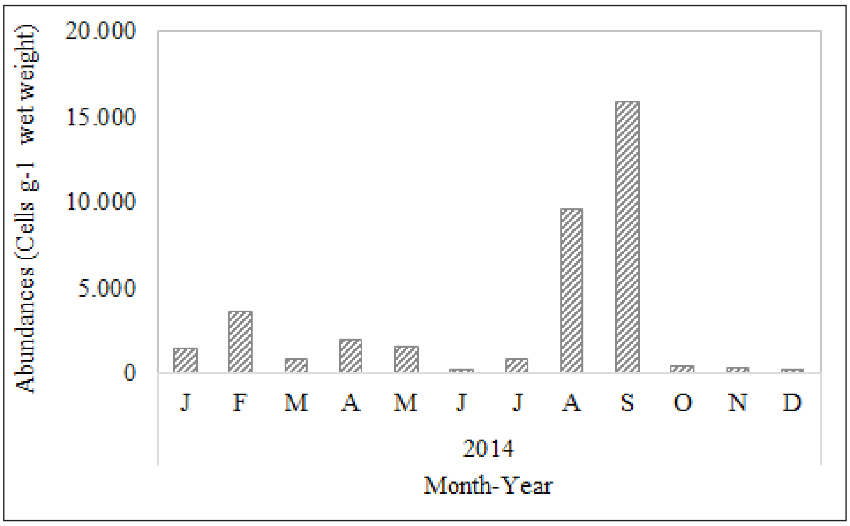

Fig. 3. Monthly changes in cell density of P. lima *on* Thalassia testudinum *in Chengue Bay, Colombian Caribbean, during 2014*

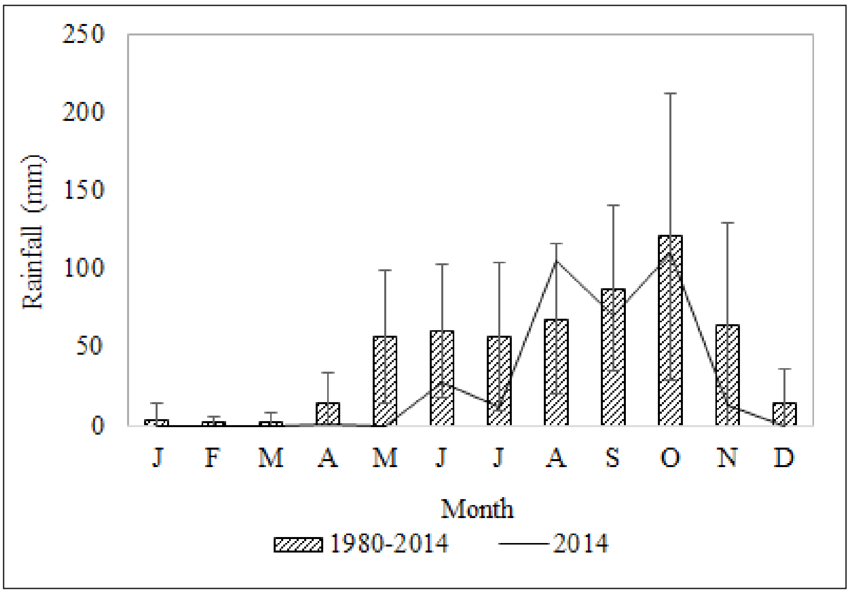

Fig. 4. Time series of rainfall (monthly average and standard deviation) from1980 to 2014 (bars), and total monthly rainfall during 2014 (black line), in the Magdalena region (airport station-IDEAM)

Maximal cell density of *P. lima* was found at salinities near 35, temperature above 29 °C, high N:P ratio (>16), nitrite 2.4 µg L^{-1}, nitrate, ammonia and phosphate concentrations below 2.7 µg L^{-1}, and high concentrations of total suspended solids. These environmental features are common when rainfall is low (70-110 mm monthly rainfall).

Rainfall did not follow the usual pattern during 2014 with values well below the historic mean (Fig. 4). These results suggest that *P. lima* population is likely to benefit during periods of low rain, small decline in salinity, high water temperature and lower inorganic nutrients in the environment.

For future risk management plans it will be important to consider toxin analyses to establish the risk involved with the presence of this species in the Colombian Caribbean. These results will help involve the public health sector, improve the diagnostic tools and reduce negative consequences of potentially toxic dinoflagellates in an important natural and tourist area.

Acknowledgements

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4. *Martínez-Cruz ME Et al 2015. Cymbella 3, 9 pp*

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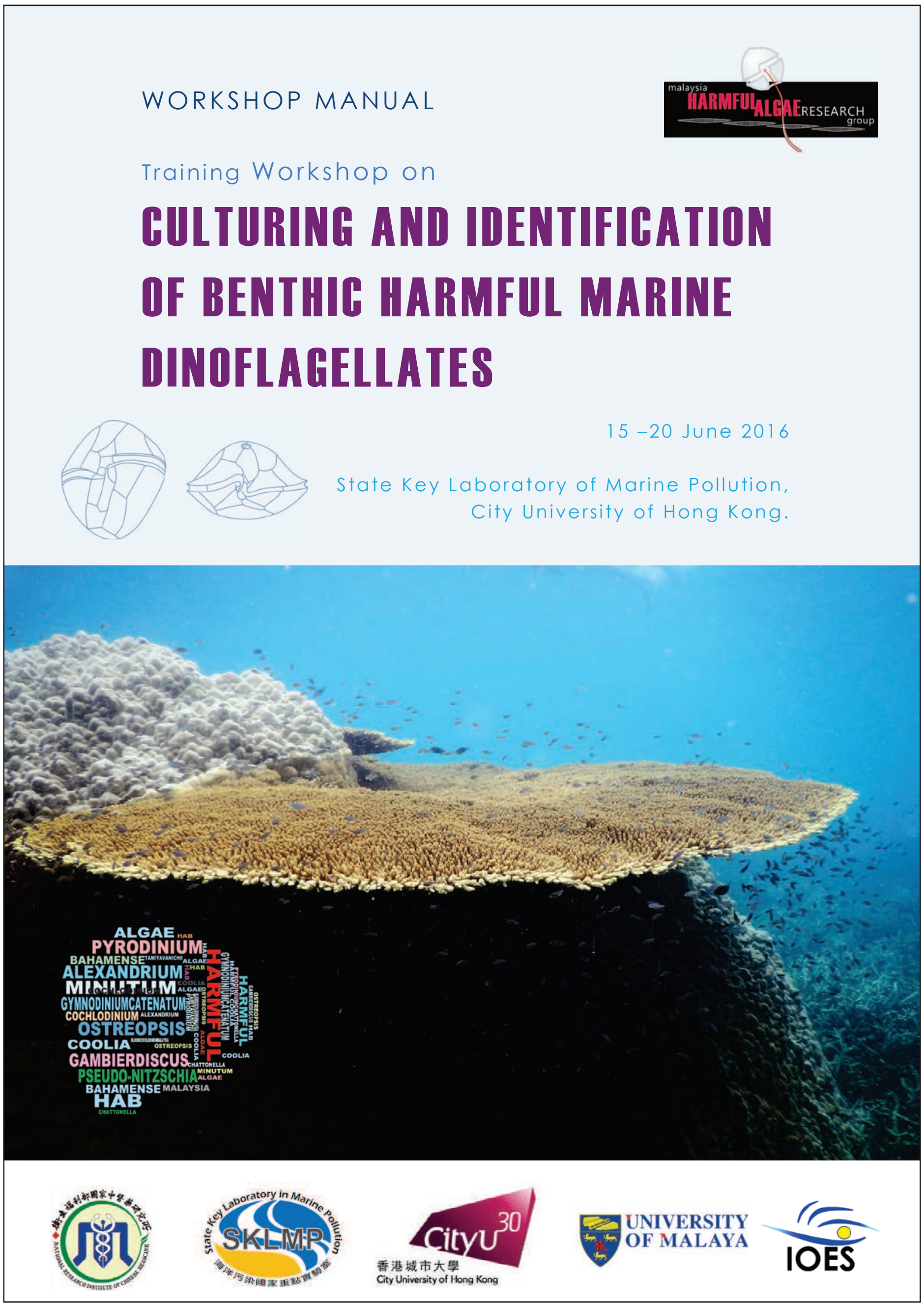
Training Workshop on the Culturing and Identification of Benthic Harmful Marine Dinoflagellates

A Training Workshop on the Culturing and Identification of Benthic Harmful Marine Dinoflagellates was held in the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong between 14 and 21 June, 2016. This training workshop was sponsored by the Collaborative Research Fund (CRF), of the Hong Kong Research Grant Council (grant # 8730040). It aimed to train the young scientists and government authorities in Hong Kong and mainland China in the standard protocols for sampling, isolation, culturing and identification of benthic harmful algal bloom (BHAB) species in the coastal coral ecosystems in the South China Sea, where the occurrence and distribution of these dinoflagellates are not known.

The workshop drew over 16 participants, including representatives from the Agriculture, Fisheries and Conservation Department (AFCD) of Hong Kong, research staff and postgraduate students of the SKLMP (Fig. 1). A series of lectures on the existing BHAB sampling methods by collecting natural substrates and deploying artificial substrates, as well as the most up-to-date knowledge about morphology-based taxonomy and molecular phylogenetic classification of BHAB species was delivered in the workshop by Dr Po Teen Lim (Associate Professor of the University of Malaya), Dr Chung-Kuang Lu (Associate Research Fellow of the National Research Institute of Chinese Medicine) and Dr Chui Pin Leaw (Senior Research Fellow of the University of Malaya). In the workshop, the participants were also given hand-on training on basic and advanced techniques on microalgal culturing and BHAB species identification including the epifluorescence microscopy technique (Fig. 2).



With the support of the Hong Kong Government, a collaborative research project has been initiated to study the effect of BHABs on marine ecosystems and to investigate the primary factors that regulate the distribution, growth and toxicity of BHAB species in Hong Kong waters and along the coast of south China, Taiwan and Malaysia. Toxins produced by BHABs can kill fish and disrupt food web structures and the functioning of coral ecosystems. One of the outcomes of the project will be a map that shows levels of BHAB-associated risks. The map should enable marine ecologists, coral and fish conservationists and governments to design strategies to monitor BHABs, to develop plans to conserve local coral communities and fisheries resources, and to protect consumers against BHAB-associated illness.

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Fig. 1. Participants in the workshop at the State Key Laboratory of Marine Pollution, City University of Hong Kong, 14-21 June, 2016.

Fig. 2. Demonstrating basic techniques in BHAB culturing (Po Teen Lim, Chung-Kuang Lu, Chui Pin Leaw and the participants).

Regional Training Course on Identification of Harmful Algal Bloom Species in the ASEAN Region, Singapore, 18th-22nd July 2016

Harmful algal blooms (HABs) can cause major environmental disturbances, severe economic loss to industries, fisheries and tourism, and also pose significant health risks to humans. Considering the increase in HABs occurrence and the lack of taxonomy experts in Asia-Pacific region, a regional training course on identification of harmful algal bloom species in the ASEAN region was held at St. John's Island Marine Laboratory, Tropical Marine Science Institute, National University of Singapore (SJIML, TMSI NUS) from 18th-22nd July 2016.

This training course was organized by TMSI NUS, Southeast Asian Fisheries Development Center (SEAFDEC) and Agri-Food & Veterinary Authority of Singapore (AVA), sponsored by Japan Trust Fund, and in kind contributions by UNESCO Intergovernmental Oceanographic Commission Western Pacific-HAB (IOC WESTPAC-HAB), Japan Funds-in-Trust (JFiT), WESTPAC and Asian Natural Environmental Science Center (ANESC). Dr Yasuwo Fukuyo (University of Tokyo), Dr Lim Po Teen (University of Malaya), Dr Mitsunori Iwataki (ANESC, University of Tokyo), Dr Sandric Leong (National University of Singapore), Dr Kazumi Wakita (Tokai University) and Dr Lim Hong Chang (Tunku Abdul Rahman University College) were invited as trainers and to deliver lectures.

This training course was attended by twenty participants from ten countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam) from Fisheries Agencies (Fig. 1). The main objective of this training course was to improve identification knowledge of harmful micro-algae through lectures and laboratory practicals. The course focused on the identification of harmful and red tide causative species including diatoms, dinoflagellates and raphidophytes that are commonly found in the ASEAN region. Moreover, another objective of the course was to encourage participants to establish an international network for communication and exchange of information in the case of HAB events.

The programme consisted of a series of lectures coupled with hands-on training sessions, field trips, demonstrations on sampling techniques, the use of Sedgewick-Rafter counting chambers, and observations of microalgae using light microscopy and field microscopy (Fig. 2). Accurate species identification is very crucial for the relevant authorities to prevent and mitigate HABs impacts. A short introduction to freshwater bloom-forming phytoplankton species, in particular cyanobacteria, for countries which have no marine HABs problems was provided. The training sessions also included discussions on current status, challenges and management of HABs in each country.

Fig. 1. Group photo of regional training course in Singapore, July 18-22, 2016.

Participants were encouraged to organize local or regional training courses to train more experts on harmful algae identification. The IOC WESTPAC-HAB working group shall assist local groups in training their local community by sending suitable trainers to the training workshop and by providing teaching references and materials. During the course a platform was created for participants and trainers to exchange HABs information and establish networks among scientists and managers. Posters on toxin-producing dinoflagellates and red tide species are expected to be produced by participants by end of this year. Subsequently, the posters will be distributed to local communities to enhance public awareness on HABs.

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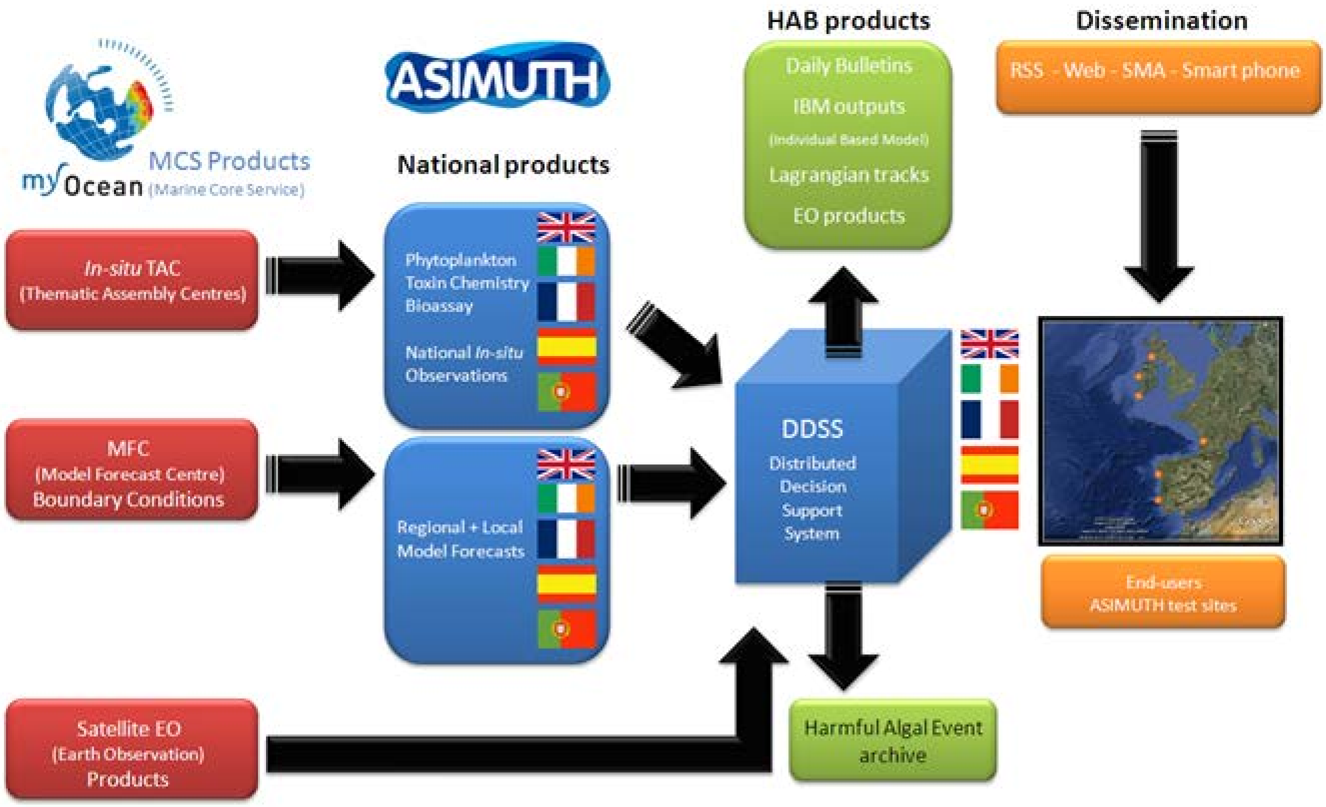
Fig. 2. Hands-on activities during the course: Light microscopic observation of specimens and field samples; Plankton net sampling at Singapore Straits on July 20, 2016; Loading of sample into Sedgewick-Rafter counting chambers; Observation of phytoplankton sample using portable field microscopy.



ASIMUTH special issue of Harmful Algae

The European Commission (EC) 7th Framework Programme (FP7) project **A**pplied **S**imulations and **I**ntegrated **M**odelling for the **U**nderstanding of **T**oxic and **H**armful Algal Blooms (ASIMUTH) ran from 2010-2013.

It involved 11 partners from Portugal, Spain, France, Ireland and Scotland from Europe's Atlantic coast, in regions that experience HAB problems with prolonged closures of aquaculture areas as a result of toxic HAB events and in some cases large losses of farmed fish.

The project had the aim of producing realistic HAB advisory and forecasting capability as a GMES (Global Monitoring for Environment and Security) downstream service to the European aquaculture industry, with a view to allowing fish and shellfish farmers to adapt their culture and harvesting practices in time, in order to reduce potential losses.

The project was the winner of the "best service challenge" at the Copernicus Masters Awards (Nov 2013)

Volume 53 of the Elsevier Journal 'Harmful Algae' (March 2016) edited by Keith Davidson, Marcos Mateus, Beatriz Reguera, Joe Silke and Marc Sourisseau is a special issue devoted to the ASIMUTH project: *www.sciencedirect.com/science/journal/15689883/53*

The special issue contains 14 papers that describe some of the modelling and early warning advances made during the project. It included work on a number of HAB genera including *Dinophysis, Alexandrium, Karenia, Pseudo-nitzschia* and *Gymnodinium*.

ASIMUTH has a legacy of continuing HAB risk alert systems in both Ireland and Scotland that can be accessed at *www.marine.ie* and *www.HABreports.org* respectively.

This project is supported by the EC FP7 Programme, Space Theme, Grant Agreement No.: 261860

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Last News on the 17th ICHA

The local and international organizing committees are busily planning the 17th International Conference on Harmful Algae (17th ICHA), in Florianopolis, Brazil from 9th-14th October 2016. For the first time in history, Latin America will host the conference and is looking forward to welcoming approximately 450 participants from many different countries from around the world.

REGULAR registration is open until August 31st. From September 1st, LATE onsite registrations will be accepted at the ISSHA rates of 1800 Brazilian Real R$ (non-ISSHA member, 2000R$) and 1000 R$ for students (non-ISSHA students, 1100 R$). So it's not too late to make your travel plans to attend the conference so that you can reconnect with your colleagues and hear many exciting talks about HABs around the world!

A new student **speed networking** workshop is scheduled for 13:00-16:00 on Sunday, October 9 at the Intercity Hotel (the conference hotel). This is an excellent opportunity for young scientists to meet and exchange ideas prior to the main conference. The networking workshop will foster an interactive environment between small groups of advanced scientists and students in hopes of creating short, high impact exchanges. There is still space, so sign up today!

The ICHA 2016 **photo competition** is still accepting photos until 30 September 2016 from registered participants. Photos can be submitted in the categories of microscopy, harmful algae and aquaculture, freshwater harmful algae, tropical harmful algae, harmful algae scientists at work and play. Please submit your best photos!

Several very reasonably-prices **tours** are planned for Wednesday, October 12, including a Florianopolis city walk, a trip to the stunning views and beaches of Lagoa de Conceição, an island adventure, an oyster experience, a sailing trip, a trekking experience and an Oktoberfest party. Sign up lists for these tours will be available at the conference.

Fig. 1. A beautiful handmade tapestry for the ISSHA Auction 2016

Voting for ISSHA Executive and Council Members will take place from October 1 to October 12 midnight Brazilian time. Voting for the 2020 ICHA venue will be open until October 13 midnight Brazilian time. Bids will be published on the ISSHA website and the candidate countries will make their presentations at the ISSHA General Assembly lunchtime meeting on Thursday October 13. All ISSHA members, including those who cannot attend the ICHA 2016 in Florianópolis are encouraged to vote ON LINE.

And last but not least, don't forget our **biannual auction**. If you have items to donate or know of a business who might be interested in supporting our society, please contact Esther Garcés at *esther@icm.csic.es*. Or just bring your items with you and drop them off at the ISSHA booth at the conference. Remember that the auction is one of the funding sources for ISSHA that allows many deserving students to attend our international conferences. This is a very worthy cause!

For more information about the conference program and travel details, please see *www.icha2016.com.*

Vera Trainer, ISSHA President

Important Deadlines to vote on line (www.issha.org)

Voting for ISSHA Executive and Council Members: October 12 midnight Brazilian time

Voting for the 2020 ICHA venue: October 13 midnight Brazilian time

Forthcoming events

Seafood Safety: New Findings & Innovation Challenges
Brussels, 25-26 January 2017
Deadline for registration: 15 January 2017 (early bird 25 November 2016).
Abstract submission deadline:
15 October 2016.
www.ecsafeseafoodconference.com

11th International Conference on Modern and Fossil Dinoflagellates
Bordeaux (France), July 17-21, 2017
Latest developments in studies of living and fossil dinoflagellates.
laplf.org/dino11/news.htm

11th International Conference on Molluscan Shellfish Safety
Galway, Ireland May 14- 8, 2017
Protecting consumers, assuring supply, growing confidence.
www.icmss2017.com

Please feel free to contact any of the editors if you have article, ideas for article or special issues and we will work with you!

Deadline
Deadline to submit material for HAN 55:
31 October 2016

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Lay-out
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