Occurrence of Pyrodinium bahamense blooms related to cyst accumulation in the bottom sediments in the bays at Ambon, Lampung and Jakarta, Indonesia

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Clinical Use of Paralytic Shellfish Toxins: First evidence of Neosaxitoxin as a long-acting pain-blocker in Bladder Pain Syndrome

The European Society for the Study of Bladder Pain Syndrome (ESSIC) and the International Consultation on Incontinence (ICI) defines Bladder Pain Syndrome (BPS) as a "chronic pelvic pain, pressure, or discomfort of greater than 6 months duration perceived to be related to the urinary bladder, accompanied by at least one other urinary symptom, such as the persistent urge to void urine frequently" [1]. BPS is not a life-threatening illness, but it has recently been acknowledged as a major health issue which seriously affects patients' quality of life, and is often accompanied by sleep and depressive disorders, anxiety and recurrent urinary tract infections. Consequently, ordinary daily activities are usually avoided.

Neosaxitoxin (neoSTX) is a phycotoxin whose molecular mechanism of action shows a reversible inhibition of voltage-gated sodium channels at the axonal level. Consequently, their main physiological effect is linked to impeding both nerve impulse propagation and neuronal transmission over the neuromuscular junction. When it is locally applied there are two clinical outcomes: the control of pain (anesthetic activity) and the control of muscle hyperactivity (relaxing effect) [2].

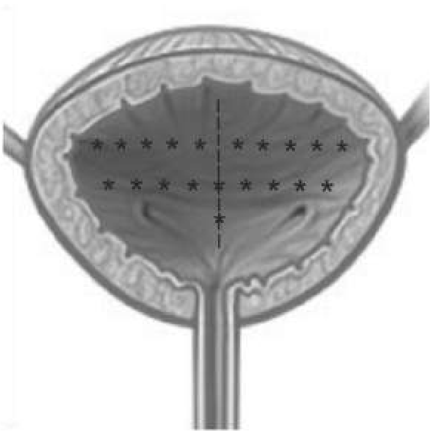

Fig 1. Cystoscopic infiltration protocol model. Cystoscopy was performed to all patients Infusion height was approximately 60 cm above the symphysis pubis. As show in the figure, twenty infiltration points were performed in the bladder submucose. Paint was totally blocked.

A study was designed to evaluate the clinical efficacy of neoSTX as a long-lasting pain blocker in the treatment of BPS. The infiltration was performed via cystoscopy, under spinal anesthesia. Questionnaires were applied immediately before and 7, 30, and 90 days after the procedure to measure the patients' reported pain severity and quality of life. All patients responded successfully to treatment. The analgesic effect lasted for the entire 90 days of follow-up, without the need for a second infiltration. NeoSTX infiltration was shown to be a safe and effective intervention to control pain related to BPS. It was tolerated well by patients who experienced extended pain relief and associated beneficial effects over the 90 days of follow-up. The present findings demonstrate that neoSTX is an innovative new long-acting local pain blocker for BPS with singular potential clinical use [3]. Until now, Neosaxitoxin and Gonyautoxins [4,5] have only been used in clinical trials at the Hospital Clínico de la Universidad de Chile in Santiago, where a pioneering collaboration between basic science investigators and clinicians has demonstrated the therapeutic properties of these biotoxins during a local infiltration are both effective and safe [2].

The paper "First evidence of neosaxitoxin as a long-acting pain blocker in bladder pain syndrome", published by the International Urogynecology Journal this year (DOI: 10.1007/s00192-014-2608-2) was recommended in F1000 Prime as being of special significance in its field.

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Content

HAB genera identified on archival samples from the Continuous Plankton Recorder Survey

Long-term datasets are becoming increasingly relevant in predicting change in marine systems. Many institutes hold archived samples that could provide additional data on species identity and long-term patterns through molecular DNA analysis. However many samples are preserved in ways that are refractory to DNA analysis e.g. formalin or even Lugol's iodine. SAHFOS holds a physical marine plankton archive from the Continuous Plankton Recorder (CPR) survey dating back to 1960 (Fig. 1) [1]. The CPR survey records around 250 phytoplankton entities from offshore waters by light microscopy (LM) as well as a Phytoplankton Chlorophyll index (PCI) – a proxy for phytoplankton. More information can be found at *http://www.sahfos.ac.uk/*. Usually larger plankton cells are captured because of the relatively large mesh size (270 µm), however smaller plankton have been observed especially when phytoplankton is abundant. As a trial to see if smaller plankton could be identified, molecular methods were used to analyse two smaller non-toxic variants of harmful algae species in the Northern North Sea (from Aberdeen in the North East of Scotland to the Shetland Islands – Fig. 2) from 2012-2014; the diatom *Pseudo-nitzschia delicatissima* (23-76 µm length) and the non-PSP toxin producing dinoflagellate *Alexandrium tamarense*, ranging between 22 - 51µm. *P. delicatissima* was recorded by presence or absence [2], whereas *A. tamarense* was also quantified [3]. Both these species are impossible to identify to species-level by LM methods. *P. delicatissima* and similar looking/cryptic species are grouped into the *P. delicatissima* type complex, whilst species within the historic *Alexandrium fundyense/tamarense/catenella* complex are indistinguishable by light microscopy. The CPR survey does not record *Alexandrium* species at all.

Our molecular results showed that both species were identified to variable degrees (see Fig. 3). *A. tamarense*, a widespread European variant as described by [4] was a non-bloom forming population with a near consistent presence at lower quantities. Earlier reports showed a low-moderate presence of the *Alexandrium* genus in this area [5]. By contrast, *P. delicatissima* was seasonal and most frequent in the autumn months of 2012 and 2014,

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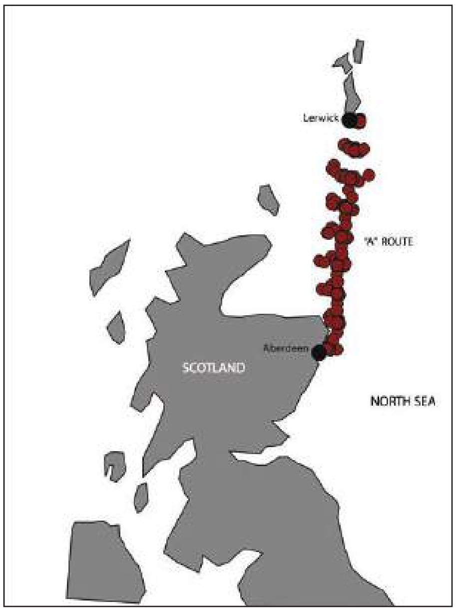

Fig. 2. Map of the "A" route in the North Sea towing the CPR from Aberdeen (north east Scotland) to Lerwick (Shetland Islands) over three years from 2011. Each red dot represents one sample. The shipping route may vary slightly from year to year

Fig. 1. A CPR Mark II device deployed from ships of opportunity. Left image an empty internal cassette. Right image internal cassette showing silk with captured phytoplankton

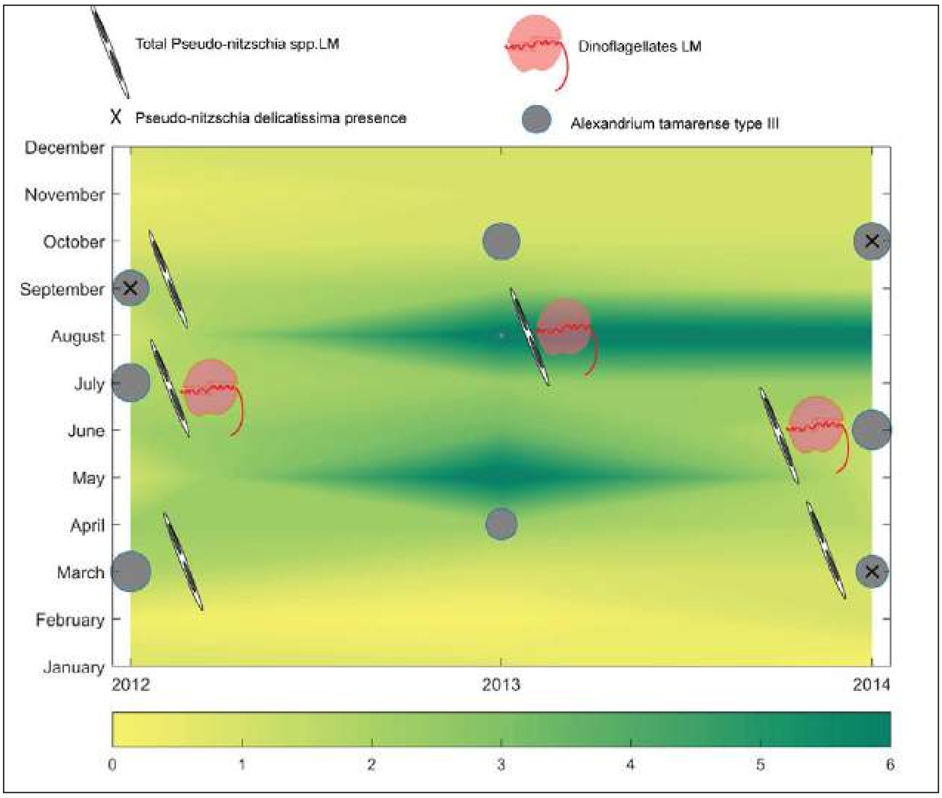

Fig. 3. Three years of Phytoplankton Colour Index (PCI) values (2012-14) were extracted from a series of tows going from Aberdeen to the Shetland Islands in Scotland. For each year, monthly averages were calculated to obtain the dataset used. Three non-consecutive months were interpolated to avoid any missing values. The frequency of occurrence and quantity of DNA of Alexandrium tamarense is represented on the diagram by grey circles where size is proportional to their quantity, while presence of Pseudo-nitzschia delicatissima is represented by a cross

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Persistent golden tides stranding Caribbean Sea in 2014 and 2015

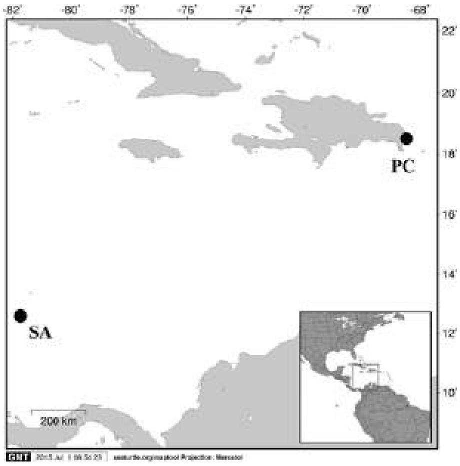

Fig. 1. Map showing the location of Punta Cana (PC) in the SE Dominican Republic and San Andrés (SA) Island (Colombia). Map made from a seaturtle.org/maptool, Mercator projection

Holopelagic seaweeds *Sargassum natans* (Linnaeus) Gaillon and *S. fluitans* (Børgesen) Børgesen coexist in the Sargasso Sea (North Atlantic Ocean) and form an important drifting ecosystem. These species occasionally form golden tides in the eastern islands of the Caribbean Sea and western Africa [1]. Golden tides of Sargassum have also been recently recorded for a few days in September 2014 in San Andrés Island (southwestern Caribbean, 280 km off the coast of Nicaragua) [2,3] (Fig. 1) and drifting thalli reaching the coastline of the Lesser Antilles occurred in August and September 2014 [4]. However, the persistence and extension of the golden tide events in other places of the Caribbean Sea in 2014 and 2015, seem to have been even more severe (Fig. 2). In particular, the golden tides in 2014 in the Dominican Republic shores lasted longer than usual, being observed from May to December. Moreover, the huge biomass of Sargassum reaching the beaches has not stopped at any time during 2015 (Fig. 2). The tides are mainly due to *S. fluitans*, with the contribution of *S. natans* being considerably lower. In the Punta Cana area, the year 2014 was locally referred to as 'the sargasso year' due to the huge biomass accumulated on the beach (50-80% higher than in past events). It must be highlighted that the term 'sargasso year' was previously applied to 2005 where atypical quantities of Sargassum were observed in the Gulf of Mexico [5]. Since tourism represents an important economic resource for the countries of the region, the economic losses during the last event have had a significant impact. It must be highlighted that the most important flow of western tourists takes place from December to March. The impact on tourism is due to three factors: i) the ecological damage involved in the withdrawal of rotten seaweed from the beach; ii) the sand and shores being covered with drifted seaweed that deter swimmers, and iii) the physical damage produced by the contact with seaweeds (dermatitis due to the accompanying epibionts) [6]. For all these reasons, some tourist resorts in Dominican Republic are using, with relative success, contention nets to prevent the stranding of *Sargassum*. However, a global rather than a local measure would be more effective. Different hypotheses have been proposed to explain the occurrence of the golden tides in the Atlantic during the last years. For instance, it has been suggested that global warming and perhaps nutrient load from the Amazon River [7] could be involved in the golden tides recorded in the Caribbean and western coast of Africa because these seaweeds originate in an area north of the river estuary [5,7]. It has also been hypothesized that golden tides in 2014 in San Andrés Island could be associated with the passage of hurricane *Edouard* towards the Atlantic coast of the USA, the currents deriving from this atmospheric event carrying seaweeds [2,3]. However, this last explanation cannot support the golden tides in the Dominican Republic and other Caribbean islands because the hurricane occurred in September and the golden tides appeared several months before.

Whether golden tides of *Sargassum* represent a symptom of anthropogenic global change is an unanswered question but, without any doubt, it is an issue that merits further study because of their ecological and economic significance, especially for the economy of developing countries in the Caribbean region.

Fig. 2. Beached Sarggasum on the coasts of Punta Cana (SE Dominican Republic) in June 2015 (courtesy from P. Guerrero)

Acknowledgements

The authors acknowledge the information provided by P. Guerrero, who collected data in situ.

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Authors

José C. Báez, Spanish Institute of Oceanography, Málaga, Spain

A. Enrique Salvo & Antonio Flores-Moya, University of Málaga, Málaga, Spain

Email corresponding author:
floresa@uma.es

Recurrence of the harmful dinoflagellate *Karlodinium australe* along the Johor Strait

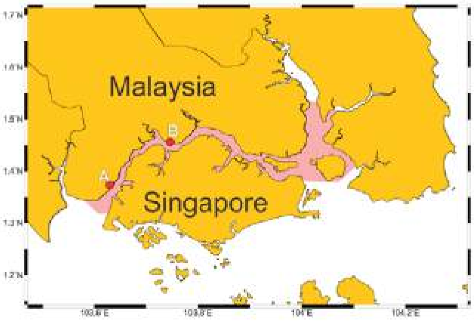

Fig. 1. Sampling sites of this study in Johor Strait. Area shaded in pink was the affected area during the 2015 blooms.

The harmful dinoflagellate *Karlodinium* is well known as a massive fish killer in tropical regions [1,2]. In February 2014, blooms of *Karlodinium* first occurred in the west Johor Strait, Malaysia, and caused massive fish mortality. Following this incident, detailed morphological and molecular studies identified the culprit as *Karlodinium australe* [3].

In February 2015, recurrence of massive fish kills both in fish cages and wild populations (including some demersal fishes and crustacean) were observed along the west Johor Strait. Water discoloration was clearly visible in the area. According to the fish farmers, fish behaved abnormally at night, jumping aggressively out of the cages from 10 pm to 1 am. An aeration system used to aerate all the cages did not seem to improve the fish conditions. Many brownish clots were observed in the mouths and stomachs of the impacted fish. The local farmers claimed that they suffered losses of over 30 t of fish, thus this event was more severe than the previous bloom in 2014.

On the 5th of March, 2015, field sampling was conducted at the western (1.377 °N and 103.641 °E) and central parts of the Strait (1.457 °N, 103.746 °E) (Fig. 1). Water flux was clearly visible near the farm areas because of the tidal movements (Sampling site A, Fig. 2 a-b), however, water movement was limited and nearly stagnant at sampling site B, mainly due to blockage of the causeway across the strait. Fish carcasses were observed in areas with heavy water discoloration (Fig. 2 c-d) where the bloom seemed to be driven by the tidal currents.

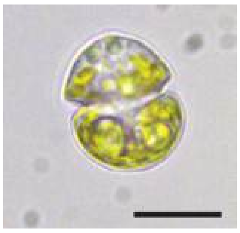

Fig. 3. Light micrograph of Karlodinium. Scale bar = 10 µm.

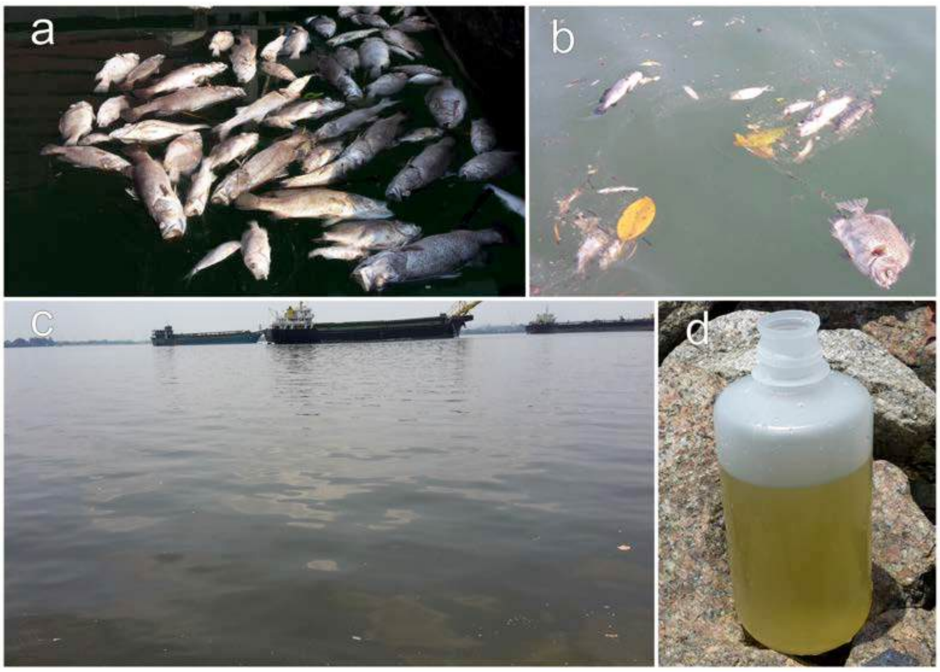

Fig. 2. (a-b) Dead cage-cultured and wild fishes along the west Johor Strait. (c-d) Sampling site B and brownish water samples.

Microscopic observations showed the unarmored *Karlodinium*-like cells (Fig. 3) dominated the samples, with maximum cell densities (up to $2×10^8$ cells L^{-1}) higher than in the previous year's bloom [3]. Single cells were isolated from the field samples for molecular analysis. Single-cell PCR [3] was performed to amplify the internal transcript spacers (ITS) region of the rDNA using primer pair, ITS1F and ITSR [4]. ITS sequence data confirmed the species as *Karlodinium australe* [3].

A simple fish kill test was conducted with water samples collected from the bloom area where fish were killed. Fish exhibited behaviours similar to that described by local farmers during the fish kill event. The mechanisms causing the fish mortalities requires further study.

Karlodinium australe was first reported from a lagoon habitat in Australia [5]. The species was also reported from Aman Island, the Straits of Malacca [3] and Singapore [6]. In this survey, we confirmed that *K. australe* was responsible for the fish kill event this year. This is an urgent issue that needs to be addressed by the local relevant authorities to ensure routine monitoring and an early warning system is in place to minimize the losses in aquaculture in the future.

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Authors

Sing Tung Teng, Faculty of Resource Science and Technology, University Malaysia Sarawak, 94300 Kota Samarahan, Sarawak Malaysia.

Chui Pin Leaw, Winnie Lik Sing Lau, Ing Kuo Law & Po Teen Lim, Bachok Marine Research Station, Institute of Ocean and Earth Sciences, University of Malaysia, Bachok,13610 Kelantan, Malaysia.

Email corresponding authors: ptlim@um.edu.my, poteenlim@gmail.com

Gonyaulax spinifera bloom in Thermaikos Gulf

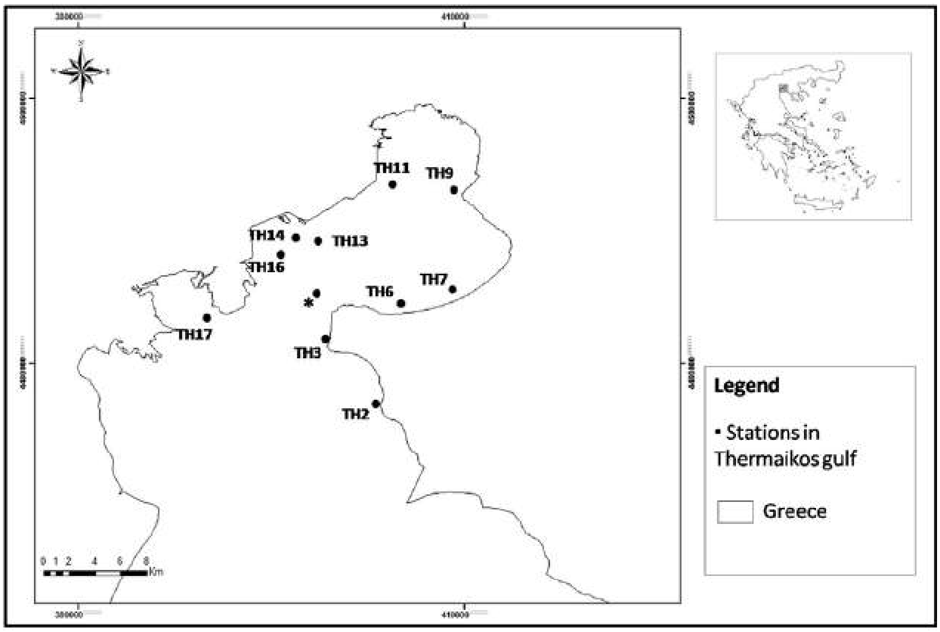

Fig. 1. Map of Thermaikos Gulf showing 10 monitoring sampling stations and the sampling point (*) where surface water discoloration was observed.

Gonyaulax spinifera (Claparède & Lachmann) Diesing 1866 has a world-wide distribution and together with *Protoceratium reticulatum* (Claparède & Lachmann) Butschli, 1885 and *Lingulodinium polyedrum* (Stein) Dodge, 1989 currently constitute the main planktonic yessotoxin producers. Its occurrence in seawater was correlated for the first time with mussel toxicity in New Zealand in 2004 [1]. In 2007, blooms of *G. spinifera* (densities up to 7.1 × 10^5 cells L^{-1}) occurred in the north-western Adriatic Sea [2]. Although there are no reports of human intoxication caused by yessotoxins, a limit of YTX equiv. kg^{-1} shellfish tissue has been set [3, 4].

Thermaikos Gulf is located in the North Western part of the Aegean Sea and constitutes the main bivalve mollusc production area in Greece. A potentially toxic microalgae monitoring programme has operated in the area since 2000 with a network of 19 sampling stations, 10 of which are located towards the inner part of the Gulf (Fig. 1). As part of this monitoring programme, integrated water samples are collected by the local responsible authorities on, at least, a weekly basis and the cell densities are determined using Utermöhl method [5] in the Laboratory Unit of Harmful Marine Microalgae-AUTH (LUHMM-AUTH) [6, 7].

G. spinifera has been recorded in Greek waters [8] and sediments [9] in the past, however not in high abundance. In this report, the first bloom of *G. spinifera* in Greek coastal waters (Thermaikos Gulf, North Western Aegean Sea) is described.

Cells were identified based on morphometrical characters using epifluorescence microscopy (Fig. 2), while individual cells were isolated, cultures were established and the characterization of the morphotypes by molecular phylogeny is also underway.

During October - November 2013, *G. spinifera* was recorded in high densities in Thermaikos Gulf with the same temporal pattern observed at all stations. From middle of October densities increased gradually reaching 113.2 x 10^3 cells L^{-1} at station TH13, located at the western coasts of the inner Thermaikos Gulf, in November (week 45). In all the other stations the maximum cell densities (not exceeding 46.5 x 10^3 cells L^{-1}) were recorded one week later (week 46). The bloom lasted approximately three weeks collapsing rapidly one week later (week 47, Fig. 3).

During the period when maximum densities were recorded at the monitoring stations, a brownish discoloration was observed at the entrance of the inner part of Thermaikos Gulf (*sampling point, Fig. 1) covering an area of approximately 1 km^2 (11/11/2013). Densities of *G. spinifera* in the surface sample collected from that area reached 6.4 x 10^5 cells L^{-1}.

At the same sample, dense *Dinophysis* cf. *ovum* populations (12 x 10^3 cells L^{-1}) were recorded. *D.* cf. *ovum* was present simultaneously with *G. spinifera* from October to November also reaching maximum densities (15x10^3 cells L^{-1}) during week 45, but at station TH7 (Fig. 4), which is located at the eastern part of the inner Thermaikos Gulf.

The recent findings in Thermaikos

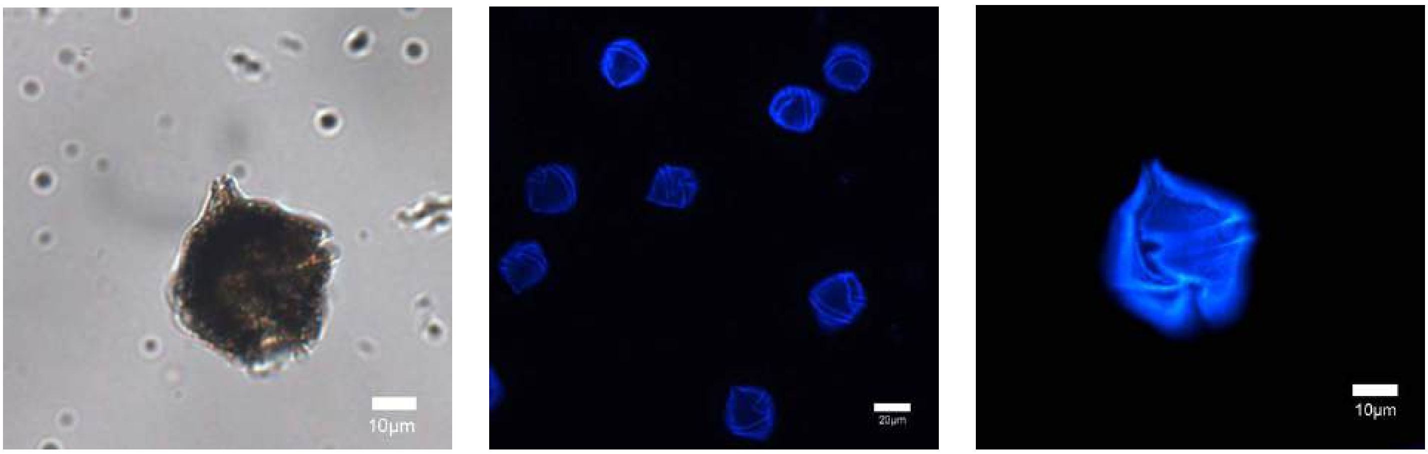

Fig. 2. Microscopy images of G. spinifera cells using (a) light microscopy and (b – c) epifluorescence microscopy

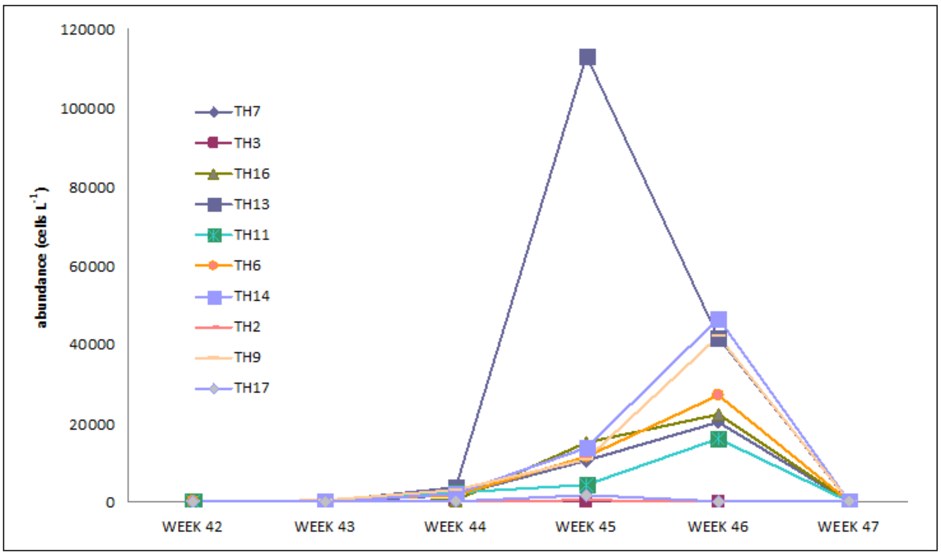

Fig. 3. The Gonyaulax spinifera bloom in Thermaikos Gulf the period October – November 2013 (G. spinifera density in cells L^{-1}).

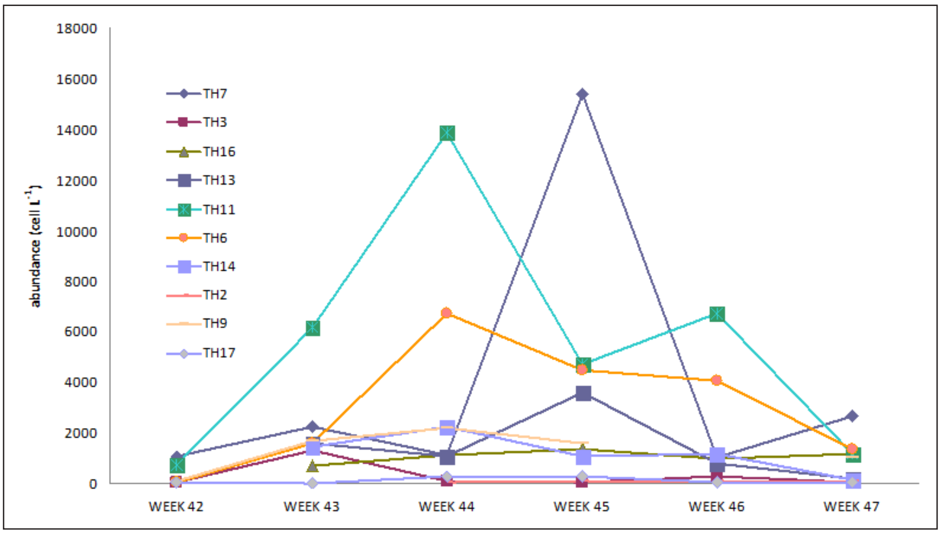

Fig. 4. The Dinophysis cf. ovum bloom in Thermaikos Gulf the period October – November 2013 (D. cf. ovum density in cells L^{-1}).

Gulf add another potential biotoxin threat in the area which could act synergistically to the existing and recurrent phenomenon of toxic *D.* cf. *ovum* blooms.

It must be highlighted that this is the first time since the initial record of *Dinophysis* blooms in Thermaikos Gulf that the *Dinophysis* bloom appears during this period of year. From 1999 to 2012 the period for *Dinophysis* blooms was from approximately mid winter until the end of spring-early summer. This observation together with the first record of such a high density bloom of *G. spinifera* and also the first highly dense bloom (8.5 x 10^3 cells L^{-1}) of *D. sacculus* in the area at mid May (LUHMM-AUTH, unpublished data) indicate possible phytoplankton community changes as a response to meteorological and hydrographic disturbances, a hypothesis that needs to be further investigated.

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Authors

Katerina Aligizaki, Eleni Arvaniti, Iliana Nikolopoulou, Agoritsa Kaliora & Minas Arsenakis, Laboratory Unit on Harmful Marine Microalgae, Laboratory of General Microbiology, Department of Biology, Aristotle University of Thessaloniki, Thessaloniki, GR 54124, Greece

E-mail corresponding author: aligiza@bio.auth.gr

Continued from page 2

except for 2013, which appears to be an anomalous year for both species. Neither species showed a consistent relationship with high PCI (Fig. 3) that may boost small-cell capture by blocking the mesh, so these species could prefer different conditions to most other phytoplankton. The molecular-detection of *P. delicatissima* corresponded with LM observations of all *Pseudo-nitzschia* spp. By contrast, *A. tamarense* generally did not occur with other dinoflagellates observed by LM (Fig. 1). These results highlight that despite design constraints, smaller species can be captured on archival CPR samples perhaps as fragments not observed by LM. This information provides additional information about their preferred habitat and temporal distribution and we hope to test more samples for better representation and compare them with other types of datasets.

Acknowledgements

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Authors

Rowena Stern, Pierre Helaouet & Jessica Clarke, Sir Alister Hardy Foundation for Ocean Science (SAHFOS), Citadel Hill, Plymouth, PL1 2PB, UK

Email corresponding author: rost@sahfos.ac.uk

Occurrence of *Pyrodinium bahamense* blooms related to cyst accumulation in the bottom sediments in the bays at Ambon, Lampung and Jakarta, Indonesia

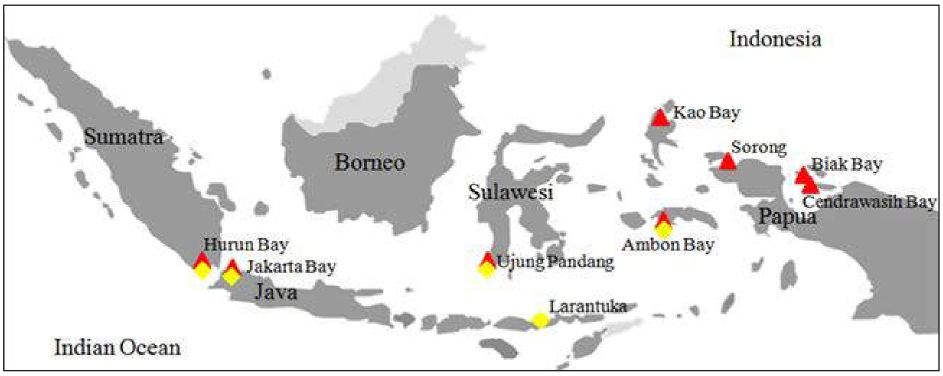

Fig 1. Location of Pyrodinium bahamense var. compressum occurrences in Indonesia. (▲) Bloom events; (●) Cysts observed in the bottom sediments. (according to Wiadnyana et al. 1996 and Matsuoka et al. 1999).

Pyrodinium bahamense var. *compressum* (Pbc) is considered one of the main causative agent of paralytic shellfish poisoning (PSP) in Southeast Asian coastal waters and the Pacific coast of central America [1]. This harmful algal species produces saxitoxins, which may be fatal to humans who consume infected shellfish. Since the first bloom in Papua New Guinea in 1972, Pbc blooms have caused major health security problems and huge economic losses in the Indo-Pacific [2].

In Indonesia, the first confirmed Pbc bloom occurred in Kao Bay (Halmahera Island, East Indonesia) on March 1994. Several months later, a tragedy happened in Ambon Bay. Three children died and 33 persons were hospitalized as a consequence of consuming shellfish [2]. High concentrations of Pbc cells (0.4-1.6 x 10^3 cells and 41% of total cells) were found to be responsible for this tragedy. Since then, Pbc bloom events have spread progressively to other areas in Indonesian waters, such as Piru and Elpaputih Bay (Banda sea), Sorong, Biak, and Cendrawasih Bay (Northern Papua waters), Ujung Pandang (Sulawesi) and Jakarta Bay [2] (Fig. 1).

Since Usup and Azanza [3] published their comprehensive review of *Pyrodinium bahamense* (Pb) in 1998, Pb has become notorious for producing resting cysts which may accumulate on the bottom sediment. It is considered that the accumulation of cysts, so-called cyst beds, has become a potential threat which may initiate blooms of their vegetative cells [4,5]. Later, Mizushima *et al.* investigated the existence of Pbc cysts in Hurun Bay (within Lampung Bay, Sumatra) and Ambon Bay (Maluku province) [5]. Based on sediment-core samples, it was shown that Pbc cysts were continuously recorded from 1830 until recently and their abundance gradually increased. Another study, by Matsuoka *et al.* [6], found cysts of Pb existed in surface sediments at Jakarta Bay (Java), Ujung Pandang (Sulawesi), and Larantuka (Flores Island, East Indonesia) (Fig. 1).

Distribution of Pb/Pbc cysts (Fig. 2a-d) in the surface sediments of the three Indonesian locations previously studied was investigated in 2014. In Jakarta Bay, the maximum density recorded was 144 cysts g^{-1} dry weight sediment. Pb cysts were observed in sites off the Ancol area and Tanjung Priok international harbor. Lampung, Hurun Bay, where Pbc blooms occurred regularly was, as expected, the area where Pbc cysts were most numerous. Ambon Bay was the place where the highest concentrations were observed within all the sampled stations in our study (max value: 1168 cysts g^{-1} dry weight sediment). The maximum relative abundances of Pbc cysts in surface sediment in Jakarta, Lampung, and Ambon Bay, were 13%, 40%, and 66% respectively. Based on these data, there is a serious concern that there is a potential threat for future PSP outbreaks in those areas.

The latest bloom event in Ambon Bay on July 2012, caused the death of thousands of cultured fish and 7 people (2 children and 5 adults) were hospitalised for a week after consuming shellfish [7]. Over 2000 cells L^{-1} of Pbc vegetative cells were observed during that

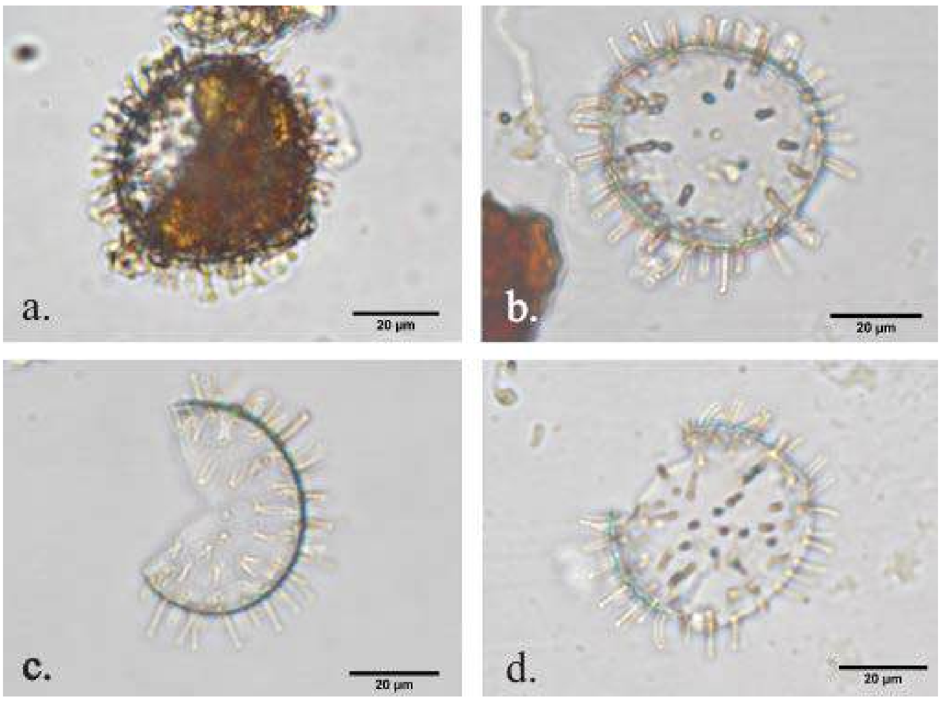

Fig 2. Pyrodinium bahamense cysts collected in 0-5 cm of the sampled surface sediments. a. Living cyst and b. Empty cyst from Ambon Bay, October 2014; c. Empty cyst from Jakarta Bay, May 2014; d. Empty cyst from Lampung Bay, May 201.

Fig 3. Pyrodinium bahamense var. compressum bloom forming red brown discoloration of sea waters close to fish cages at Passo in Ambon bay (12th July 2012)

event [7] (Fig. 3). From all the above it can be concluded that evaluation of the cysts beds would be important additional information to Pbc vegetative cell monitoring and shellfish toxicity surveys in any programme aimed at improving food safety of local people and establishing mitigation measures.

Acknowledgements

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Authors

Tumpak Sidabutar, Hikmah Thoha, Mariana D. Bayu, Arief Rachman, Oksto Ridho Sianturi & Nurul Fitriya, Research Center for Oceanography, Indonesian Institute of Sciences-LIPI, Jl. Pasir Putih N°1, Ancol Timur, Jakarta 14430, Indonesia

Muawanah, Main Center for Marine Aquaculture of Lampung (BBPBL), Jl. Yos Sudarso, Desa Hanura Kec. Padang Cermin, Pesawaran- Lampung 35454, Indonesia

Hanung Agus Mulyadi & Sem Likumahua, Research Center for Deep Sea, Indonesian Institute of Sciences-LIPI, Ambon Maluku, Indonesia

Estelle Masseret, UMR MARBEC IRD-Ifremer-UM-CNRS, Université de Montpellier, cc93, Place Eugène Bataillon, 34095 Montpellier Cedex 5, France

Email corresponding author:
estelle.masseret@umontpellier.fr

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Authors

Valentín Manríquez, Daniela Castro, Rodrigo Guzmán & Michel Naser, Female Pelvic Floor Unit, Gynecologic and Obstetric Department, Hospital Clínico Universidad de Chile, Chile. Veronica. Iglesia, Public Health School, Faculty of Medicine, Universidad de Chile, Chile

Daniela Castro & Néstor. Lagos, Membrane Laboratory, Physiology and Biophysics Department, Faculty of Medicine, Universidad de Chile, Chile

Email corresponding author:
nlagos@med.uchile.cl

Encystment and excystment of tropical strains of the toxic dinoflagellate *Alexandrium minutum* (Dinophyceae)

The marine dinoflagellate *Alexandrium minutum* is one of the harmful species responsible for paralytic shellfish poisoning (PSP) in the warm Western Pacific region. This highly toxic species was first known in Malaysian waters after the PSP incident in Tumpat, Kelantan (Fig. 1), in September, 2001 [1], when six people were hospitalized with one fatality [2]. Although there has been no recurrence of blooms since then, cells of *A. minutum* were commonly found in the plankton samples. Factors promoting bloom formation of this species remain unclear, in particular the role of encystment-excystment in bloom initiation.

Dormant resting cysts play an important role in the survival, dispersion, bloom initiation and recurrence of dinoflagellate populations [3]. Like many toxic dinoflagellates, *A. minutum* produces resting cysts in its life cycle. Little is known about the bloom dynamics and life cycle of the tropical toxic *A. minutum* and it is suspected that the mechanisms differ from those of temperate waters as the environmental regimes of tropical waters are so different.

In an attempt to understand the encystment and excystment of *A. minutum*, 15 strains of *A. minutum* were used in cross-mating experiments with a pairwise combination. Sexual fusion of gametes, formation of planozygotes and hypnozygotes (resting cysts) were investigated and confirmed under light microscope daily (Fig. 2). Hypnozygotes were found in nine out of 15 combinations of strains, with the earliest found on the third day after cross-mating of culture strains (3–6 days). Resting cysts of *A. minutum* were spherical. Some were ellipsoidal, with a thick layer of transparent cyst walls [4]. The appearance of the cyst content was granular and a condensed yellow-orange accumulation body was present.

In the excystment experiment, *A. minutum* cysts were isolated individually and transferred into a 96-wells culture plate containing seawater or seawater with enrichment medium. Cysts were monitored daily to determine the dormant period of individual cyst. They were observed to germinate 3–5 days after encystment. In the enriched seawater medium, ten cysts out of 35 were successfully germinated during the first 25 d of observation. A 60-d observation period revealed an excystment rate of 62.9%.

The results of this preliminary study showed that the dormant period of *A. minutum* cysts was relatively short when compared to its temperate counterparts. Dormancy periods of temperate strains of *A. tamarense* and *A. fundyense* were six and 11 months, respectively, where cyst germination was commonly reported in spring and autumn [4,5,6]. In contrast, encystment/excystment of tropical *A. minutum* was estimated less than two weeks. We hypothesized that the low cyst abundances observed in the tropical region are due to the extremely short dormancy period. This information is pivotal in understanding the initiation and development of blooms of the tropical dinoflagellate *A. minutum*.

Fig. 1. A semi-enclosed lagoon in Tumpat, Kelantan, Malaysia where blooms of Alexandrium minutum and PSP were first encountered.

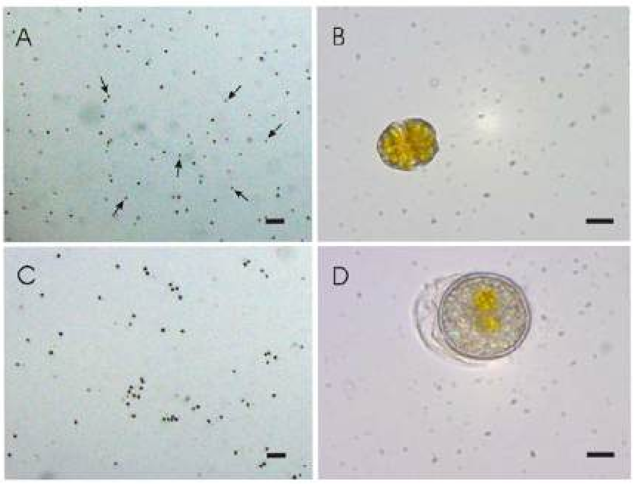

Fig. 2. (A) Cross-mating experiments of Alexandrium minutum, arrows indicate gametes, bar = 100 µm. (B) Gamete, bar = 10 µm. (C) Cysts formed at the bottom of plate, bar = 100 µm. (D) Hypnozygotes or Resting cysts, bar = 10 µm.

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Authors

Guat Ru Liow, Po Teen Lim, Suh Nih Tan & Chui Pin Leaw, Bachok Marine Research Station, Institute of Ocean and Earth Sciences, University of Malaya, 16310 Bachok, Kelantan, Malaysia.

Email corresponding author: cpleaw@um.edu.my, chuipinleaw@gmail.com

Extensive outbreaks of heterotrophic dinoflagellate *Noctiluca scintillans* blooms along coastal waters of the South Eastern Arabian Sea

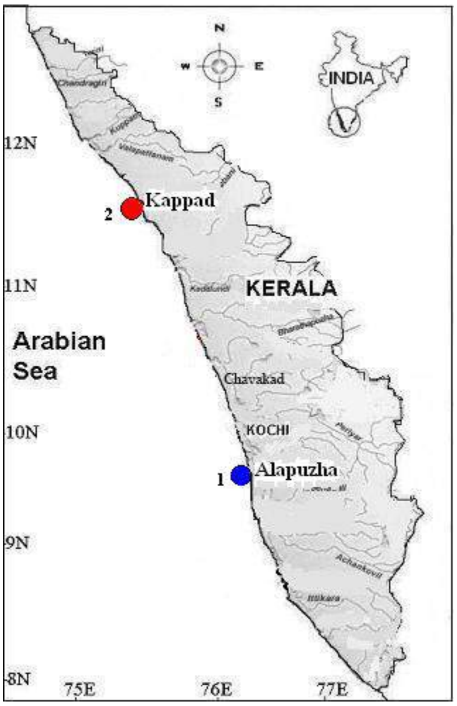

Fig. 1. Map showing Noctiluca bloom locations (1) Bioluminescent bloom off Alapuzha (2) red surface water discolouration off Kappad- Calicut

Fig. 3. Red surface water discolouration by Noctiluca scintillans bloom along the coastal waters off Kappad- Calicut (Photo courtesy: www.malayalivartha.com)

The heterotrophic dinoflagellate *Noctiluca scintillans* has long been present in the eastern Arabian Sea. It forms recurrent blooms during summer and winter monsoons along the south and northeastern Arabian Sea shores respectively. Since the first reported incident in 1908 [1] the southeastern Arabian Sea (southwest coast of India) (Fig 1) has been experiencing *Noctiluca* blooms annually for the past two decades [2-5]. Seasonal blooms of *Noctiluca* in the area were rarely associated with mortality of marine fauna, odour events etc [6, 7].

During summer monsoon of 2015 two massive outbreaks of red *Noctiluca* occurred along the south eastern Arabian Sea (Fig. 1). In the second week of July 2015, a 'glowing sea' was observed during the night time along the inshore waters off Alleppey (Lat. 09°49 N; Long. 76°31 E) and nearby areas (Fig. 2). The coastal inhabitants of these areas had concerns about this phenomenon and the 'glowing sea' condition was the main topic of conversation amongst them. Following newspaper reports, water samples were collected during the day and in the evening time when it was dark. Analysis of water samples confirmed that the 'glowing sea' was due to a bloom of *Noctiluca scintillans* (3.1×10^5 cells L^{-1}). The *Noctiluca* cells were between 600 and 1000 µm in diameter and were "red *Noctiluca*", i.e. lacking the prasinophyte endosymbiont *Pedinomonas noctilucae. Noctiluca* (latin meaning: night shiner) is commonly known as 'sea sparkles' because of its ability to produce blue bioluminescence at night. This bioluminescence is produced by a luciferin-luciferase system located in thousands of spherically shaped organelles, or 'microsources', distributed throughout the cytoplasm of this single-celled protist [8].

On 5th August 2015 the coastal waters off Kappad- Calicut (Lat. 11°38 N; Long. 75°72 E) became red and appeared to have a tomato soup-like consistency (Fig. 3) creating panic among the coastal dwellers. The very next day water samples were collected from the

Fig. 2. Dense bloom of bioluminescent Noctiluca scintillans along Alapuzha coast, here the algal cells sparkle as waves splash on the shore (Photo courtesy: www.metrovaartha.com)

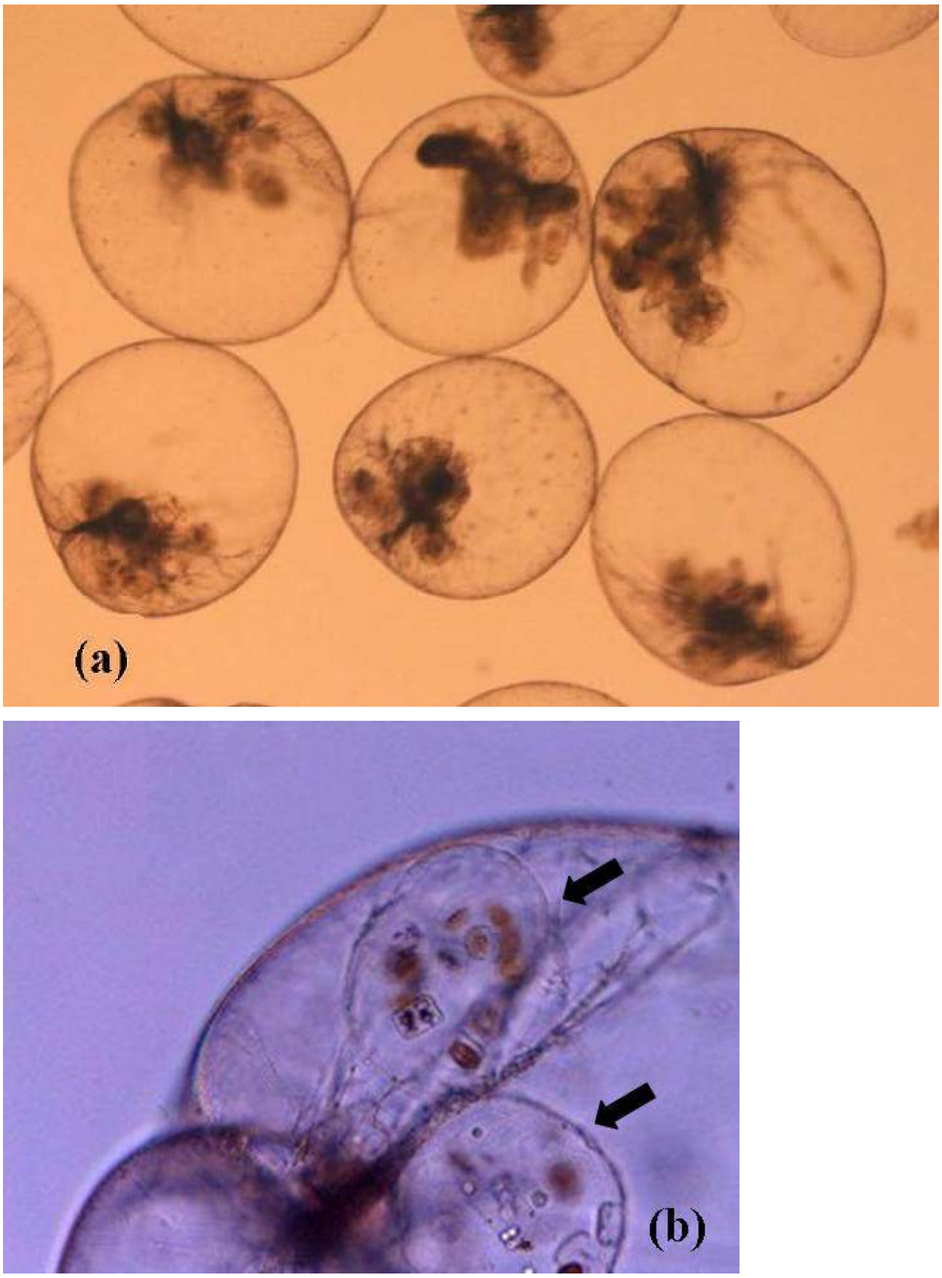

Fig. 4. Microphotographs (a) Noctiluca scintillans (x 40) (b) Food vacuole with diatoms cells inside (x 200)

incident area and analysed. Microscopic observations showed that the red surface water discolouration was due to high densities (5.3x 10^6 cells L^{-1}) of red *Noctiluca*. During this and the previous event *Noctiluca* cells had food vacuoles containing cells (Fig. 4) from co-occurring diatoms. The percentage composition of *N. scintillans* and mainly chain forming centric diatoms (*Thalassiosira* spp., *Rhizosolenia* spp. *Chaetoceros socialis, C. curvisetus, Fragilariopsis cylindrus*) in the plankton community in the bloom waters were 60% and 40% respectively. Although the blooms were dense mortality of marine fauna was not reported during the two incidents. Local fishermen reported that fish catches were considerably lower during the bloom period and shoreward drifts of moribund crabs were observed in these regions.

Data from the regular HAB monitoring, that is part of the MLR programme (MoES, Govt. of India), indicate clearly that the incidence of *N. scintillans* blooms has increased in the last decade during summer monsoons along the coastal waters of south eastern Arabian sea. The frequent occurrence of these blooms poses a threat to coastal ecosystem health. Summer monsoon upwelling and associated high primary production are one of the major contributors of the biological production of eastern Arabian Sea. With increased occurrences of *Noctiluca*, a voracious heterotroph [9] unpalatable to other animals, disruptions in the coastal marine food chains such as shorter food chains and decreased diversity of coastal ecosystems are the most probable outcome. The recent incidence of jellyfish blooms [10] along the coastal waters of the south eastern Arabian Sea can be considered as an outcome of such changes. Since jellyfish are the primary grazers of *Noctiluca*, their abundance can increase following these dinoflagellate blooms. The increased frequency of *Noctiluca scintillans* blooms can be considered as an indication of a species shift in the primary producers in this region.

Acknowledgments

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Authors

Kunnatholickal B Padmakumar, Lathika Cicily & Maruthadu Sudhakar, Centre for Marine Living Resources and Ecology (CMLRE), Ministry of Earth Sciences, Kochi-37, Kerala, India

Bijoy Nandan S, Dept. of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science & Technology, Kochi-16, Kerala, India

Email corresponding author: kbpadmakumar@gmail.com

Predicting the unknown from the unknown: Can we model our way out of ecological ignorance?

Charles Darwin´s passionate belief that *"Ours is but to observe the ways of Nature"* helped lay the foundation for what we now call ecology – but his approach would not stand a chance in today´s funding system for science. Is this because science has honestly developed beyond the "primitive" concepts he and his colleagues gave us two centuries ago, or have we as a society lost the plot? I was provoked into thinking about this recently by a powerful emerging trend in research on harmful algal blooms (HABs or "red-tides"). Here, as in many other fields of research, scientists are trying to predict future events, but the available background ecological data is inadequate, and scientific modelling is being proposed to somehow compensate for this. In my opinion, this is unrealistic for HAB-research or the many other fields of science facing the same dilemma. At its best, ecology involves observing which organisms live where and when, in order to ask the important questions of why and how they do so. This might eventually offer the possibility of predicting ecological events such as HABs, but can we ignore these first steps? Can we really model our way out of ecological ignorance?

The early ecologist´s world was very different, but they were at least as highly motivated as present-day scientists. These were a few, independently wealthy, privileged gentry, able to pursue basic science as a full-time "hobby". For them, it was sufficient to observe and record the ways of Nature for its own sake – revealing the wonderful "miracles" in the details of the natural world as an intellectual exercise for the few. It took another hundred years before David Attenborough could bring such delights into the homes of the masses through television, but in so doing, he too, always shows the greatest respect for these early pioneers – he certainly has not lost the plot! So what *has* changed?

Society´s basic attitude to science has definitely not changed since Darwin´s time; society still expects a "payback". Already back then, there were huge socio-economic benefits from "observing the ways of Nature" – for example, greatly improved agriculture and increased food production. But Nature paid a dreadful price; and today, what started as "observing the ways of Nature" has become an urgent, headlong rush into "*understanding* the ways of Nature", as the ecological damage caused by our "progress" threatens our very existence. "The gentlemen´s hobby" has rapidly developed into crisis management of the planet.

Today, basic scientific research is a "public service industry" – the public pay for research, and in return, they expect practical solutions for serious environmental problems: how damaged is the biosphere, and how will it respond to future global change? By now, the initial concept of observing the ways of Nature could, and should have led to a long-term monitoring effort that would give us at least one hundred years of ground-truth data on what has been happening in the natural world. Sadly, however, we have seriously neglected these first steps, and scientists now feel pressured into making ecological predictions, even in the absence of adequate data. This can be likened to a person trying to plan where to go, without knowing where he is coming from, or where he is. This is where the plot was lost, as illustrated by the example from HAB-research. HABs threaten public health, wealth and welfare worldwide, and hundreds of researchers are working on them. Some HAB-species in the phytoplankton (microscopic algae in the sea and lakes) produce toxins causing sickness, or even death in humans, other species kill fish, while others interfere with the workings of fishing gear or desalination plants. More than forty years of research has seen great progress in identifying the organisms and toxins for short-term public warnings of up to a few weeks prior to any danger. However, this has not led to a general ecological understanding of why these organisms cause problems where and when they do, and both scientists and the public should be asking: why? This is not just to point the finger of blame at science – scientists alone have not caused society´s problems with the natural environment, and they do not control funding priorities for addressing them – we are all in this together!

Nobody should be surprised at the lack of ecological answers, here, or elsewhere in science. Generally, there is no long-term phytoplankton monitoring prior to HAB-events that would provide ground-truth data for asking "why here and now?", and researchers have to devise their own investigative strategy "after the fact". It is hard to understand why it has proved so difficult to establish long-term environmental monitoring programs, but it probably involves political reluctance to commit long-term funding. Still, such monitor-

ing is the crucial first step towards understanding changing environments and biotic responses, and scientists and funding agencies together bear responsibility for not having pressed more for this at the highest levels of decision-making.

The alternative strategies have usually identified “the target species”, and attempted to study their ecological requirements with respect to a few abiotic factors such as temperature and salinity, often in laboratory cultures, and with little or no attention to the complex biotic interactions with other organisms within the plankton. Basic ecology teaches us that organisms live where they do in response to *both* biotic and abiotic factors, and it is therefore not surprising that the resulting ecological data is inadequate. However, if the data is inadequate for understanding past and present events, what possibility is there for plausible predictions of future events? Surely, we need to get back to basics and concentrate efforts more on “good old fashioned” environmental monitoring to find out what is really happening out there.

In Darwin´s time, customers could consult a fortune-teller gazing into a crystal ball to predict their looming fate. Today, science should be seen as doing better than re-inventing the crystal ball!

The following article was first published in Sherkin Comment [1], the environmental quarterly of Sherkin Island Marine Station. It expresses my personal belief that HAB research should reconsider the need for more long-term monitoring of the plankton. Recent meetings and workshops show that our science is seriously addressing possible effects of climate change. Lack of funding prevented my participation, but I presume those attending did consider the role of long-term monitoring, well aware of the seemingly impossibility of funding such efforts even if they were willing to tackle the issue. Bradburry [2] criticized HAB science as expressed in Anderson and Garrison [3] for disregarding the ecological principle that organisms respond to a combination of physical and biological factors in their environment (“physics is not biology”). I agree with this criticism, while at the same time acknowledging the awesome implications of facing up to it. I sometimes include in presentations a slide stating that this (plankton ecology) “is not rocket science”, followed by another stating “it is much more complex”. The one builds on well-known basic principles, while ours is still largely “work in progress” – we can land instruments on a small extraterrestrial body in motion out there, but we are generally unable to give long-term warnings of HAB down here. The threat of HAB to public health and welfare adds urgency to our need to probe the enormous complexity of plankton ecology – why, when and how HAB occur? As HAB research progresses, with projects aimed at “predicting” how HAB may be affected by an ever-changing world, I hope we will raise the effort along the way to find out what is actually happening out there in the plankton.

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Author

Barrie Dale, Professor emeritus, Geosciences Department, University of Oslo, Norway

Email: barrie.dale@geo.uio.no

IOC and IAEA together in a Regional Science Planning Workshop on Harmful Algae in the Caribbean and Adjacent Regions

The VI IOC Regional Science Planning Workshop on Harmful Algal Blooms in the IOCARIBE region was held at the Universidad Nacional Pedro Henríquez Ureña in Santo Domingo, the Dominican Republic, from 26 to 30 October, 2015. The workshop was part of an International Atomic Energy Agency (IAEA)-IOC "Regional Training Course on Ciguatera Fish Poisoning (CFP): Field Monitoring and toxin data management".

The workshop was sponsored by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, and the IAEA project RLA7020: "Establishing the Caribbean Observing Network for Ocean Acidification and its Impact on Harmful Algal Blooms, using Nuclear and Isotopic Techniques".

The aim of the meeting was to:

i. Train participants to compile and share data and metadata on harmful algal events and occurrences of toxic microalgae in the IOCARIBE region, using the IOC/IODE datasystems HAEDAT and OBIS. This information is required to include the IOCARIBE region in the Global HAB Status Report in progress with the financial support of Flanders (Belgium).

ii. Strengthen the IOCARIBE/ANCA network through inclusion of IAEA/RLA 7020 project participants, and the planning of future joint regional activities.

Participants came from Colombia (2), Costa Rica (2), Cuba (4), Dominican Republic (4), El Salvador (2), Guatemala (1), Jamaica (1), México (2), Panamá (2), and Venezuela (1). Henrik Enevoldsen (IOC UNESCO) and Mary Kennedy assisted as HAEDAT and OBIS database trainers respectively; Patricia Tester and Santiago Fraga as international experts on Ciguatera, and Carlos Alonso as IAEA designated team member.

The participants actively exchanged knowledge on HABs from their respective countries; the full group assessed the gaps, constraints, and bottle-necks in each participating Member State; identified responsible individuals in ANCA and IAEA/RLA in each country for compiling data and uploading them to HAEDAT and OBIS. The responsible people in each country defined HAEDAT Area Codes for reporting HAB events, each country representative dividing his coast into areas that are meaningful in the context of how sampling is made. A timeline was agreed to for completing a first phase of regional data compilation.

For the next two years, the group agreed to:

i. Organize a HAB-Caribbean Symposium in the frame of the XXIII Congress of Science and Technology of the Sea to be held in Tapachula, Chiapas- México.

ii. Develop the "IV Theoretical and practical course on IOCARIBE - HABs: Emphasis on Public Health".

iii. Publish a special issue of harmful algae in the Caribbean in the Cuban Journal of Fisheries Research (RCIP).

iv. Generate a risk map of HAB vectors in the Caribbean.

v. Develop a proposal for ANCA participation in the implementation of a global Ciguatera strategy.

Authors

J. Ernesto Mancera-Pineda, IOCARIBE ANCA Chair, Universidad Nacional de Colombia, Departamento de Biología, Edificio 421, Ciudad Universitaria, Bogotá, D.C., Colombia

Henrik Enevoldsen, HAB Programme Coordinator, Intergovernmental Oceanographic Commission of UNESCO, Paris, France

Carlos Alonso-Hernández, IAEA/RLA 7020 Project Dessignated Team Member, Centro de Estudios Ambientales de Cienfuegos, CUBA, DTM RLA7020.

Email corresponding author: jemancerap@unal.edu.co

Algae for the future: from harm to benefits – Highlights on the HABSCS-ICBUAB 2015, Hong Kong

The recent *6th International Conference on Prevention and Management of Harmful Algal Blooms in the South China Sea and the 2nd International Conference on Beneficial Uses of Algal Biomass 2015* (HABSCS-ICBUAB 2015) was attended by more than 100 participants. They gathered at the Open University of Hong Kong (OUHK) on 20–23 December to discuss the management of harmful algal blooms as well as the beneficial uses of algae. There were key note presentations, oral and poster contributions as well as a lively session of speed-talks by some of the numerous young students participating in the conference; some of them as participating in the student exchange programme between University of Xiamen and OUHK.

Management of HABs

Key speeches focused on HAB monitoring and prediction, investigations of HABs in Northeast Atlantic Europe (Beatriz Reguera), the biodiversity of harmful benthic dinoflagellates in Hainan Island, south China (Songhui Lu), control and mitigation of HABs, environmental-friendly prevention strategies for HABs using diatoms and algicidal bacteria (Ichiro Imai) and rapid treatment of ship's ballast water using hydroxyl radicals (Min-dong Bai).

Other studies concentrated on the genomic and proteomic analysis of harmful algae, including a review on the current status and future perspectives of marine dinofagellate proteomics (Dazhi Wang) and the molecular response of diatoms to nutrient stresses in the ocean. Studies presenting the toxicology results of the shellfish killing species *Karenia mikimotoi* (Tian Yan) and the effects of dietary composition and nutritional quality on the feeding and growth of *Noctiluca scintillans* (Hongbin Liu) were presented.

Beneficial uses of algal biomass

Microalgae are widely used in wastewater treatment, e.g. in the removal of polybrominated diphenyl ethers in wastewater by microalgal isolates (Nora Fung-Yee). Microalgal biofuel production was thoroughly discussed in the conference. Michael Borowitzka shared the cultivation experience, from strain selection to optimizing productivity in open ponds and Rainer Buchholz introduced the cultivation systems for high-value products derived from photoautotrophic microorganisms. Hongye Li talked about the metabolic engineering of microalgae for boosting neutral lipid accumulation.

Prof. Kin-Chung Ho, Chairman of the Conference Organizing Committee, gave concluding remarks at the end of the conference to summarize the current research status and future perspectives of algal studies. During the final day participants had the opportunity to visit the *Water Resources Education Centre* in Kowloon.

Author
Kin Chung Ho, Dean, School of Science & Technology, The Open University of Hong Kong, China

Email: kcho@ouhk.edu.hk

Fig. 1. Group photo in the Opening Ceremony, HABSCS-ICBUAB 2015

Fig. 2. Fruitful discussion during Q&A and Poster Presentation Sections

Colombia organized its first national workshop on HABs

Harmful algal blooms (HABS) have been recognized as a public health issue in several countries for decades. However, Colombia is just starting to accept it as an issue that may affect public health as well as tourism. As a result of this late awareness, the Colombian Oceanographic Commission (CCO), the IOCARIBE-HAB-ANCA group and the Universidad Nacional de Colombia, working as members of the National Technical Committee on Marine Pollution, organized the first national workshop on HABs.

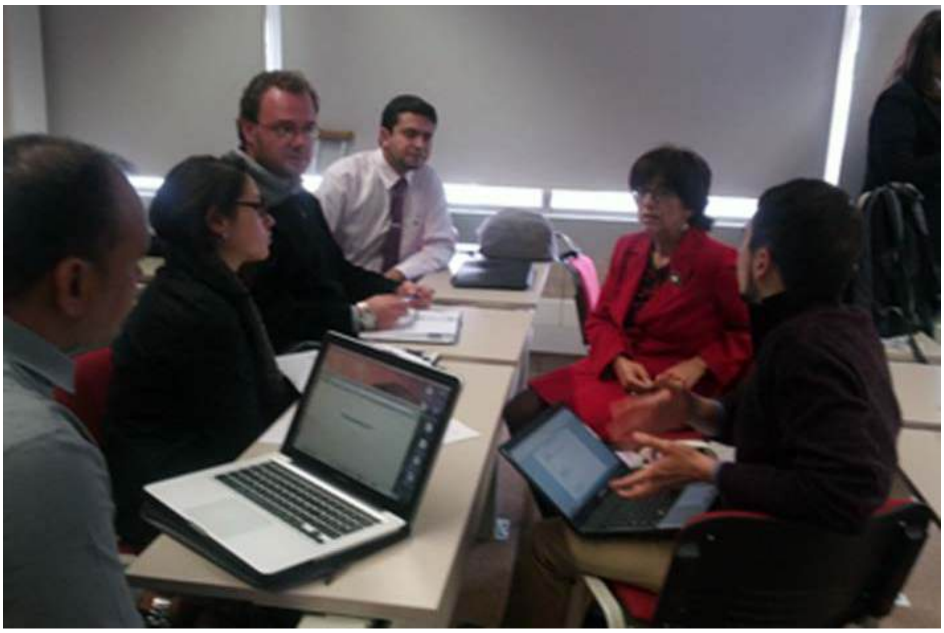
The meeting titled: "I Seminario-Taller Sobre Floraciones Algales Nocivas: Impactos en el Desarrollo Local, Regional y Nacional" (Seminar-Workshop on HABs: Impacts on local, regional and national development), was held on 5th June 2015 at the Universidad Jorge Tadeo Lozano, Bogotá and was part of the Colombian World Oceans Day celebration (Fig. 1). Representatives of 11 Colombian institutions and one from Spain (Ministry of Health and Social Protection, Ministry of Environment and Social Development, Chancellery, Institute of Marine and Coastal Research – INVEMAR, National Authority of Aquaculture and Fishery- AUNAP, Navy of Colombia, Gobernación de César, Executive Secretary of the Colombian Oceanographic Commission, Universidad Militar Nueva Granada, Universidad Tadeo Lozano, Instituto Español de Oceanografía, Universidad Nacional de Colombia) belonging to different sectors such as environment, public health, fishery, aquaculture, education, research, defense and international affairs attended the meeting.

The main goal of the workshop was to answer the question: *Which elements must be included in a Colombian HAB risk management plan?*

To answer this question a wide-perspective overview including international experiences of environmental and public health issues and the requirement for economic assessment was presented. Beatriz Reguera showed the Spanish approach as well as other European cases. J. Ernesto Mancera, current chair of IOCARIBE-HAB-ANCA and Colombian HAB focal point, presented general aspects of HAB and the Colombian situation, stressing the importance of including HAB issues as a part of the coastal development plans. Mónica Puyana introduced a case study of Cyanobacteria blooms in the SEAFLOWER International Biosphere Reservation. Milena Borbón emphasized the health aspects of HABs in Colombia, based on medical reports from San Andrés island. Finally, Julián Prato showed the importance and need to assess the economic impacts of HABs in the country.

For the second section of the workshop a prospective methodology was used which facilitated dialogue between experts of different topics and integrated their knowledge to plan future scenarios. During this section, the experts worked in small groups and identified priorities to be included in a future management plan. These activities were related to three main aspects: 1) Sociocultural factors of the Colombian population; 2) Public policy requirements and regulations, in areas such as public health, fishery resources and environment; 3) Needs for scientific research and environmental monitoring systems, including economic and health aspects.

Later, the participant discussed the results in a plenary session and drew a general list of activities. Using two criteria, Importance (I) and Governance (G), the experts assessed each activity, and results were plotted in an IGO-graphic, which grouped the activities according to four components: a) Strategic Actions: High importance and high governance; b) Challenges: High importance but low governance; c) Minor Actions: Low importance and low



governance; and c) Short Term Actions: Low importance and high governance (Fig. 2).

The results allowed us to identify elements that should be prioritized in future national risk management plans, highlighting the importance of inter-agency work to carry out the proposed actions.

A total of 35 actions were identified. The main strategic actions are: (i) map the annual cycle in the coastal regions of Colombia of the main artisanal and semi-industrial fishery products; (ii) determine the treatment given to the fishery products in terms of: cleaning, loading, transportation, storage and marketing; (iii) identification, monitoring, and evaluation of seafood habits of the Colombian population; (iv) educational programs and information campaigns on HAB impacts, addressing coastal and island communities in the Caribbean and Pacific coasts; (v) implementation of HAB training programs for administrators and decision makers; (vi) strengthen the national group of HAB experts to provide ongoing advice in monitoring, identification of toxic species and toxin analysis; (vii) establish a national network for monitoring, research, and communication on HAB events; (viii) make a survey of HAB events in Colombia and incorporate this information into the HAEDAT system of the IOC HAB Programme; (ix) strengthen environmental monitoring programs to improve the knowledge on harmful and toxic algae; (x) update the list of potential toxic species present in Colombian ecosystems.

The workshop stimulated interest in HABs in Colombia. It was an opportunity to introduce an ongoing problem in a comprehensive way. The representatives of different institutions expressed a high level of commitment. Based on these results, the National Technical Committee on Marine Pollution will work on a proposed HAB risk management plan for the next five years.

To complement to the workshop, a theoretical and practical course on HABs took place from 8th – 12th June 2015. Beatriz Reguera (IEO, Spain), Brigitte Gavio, Luis Carlos Montenegro, J. Ernesto Mancera (Universidad Nacional de Colombia) and Howard Junca (Universidad Militar Nueva Granada) gave lectures and laboratory practicals on the biology, taxonomy, and ecology of HABs, including Ciguatera Fish Poisoning (Fig. 3). A total of 20 participants from different universities and institutions from Colombia and Perú attended the course. As a result, knowledge and dissemination of information about HABs in Colombia was improved; the network of researchers was strengthened and the list of potentially toxic species present in the country was updated (Fig.4).

Authors

J. Ernesto Mancera-Pineda, Brigitte Gavio & Luis Carlos Montenegro-Rodríguez, Universidad Nacional de Colombia, Departamento de Biología, Edificio 421, Ciudad Universitaria, Bogotá, D.C., Colombia

Liliana Rodríguez, Comisión Colombiana del Océano (CCO), Carrera 54 # 26-50, CAN, Bogotá, D.C., Colombia.

Email corresponding author: jemancerap@unal.edu.co

Phytoplankton taxonomists at work!

The Marine Institute, Ireland, in conjunction with the IOC Science and Communications Centre on Harmful Algae in Copenhagen, Denmark organised the *2015 BEQUALM Marine Phytoplankton Intercomparison Exercise* three day workshop in the Danhostel, Hillerød, Denmark, 9th-11th November 2015. There were approximately 20 attendees from different laboratories from across Europe and Asia at the workshop this year (a full house). Lectures on the genera *Prorocentrum* and *Protoperidinium* were presented by Jacob Larsen as well as updates on nomenclatural changes, including the name change from *Ceratium* to *Tripos* and the latest changes under discussion about the *Alexandrium* genus. Nina Lundholm also gave two lectures focussing on the genus *Pseudo-nitzschia* reviewing all the new toxic species recently described and also taxonomic developments in the genus *Chaetoceros*. We are very grateful to have such an excellent quality lecturers at the workshop. Thanks also to Eileen Bresnan from Marine Scotland for her talk on carbonate chemistry and ocean acidification and Paula Hynes, Marine Institute for her talk on harmful algal bloom forecasting through the ASIMUTH project and its HAB bulletins.

Fig. 1. Jacob Larsen lecturing at the BEQUALM workshop

Author
Rafael Salas, Marine Institute, Rinville, Oranmore, Co. Galway, Ireland

Email: Rafael.salas@marine.ie

IOC-SCOR GlobalHAB Steering Meeting, Oban, UK 8-10 March 2016

GlobalHAB, the new joint IOC-SCOR programme, will be launched in 2016, with financial support from the U.S. National Science Foundation (through SCOR) and from IOC. The overall goal of the new programme is to foster activities to stimulate the scientific advance for a better understanding of harmful algal blooms and to contribute to mitigate their impacts. GlobalHAB will address and build upon the most relevant objectives identified by the preceding GEOHAB programme and will incorporate new pressing issues that face the international harmful algal bloom (HAB) science community. GlobalHAB will also take into consideration recommendations posed by the international community to make the new programme relevant to contemporary and future research, funding, and management priorities, continuing to provide an international approach based on science.

International Council for Science
SCOR
Scientific Committee on Oceanic Research

United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

The members of the GlobalHAB SSC are Elisa Berdalet (Chair), Neil Banas, Michele Burford, Chris Gobler, Bengt Karlson, Raphael Kudela, Po Teen Lim, Lincoln Mackenzie, Marina Montresor and Kedong Yin. The first meeting of the Scientific Steering Committee of GlobalHAB will be host by Keith Davidson at the Scottish Association for Marine Science (SAMS) in Oban (UK) on 8-10 March, 2016. In this first meeting, the SSC will design the general plan of the programme over the next decade, and map out specific activities for the next three years. The worldwide HAB research community is invited to actively engage in this project.

Contact: Elisa Berdalet, Institut de Ciències del Mar, Passeig Marítim de la Barceloneta 37-49, 08003 Barcelona, Spain

Email: berdalet@icm.csic.es

Theme session about phytoplankton trends to be held at the ICES ASC 2016

The International Council for the Exploration of the Sea (ICES) Annual Science Conference will take place in Riga, Latvia from 19 – 23 September 2016. The ICES science committee has approved a joint proposal from the ICES Working Groups on Phytoplankton and Microbial Ecology (ICES WGPME) and Harmful Algal Bloom Dynamics (IOC-ICES-WGHABD) for a theme session on "Long-term phytoplankton trends: regional distribution, bloom dynamics and response to environmental drivers". This session aims to bring together phytoplankton and microbial ecologists, HAB scientists and statisticians to discuss observed long-term changes in the phytoplankton/microbial communities and associated impacts on fisheries, aquaculture and the marine environment. Presentations are welcome on a range of topics relating to phytoplankton and HAB ecology including dynamics of algal bloom development, long term changes in phytoplankton communities, large-scale comparisons (meta analyses) of long-term trends, phytoplankton/HAB responses to environmental drivers, ecosystem impacts/effects on ecosystem services, monitoring methods and assessment of ecological/environmental status. The call for papers will be released in January 2016. Further information about the theme sessions at the 2016 Annual Science Conference will be posted on the ICES website towards the end of this year (*http://www.ices.dk/news-and-events/asc/ASC2016/Pages/default.aspx*).

We look forward to seeing you there.

Contacts
Alex Kraberg (Alexandra.Kraberg@awi.de), Eileen Bresnan (Eileen.Bresnan@gov.scot) and Marie Johansen (marie.johansen@smhi.se)

The US 9th Symposium on Harmful Algae

The National HAB Committee (NHC) announces that the US Ninth Symposium on Harmful Algae will be held in Baltimore, Maryland from October 28 to November 3, 2017. The theme of the Ninth Symposium will be "Training the Next Generation" and will include several hands-on workshops for the students and postdoctoral fellows. A presentation by the local DELMARVA organizing committee will be made at the Eight Symposium in Long Beach, California to provide additional details.

The SETAC Europe 26th Annual Meeting

Nantes 2016
SETAC Europe

The SETAC Europe 26th Annual Meeting, which will be held in Nantes, France, from 22-26 May 2016. Under the general theme *Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry*, experts from academia, government and industry will share the most recent advanced knowledge in environmental sciences in order to improve chemical risk assessment and support current and future policies.

A session on *Consequences and Solutions of toxins produced by microorganisms: monitoring, management, risk assessment, and future challenges* will be held.

For more information and updates on the meeting, please check website *http://nantes.setac.eu*

Tribute to Yves Collos (1949-2015)

We are extremely sad to inform you that Dr. Yves Collos (CNRS, Montpellier, France), who was head of the "Harmful Algal Blooms and Diversity" group for 8 years, passed away on Sunday 25 October 2015. Although Yves retired last year, he was still very active in writing scientific papers and giving us advice. We have lost a friend and a great scientist who made major contributions in the knowledge of the processes involved in the nitrogenous nutrition of the phytoplankton. More generally, he made a great contribution to the understanding of the marine phytoplankton ecology in the Mediterranean Sea with an emphasis on HAB species developing in the Thau Lagoon. We wholeheartedly express our sympathy to Yves' family.

Yves Collos completed his Bachelor of Science in the Old Dominion University, Norfolk, USA (Sept 1969-Aug 1970) and obtained his Master of Science in Biological Oceanography from University of Washington (Sep 1970-June 1973) Seattle, USA. He prepared his PhD (1982) in Biological Oceanography at Aix-Marseille University. Yves joined CNRS in the Oceanology Center in Marseille in 1976. He moved to l'Houmeau CREMA in 1982 for a 7-year period, after which he joined the Hydrobiology Laboratory in Montpellier where he finished his career as Director of Research. Yves has authored more than 110 papers, which included 91 peer-reviewed publications in the most relevant journals in marine science. He is also author of chapters in several books and made major contributions to nutritional studies in micro-phytoplankton. Over the last fifteen years, he published many relevant papers on the use of different forms of nitrogen by the neurotoxic *Alexandrium catenella* blooming in Thau lagoon and demonstrated that urea together with particulate organic nitrogen trigger *Alexandrium* development in this ecosystem and could explain the high growth rate (up to 1.3 d^{-1}) observed for this species *in situ*. In May 2013, Yves Collos received the Hutchison Medal named in memory of past President, Sir Kenneth Hutchison, which he was awarded for both practical and wide-ranging, philosophical or thought-provoking published papers; among others for a joined paper with colleagues on "Ocean fertilization for geo-engineering: a review of effectiveness, environmental impacts and emerging governance", published in "Process Safety & Environmental Protection", November 2012. Dr. Collos was a member of the Association for the Sciences of Limnology and Oceanography, International Society for the Study of Harmful Algae and Phycological Society of America.

Only one year ago Yves wrote the following beautiful text on the eve of his retirement. It traces the events that have marked his career. We think this is the best way to discern the man and the scientist he was.

"Having started my career at the CNRS in Marseille Oceanology Centre in 1976, I worked in the team Pelagic Primary Production and participated in several missions at sea (off the West African coast mainly, but also in the North Atlantic and in the Antarctic Ocean). If these missions were sometimes quite exotic (14 m waves to attack the Marion Dufresne 66 ° S and the loss of the Jean Charcot anchor in the port of Nouadhibou in Mauritania after a very festive stop with our American colleagues Atlantis II were the most vivid memories), the extreme diversity of the sites brought some difficulties when writing my PhD dissertation (1982). This led me to change the laboratory in order to focus on a single site where one can easily return regularly to test working hypotheses. Thus, I was one of the gang of eight "CNRS mercenaries" led by Serge Maestrini in 1982 to found the new Laboratory at L'Houmeau, near La Rochelle. If the benefits (to draw ourselves the lab plans and work in brand new premises) were evident, in the longer term, the isolation of the laboratory would quickly become a disadvantage (University of La Rochelle had not yet been founded). After 7 years at CREMA (with a stay of one year at the University of British Columbia in Vancouver), I joined the Hydrobiology Laboratory of Montpellier 2 University in 1991. The Thau lagoon (West Mediterranean, France) had obviously caught my attention as a remarkable site and was easily accessible. Our first goal was basically to decipher the functioning of the ecosystem, particularly at the level of the nitrogen cycle (ah, fabulous 24 hours experiments at the edge of the pond with a barbecue and a night under the stars on the terrace of oyster mas Ifremer in Bouzigues). But it is the appearance of toxic algae blooms in 1995 which enabled the initiation of work of greater scope, because we could not only devote our study to a single site, (especially at the Crique de l'Angle which is a kind of giant continuous culture pond), but mostly studying a unique species among the phytoplankton communities. The combination of in situ and laboratory studies of Alexandrium catenella/ tamarense was certainly the highlight of my career. So if we had to leave a message for those who will follow, I would continue to study the Mediterranean lagoons that are fabulous incubators of phytoplankton where time and space are no longer inextricably linked, and at a time when modeling seems to outweigh all else, remember that nothing can replace field observations."

Authors

Estelle Masseret & Mohamed Labir, Université de Montpellier, cc93, Place Eugène Bataillon, 34095 Montpellier Cedex 5, France

Philipp Hess
IFREMER - BP 21105, Rue de l'Ile d'Yeu
44311 Nantes Cedex 03, France

Email: estelle.masseret@umontpellier.fr; mohamed.laabir@umontpellier.fr; philipp.hess@ifremer.fr

10th International Conference on Toxic Cyanobacteria

October 23–28, 2016 in Wuhan, China. Conference theme: *Research to Risk Management*

Scheduled sessions include: Cyanobacterial detection; Cyanotoxin analysis; Toxicology and toxicity assessment; Secondary metabolites production and functions: biosynthesis, regulation, biological functions; Ecology and Cyanobacterial Bloom Dynamics: the nutrient control of cyanobacterial blooms; Cyanotoxin compartmentation and persistence; Interactions between bacteria and cyanobacteria; Risk management of cyanobacterial blooms and cyanotoxins at scales of catchment, in-lake and water treatment; Remote sensing of blooms.

Abstracts of poster and oral presentations, deadline June 23, 2016.

For more information see: *http://www.ictc10.org/dct/page/1*

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!

Compiled and edited by
Beatriz Reguera, Instituto Español de Oceanografía (IEO), Subida a Radio Faro 52, 36390 Vigo, Spain
Tel: +34 986 492111
Fax: +34 986 498626
Email: *beatriz.reguera@vi.ieo.es*
and
Eileen Bresnan, Marine Scotland, Victoria Road, Aberdeen AB1 9DB, Scotland
Tel.: +44 122 4876544
Fax: +44 1224295511
Email: *eileen.bresnan@scotland.gsi.gov.uk*

Project Coordinator
Henrik Enevoldsen, IOC Science and Communication Centre on Harmful Algae, University of Copenhagen, Universitetsparken 4, 2100 Copenhagen Ø, Denmark
Tel.: +45 33 13 44 46
E-mail: *h.enevoldsen@unesco.org*

Lay-out
Department of Biology, University of Copenhagen, Denmark

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