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IOC/WESTPAC Scientists Develop Technical Guidelines for Ciguatera Studies

On 5-6 November 2013, an IOC/WESTPAC Training Workshop on Toxic Marine Organisms was organized at the University of Tokyo, Japan, with one of its major objectives to develop regional technical guidelines on ciguatera studies, drawing on experiences from Japan.

Ciguatera Fish Poisoning (CFP or Ciguatera) is a foodborne illness caused by eating certain reef fishes contaminated with ciguatoxins and its analogues originally produced by toxic dinoflagellates of the genus *Gambierdiscus.* Large reef-dwelling fish in tropical and sub-tropical waters accumulate marine toxins by eating toxic algae growing on coral reefs, and are most likely to cause ciguatera poisoning. CFP is difficult to prevent as ciguatoxic fish do not carry a strange odor or taste, and cooking fish does not inactivate the heat-stable toxin.

CFP is the most problematic algal poisoning syndrome, with reported cases amounting to 20,000 – 30,000 per year, but no effective management system has been developed yet in the IOC/WESTPAC region. Despite the low number of reported cases of CFP in the region, scientists are concerned that there must be many unreported cases in the region, and reports may increase in the near future, given that CFP occurs mainly in tropical and subtropical coral area.

"We must provide scientifically reliable information to prevent and reduce the impact of CFP" said Dr. Dao Viet Ha, WESTPAC Project Leader on Toxic Marine Organisms, emphasizing the need for one regional standard method for CFP studies. The two days workshop, with the contribution of invited Japanese experts on ciguatoxins and other marine toxins, aimed to improve knowledge on the present situation of CFP in Member States, and develop a regional technical guide on the collection of ciguatera poisonings data, including clarification of clinical symptoms, identification of possible causative food, sample collecting for screening for toxicity and toxin identification.

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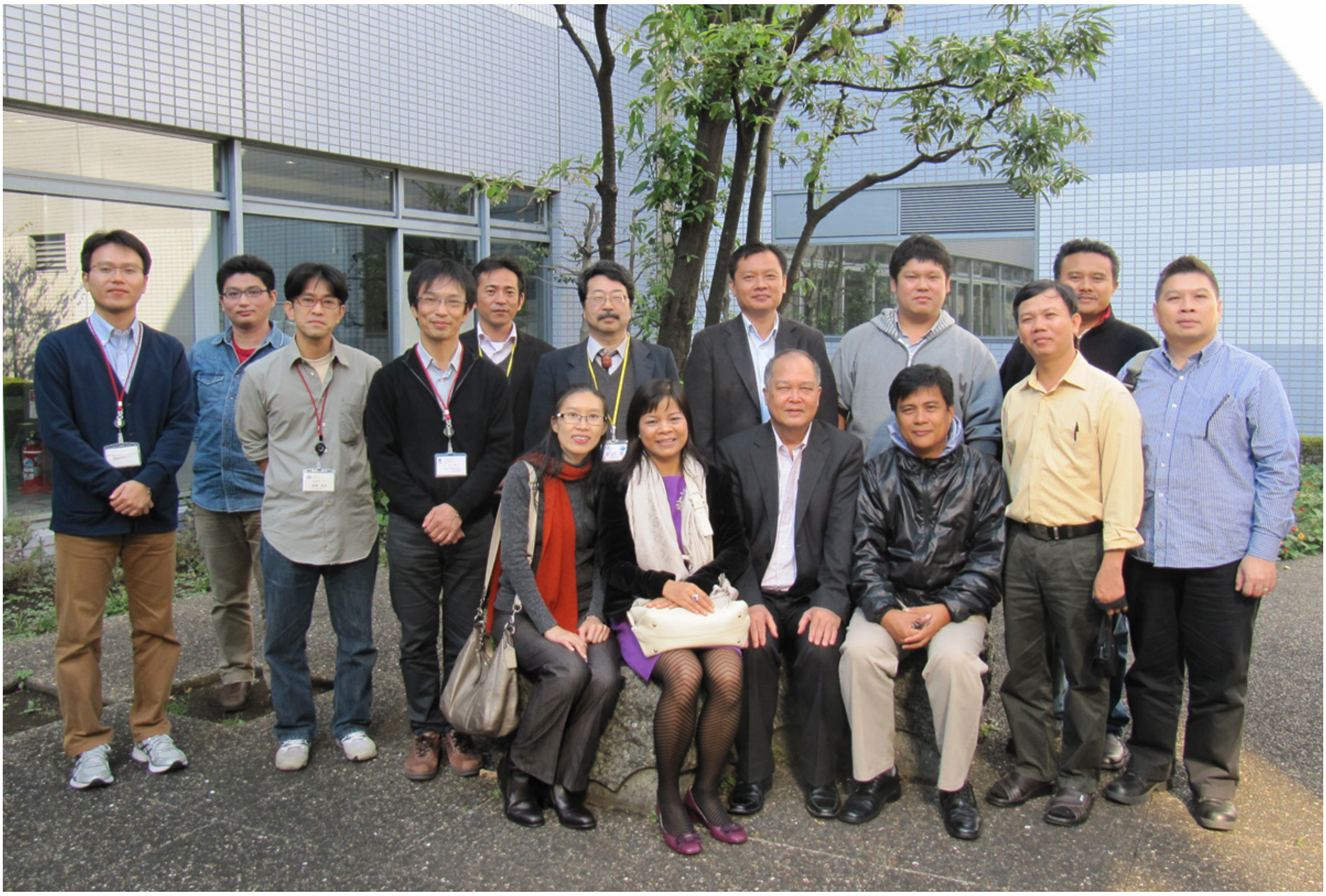

Participants in the 3rd IOC/WESTPAC-TMO training workshop in Japan, 5-6 Nov. 2013.

First report of an *Ostreopsis ovata* bloom on Abruzzo coast (W Adriatic) associated with human respiratory intoxication

At the end of August 2013, the first bloom of the benthic dinoflagellate *Ostreopsis ovata* occurred on the coast of "Trabocchi", Chieti Province, in the Abruzzo Region, Western Adriatic Sea. The bloom formed a brown velvet mat covering natural and artificial rocks, seaweed thalli, and mollusc shells, and persisted for about 1 month. By the end of September, *O. ovata* was only found sporadically. This species was first reported on the Abruzzo coast in summer 2008 [1]. Since then, it has been quite abundant every year, but it had not previously formed a bloom nor raised concerns. Here we describe the first event with human intoxications and mussels/octopus mortality related to an *Ostreopsis* bloom in Abruzzo coastal waters. The distribution of *Ostreopsis* was mostly observed at three rocky beaches, where several cases of human intoxication were recorded, from late August to mid-September 2013.

Ostreopsis species are benthic dinoflagellates generally recorded in tropical and subtropical seas, but the worldwide records of this genus have increased markedly in the last decade and this trend is likely to continue [2]. *Ostreopsis* belongs to the family Ostreopsidaceae: cells are narrow, ovate in dorso-ventral view with biconvex, drop-shaped theca, scattered pores and eight sulcal plates [3]. The life cycle includes a resting stage, probably a hypnozygote [4]. This species is occasionally planktonic but generally benthic on macroalgae, rocks, sediment or detritus aggregates, and forms a mucilaginous matrix within which the solitary cells can move [5].

Ostreopsis ovata produces palytoxin-like (PTX) compounds [6]. Blooms of *O. ovata* can cause hypoxia, anoxia and benthic invertebrate kills by forming mucilaginous layers hosting thousands of cells covering both biotic and abiotic substrates [7]. In addition, formation of toxic aerosols by wave action can produce asthma-like symptoms. In temperate zones, *Ostreopsis* blooms are associated with intoxication by inhalation [8], skin irritation by contact, and mass mortalities of invertebrates. Intoxication by ingestion has not been reported, even when PTX and/or analogs have already been found in seafood by chemical or toxicological analysis [9].

O. ovata has been recorded in the Mediterranean since the 1970s on French coasts. It was first detected on the western coast of Italy (Tyrrhenian Sea) in the 1980s [10]. In the last decade, massive blooms of this species have become more frequent, above all in the Tyrrhenian and Ligurian Seas, causing death of benthic organisms and human health problems such as respiratory difficulties and skin irritation [11]. Over the last decade, people swimming or exposed to marine aerosols along the Tyrrhenian and Adriatic coasts of the Mediterranean Sea have reported a range of symptoms (rhinorrhoea, bronchoconstriction, coughing, fever, dermatitis) associated with high densities of *O. ovata*. In the early 2000s, the most important inhalation intoxications were observed in Italy in 2001 [12] and in 2005 [13], and in Spain in 2004 and 2006 [14], affecting more than 200 persons each time (swimmers, beach goers, local residents). Since then, *Ostreopsis* blooms has been detected in several northern and southern Mediterranean countries [15].

The Trabocchi coast is characterized by shallow rocky coves with pebbly bottoms. The appearance of the *O. ovata* bloom led to intense sampling; it was mostly present off three rocky beaches, Rocca San Giovanni, Fuggitella and Fossacesia (Fig.1). Sampling was carried out from 29th August to 13th September when respiratory problems were reported and poisoning occurred. The water column and different substrates were sampled for phytoplankton and chemical-physical analysis. Samples of macrophytes (15-25 gr fresh weight) were collected from depths between 0.5 and 1.5 m, placed in plastic bottles with filtered seawater and kept in the dark. A surface water sample was immediately fixed with Lugol's solution to estimate the abundance of epiphytic dinoflagellates in the water column (in cells L^{-1}). Macrophyte samples were shaken for more than one minute to detach epiphytic cells. The material was then passed through 250 and 100 µm mesh sieves to remove large particles, and was fixed with Lugol's solution. Epiphytic abundance was expressed in cells gr^{-1} fresh weight of macrophyte (fwm). The fixed material was settled in 2–10 ml chambers for the appropriate time according to Utermöhl's method.

The highest water column concentrations coincided with maximum epiphytic abundance. The highest *Ostre-*

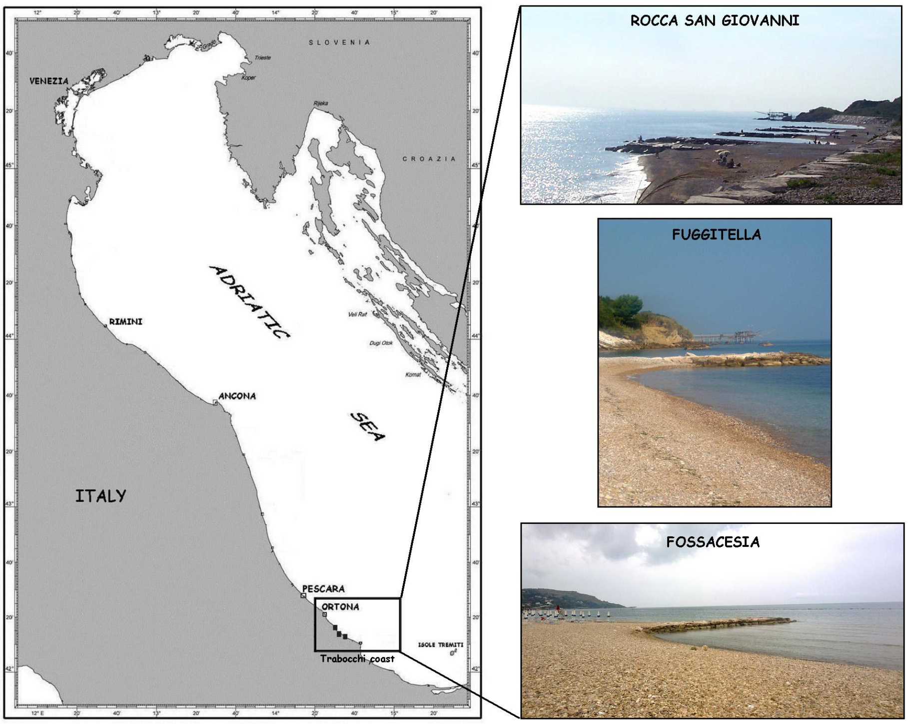

Fig. 1. Trabocchi coast (Adriatic Sea – Abruzzo Region) and location of sampling sites

Fig. 2. Towns affected by O. ovata *bloom where beaches were closed for bathing: (a) Rocca San Giovanni and (b) Fossacesia. The brown biofilm of the epiphytic* O. ovata*: c) on rocks and d) inside flask. Light microscopy photographs of* O. ovata *bloom: e) and f) field samples with high cell counts, 50x magnification, scale bar = 100 µm and 400x magnification, scale bar = 50 µm respectively. g) Scanning electron micrographs of* O. ovata *from isolated strain: epithecal view with pore plate (Po) short and straight (arrows), scale bar = 5 µm. h) LM epifluorescence of* O. ovata*: epithecal view with plates Po and 1', 1000x magnification, scale bar = 10 µm.*

opsis concentration recorded reached 5.28 x 10^5 cells g^{-1} fwm and 9.21 x 10^4 cells L^{-1} in the water column on 6th September 2013 at Fossacesia during the *O. ovata* bloom maximum, with 25 °C water temperature, 34.3 psu salinity and 6.7 mg L^{-1} dissolved oxygen (106% saturation).

During the period of the *O. ovata* bloom, there was strong coloration of the water and a prominent biofilm on rocks. The water had a strange smell like eggs, and dead mussels and octopus were also noticed during the bloom. Thirty two cases of human intoxication occurred, ten of whom required medical assistance. Symptoms included severe pain in the trachea, nausea, breathing problems, vomiting and fever. The mayors of the affected towns subsequently prohibited bathing on beaches from Rocca San Giovanni to Fossacesia. Since it was the first human poisoning event due to a toxic microalgae on the Abruzzo coast, there was much fanfare in local media (newspapers and television).

A week later after a weak gale, sampling on September 13th at Fossacesia revealed the highest concentration of *O. ovata*. There were then 8.35 x 10^4 cells g^{-1} fwm on macrophytes and 7.28 x 10^3 cells L^{-1} in the water column, 24 °C water temperature, 33.3 psu salinity and 7.0 mg L^{-1} dissolved oxygen (108% saturation). Thus *Ostreopsis ovata* concentrations had greatly decreased; but the number of degraded cells increased. The water was still smelly and slightly brownish and nutrient concentrations almost unchanged.

References

1. *Ingarao C et al 2009. Harmful Algal News 39: 4-5*
2. *Rhodes L 2011. Toxicon 57 (3): 400–407*
3. *Tomas CR 1997. Identifying marine phytoplankton (Academic Press)*
4. *Barone R 2007. Harmful Algal News 33: 1–3*
5. *Faust MA et al 2002. Smithsonian Institution 42: 1–144*
6. *Ciminiello P et al 2006. Anal Chem 78: 6153–6159*
7. *Congestri R et al 2006. Harmful Algal News 32: 11–12*
8. *Gallitelli M et al 2005. JAMA 293: 2599–2600*
9. *Aligizaki K et al 2008. Toxicon 51: 418–427*
10. *Lenzi Grillini C & Lazzara L 1980. Giorn Bot It 114: 199–215*
11. *Bianco I et al 2006. Biol Mar Medit 13: 947–950*
12. *Casavola N et al 2005. Rapporti ISTISAN 05/29: 92-97*
13. *Brescianini C et al 2006. Eurosurveillance 11: 3040*
14. *Vila M et al 2008. Proc 12th Intern Conf on Harmful Algae, pp. 334-336*
15. *Totti C et al 2010. Harmful Algae 9: 233-239.*

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Germinating cysts of *Heterosigma akashiwo* from marine sediments of British Columbia, Canada

Heterosigma akashiwo (Hada) Hada ex Hara et Chihara is one of the most noxious algae causing harmful algal blooms (HABs) worldwide and has been the principal fish killer of farmed salmon in British Columbia (BC) since the late 1980s; in 1997 alone the cumulative loss to the BC aquaculture industry exceeded CAD 10 million due to extensive blooms of *H. akashiwo* [1]. During the period from 1999 to the present, BC's Harmful Algae Monitoring Program (HAMP) has observed a continuous series of losses of cultured salmon due to *H. akashiwo* and in 2009 – 2012 direct economic losses of BC-farmed salmon due to HABs totaled more than CAD 16 million (HAMP, unpublished data), with *H. akashiwo* causing the majority of these losses.

To improve local knowledge of HABs, in 2012 a 2-year collaborative research project with Fisheries and Oceans Canada (DFO), the aquaculture industry, and the HAMP was initiated; one of the primary goals was the isolation and culture of harmful algae species collected from local finfish and shellfish aquaculture sites. Two sources were examined for species isolation: (1) live bloom samples from farm sites and (2) sediments collected from sites with past observed HABs, as some harmful algae produce cysts that play an important role in initiating subsequent blooms [2]. Here we discuss the results of harmful algal isolation from sediment samples.

In late winter and spring 2013, sediment samples were taken from 16 sites in 3 areas around Vancouver Island, BC (one sample from each of 4 sites in Baynes Sound, 4 sites in Okeover Inlet, and 8 sites in Quatsino Sound) (Fig. 1). Target species for isolation and germination were:

- *Alexandrium* spp. – which cause Paralytic Shellfish Poisoning (PSP). Numerous PSP closures in summer 2012 were recorded in Baynes Sound and Okeover Inlet [3];
- *H. akashiwo* and *Chattonella* sp. – which caused fish mortalities in late summer 2012 in Quatsino Sound [4].

Sampling was done on February 28 (Baynes Sound), April 10 (Quatsino Sound), and April 18 (Okeover Inlet), 2013 using van Veen and Ekman grab samplers (Fig. 2). Sediment samples (3 – 5 L) were taken from depths of 5 – 45 m with sites within areas being located at least 250 m apart. Sites were chosen based on the assumption that cysts accumulate in the same areas as silt and clay [5]. The top 3 cm of sediments in the grab samples were collected, mixed well, placed in re-sealable plastic bags, and immediately stored in a cool, dark place until delivered to the DFO laboratory in Nanaimo. Samples were kept in the dark at 4 °C until germination experiments were conducted. All 16 sediment samples were used for 2 sets of experiments: germination under regular laboratory conditions with (1) culture medium only and (2) culture medium with addition of a chemical to suppress diatom growth.

The first germination experiments were started 1 – 4 days after collection dates (i.e. March 1 for Baynes Sound, April 12 for Quatsino Sound, and April 22 for Okeover Inlet). A small portion of the collected sediments was sieved to produce a 20 – 120 µm fraction, and ~ 1 – 2 mL of the sieved sediments were added to petri dishes (3 replicates for each site) containing modified HESNW medium [6] – i.e. without added silicate and organic phosphates partially substituted with inorganic phosphates. The cultures were incubated at 18 °C under continuous illumination (20 µmol photons m^{-2} s^{-1} provided by full-spectrum fluorescent lamps). Petri dishes were scanned twice a week at 10 – 60X magnification using an inverted microscope. Samples were refreshed with additional media approximately weekly.

One to 2 days after the start of the experiments, diatom cells began to appear in the petri dishes. After 1 week, all dishes had noticeable coloration with various diatom species present, the most abundant being *Skeletonema costatum, Thalassiosira* spp., and *Chaetoceros* spp. In all replicates, diatoms reached several thousand cells mL^{-1} in 2 – 7 days. After a week, in many replicates, *H. akashiwo* cells were seen, sometimes in concentrations up to several hundred cells mL^{-1}. Within 2 weeks, most of the petri dishes had at least several cells of *H. akashiwo* and in some samples dinoflagellate cells also began to appear. After 3 weeks, all replicates had *H. akashiwo* cells, from a few cells mL^{-1} to several thousand cells mL^{-1}. Some samples from Quatsino Sound had thick surface accumulations of *H. akashiwo* – termed "rafts". The sample with the thickest rafts was from Kultus Cove (Quatsino Sound), which is known to be a hot-spot for *H. akashiwo*

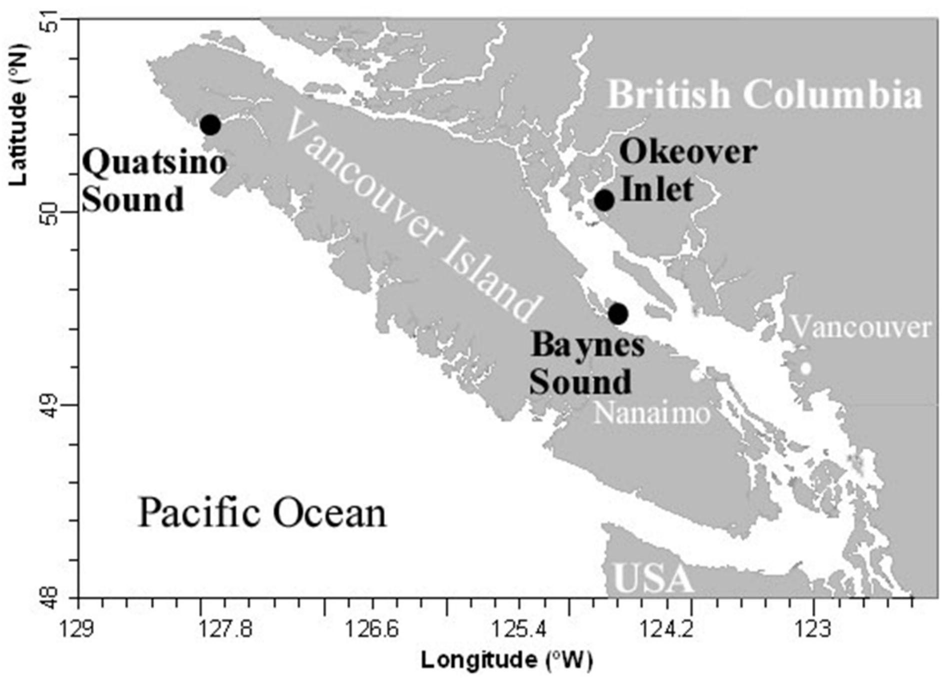

Fig. 1. Map showing sampling areas.

Fig. 2. Sediment sampling at Quatsino Sound on April 10, 2013.

blooms [N. Haigh, unpublished observations]. Some of these rafts were then used for serial dilution attempts to obtain pure cultures [7]. Serial dilution was performed in a laminar flow hood using a micropipette and sterile 24-well plates. This method involves dispensing and subsequent dilution of the sample in media in well plates where, with each transfer, the concentration of the cells in the sample is decreased by a factor of 10. After a further 2 weeks, cells of *Alexandrium* spp. started to appear in Okeover samples, although these species never reached concentrations that would have made isolation practical. After about 6 weeks, a mixture of other small flagellates dominated all petri dish replicates: the experiment ended after ~8 weeks.

The second set of germination experiments was set up at the beginning of June, 3 – 4 months after collection dates. The same germination method (as described above) was used but with the addition of germanium dioxide to the culture medium to suppress diatom growth [8]. Sediments stored in the dark at 4 °C were processed as above and added to 3 replicate petri dishes with media (which included ~ 0.5 – 1 mL (in each petri dish) of prepared stock solution of 2 mg GeO_2 in 100 mL of MilliQ water [9]). After several days, *H. akashiwo* cells were found in some replicates and in about 2 weeks all samples had at least a few cells of *H. akashiwo*. In 2 – 3 weeks, many replicates had thick rafts, providing good material for *H. akashiwo* serial dilution. In 2 weeks, samples from all 4 sites in Okeover Inlet had a few *Alexandrium* cells and other dinoflagellates present. Only a few diatom cells were seen in some replicates (mostly from the Okeover area); diatom growth was greatly inhibited and concentrations never reached 100 cells mL^{-1}. Samples with suppressed diatom growth were better suited for cell isolation and in this way several pure cultures of *H. akashiwo* and *Alexandrium* spp. were successfully established.

Conclusions

All 16 surface sediment samples collected in 3 areas around Vancouver Island produced viable *H. akashiwo* upon incubation. At 18 °C, under continuous illumination, *H. akashiwo* germinated in 1 – 3 weeks. Germanium dioxide stock solution added to media inhibited diatom growth, allowing easy germination and isolation of *H. akashiwo* from sediment samples containing cysts. This technique makes it possible to obtain cultures of *H. akashiwo* from various locations even when vegetative cells are not present in the water column.

Acknowledgments

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References

1. *Whyte JNC et al 1999. Martin J & Haya K. (Eds), Pro. Sixth Canadian Workshop on Harmful Marine Algae, Can. Tech. Rep. Fish. Aquat. Sci. 2261: 1-9*
2. *Anderson DM et al 2003. Cyst methodologies. In: Manual on Harmful Marine Microalgae (IOC-UNESCO), 165-189*
3. *DFO 2012 - http://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/biotox/index-eng.html*
4. *HAMP, unpublished*
5. *Wall D & Dale B 1967. Review of Palaeobotany and Palynology 2: 349-354*
6. *Harrison PJ et al 1980. Journal of Phycology 16: 28-35*
7. *Guillard RRL 1995. Culture methods. In: IOC Manuals and Guides 33 (IOC-UNESCO), 46-62*
8. *Lewin J 1966. Phycologia 6: 1-12*
9. *http://www.marine.csiro.au/microalgae/methods*

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Saxitoxin analyses with a receptor binding assay (RBA) suggest PSP intoxication of sea turtles in El Salvador

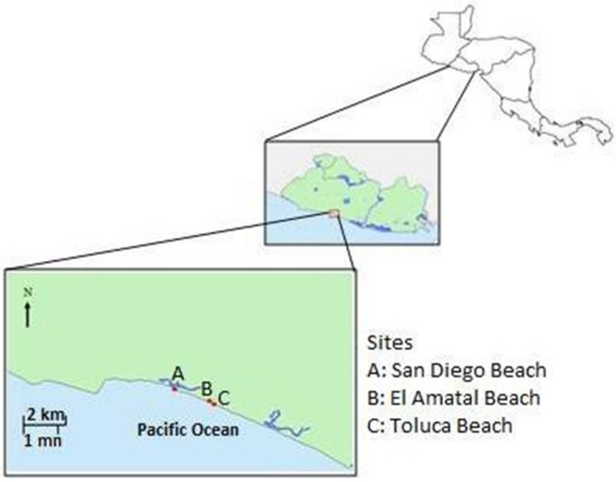


Fig. 1. Locations on El Salvador coasts where stranded sea turtles were found, mainly on San Diego (13°28'16.03"N, 89°15'49.01"W), El Amatal (13°27'37.00"N, 89°14'16.00"W) and Toluca (13°27'47.53"N, 89°14'0.92"W) beaches, October 2013.

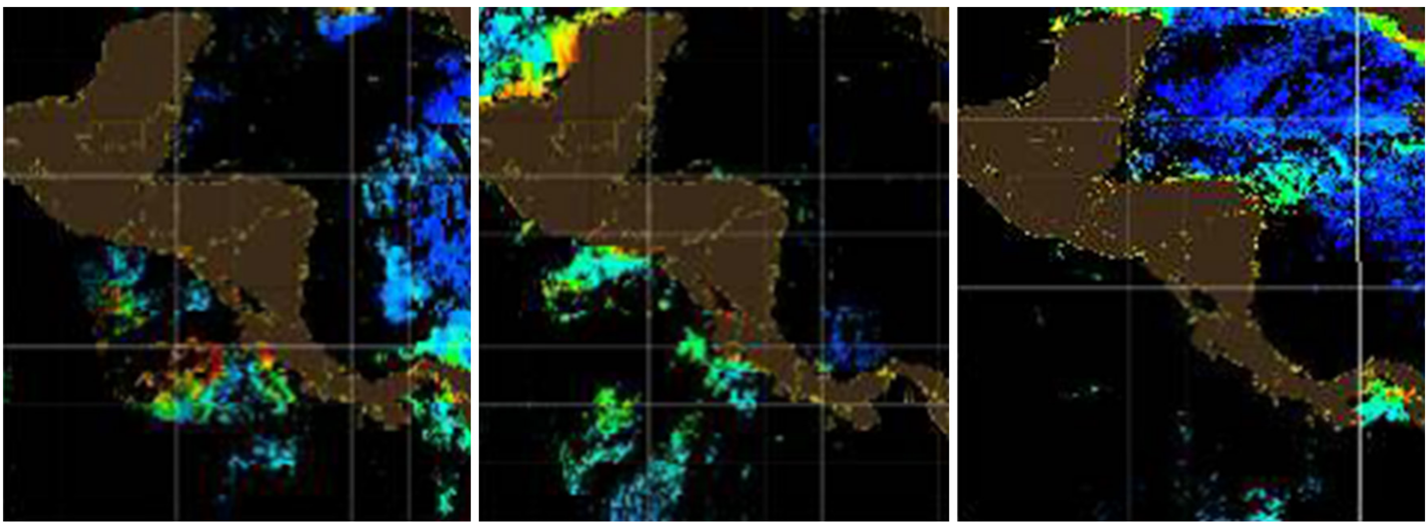
Great efforts are invested on the Eastern Tropical Pacific coast to protect sea turtles, evaluate their populations, and identify threats to their survival. Toxic HABs represent a major threat to turtles, and have been associated with mortalities. The main species found in coastal waters of El Salvador are the green (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), the olive ridley (*Lepidochelys olivacea*) and the leatherback (*Dermochelys coriacea*) sea turtles [1].

There are records of dead sea turtles on El Salvador beaches. During a PSP outbreak in 2005, which included 3 human deaths, 206 dead sea turtles were reported. Liquid chromatography (HPLC) analyses revealed concentrations of saxitoxin of 27.9-627.8 µg STX eq $\cdot 100g^{-1}$ in brain tissue of *Lepidochelis olivacea* and *Chelonia mydas* [2].

PSP events in El Salvador are associated with blooms of *Pyrodinium bahamense* var *compressum* [3]. In November 2009 brownish red patches were observed 46 nm off the coast between Bahía de Jiquilisco and Acajutla and 5 dead turtles were reported in the area. This event was associated with *P. bahamense* cf *compressum* (unpubl. data). In May 2010, intense patches reached the coastline and 17 dead sea turtles were reported from El Salamar and Las Tunas beaches on the eastern end of the country; later in October 2010 a new report of 12 dead turtles was associated with a bloom of *Alexandrium* cf *peruvianum/ostenfeldii* in Los Cóbanos beach. In May 2011, a Receptor Binding Assay (RBA) was applied for the first time to test the presence of STX and its analogues (STXs) in samples from dead specimens but no toxins were detected in that occasion (unpubl. data). Since 2009 the Laboratory of Marine Toxins from the University of El Salvador (LABTOX-UES) carries out a monitoring of potentially toxic phytoplankton. In addition, PSP toxin analyses (by RBA) in oysters (*Crassostrea iridiscens*), sea snails (*Plicopurpura columellaris*), crabs (*Carcinus maenas*) and mussels (*Modiolus capax*) have been performed routinely since 2011 [4].

Between late September and early October 2013 there was a mortality of 201 turtles (information from the Ministry of Environment and Natural Resources). Dead specimens were found mainly on beaches in the department of La Libertad [5] (Fig.1).

Following the sea turtle mortality in 2013, experts from LABTOX-UES in cooperation with officials from the Centre for Development of Fisheries and Aquaculture (CENDEPESCA) collected water samples for qualitative (20-µm plankton hauls) and quantitative (10-L Niskin bottles, Sedgewick Rafter counting chambers) analyses of phytoplankton (Carl Zeiss, Axio Imager M1 and Axiovert 40CFL microscopes



MODIS-Aqua CHLOR_A 2013.09.08 MODIS-Aqua CHLOR_A 2013.10.27 MODIS-Aqua CHLOR_A 2013.11.11

Fig. 2. MODIS satellite images from dates before, during and after the report of sea turtle mortality in El Salvador.

Table1. Phytoplankton cell densities in water samples collected from El Salvador beaches during the sea turtle mortality, October 2013.

species		La Libertad (15 Oct) cells L^{-1}	Acajutla (16 Oct) cells L^{-1}
Pyrodinium	*bahamense*	20	-
Cochlodinium	*polykrikoides*	880	520
Gymnodinium	***catenatum***	**480**	**5400**
Gyrodinium	*instriatum*	120	480
Alexandrium	*monilatum*	-	4080

respectively). MODIS satellite images (Chl a fluorescence) from dates before and during the mortality are shown in Fig. 2. Samples of stomach, intestines, liver and kidneys were taken from 16 specimens of *Chelonia mydas* and *Lepydochelis olivacea*, as well as from oysters (*Crassostrea iridiscens*) and kept at – 80 °C until analysis. Analyses of STXs were carried out by RBA, a competitive receptor binding assay in which the radio-labelled [3H]STX competes with unlabelled STXs for the sodium channel sites present in a crude membrane preparation of rat brain. When the binding equilibrium is reached, free [3H] toxins are removed by filtration and collected receptor-bound [3H]toxins are quantified with a liquid scintillation counter with microtiter plate format MicroBeta trilux1450 LC. The reduction in [3H]toxin binding is directly proportional to the amount of unlabelled toxin present. A standard curve is generated using increasing concentrations of unlabeled toxin standard; the concentration of toxin in extracts of samples is determined in reference to the standard curve [6].

The most abundant potential producer of PSP toxins found in the phytoplankton samples was *Gymnodinium catenatum* (5400 cells L^{-1}) (Table 1). Analyses of STXs in liver, intestine and stomach tissue samples from the dead sea turtles showed levels ranging from 116.11 to 478.28 µg STX eq. 100g^{-1} (Fig 3). Toxin levels in oysters (58.33 µg STX eq. 100g^{-1}) were below the regulatory level (80 µg STX eq. 100g^{-1}).

Stranded vertebrates are not seen very common on El Salvador coasts, so we assume that sea turtles were members of the fauna most affected by the toxic outbreak. The low densities of potentially toxic phytoplankton found in inshore samples and of toxins in oysters (below regulatory levels) would not justify the levels of STX found in the turtles. But we know that medusae, which are carnivorous megazooplankters, are part of the diet of some turtles. We suggest that offshore toxic phytoplankton, eaten by herbivorous zooplankton was transmitted to the sea turtles through medusae acting as vectors of the toxins and caused their death.

Acknowledgements

To IAEA for its valuable support to set up the LABTOX-UES laboratory. To the Ministry of Environment and Natural Resources MARN and the Centre for Development of Fisheries and Aquaculture CENDEPESCA for their support in monitoring harmful algal blooms.

References

1. *Inter-American Convention for the Protection and Conservation of Sea Turtles 2012. Report CIT-CC8-2011-Tec.1, 27 pp (PDF)*
2. *Licea et al 2008. In: Moestrup et al (eds), Proc 12th Intern Conf Harmful Algae (IOC, UNESCO), pp 86-89*
3. *Guardado et al 2011. Revista El Salvador Ciencia y Tecnología 16: 26-32*
4. *Amaya O et al 2012. Harmful Algae News 45: 15*
5. *Moran, G. 2013. Diario Digital Contra Punto. Octubre 22 (PDF)*
6. *Van Dolah et al 2012. Journal AOAC International 95: 795-812*

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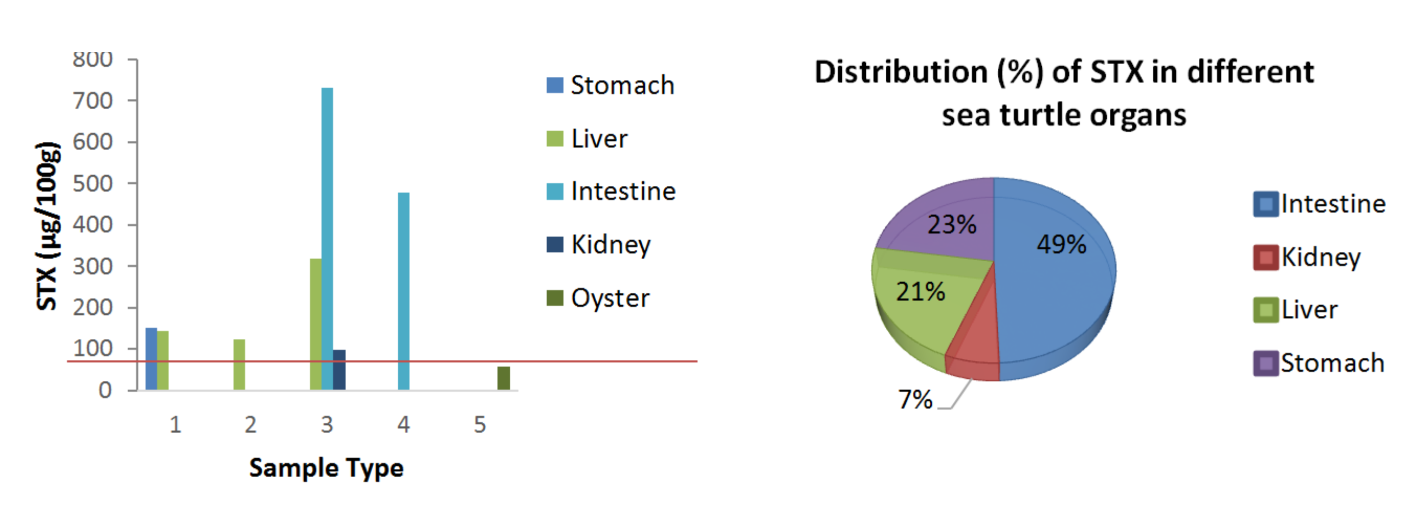

Fig. 3. Left, saxitoxin levels found in sea turtles and oysters from El Salvador applying the RBA (red line indicates the regulatory level); Right, distribution of STXs found in different sea turtle tissues.

Fish die-offs along southern coast of Baja California

Many algal blooms are innocuous to marine fauna or increase productivity of coastal zones. Harmful algal blooms (HABs) can cause negative impacts on other or¬ganisms via production of toxins, by mechanical damage, or by other means [1]. Although HABs are common along the coasts of the Baja California [2], few events have been reported along its southern coast [3, 4, 5]. A bloom of *Pseudonitzschia* sp. occurred from December 1995 to January 1996 at Cabo San Lucas. More than 150 brown pelicans died [4]. In March 1996, a bloom of cyanobacteria and *Chatonella* sp. provoked mortality of benthic fish & fan corals at Cabo San Lucas [4]. A bloom of *Prorocentrum minimum* (2.4–3.0 × 10^6 cells L^{-1}) and *Ostreopsis siamensis* (0.2–0.4 × 10^6 cells L^{-1}) occurred on April 2002 in the Los Cabos area [3]. A small bloom of *Noctiluca scintillans* were observed at Los Barriles on 24 March 2007. Densities of *Noctiluca* at Los Barriles were 250–950 × 10^3 cells L^{-1}. *Gymnodinium catenatum* also occurred at densities of 98 × 10^3 cells L^{-1} (this report). Another smelly bloom occurred on 8 March 2007 at Los Frailes (Fig. 1). No marine faunal die-offs were detected in either event. More recently, two varieties of *Pyrodinium bahamense* were reported at the southern end of Baja California. This region is an important area for fisheries [6]. A fish mortality occurred on 16–21 June 2011 in the Los Cabos region (Fig. 2), first reported by the organization “Red para la Protección de la Tortuga Marina” (Redprotormar, Marine Turtle Protection Network) at El Zacatito, and extending northwards to Playa San Luis. To the south, fish mortality was reported at the Hotel Sheraton. The largest die-offs occurred at La Fortuna (23°09′0.54″N, 109°29′ 39.54″W). Recently, The Procuraduría Federal de Protection al Ambiente (PROFEPA) and the Dirección de Ecología of Los Cabos mentioned died-offs observed at La Playita (23°3′38.98″N, 109°40′7.47″W), and later at Punta Gorda (23°05′00.46″N, 109°34′33.70″W) and La Fortuna (23°09′00.54″N, 109°29′39.54″W). Approximately 20 km of beaches were heavily affected (http://www.youtube.com/watch?v=Yk4o5NRt6ac). The most abundant fish on the beaches were damsel bass (*Hemanthias signifer*; Fig. 3a) and yellowtail surgeonfish (*Acanthurus* sp.; Fig. 3b). Less abundant were azure parrotfish (*Scarus compressus*; Fig. 3c), blue-bronze sea chub (*Kyphosus analogus*; Fig. 3d), and California sheephead (*Semicossyphus pulcher*; Fig. 4). This is the worst fish die-off recorded on this coast. Fish were not eaten by sea birds, crabs, or other marine fauna. Many ctenophores (*Beroe* cf *ovata*) accumulated near the beaches. Ctenophore swarms have not been reported previously in these waters. The die-offs were probably related to the presence of red tide patches reported by fishermen during this event; however, no bloom samples were taken. Die-offs of pelicans occurred shortly before and after the fish die-offs. Phytoplankton samples were collected on 25 June 2011 in the affected area. The most common microalgae were *Chaetoceros* spp., *Thalassionema nitzschioides, Thalassiosira* sp., and at least three species of *Pseudonitzschia*. The ciliate *Myrionecta rubra* was also found. Toxic dinoflagellates in the samples included *Coolia monotis, Dinophysis acuminata, D. caudata, D. fortii, Ostreopsis heptagona, Prorocentrum gracile, Prorocentrum micans,* and *Prorocentrum minium*. Per-

Fig. 1. Smelly bloom in Bahía de Los Frailes.

Fig. 2. Fish die-offs occurred along the shore of Los Cabos Region (red area).

Fig. 3. Fish die-off on 16–21 June 2011 at La Playita and the Hotel Hilton beach on the Los Cabos.

sistent cold winds from the south produced cooler currents, water temperature dropped from 24.5 to 18 °C along much of the Southern Baja coast (Eric Brictson, pers. comm.). Health authorities responded rapidly and no human intoxications were recorded. According to a local authority (Pablo César Támez), ~50 t of fish were removed from beaches over two weeks [7]. Fish markets and seafood restaurants were monitored by the Comisión Estatal para la Protección de Riesgos Sanitarios [8]. The mass die-offs caused by these HABs resulted in economic loss and contributed to pollution of coastal waters. Fish catches of commercial importance were prohibited while the toxicity in fish was detected (Mario García Isais). After this die-off, a training workshop on red tides was organized in Cabo San Lucas. Monitoring of red tide-producing species, particularly toxic species, is ongoing along the coast of the Los Cabos region.

This project was funded by Instituto Politécnico Nacional Project (Grants SIP-20100985, SIP-20100192, and SIP-20100870). Thanks to José de La Cruz-Aguero for fish identification.

*Fig. 4. Male sheephead (*Semicossyphus pulcher*) stranded on beach near Los Cabos.*

References

1. *Gárate-Lizárraga I et al 2006. Rev Invest Mar 27: 31–39*
2. *Gárate-Lizárraga I et al 2011. Harmful Algae News 44: 6–7*
3. *Gárate-Lizárraga I et al 2007. In: Estudios Ecológicos en Bahía Magdalena. Funes-Rodríguez R et al (eds). Comité Editorial IPN, pp. 145–175.*
4. *Ochoa JL et al 1997. Hydrobiologia 352: 195–200*
5. *Núñez-Vázquez EJ et al 2011. J Environ Biol 32: 413–423*
6. *Gárate-Lizárraga I & González-Armas R 2011. Mar Poll Bull 62: 626–630*
7. *Montero-Becerril P 2011. La Tribuna de Los Cabos (Newspaper) 27/06/2011*
8. *de la Toba G & Mora Rojo Á 2011. La Tribuna de Los Cabos (Newspaper) 22/06/2011*

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Pseudo-nitzschia australis blooms are not always toxic

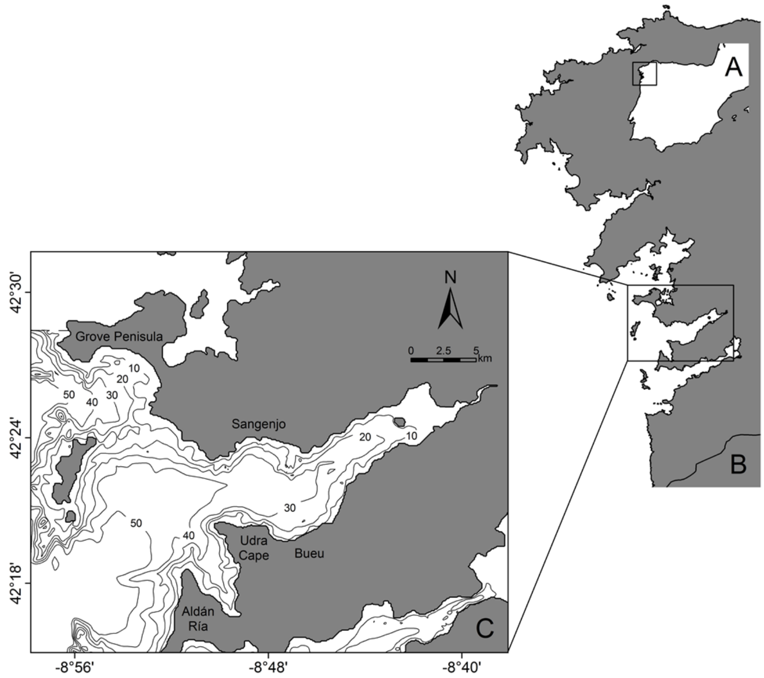

Fig. 1. Maps showing A) Iberian Peninsula; B) Galician Rias Baixas and C) Study area in Ría de Pontevedra.

Diatom species of the genus *Pseudo-nitzschia* H. Peragallo are regular components of the microphytoplankton assemblages in the Galician Rías (NW Spain). Twelve species of this genus have been confirmed as producers of domoic acid (DA) [1, 2], a neurotoxin which causes Amnesic Shellfish Poisoning (ASP). Eight potentially toxic species of *Pseudo-nitzschia* have been reported so far in Galician coastal waters [3]. But the occurrence of domoic acid in shellfish above regulatory levels (ASP outbreaks) in this area has mainly been associated with high concentrations (> 10^5 cell L^{-1}) of *Pseudo-nitzschia australis* Frenguelli [3, 4]. Phytoplankton succession in the Galician Rías [5] is closely related to the seasonal (March to October) upwelling pattern [6]; *Pseudo-nitzschia* species appear at an intermediate stage in the upwelling-downwelling cycles (late spring-summer), following large centric diatoms [5]. Since June 1992, the Technological Institute for the Control of the Marine Environment in Galicia (INTECMAR) carries out a weekly monitoring of potentially toxic phytoplankton (including *Pseudo-nitzschia* spp.) and phycotoxins, according to EU Directives, on Galician coasts (Fig. 1). ASP outbreaks in the region have proven to be short-lived events leading to mussel harvesting bans of one to a few weeks duration. Nevertheless, they represent a serious threat to sustainable exploitation of pectinids (*Pecten maximus, P. jacobeus*). These species have slow depuration rates for DA (0.007 day^{-1} in *P. maximus*) [7] and may need months or even years to eliminate toxins.

Since the first event reported in the Galician Rías in autumn 1994 [4], ASP outbreaks have been reported almost every year in northwest Iberia [8], including the coast of Portugal [9]. The long retention time of DA in pectinids and its impact on the scallop industry in Galicia and Scotland led to implementation of specific regulations (Commission Decision 2002/226/EC) to control DA in pectinids in the European Union [10].

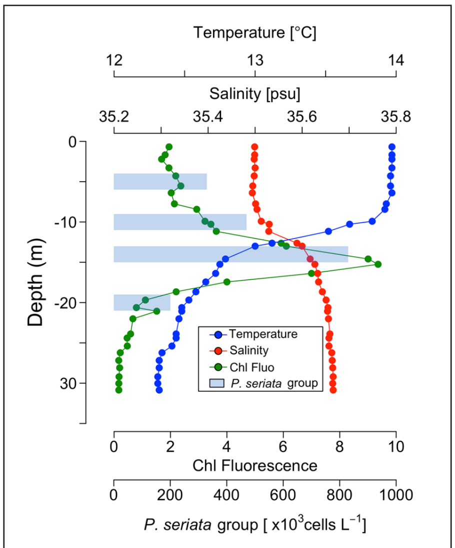

Fig. 2. Vertical distribution of temperature (blue), salinity (red), chl-a fluorescence (green) and Pseudo-nitzschia seriata *group cells density (blue bars) recorded during the survey on 28 May 2007.*

A dense bloom of *Pseudo-nitzschia* spp. was recorded during the *HABIT-Pontevedra 2007* survey carried out in Ría de Pontevedra, from 28 May to 7 June 2007 [11]. *Pseudo-nitzschia* species were identified following Hasle [12]. Particulate DA concentrations were analyzed by liquid chromatography-multiple tandem mass spectrometry (LC-MS) according to Furey et al. [13]. Weekly monitoring results from INTECMAR during the cruise period also reported the occurrence of a *Pseudo-nitzschia* spp. bloom (> 10^6 cells L^{-1}) that reached its annual maxima on 28 May 2007 [14].

Results from the cruise showed that the bloom formed a thin layer of *Pseudo-nitzschia seriata* group spp., dominated by *P. australis* at 14 m depth, associated with marked density gradients in the water column (Fig. 2). Despite the predominance of *P. australis* (Fig. 3), DA was not found (detection level 0.02 μg DA mL^{-1}) in any of the samples with high *Pseudo-nitzschia* densities. Nor were shellfish harvesting bans implemented by the Galician authorities due to the occurrence of ASP toxins in mussels during the cruise period.

It is well known from laboratory cultures of toxigenic *Pseudo-nitzschia* species that large differences in cellular toxin content can be observed during population growth, with the maximum per cell usually found during the late exponential or stationary phase [2]. It could be argued here that the toxin content of *Pseudo-nitzschia* was below detection limits during the cruise and increased later in the season. But there were no mussel harvesting bans in Galicia due to ASP for the whole of 2007 (www.intecmar.org). This can only be explained by the existence of very weakly toxic or non-toxic strains of *P. australis.*

Our results show the occurrence of a non-toxic *Pseudo-nitzschia* bloom, dominated by *P. australis*, the species commonly associated with ASP on the Atlantic coast of Iberia (Spain and Portugal). Therefore, the detection of high densities of "known" toxigenic species of *Pseudo-nitzschia* is not enough for monitoring purposes, if it is not accompanied by toxin analyses to confirm the presence of domoic acid. In this context, monitoring based on ASP toxin content per volume of water in addition to routine *Pseudo-nitzschia* cell counts, would be a more realistic early warning tool for seafood safety management. This is applied in the monitoring programme of the U.S. west coast [15], where a combination of microscopic monitoring of the algae and assessment of cellular toxicity (expressed as "particulate DA") using test strips (Jellett Rapid Tests) gives an effective early warning of shellfish toxification events, reducing the risk associated with potential toxicity in razor clams.

Acknowledgements

We thank INTECMAR for weekly reports on phytoplankton distributions in the Galician Rías Baixas. S. Fraga helped with identification of *Pseudo-nitzschia* spp. and J.M. Franco with HPLC analysis. This work was funded by ASIMUTH project (*Applied Simulations and Integrated Modelling for the Understanding of Toxic and Harmful algal blooms*) from the 7th Framework Programme (ASIMUTH/SPACE-Grant Agreement 261860) of the European Commission. Patricio A. Díaz is supported by a PhD fellowship from the BECAS–CHILE Programme of the National Commission for Scientific and Technological Research (CONICYT), Chile.

References

1. *Trainer VL et al. 2012. Hamrful Algae 14: 271-300*
2. *Bates SS 1998. In: Physiological Ecology of Harmful Algal Blooms, pp 405-426*
3. *Fraga S et al. 1998. In: Harmful Algae, Xunta de Galicia. IOC UNESCO, pp 270-273*
4. *Míguez A et al. 1996. In: Harmful and Toxic Algal Blooms, pp 143-145*
5. *Figueiras F & Pazos Y 1991. Mar Ecol Prog Ser 76: 219-233*
6. *Wooster WS et al. 1976. J Mar Res 34: 131- 141*
7. *Blanco J et al. 2002. Aquat Toxicol 60: 111-121*
8. *Moroño A et al. 1999. In: VI Reunion Iberoamerica sobre Fitoplancton Tóxico y Biotoxinas, pp 59-65*
9. *Vale P & Sampayo MA 2002. Harmful Algae 1: 127-135*
10. *Salgado C et al. 2003. In: Molluscan Shellfish Safety, pp 169-177*
11. *Díaz PA et al. 2013. Deep Sea Res II doi:10.1016/j.dsr2.2013.09.043i:*
12. *Hasle GR 1965. Skr norske Vidensk Akad I Mat Nat Kl NS 18*
13. *Furey A et al. 2001. J Chromatogr 938: 167-174*
14. *INTECMAR 2009. Anuario Oceanográfico de Galicia, p 434*
15. *Trainer VL & Suddleson M 2005. Oceanography 18: 228-237*

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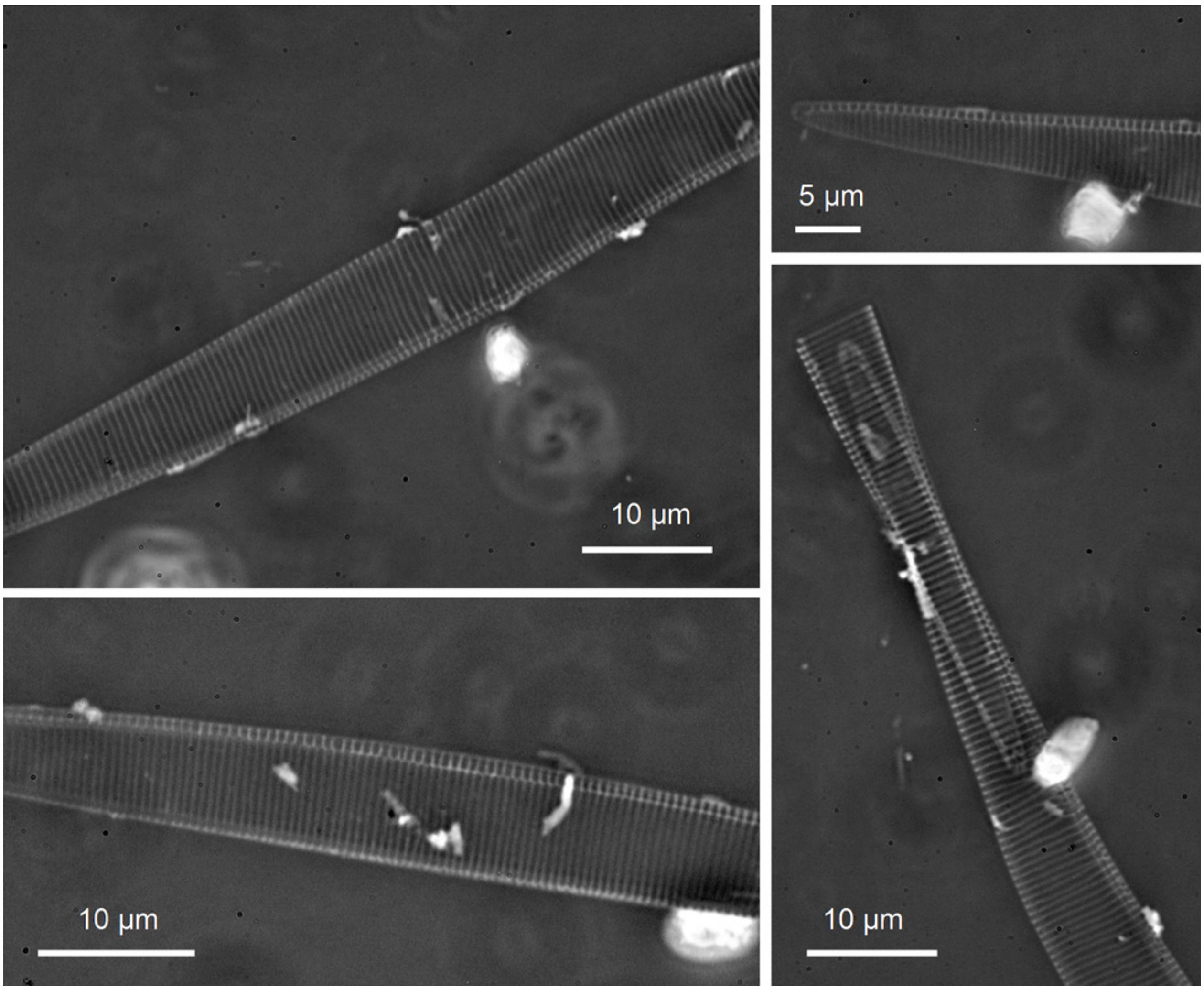


Fig. 3. Phase contrast micrographs of Pseudo-nitzschia australis *found in Ría de Pontevedra (NW Spain), during a bloom in May 2007.*

Blooms of a *Chattonella* species (Raphidohyceae) in La Redonda Lagoon, Northeastern Cuba

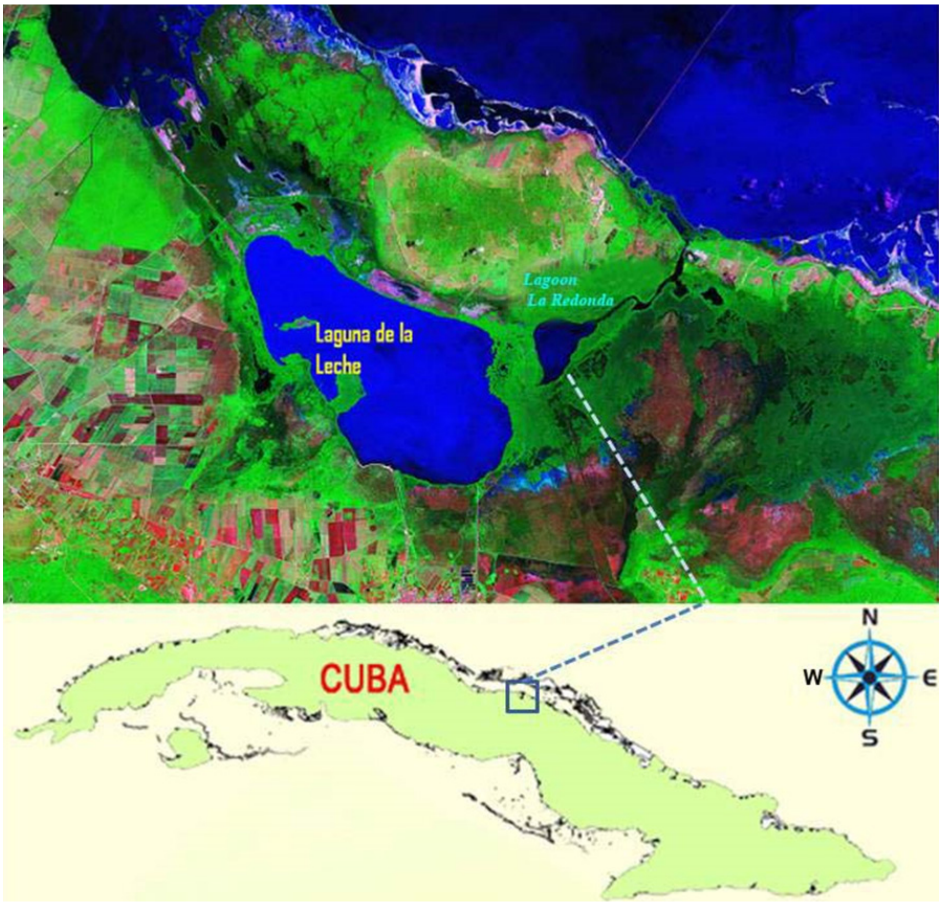


Fig.1. Map showing the study area: Lagoon La Redonda, northeastern coast of Cuba.

Species of the genus *Chattonella* Biecheler (Raphidophyceae) are widely distributed in temperate and subtropical/tropical areas of the world. Blooms of *Chattonella* have been associated with mortality of captive and wild fish populations [1-4]. The genus according to Hara et al. [5] comprises seven species, among which, *C. antiqua* (Hada) Ono 1980 and *C. marina* (Subrahmanyan) Hara et Chihara 1982 are known to be the most harmful fish-killing species. "*Chattonella* red tides" are most frequent in east Asia [6], but species of this genus have been reported from Brazil and The Netherland coasts [7,8].

La Redonda Lagoon together with Laguna de la Leche, belong to a shallow brackish lagoon system located in northeast Cuba (Fig. 1). Table 1 shows the main characteristics of this lagoon (González de Zayas & Lestayo, *in litt.*) which has been used as a reservoir for *Micropterus salmoides* Lacepède 1802 (largemouth black bass). No red tides or fish mortality were previously detected in the area, but the fish population density had decreased in the last years, due apparently to poor larval survival.

Plankton samples collected in La Redonda Lagoon in November 2013 and observed in a Laborlux Leica-Leitz microscope revealed an abundant (9.66 x 10^4 cells/L) population of a flagellate whose main morphological features corresponded with those of the genus *Chattonella*: i.e. cells with i) two subequal, heterodynamic flagella emerging from the bottom of an apical cell depression and ii) numerous yellowish-green or yellowish-brown chromoplastids radially arranged in the cytoplasm (Figs 2-8). Members of this genus were not found earlier in Cuban waters.

Cells of the Cuban strains were obovoid, oblong to near heart-shaped (probably corresponding with earlier steps of cell division), 19,6-47,6 μm length and 12,6-30,8 μm broad, slightly flattened, lanceolate or somewhat asymmetrical in lateral view, with an anterior end rounded or flat-rounded with a median depression. From the bottom of these depressions emerge two subequal, heterodynamic flagella. Posterior end acutely rounded or very often with a terminal short, colourless, nearly straight, cylindrical or slightly curved tail. Chromoplastids are many, radially arranged, occupying the entire cytoplasm or withdraw from the posterior tail, yellowish-green or yellowish-brown, ellipsoid to cuneiform, each with a hardly visible, naked pyrenoid. Contractile vacuoles, eyespots and ejectisomes (mucocysts) are lacking. Reproduction by cell division occurs along the longitudinal axe (Figs 2-8).

These Cuban specimens could be identified either as *C. marina* (cells are obovoid with the posterior tail acute and evidently curved) or *C. subsalsa* (cells are obovoid or nearly oblong with acutely rounded, straight posterior end); then the diagnostic features of both species overlap, except for the presence of ejectisomes (mucocysts) which should be present in *C. subsalsa* but not *C. marina*. According to traditional taxonomy (based on morphological features), different authors consider the two identical, but taking into account the presence of ejectisomes and no thylakoids penetrating the pyrenoids in *C. subsalsa*, Hallegraeff & Hara [3] maintain them as separated spe-

Table 1. Some characteristics of La Redonda Lagoon, Cuba, after González de Zayas & Lestayo (in litt.); figures are mean values.

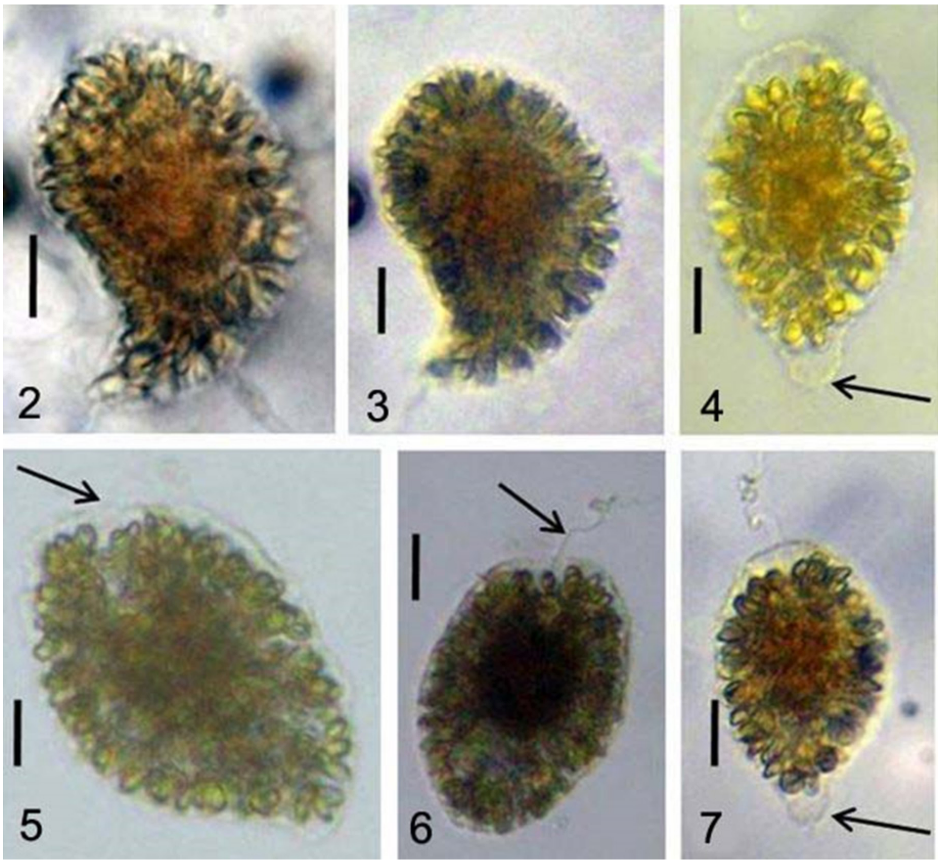
Area	4,5 km²
Depth	3 m
pH	7,98
Temperature	27,37°C
Salinity	1,61 psu
Total N	104,0 μM
Total P	3,1 μM
Ca	1,38μg/L

cies. Bowers et al. [9], based on gene sequence analysis, accepted them as different species in spite of their weakly supported results. Because our population was found in a low salinity environment we prefer to consider it "*ad interim*" as *C. subsalsa* Biecheler. Further studies are needed for a definitive identification.

This is the first time phytoplankton is studied in this lagoon ecosystem. Attention should be paid to the potential relation of *C.* cf. *subsalsa* and low survival of largemouth black bass larvae. Moderate concentrations of *Chattonella* were found in our sampling, but eventual blooms (>10^6 cells L^{-1}) could cause mass mortalities of fish in the lagoon.

Acknowledgements

To Rosely Peraza and Misael Diaz from CEAC, and Roberto González from CIEC, Cuba. To the IAEA Regional Project RLA-7-014 and IOC-IEO from Vigo, Spain.



Figs. 2-7. Chattonella *cf.* subsalsa*: 2-3)* C. marina-*like; 3,7)* C. subsalsa-*like, but with a short cylindrical posterior tail (black arrow); 5) earlier stages of cell division (black arrow); 6) longer flagellum (black arrow).*

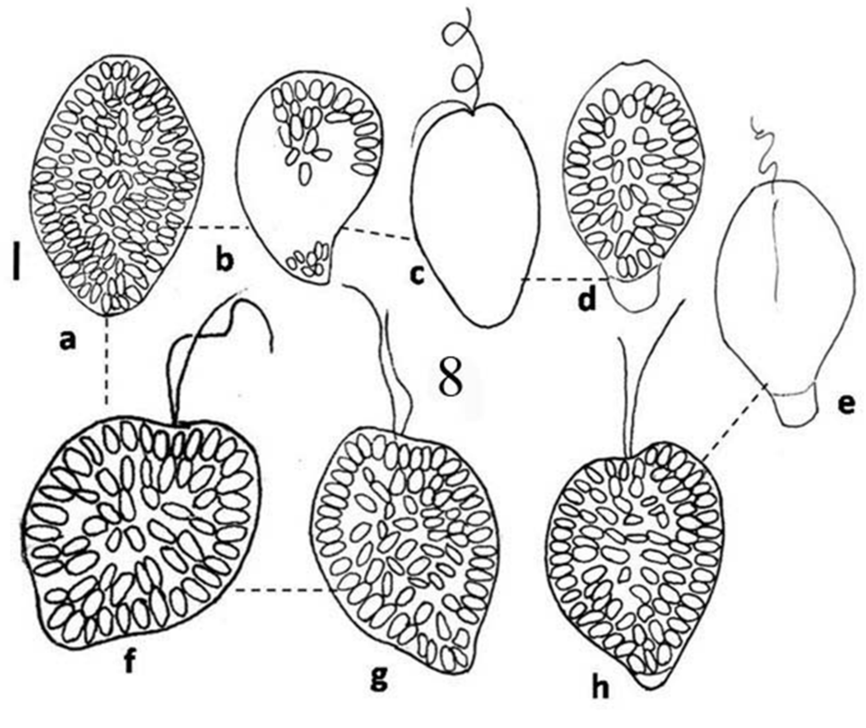


Fig. 8a-h. Chattonella *cf.* subsalsa*; a)* C. subsalsa-*like; b-c)* C. marina-*like; d-e)* C. subsalsa-*like, but with a short cylindrical terminal tail; f-h) earlier steps of the longitudinal cell division.*

References

1. *Subrahmanyan R 1954. Indian J Fish 1: 182-203*
2. *Okaichi T 1989. In: Okaichi T et al (eds), Red tides: Biology, environmental science and toxicology. (Elsevier, New York), pp137-142*
3. *Hallegraeff GM & Hara Y 2004. In: Hallegraeff GM et al (eds), Manual on Harmful Marine Microalgae (UNESCO), pp511-522*
4. *Backe-Hansen P et al 2001. In: Hallegraeff, GM (eds), Harmful Algal Blooms 2000 (UNESCO), pp78-81*
5. *Hara Y et al 1994. Japanese Journal Phycology 42: 407-420*
6. *Imai I et al 1998). In: Anderson, DM (eds), Physiological Ecology of Harmful Algal Blooms (Springer-Verlag) pp95-112*
7. *Odebrecht C & Abreu PC 1995. Harmful Algae News 12/13: 4*
8. *Vrieling EG (1995). Neth J Sea Res 33: 183-191*
9. *Bowers HA et al 2006. J Phycol 42: 1333-1348*

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Foam events due to a *Phaeocystis* bloom along the Catalan Coast (NW Mediterranean)

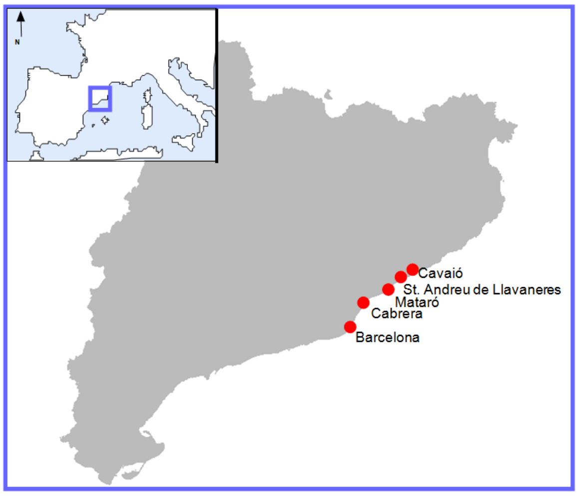

Fig.1. Location of the beaches where foams were observed.

Species of the genus *Phaeocystis* (Prymnesiophyceae) have a world-wide distribution and can produce nearly monospecific blooms. Their life cycle is generally polymorphic with free living non-motile and flagellated cells, and colonies composed of few to thousands of cells embedded in a mucilaginous matrix [1]. Massive blooms of the colonial phase have been observed in nutrient-rich waters such as those of North European coastal zones and polar regions. These blooms may cause problems for local fishing activities (because of clogging fishing nets) and are often associated with an accumulation of foam at the coast, which may have negative consequences for the tourist industry. In addition, some species may produce substances that are toxic to fish [2].

The presence of *Phaeocystis* in the Catalan Sea (NW Mediterranean) has been reported on several occasions. This genus is an important component of the winter-spring phytoplankton community in offshore waters of the NW Mediterranean, outside of the diatom-dominated patches that develop after deep convection in the Liguro-Provençal region [3]. On the other hand, foam events have been recorded throughout the year along the Catalan coast (especially during autumn and spring), but only one observation in March 1996, off the coast of Montroig (Tarragona) had been related to the presence of *Phaeocystis* (M. Delgado, personal communication). In fact, in most cases, the occurrence of foam on the Catalan coast could not be directly associated with any particular phytoplankton species.

In March 2006, foam was observed at various locations along the central coast of Catalonia (NW Mediterranean). A foam event lasting for one day was first detected on March 19 by five ARGUS video cameras focusing on the Barcelona city coast (Fig. 1, 2a). These cameras started to monitor the area in 2001; in addition, since March 2002, water samples are collected regularly (usually once a month) at 8 coastal stations (1.1 to 1.4 and 2.1 to 2.4, Fig. 2a), within the framework of the Coastal Oceanographic Observatory programme (http://coo.icm.csic.es/content/barcelonaelb). Phytoplankton counts by inverted microscopy are routinely carried out for the surface samples of Station 1.4. One week later (March 27), the Harmful Algae Monitoring Programme (focusing on harmful and noxious species along the Catalan coast) detected foam on several beaches along approximately 40 km of shoreline to the north of Barcelona (Cabrera, Mataró, St. Andreu de Llavaneres and Cavaió beaches; Fig. 1, 2b). Phytoplankton samples (fixed with acidic Lugol´s solution) taken four days prior to foam detection (March 15) at station A (Fig. 2a), revealed the presence of high *Phaeocystis* abundance, both in surface waters and at depth (decreasing from 1.64 x 10^6 cells L^{-1} at the surface to 0.80 x 10^6 cells L^{-1} at 30 m depth; Fig. 3a). One day later (March 16), a phytoplankton sample (fixed with formaldehyde-hexamine) taken at Station 1.4 also revealed a very dense *Phaeocystis* population (Table 1). Similarly, water samples (fixed with Lugol´s solution) from the Cabrera, Mataró, St. Andreu de Llavaneres and Cavaió beaches presented more than 5 x 10^6 cells L^{-1} of Phaeocystis (Table 1). High *Phaeocystis* concentrations remained in coastal waters of Barcelona for more than one month, given that high concentrations of this organism were recorded at station A on April 4, (increasing from 0.41 x 10^6 cells L^{-1} at the surface to 1.62 x 10^6 cells L^{-1} at the bottom, Fig. 3b), and at station 1.4 on April 27 (Table 1).

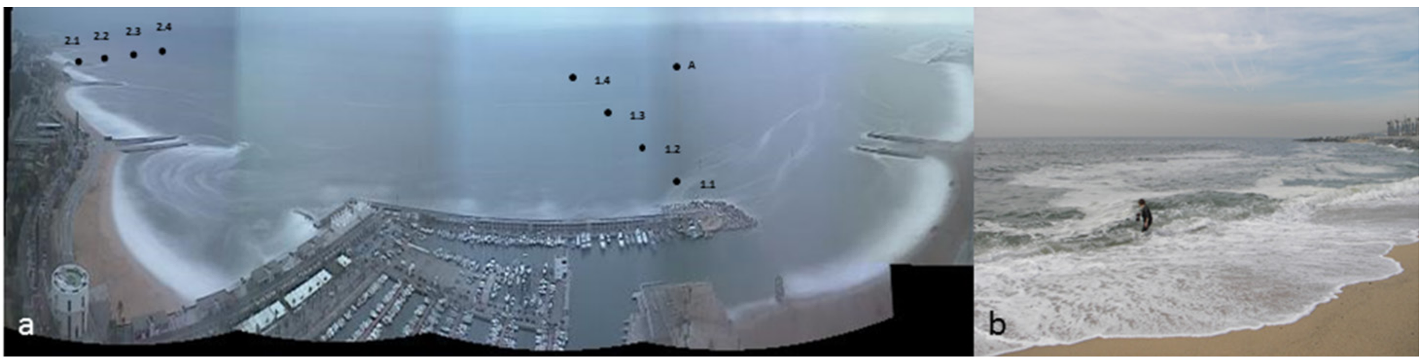

Fig. 2. a) Photography of the Barcelona coast taken with an ARGUS video camera system showing the presence of foams. Location of the sampling stations is indicated by black dots. b) Foams at the Mataró beach (Photo: Catalan Water Agency).

Table 1. Surface concentration of Phaeocystis *cells and Chlorophyll-*a *(Chl-*a*) at sites where formation of foam was observed.*

Location	Station	Date (dd/mm/yy)	*Phaeocystis* (10^6cells L^{-1})	Chl-*a* (µg L^{-1})	Programme/Projects
Barcelona	1.4	16/03/06	0.77	2.61	Coastal Oceanographic Observatory
Barcelona	1.4	27/04/06	0.01	0.76	Coastal Oceanographic Observatory
Barcelona	A	15/03/06	1.64	2.14	MicroRol
Barcelona	A	04/04/06	0.41	1.22	MicroRol
Cabrera	Coastal line	27/03/06	15.4		Harmful Algae Monitoring
Mataró		27/03/06	11.0		
St. Andreu de Llavaneres		27/03/06	8.18		
Cavaió		27/03/06	5.94		

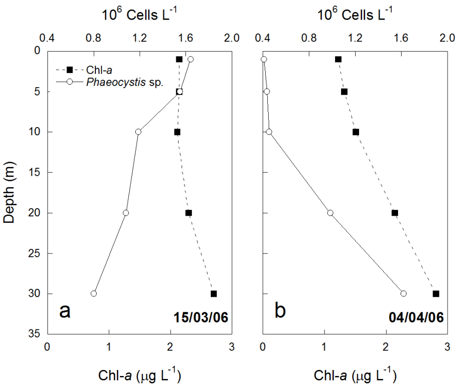

Fig. 3. Vertical profile of Phaeocystis *sp. abundances (cells L-1) and chlorophyll-*a *(Chl-*a*) concentrations (µg L-1) at Station A (Barcelona) for a) March 15, 2006 and b) April 4, 2006.*

The bloom of *Phaeocystis* was not monoespecific, since high concentrations of diatoms were also found (between 10^4 and 10^6 cells L^{-1}), mainly species of *Bacteriastrum*, *Rhizosolenia*, *Pseudo-nitzschia* and *Chaetoceros*. It is not clear what caused the termination of the *Phaeocystis* sp. bloom on the Catalan Coast; potential mechanisms include colony sedimentation, microzooplankton and viral infection. A bloom of ciliates (predominantly *Laboea* sp.), observed in April 2006 on the Barcelona coast [4], suggests that ciliate grazing could have been one of the main causes for the *Phaeocystis* bloom termination.

Based on colony morphology (Fig. 4a), *Phaeocystis* sp. was first identified as *Phaeocystis globosa* [5]. However, scanning and transmission electron microscopy observations revealed neither the typical body scales described for the flagellate stage of this species (Fig. 4b and c) nor filaments of any kind. The morphological characteristics of both the colonies and the flagellated and non-flagellated free cells agree with those of a new species of *Phaeocystis* found in Mediterranean waters (*Phaeocystis* sp. 2 in [6]). However, genetic information is needed to confirm whether the *Phaeocystis* from Catalonia is cospecific with *Phaeocystis* sp. 2.

The occurrence of the *Phaeocystis* bloom on the central coast of Catalonia was probably due to an intrusion of surface offshore aged Atlantic waters into the zone, a phenomenon related to the hydrographic changes observed in the whole NW Mediterranean during 2005 and 2006 as a consequence of two consecutive unusually dry, cold and windy winters. Information on how this hydrographic forcing affected the nutrient and phytoplankton dynamics on the Barcelona coast, as well as more details related to the bloom conditions, can be found in [7].

Acknowledgements

We thank Oscar Chic, José Manuel Fortuño and Gandhi Forlani for assistance, and Adriana Zingone for her help on *Phaeocystis* identification.

References

1. *Rousseau V et al 2007. Biogeochemistry 83: 29-47*
2. *Aanesen RT et al 1998. Aquatic Toxicology 40: 109-121*
4. *Almeda R et al 2011. Limnology and Oceanography 56: 415-430*
5. *Arin L et al 2006. Poster, 12th Intern Conf on Harmful Algae (Copenhagen)*
6. *Medlin L & Zingone A 2007. Biogeochemistry 83: 3-18*
7. *Arin L et al 2013. Estuarine, Coastal and Shelf Science 133: 116-128*

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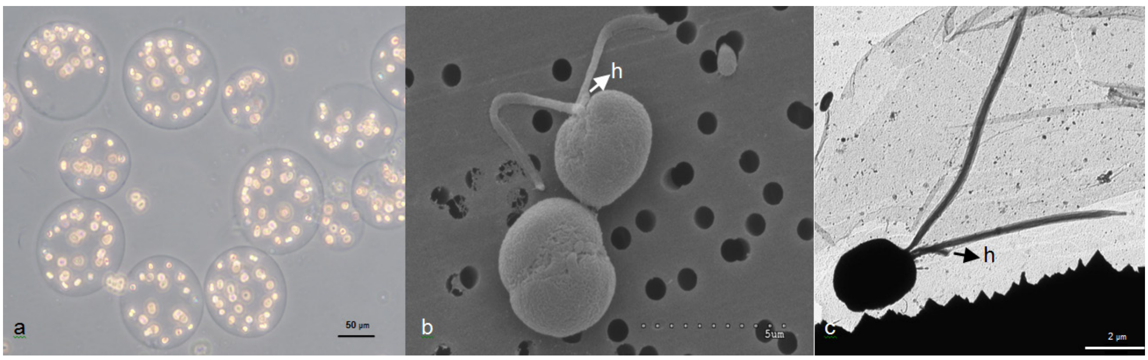

Fig. 4. Phaeocystis *sp. colonies and cells observed at different magnifications a) Small new colonies, Light microscopy; b) Free non-flagellate and flagellate cells, SEM (Photo: Fortuño and Arin); c) Free flagellate cell, TEM (Photo: Forlani); h = haptonema.*

PHENOMER: Better Knowledge of HAB with the help of Citizen observations

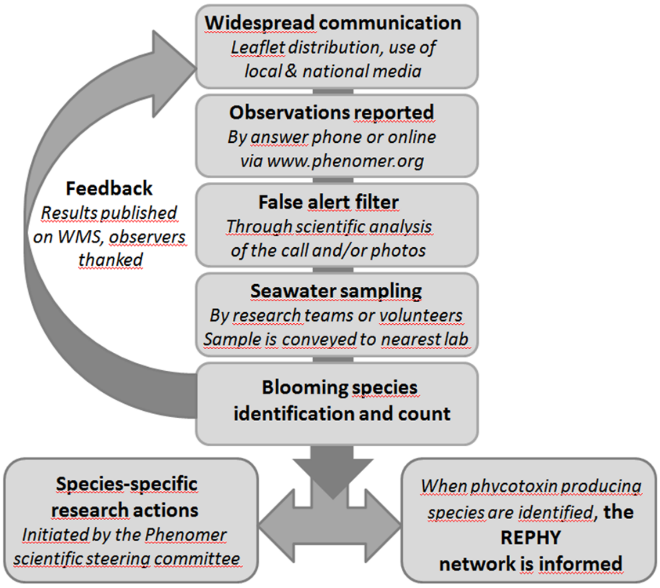

Fig. 1 The Phenomer HAB reporting process.

A citizen monitoring programme of water discoloration observations was launched across Brittany (France) waters in 2013, in parallel with the ongoing phytoplankton and biotoxin monitoring network REPHY [1]. This project, named PHENOMER (an acronym for 'visible phenomena at sea', combined with 'phenology', in French) is carried out by Ifremer and scientific and non-government organization partners and has as objectives a) to increase general public awareness of Harmful Algal Blooms (HABs) and b) to provide scientific data for current and future research.

To our knowledge, PHENOMER (www.phenomer.org) is a unique and new initiative in European waters. Volunteer HAB monitoring programmes were launched along the United States west coast in the early 1990's [2], along the east coast of the U.S.A. since 2001 via the NOAA-sponsored Phytoplankton Monitoring Network [3], and very recently along Canada's west coast due to an outbreak of diarrhetic shellfish poisoning [4]. The PHENOMER pilot study area is the Brittany coastline, a region frequently subject to microalgae blooms in its many tideways and small coastal rivers. Examples of high biomass HAB species already reported in Brittany are *Alexandrium minutum, Lepidodinium chlorophorum, Noctiluca scintillans* and *Mesodinium rubrum*.

Citizens are invited to report events they may observe (water discoloration, foam, or faunal mortalities) (Fig.1). The observations are reported either by phone or via an on-line form, and are subsequently analysed by the scientific team on-call in order to discard false alerts. In case of phytoplankton discolorations, either the nearest research teams of the project network promptly go and sample the bloom, or the volunteers are asked to follow a sampling protocol. Sample are then taken to the nearest laboratory (there are 6 dotted around Brittany's 2730 km of coastline) for analysis. The species responsible for the blooms are identified and feedback is spread both to the scientific community and to the general public on the internet site and via social media.

Prompt and very localised reports of water discolorations across a wide spatial scale can provide information on the distribution and extension of these phenomena, as well as on the biogeography of the causative organisms, including harmful species. Ecosystems where water discolorations are more likely to occur can be better identified on the basis of a monitoring system based on a theoretically infinite number of sampling points (via public observations). This would eventually favour the managing and monitoring of areas at risk as well as the realisation of new research projects. From a practical point of view, the PHENOMER network allows for rapid bloom sampling. Depending on

Fig. 2. Photograph of a Noctiluca scintillans *bloom sent in by a volunteer. Taken in July 2013 in the Bay of Biscay. Source: Maxence Loridan/Phenomer.*

the blooming species and the ongoing research programmes, the water samples and subsequent cultures can be dispatched to different research teams. By combining human observation data from PHENOMER with chlorophyll *a* satellite imagery and results from ongoing water quality programmes, we hope to shed new light on the cell concentrations at which high biomass HABs can be observed.

Citizen science has influenced both the scale of ecological research that is being done and the relationship between ecologists and the public [5]. It can be very effective for engaging people with how science works and for increasing their awareness of environmental issues and their local environment [6]. Projects including citizen participation must cross national boundaries, necessitating partnerships between governmental and non-governmental organisations to achieve relevant geographic scope. We therefore hope to extend PHENOMER to the rest of mainland France's coastline, before developing partnerships with neighbouring countries.

Acknowledgements

The authors gratefully acknowledge the PHENOMER participants who shared their bloom observations. We would like to warmly thank the scientific and environmental association partners (http://www.phenomer.org/Phenomer/Partenaires). Support for Phenomer was provided by the "Quels littoraux pour demain?" tender of the Fondation de France, the Loire-Brittany Water Agency and the French Ministry of Environment.

References

1. *Comas González A et al 2010. Bol Soc 1. REPHY http://envlit.ifremer.fr/infos/rephy_info_toxines (in French).*
2. *Anderson D M et al 2001. APEC #201-MR-01.1, Asia Pacific Economic Program, Singapore, and Intergovernmental Oceanographic Commission Technical Series No. 59, Paris*
3. *NCCOS Phytoplankton Monitoring Network http://products.coastalscience.noaa.gov/pmn/*
4. *McIntyre L et al 2013. Mar Drugs 11: 4144-4157*
5. *Dickinson J et al 2010. Ann Rev Ecol, Evol Syst 41: 149-172*
6. *Tweddle J C 2012. Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK (Natural History Museum and NERC Centre for Ecology & Hydrology for UK-EOF) Available online: www.ukeof.org.uk*

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The UK Marine Climate Change Impacts Partnership launches the 2013 annual report card

The United Kingdom Marine Climate Change Impacts Partnership (MCCIP) brings together scientists and policy makers from universities, government, government agencies and non-governmental organisations to provide co-ordinated advice on the impacts of climate change in UK waters. One of the main activities of the MCCIP is the production of an annual report card supported by scientific documents which have been peer-reviewed. This report card provides an update on the understanding of the impacts of climate change on the UK and Republic of Ireland (RoI) marine ecosystem and associated services. The MCCIP has recently launched the 2013 annual report card. Peer reviewed scientific reports support the 33 topics discussed. These include temperature, salinity, ocean acidification, eutrophication, plankton, harmful algal blooms (HABs), non-native species, aquaculture and fisheries.

Plankton and HAB highlights from the supporting scientific reviews reveal a decrease in dinoflagellates in the north east Atlantic and North Sea areas as well as changes in the timing of some plankton production. HABs remain a concern in both the UK and RoI with blooms of *Karenia mikimotoi* continuing to impact areas with an Atlantic influence. Closures of shellfish harvesting areas are still enforced in both UK and RoI due to high concentrations of algal toxins in shellfish flesh. Since the previous report card in 2011, the first closures of shellfish harvesting areas as a result of concentrations of azaspiracids (AZA) above the EU closure limit have also been enforced in Scottish waters. Prior to this, closures for AZA had only been enforced in the RoI.

2013 MCCIP Report Card

The MCCIP annual report card can be found at http://www.mccip.org.uk/media/18758/mccip-arc2013.pdf. The individual supporting scientific reviews can be found at http://www.mccip.org.uk/annual-report-card/2013.aspx/#Supporting. For further information about the MCCIP please contact office@MCCIP.org.

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ICHA NEW ZEALAND 2014

THE 16TH INTERNATIONAL CONFERENCE ON HARMFUL ALGAE

27 – 31 October 2014 • Wellington, New Zealand

The theme of the conference is "**Advancement through Shared Science",** which reflects the multidisciplinary nature of the field and the immense value of international collaboration. Topics include:

- HAB biogeography, regional events and population dynamics (modeling and prediction)
- Harmful and nuisance algae in marine and freshwater benthic environments (including diatoms, cyanobacteria and ciguatera)
- Toxin chemistry and analytical methods
- Toxicology and international regulation of algal toxins in food
- Taxomony, functional genomics and genetic diversity of HABs
- Sensors and new technologies for cell and toxin detection
- Impacts of HABs on ecosystems, aquaculture, fisheries and public health
- Climate change, eutrophication and HABs (including macro-algae)
- Monitoring and remote sensing, management and mitigation of HABs

CRITICAL DATES

First circular and call for papers:	6 Jan 14
Paper submission deadline:	15 May 14
Notification to authors of acceptance:	15 Jul 14
End of early-bird registration:	15 Aug 14
Conference:	27-31 Oct-14

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International Society for the Study of Harmful Algae ISSHA

EASTHAB-VIII Symposium held in Seoul, Korea, November 2013

Some participants in the EASTHAB-VIII Symposium, 7 Nov. 2013

The EASTHAB-VIII Bi-annual Conference was held on November 7-8, 2013 at Hanyang University, Seoul, Korea with more than 50 scientists and experts from the four member countries, China, Japan, Philippines, and Korea. Each country presented its national report on harmful algal blooms (HABs), focused on outbreaks and recent trends. There were also 20 scientific reports including 12 oral presentations and 8 posters. Three scientific sessions were established, on 1) bloom environments and monitoring, 2) ecology, physiology, and oceanography, and 3) benthic dinoflagellates and mitigation, to understand the present situation and to find out collaborative procedures for more efficient monitoring.

According to these reports, a total of 43 HABs occurred in Korean coastal waters in 2013, of which, 28 events were caused by *Cochlodinium polykridkoides*. *C. polykridoides* blooms occurred both on the southern and eastern coasts from mid-July to early September, with a massive fish kill (about 24.7 billion Korean won, equal to US$ 25 million), the second largest fish kill since 1995. It was assumed that the large-scale blooms in 2013 were closely related to low rainfall, high water temperature, high salinity, and the strong influence of the Kuroshio warm current on Korean coasts in the summer season (Dr. Changkyu Lee).

Seventy three HAB events were reported in Chinese coastal waters in 2012. HABs occurred mainly during May and June. The main species responsible were *Prorocentrum donghaiense, Alexandrium tamarense, C. polykrikoides, Karenia mikimotoi, Aureococcus anophagefferen* and potentially toxic species such as *Karlodinium veneficum, Heterosigma akashiwo*. SOA recorded a large mortality of abalone caused by *K. mikimotoi* in the East China Sea, with an economic loss of over 2 billion Chinese Yuan (Dr Douding Lu, Dr Xinfeng Dai).

In Japan in 2011-2012, serious HAB problems for aquaculture have continued, mainly in western Japan. The causative organisms are diatoms, dinoflagellates, and raphidophytes. *K. mikimotoi* blooms occurred widely in western Japan and caused great damage, particularly in the western part of the Seto Inland Sea and Bungo Suido. Blooms of *Heterocapsa circularisquama* in Lake Kamo (Niigata Prefecture) and *C. polykrikoides* in the west caused significant economic loss (Shigeru Itakura, Kazumi Matsuoka).

In the Philippines, *Pyrodinium bahamense, Gymnodinium catenatum,* and *Alexandrium* spp. have caused PSP events. *C. polykrikoides* caused a fish kill on the western coast of Palawan (Rhodora Azanza).

Following the provisional agenda of the host country, three topics were discussed, 1) operation of the terms of reference (ToRs) of EASTHAB, 2) future activities for 2014-2015, 3) the EASTHAB-XI meeting venue. The EASTHAB International Office is to revise and enlarge ToRs to accommodate recent changes. Dr. Hak-Gyoon Kim was reelected Secretary General to serve a four year term from 2014.

With regard to Future Activities for 2014-2015, a Scientific Steering Committee (SSC) was established based on the revised ToRs. Twelve SSC members comprised of three scientists from each of the four countries were nominated as follows: Dr. Mingjiang Zhou (IOCAS), Dr. Douding Lu (SIO-SOA), Dr. Songhui Lu (Jinan University China), Dr. Goh Onitsuka (Fisheries Research Agency), Dr. Mitsunori Iwataki (Yamagata University), Dr. Ichiro Imai (Hokkaido University Japan), Dr. Changkyu Lee (NFRDI), Dr. Myungsoo Han (Hnyang University), Dr. Joongki Choi (Inha University Korea), Dr. Rhodora Azanza (UP-MSI), Dr. Ulysses Mentojo (NFRDI Philippines), Dr. Aletta Yniguez (UP-MSI Philippines).

A work plan for a collaborative cruise to clarify the initiation and subsequent transport routes of fish killing HABs was proposed by NFRDI-Korea. The plan would include keeping track of simultaneous HABs such as fish killing blooms of *Cochlodinium polykrikoides*, for the purpose of HAB prediction, especially in the East China Sea and adjacent regions. When the cruise is funded and implemented, an interim meeting including a workshop or forum will take place in 2014. One option to improve public attention to the EASTHAB scientific reports, is an agreement to publish scientific articles in special issues of scientific journals. Creation of an EASTHAB web site and ways of fund raising were also discussed. More in-depth issues pertaining to this work are to be discussed at the EASTHAB-IX.

Dr. Songhui Lu (Jinan University) offered to host the next EASTHAB-IX Meeting, to be held November 2015 in Guangzhou (Canton).

Dr. Hak Gyoon Kim, Secretary General, EASTHAB, Pukyong National University, LED-Marine Convergence Technology R&BD Center, San 100 Yongdand-dong, Nam-gu, Busan, 608-739, Korea

National Shellfish Sanitation Programme in Argentina

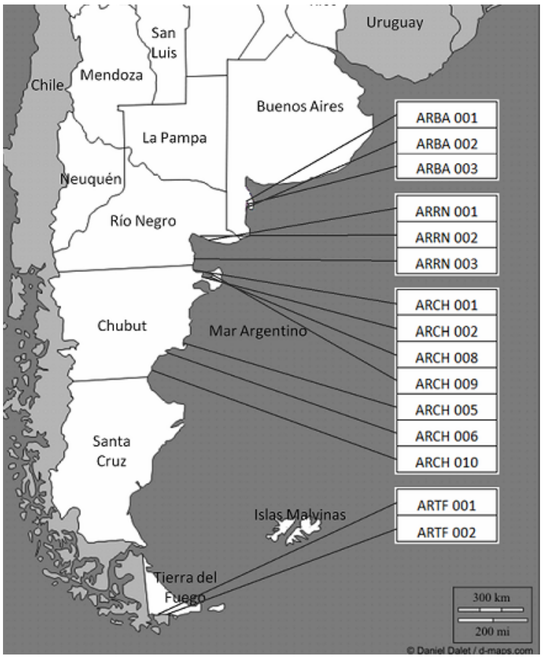

Fig. 1. Classified Shellfish Production Areas in the Argentinean coasts.

In 2005 Argentina began a National Programme to classify shellfish harvesting areas, to provide a framework for the development of molluscan shellfish aquaculture and harvesting activities in coastal areas. One of the first steps was the establishment of a covenant between the "National Subsecretariat of Fisheries and Aquaculture" and the "National Service for Food and Agriculture Quality Control and Sanitation", both belonging to the Ministry of Agriculture, Fisheries and Food (MAGyP). Activities were coordinated by the Aquaculture Directorate from the same ministry.

National regulations for classification of shellfish production areas (Fig. 1) were modified and implemented after meetings with the provincial authorities and taking into account the different kinds of exploitation. Training courses were organized for phytoplankton and shellfish sampling, good procedures for handling shellfish, and identification of harmful algae species, and followed by the application of these common criteria to the whole country. In addition, technical staff had open workshops with shellfish growers and fishermen.

Advances in standardization required coordination between the central government and the competent maritime authorities (ACP), in gulfs and embayments and in coastal waters up to the 12 miles limit in their respective jurisdictions (Table 1). Shellfish production areas are classified as A, B, or C on the basis of their levels of chemical pollutants and microbiology. The National Food Security Agency, SENASA, is the authority which classifies the areas and audits results provided by the provincial authorities. All coastal areas in Argentina are classified as A, and shellfish harvests do not require depuration before going to market. Specific regulations to control a variety of resources are published in resolution 829/2006 of the Secretary of Agriculture, Fisheries and Food.

The Pacific oyster (*Crassostrea gigas*), an exotic species successfully adapted to northern Argentina, is harvested from shellfish beds and cultures in Bahía Anegada, south of Buenos Aires Province. Purple clams (*Amiantis purpurata*), mussels (*Mytilus edulis platensis*), geoduck (*Panopea abbreviata*) and "cholga" (*Aulacomya atra*) are the main shellfish resources in the province of Río Negro; the same species, (except the purple clam), and also scallops (*Aequipecten tehuelchus*), white clams (*Protothaca antiqua*) and razor clams (*Ensis macha*), are exploited in the southern provinces of Chubut and Santa Cruz. Mussel (*Mytilus edulis*) cultivation predominates in Tierra del Fuego, Antártida and the South Atlantic Islands, and "cholga" and deep-water scallops (*Zygochlamys patagonica*) are harvest in the Beagle Channel.

Provincial authorities have implemented monitoring of harmful algae, and provide information to consumers on the risks involved in eating seafood unregulated by official controls, and the need to establish shellfish harvesting bans to protect public health in all areas associated with commercial exploitations or recreational shellfish collection. Some provinces (e.g. Chubut) have a long history of HABs and shellfish monitoring, but others have started monitoring quite recently. Monitoring is carried out by the ACP in cooperation with universities, such as the National University of La Plata in Buenos Aires and the University of San Juan Bosco in Patagonia, and staff trained by the administration for these specific tasks. Provincial inspectors are responsible for phytoplankton and shellfish sampling and for their custody such that products sent to SENASA laboratories can be traced.

Biweekly analyses of phytoplankton samples with a focus on HAB species

Table 1. Competences of the Provincial (ACP) and National (ACN) Authorities for Molluscan Shellfish Safety in Argentina.

COMPETENT PROVINCIAL AUTHORTIY (ACP)	COMPETENT NATIONAL AUTHORTIY (ACN)
1. ESTABLISHES MOLLUSCAN SHELLFISH PRODUCTION AREAS	1. ENDORSES PROPOSED PRODUCTION AREAS
2. UNDERTAKES STUDIES FOR TO CLASSIFY	2. KEEPS NATIONAL REGISTER OF THE AREAS
3. DEFINES SURVEILLANCE CONDITIONS FOR EACH AREA (MONITORING PRGRAMME) AND PREPARES PROTOCOLS.	3. CARRIES OUT AUDITS TO VALÍDATE COMPLIANCE WITH REGULATIONS AND EFFICIENCY
4. ENFORCES SHELLFISH HARVESTING BANS	4. NEGOTIATES SHELLFISH EXPORTS TO THIRD COUNTRIES
5. ORGANIZES CAPACITY BUILDING WORKSHOPS	
6. SETS THE REQUIREMENTS FOR SHELLFISH COLLECTION AND CULTURES AND UPDATES RECORDS	

Fig. 2. Participants in the First National Workshop on Marine Biotoxins and Harmful Algal Blooms, Puerto Madryn, Argentina, 23-27 September 2013

are carried out in most coastal provinces. Results and early warnings of the occurrence of toxigenic species are sent to the provincial authorities and to the national network of laboratories. The latter perform the testing and calibration required by regulation ISO 17025, and are responsible for toxin analyses of shellfish collected at the same time as plankton samples. PSP toxins are analyzed according to the standard mouse bioassay (AOAC 959.08), and lipophilic toxins by the procedure of the EU Reference Laboratory for Marine Biotoxins (CRLMB 2011). ASP toxins are analyzed by HPLC. Results are communicated to the provincial authorities who enforce harvesting bans/openings. Recently SENASA has acquired an LC-MS that will be used to solve uncertainties in lipophilic toxin results obtained by mouse bioassay.

The First *National Workshop on Marine Biotoxins and Harmful Algal Blooms*, convened by the MAGP through the Subsecretariat of Fisheries and Aquaculture, was held in Puerto Madryn, Chubut, 23-27 September 2013 (Fig. 2). Researchers from Universidad Nacional de La Plata, Universidad de la Patagonia San Juan Bosco, and INIDEP, technical officers from the MAGP coastal laboratories and from SENASA, as well as officers from the Aquaculture Directorate and two invited speakers from Galicia, Spain (Ángeles Moroño, INTECMAR and Beatriz Reguera, IEO) participated in this meeting to coordinate ongoing activities of HAB research and monitoring in Argentina, and to identify the main impediments to progress.

The first day of the workshop was open to representative fishermen and shellfish grower associations. Protocols and results obtained in phytoplankton and shellfish toxin monitoring programmes carried out in each maritime province were presented. Special attention was focused on regulations for classification of shellfish production areas, emerging toxins, and the way European laboratories, such as INTECMAR, are adapting their existing control to recent European Union regulations for marine phycotoxins. On the second day, three round tables were arranged to discuss: i) harmful algal blooms in Argentina; ii) the main problems met by laboratories in charge of toxin analyses; iii) management of classified production areas.

The group recognized the success of the workshop in facilitating contact between professionals dedicated to different aspects of HAB-related problems in Argentina. They underlined advances in recent years concerning implementation of monitoring programmes and identification of the main agents of toxic events. They directed attention to new issues on regulated and unregulated emerging toxins (azaspiracids and fast acting toxins) that seem to be widely distributed on Argentinian coasts. Future goals identified were: i) to establish a communication network including all participants in HAB-related activities; ii) news dissemination; iii) updates on harmful phytoplankton species identification; iv) periodic meetings to coordinate all HAB and biotoxin monitoring programmes in the country. The group on toxin analyses considered essential: i) common purchase of imported toxin standards; ii) to set as soon as possible the analytical procedures with the new LC-MS/MS system to resolve uncertain results of lipophilic toxins obtained by mouse bioassay; iii) to ensure participation of missing provincial laboratories on the National Laboratories Network. In the context of classification of production areas, there is a need to revise current regulations including: i) checking the time gaps between sampling and analysis; ii) communication of harvesting bans; iii) sampling frequency for different toxins; iii) review of the applied system for classification of areas.

Participants in the meeting had the opportunity to visit the HAB monitoring laboratory of the National University of Patagonia (Trelew) and the provincial laboratory of the Health Ministry in Chubut. In addition, the invited speakers met with authorities from the National Fisheries and Aquaculture Directorates, and visited the SENASA Laboratory in Buenos Aires.

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News from Latin America

Participants in the RLAN (Latimerican Meeting on Harmful Algae) meeting. Florianápolis, Brazil, 7-9 October 2013.

Researchers from Latin American countries met in Florianópolis, southern Brazil for the Latin American Meeting on Harmful Algae (RLAN). The meeting between 7 and 9 October 2013 was attended by about 60 participants from Argentina, Chile, Uruguay, Ecuador, Peru, and Mexico,as well as colleagues from Sweden and Spain. The main objective of RLAN is to meet and discuss the harmful algae theme, recent advances in the field and future perspectives. This event also aimed to discuss strategies for organization as a regional initiative of the 17th International Conference on Harmful Algal - ICHA, the International Society for the Study of Harmful Algae, which will take place in Florianópolis in 2016.

The RLAN was very productive and brought together old colleagues with the new generation of researchers in the region. There were 3 days of discussions, with presentation of oral and panel contributions and several roundtables. These activities were joined by people involved in bivalve mollusk production in Santa Catarina. The meeting strengthened the idea of 17 ICHA as a regional event with the effective participation of Latin American colleagues in the organizing committees. The event is scheduled to take place between 9 and 14 October 2016.

During the RLAN, the *Latin American Association for Harmful Algae Studies* (AlEAN) was created, with statutes and philosophy inspired by the International Society for Harmful Algal Studies, ISSHA. The association will work with ISSHA to strengthen their common goals and prepare a great event in 2016. More details about plans for the 2016 ICHA will be presented to the society at the meeting in Wellington, New Zealand.

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GEOHAB
Global Ecology and Oceanography of Harmful Algal Blooms

GEOHAB Activities and Synthesis Plans

It has been an active year for GEOHAB. The Core Research Project on HABs in Stratified Systems held an Open Science Meeting in 2012. The outcomes from that meeting are published and available at www.geohab.info (Advances and Challenges for Understanding Physical-Biological Interactions in HABs in Stratified Systems) as a GEOHAB Report. This workshop directly led to a special issue in *Deep Sea Research II.* Guest editors include R. Raine, E. Berdalet, M. McManus, and H. Yamazaki. The special issue "Harmful Algal Blooms in Stratified Systems" is already published. It includes 21 peer-reviewed manuscripts and a preface. GEOHAB has also participated in several international meetings and workshops, including co-sponsoring the "Harmful Algae Blooms in a Changing World" workshop with ICES and PICES (see accompanying article), and participation in the Group on Earth Observations (GEO) Oceans and Society: Blue Planet Symposium, held in Sao Paolo State, Brazil. GEOHAB was also asked to participate in the recent Joint Programming Initiative for Health and Productive Seas and Oceans Initiative (JPI-Oceans).

The most exciting activity, however, was the successful Open Science Meeting (OSM) held in Paris, France, April 24-26, 2013. This meeting attracted an international group of scientists to share their insights regarding GEOHAB past, present, and future activities. This meeting had special relevance not only for the GEOHAB programme, but also for the entire international scientific community of researchers and managers engaged in the advance in harmful algal bloom research and mitigation of impacts. This synthesis OSM had two objectives, first to review scientific advances accomplished under GEOHAB since its inception, second to identify a near-future roadmap of GEOHAB-like activities to be pursued beyond 2013. As part of the meeting, GEOHAB solicited submission of concept papers focusing on potential activities that could be completed within the next 5 years, and asked the international HAB community to envision what opportunities and challenges we face over the next decade.

A total of 15 concept papers were presented and discussed. These form a core list of potential science objectives moving beyond the 2014 end-date for the GEOHAB Programme. Meeting participants identified several positive outcomes from GEOHAB, including the success of the various Open Science Meetings and workshops, the process for endorsing programmes and projects from the community, and the emphasis on technology development, capacity building, and training of young scientists.

The primary outcome from this meeting was the proposal to initiate a new International HAB Programme, GlobalHAB, as a follow-on to GEOHAB. This programme focuses on the theme of "HABS in a Changing World" and is to be based on the GEOHAB Science Plan. A new Science Steering Committee will be formed, and an Implementation Plan will be developed for GlobalHAB. This will build on the success of GEOHAB, but will provide the opportunity to address areas identified in the GEOHAB Science Plan but not previously implemented, such as a science-based focus on HAB toxins, socio-economic impacts, and HABs at the land-sea interface.

Immediately following the Paris OSM, this plan was presented to the Intergovernmental Panel on Harmful Algal Blooms (IPHAB). The plan was endorsed by the International Oceanographic Commission (IOC), with an invitation to the Scientific Committee on Ocean Research (SCOR), the co-sponsor of GEOHAB, to continue their involvement.

In preparation for the termination of the GEOHAB of synthesis documents and publications, while also maintaining our active involvement with relevant international groups and agencies. We look forward to providing updates on both the GEOHAB Synthesis and the launch of the GlobalHAB Programme at the 16th International Conference on Harmful Algae in New Zealand!

Raphael Kudela, GEOHAB-SSC Chair, Department of Ocean Sciences, University of California, Santa Cruz, CA 95064, USA.

"We all came to Paris because we recognize a fundamental problem (HABs), and cannot solve this problem in our individual laboratories. This requires an international approach." Participants in the OSM on GEOHAB Synthesis, UNESCO, Paris 24, 26 April 213

Harmful Algal Blooms in a Changing World

There are projections that the process of climate change will lead to increased frequency and severity of Harmful Algal Blooms (HABs). Indeed there is evidence that climate change already may be causing shifts in phytoplankton community composition, but the projections on climate-increasing the HAB impact remain, at this point, largely speculative. Although there are many intuitive linkages, these scenarios are founded on limited and often conflicting experimental data, so that scientific debate at this time cannot establish a link between HABs and climate change, let alone how dramatic any change in HABs might be in the future. Moreover, the field of HAB research lacks the rigorous organization structure of the Intergovernmental Panel of Climate Change, where scientists worldwide work in collaboration to quantify and evaluate trends in climate impacts. HAB scientists need to proactively identify the fundamental parameters and research infrastructure needed to effectively address this important question if we are to have those data we need when called upon to forecast or explain changing HAB patterns.

It is important to recognize that the issue here is not simply whether a pattern might develop where fluctuations in HAB frequencies become more prevalent in the future. Instead, based on limited ecophysiological insights, it is reasonable to postulate there will be fundamental changes in the distributions of HABs, bringing ecosystem and human health threats to extensive new regions, perhaps compounding current problems. There also likely will be increased "windows of opportunity" for existing regional HABs, intensifying existing threats at a time when humans will be relying more on coastal resources for food security. As it stands, the HAB research community is woefully unprepared to provide solid insights into the changes that will define the next generation's access to many marine resources.

A workshop of international experts convened in March, 2013 at the Whiteley Center, Friday Harbor Laboratories, University of Washington (funded by PICES, GEOHAB and NOAA) to develop a preliminary assessment of where the field of HAB research stands in terms of addressing HAB/climate change, and the directions it needs to move over the next decade.

Three broad classes of HABs were considered: toxic HABs that impact human health, fish-killing HABs where the causative organisms affect both wild and cultured fish populations, and high-biomass HABs, whether caused by natural or anthropogenic processes, leading to hypoxia, foam, and other negative impacts. The key underlying consideration surrounding climate related distributional changes in HABs is three-pronged: HAB species "getting there", being adapted well enough to "remain there" over the course of the season, and ultimately "staying there" for multiple seasons. There is much in the invasive species research field that could be applied to investigate HAB/climate change links.

The workshop deliberations used as a foundation observed and predicted climate changes in the physical and chemical conditions in aquatic systems identified in the AR4 IPCC Synthesis Report on climate change, and combined what is known about how these affect the physiology of both general phytoplankton as well as HAB species. The central questions asked were: what do we know about how a given parameter affects HAB species, what do we not know of importance in terms of this parameter's impacts, which of these unknowns are the most pressing questions, and how should we go about addressing them?

Topics considered included *temperature* and it's effects on cellular growth rates, nutrient uptake rates, toxin production and cellular lipid composition, and *stratification* and its impact on vertical nutrient flux, physical and chemical stability of the system and the prolonging of HAB windows of opportunity. Similarly, the effect of ocean *acidification* was examined in terms of success of HAB species and cellular toxin synthesis and accumulation, along with the effects from altered *nutrient inputs* associated with changing precipitation characteristics (e.g., pulsed terrestrial riverine flows) and facilitated transport of culturally-derived nutrients. While each of these four broad parameters have known impacts on HAB species, it will be synergistic interactions among them that will determine the overall impact on HAB species success in phytoplankton communities, interactions that, realistically, there is at present no evidence with which to inform.

The workshop participants felt that current insights on how climate change may influence grazing, and the effects of light on HAB species, are entirely insufficient. Many HAB species are both grazers and prey, but there is very limited information on how the balance of these processes might deviate as the ocean environment changes. There are model projections that climate change will alter patterns of cloud cover, and thus change light fields spatially in surface waters. While light is a key parameter affecting phytoplankton communities, and different species are know to be better light or shade adapted candidates, there is no indication so far that HAB species will be affected differently from non-HAB species.

An overriding theme during the workshop discussions was consideration of how environmental changes will impact HAB species relative to non-HAB species. Participants recognized that much of the HAB research to date has focused on the specifics of HAB organisms, which though essential for understanding the ecophysiology of the organisms provides limited insight as to how HAB organisms interact within the broader phytoplankton communities. One of the key workshop findings was the need for a shift in the strategy of HAB research towards more comparative investigations that inform on the thresholds for shifting balance among HAB and non-HAB species in the context of climatically driven changes in coastal and oceanic environments.

The workshop participants also considered what new research tools would help move the science forward most quickly. The primary need at this time is organizing long-term sampling programs to collect HAB-centric datasets of relevant parameters across diverse geographical and oceanographic regimes. While regional and national monitoring programs already exist, none are sufficient to provide the data streams to assess changes in HABs in new, currently

Participants in the PICES-GEOHAB-NOAA workshop on HABs in a Changing World, Whiteley Center, Friday Harbor Laboratories, University of Washington, March, 2013.

unaffected regimes. The vast majority of these HAB data also lack the essential calibrated oceanographic data to link HAB changes to climate-dependent parameters.

Participants agreed that the most productive means to initiate these data collection streams is to collaborate with existing coastal and offshore oceanographic monitoring sites, to add a limited list of parameters (e.g. phytoplankton composition, toxins, etc.) to establish HAB "observer sites". Recognizing that laboratory facilities and expertise in many areas of interest are limited, a shorter list of key parameters that are easily obtained with simple sampling approaches was developed to facilitate new outpost-type monitoring sites.

A second kind of sentinel site was envisioned by participants, termed "super sites", that while limited in number, would be equipped with sophisticated monitoring equipment to enable high-frequency sampling of phytoplankton species composition along with a wide range of environmental parameters. Their purpose would be to enable *in situ* investigations of the ecology of HABs in relation to non-HAB species. The goal of both "observer" and "super" sites is to ensure adequate datasets for statistical assessment of long-term change across multiple coastal and oceanic regimes.

New investigative approaches will also be needed to address the HAB/climate change issue. It is recognized that isolates of given phytoplankton species differ in their growth responses to different stimuli, so there is a strong need to understand these localized differences in projecting climate change effects. One novel approach is to organize "common garden" style culture experiments, where many laboratories around the globe conduct identical experiments using precise established procedures to test the effects of one or more parameters on a single species isolated from their local waters. This approach provides the ideal mechanism for evaluating species responses as well as characterizing inter-strain variability. Other methods included cross–sectional research programs such as mesocosms and other enclosures using standardized methods, design, analysis, and assessment. Enclosed basin study sites, where HABs are a repetitive feature, were also cited as promising instruments for gauging HAB competitive interactions in unrestricted coastal waters.

Participants also identified a strong need to develop measures for dealing with HAB outbreaks, including proactive (avoidance), abatement (halting) and mitigation (reduced impact) strategies. In addition, virtual assessment approaches to understand past outbreaks and forecasting future outbreaks built upon detailed conceptual or heuristic models were felt to be under-utilized.

Participants felt that next logical step in focusing HAB/climate change research was to convene an Open Science Meeting on global change impacts on marine and freshwater HABs. The goals of this symposium would be to promote research in the topics along the lines identified by the workshop participants to be of high priority over the next decade, to bring new people and expertise into the field (i.e., to make climate change researchers aware of the HAB issue, and how their expertise and methods may find rich ground for research), and to focus community efforts towards identifying the data needed to unequivocally demonstrate a linkage between HABs and climate change.

The workshop findings are now being integrated into a manuscript intended for publication in the international journal *Harmful Algae.* The findings will help provide a broader view for the HAB research community on some of the key gaps in our understanding, and to help focus global research efforts on addressing HABs and climate change.

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GEOHAB

Global Ecology and Oceanography of Harmful Algal Blooms

Participation of GEOHAB in “CSA Oceans UN/International Organisations Consultation Workshop”, Brussels, June 11th 2013

GEOHAB was invited to participate to the CSA Oceans UN/International Organisations Consultation Workshop (June 11, 2013). The activity was part of a broad mapping exercise being conducted by the European Commission FP7 Coordinated Support Action (CSA) Oceans to the Joint Programming Initiative on Healthy and Productive Seas and Oceans (JPI Oceans, www.jpi-oceans.eu). Inputs provided in the framework of this workshop and a subsequent extensive questionnaire filled by the participants are analysed to inform the European Commission on the development of the JPI Oceans Draft Strategic Research and Innovation Agenda.

Participants provided their views on the gaps and knowledge needs that could potentially be relevant to JPI Oceans and how best to interface with other mechanisms for European international coordination and cooperation on marine and maritime research. In particular, JPI Oceans aims to add value at a European level to make better use of R&D related national investments and resources, including human capacities and infrastructures. The document elaborated by GEOHAB emphasized pressing issues and promising research, technology and innovation potentials, in a 20-30 years perspective, related to the seas and oceans in general. In addition, the major challenges related to harmful algal blooms (HABs) in European waters were highlighted, such as the need for an operational oceanography of HABs events, technical advances to develop sustained long term and high-resolution observing systems for biological processes (in general), to ascertain the impact of climate change on HABs (including benthic ones), to implement sustainable and secure fisheries, aquaculture and tourism, organization of common and efficient ocean data bases, etc. JPI Oceans was also informed in detail about the scientific GEOHAB programme and its achievements as a platform to coordinate and foster international research on HABs since its launch in 2000. In the future, GlobalHAB, recently endorsed by IOC/UNESCO in the last IOC Assembly, will continue to work with the principle that the fundamental problem of HABs cannot be solved in individual laboratories and requires an international approach. The delivered document indicated that collaborative links between GlobalHAB and JPI Oceans will contribute to the structuring of efficient and sound marine research in Europe.

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In Memoriam - Grethe Rytter Hasle

Grethe Rytter Hasle, 93, passed away quietly while sleeping between Nov 8 and Nov 9. She was born Jan 3, 1920. She was buried in Haslum near Oslo, Norway.

Grethe was active until the very last. She drove her car for the last time a week before she died. She had her last scientific discussion 1½ week before she died, thus scientific ideas that she could not explore herself were passed on. Her photos, slides and a huge collection of samples will be transferred to the Natural History Museum of Oslo to form the core of a newly established algal collection.

Grethe Hasle was a dedicated, inspiring and productive scientist. She published several important pioneering papers, and has influenced science and scientists throughout the world in the field of algal taxonomy. Grethe started her career at Oslo University studying the vertical migration of dinoflagellates and the reliability of single observations in phytoplankton surveys. Her subsequent work was on the taxonomy of coccolithophorids and ciliates. Her 1968 Ph. D. dissertation was entitled "An analysis of the phytoplankton of the Pacific Southern Ocean: abundance, composition and distribution during the 'Brategg' Expedition, 1947-1948".

Stimulated by a visit to Dr. Friedrich Hustedt in Bremen, Grethe turned to diatom taxonomy, ranging from pennate (*Nitzschia, Fragilariopsis*) to centric

(*Thalassiosira, Cymatosira*) genera. As a pioneer in the combined use of light, scanning and transmission electron microscopy, she became an internationally renowned expert on diatom ultrastructure, and described the strutted and labiate processes of Thalassiosiraceae. She has supervised students from all over the world, and her dedication has inspired diatomists everywhere. Grethe Hasle was nominated a Full Professor in Marine Botany at the University of Oslo in 1977, the third female professor in Natural Science at the university.

The high quality of Grethe's work is illustrated by her 1965 publication in "Skrifter utgitt av Det Norske Videnskaps-Akademi", on the group *Pseudo-nitzschia*. She paid careful attention to details of the number of striae and fibulae, rows of poroids on the striae membrane, the presence/absence of a central interspace, as well as to diatom type material. This ground-breaking work includes a description of *Nitzschia pungens* forma *multiseries* (now *Pseudo-nitzschia multiseries*), which in 1987-88 was found to be responsible for the production of domoic acid, causing Amnesic Shellfish Poisoning in Prince Edward Island, Canada. Grethe Hasle's research is thus a prime example of the practical importance of basic science. Grethe helped researchers from all over the world with the difficult taxonomy of this domoic-acid-producing genus, culminating in her 2002 review in "Harmful Algae" on the global distribution of toxigenic *Pseudo-nitzschia* species.

Grethe continued her prolific publication output throughout her eighties. She worked until the very last with manuscripts still in progress, and had her last paper published only a few years ago. She was elected to the Norwegian Academy of Science and Letters in 1980, and at the time she was the only woman in the Science Class. In 1999, she received the Excellence Award from the Phycological Society of America, and in 2002, she was awarded the Yasumoto Lifetime Achievement Award by ISSHA. She is honoured by the names of the diatoms *Haslea, Nanoneis hasleae, Praethalassiosiropsis hasleae, Thalassiosira hasleae* and *Pseudo-nitzschia hasleana,* and the dinoflagellate *Dinophysis hasleae*.

Nina Lundholm, Natural History Museum, University of Copenhagen, Denmark
Gustaaf Hallegraeff, Institute for Marine and Antarctic Studies, University of Tasmania, Australia

In Memoriam - Professor Zhu Mingyuan

We are sad to communicate the passing away of our dear colleague, Professor Mingyuan Zhu.

Professor Mingyuan Zhu, was an outstanding Chinese expert on phytoplankton and HAB studies, at the State Ocean Administration of China, First Institute of Oceanography, Qingdao City. He suddenly passed away without any warning while attending the PICES 2013 annual meeting in Nanaimo, BC, Canada. He was 70. Prof. Zhu was elected to many academic positions. He was Secretary General of the Chinese Committee of SCOR, Vice Chairman of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Head of the Regional Working

Group (RWG) on Investment, and Vice Head of the RWG on Ecosystems, UNDP/GEF Yellow Sea Large Marine Ecosystem Project, as well as Vice-Chairman of the Chinese Committee of the SCOR-IOC Working Group on Harmful Algal Blooms, and many others. He was very active both in Chinese ocean science and in regional and international programmes and projects such as LME, GEOHAB, and GLOBEC. His death is a great loss for the Chinese and worldwide phytoplankton and HAB communities. This has been a shock not only for his numerous former students, many of them now in key positions in China and elsewhere, but also for the many colleagues who have had close cooperation with him and his research team.

Ian Jenkinson & Ming Jiang Zhou, Chinese Academy of Sciences, Institute of Oceanology, 7, Nanhai Road, Qingdao 266071, China

Future Events

ICES Annual Science Conference 2014

A Coruña, Spain, 15-19 September 2014

Call for Abstracts now open

ICES Theme Session H: Harmful Algal Blooms in Aquac Culture and Fisheries ecosystems: prediction and societal effects

ICES 2014 ICES Annual Science Conference

Conveners: Beatriz Reguera, Spain (beatriz.reguera@vi.ieo.es), Juan Blanco, Spain (juan.blanco@cimacoron.org) and Bengt Karlson, Sweden (bengt.karlson@smhi.se)

We invite you to contribute with oral/poster presentations on the following topics:

- Advances in the ecology and oceanography of HABs in the ICES domain
- Improvements in HAB forecasting – coupled physical-biological, and toxin uptake-detoxification models.
- HABs and their impact on wild fisheries and shellfisheries
- Emerging benthic HABs and their toxins.
- Advances in automated HAB observing systems, biosensors and toxin-detection methods.
- Mitigation strategies
- Supporting information for the end-users

Deadline abstracts submission: 14 April 2014

The ICES IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD)

The working group, chaired by Bengt Karlson, Sweden, will meet in IJmuiden, Netherlands, 29 April – 2 May 2014 to:

a) Report on new findings in the area of harmful algal bloom dynamics;
b) Deliver National Reports on harmful algal events and bloom dynamics for the year 2013;
c) Summarize the harmful algal bloom events 1990-1999 and in 2000 to 2009 in the ICES region based on decadal maps using HAEDAT with a view to investigating if data are of a quality that allows inter-decadal comparisons;
d) Review progress regarding the entering of data onto the HAEDAT data-base and review synthesis stories (HAEDAT entries from start to date) submitted in advance from each country with a view of drafting a 'synthesis story' about HAB events in the ICES area;
e) WG should report on Automated Harmful Algal Bloom in situ Observation Systems;
f) Finalize draft a review document quantifying on the scale nature and extent of the problems associated with fish killing algae in the ICES region;
g) Review progress and advise the conveners on the planned session on Harmful Algal Blooms in Aquaculture and Fisheries ecosystems: prediction and societal effects at the 2014 ICES Annual Science Conference in La Coruna, Spain;
h) Review progress and advice the scientific steering committee for the planned joint ICES-PICES-IOC scientific symposium on Climate change and harmful algal blooms. The symposium is planned to be arranged in 2015;
i) Contribute to the development of a Global Harmful Algal Bloom Status Report.

The Working Group is open to participation by experts also from IOC Member States outside the ICES region. If you or experts you wish to involve in the WGHABD are interested in participating they should communicate their interest to the IOC (H. Enevoldsen) and with copy to the Chair of the Group (B. Karlson). Participation is at national/institutional/personal expense.

Priorities for International Cooperation on HAB set for next two years

In April 2013, the Eleventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms met at UNESCO Headquarters in Paris to review actions completed during the past two years by IOC and partners in the area of HABs. Major achievements reported included: (i) developments within GEOHAB including the launch of the GEOHAB Research Plan for the Core Research Project in Benthic Systems and the development of a revised international coordinated research plan for HABs; (ii) development of regional activities within ANCA, FANSA, HANA and WESTPAC-HAB; (iii) implementation of more than ten training courses and training-through-research projects; (iv) results from the ICES-IOC WGHABD and ICES-IOC-IMO WGBOSV; (v) continued development of the integrated IPHAB-IODE Harmful Algae Information System (vi) continued publication of the IOC Harmful Algae News; (vii) and IOC co-sponsorship of international HAB conferences.

The Panel made decisions concerning (i), a Scientific Symposium on Harmful Algae and Global Change with ICES and PICES (ii) Development of a Global HAB Status Report, (iii) an initiative on Harmful Algae and Desalination of Seawater, (iv) Regional HAB Programme Development, and revised terms of reference for the (v) Task Team on Biotoxin Monitoring, Management and Regulations, (vi), Task Team on Algal Taxonomy, and (vii) Task Team on Harmful Algae and Fish Kills.

The Panel made recommendations (which were endorsed by the IOC Assembly June 2013) concerning (i) a new global approach to HAB research to meet societal needs, (ii) an increased coordinated international focus on ciguatera, (iii) a summary of the Decisions and planned intersessional activities into a Work Plan and budget for the IOC HAB Programme 2014-2015, and (iv) continuation of IPHAB and time of next Session, in April 2015. Dr. R. Magnien (USA) was re-elected as Chair and Dr. Gires Usup (Malaysia) was re-elected as Vice-Chair.

A list of current members of IPHAB can be found at http://hab.ioc-unesco.org, and individuals or institutions who have issues or ideas for international cooperation that they wish to bring to the attention of IPHAB, are welcome to contact the IOC Secretariat (hab.ioc@unesco.org) or the Chairs are of IPHAB (see web site).

Highlights and new initiatives

Scientific Symposium on Harmful Algae and Global Change: IOC, PICES and ICES will convene an open scientific symposium on harmful algal blooms and climate change in 2015 to:

a. provide examples of locations and events where climate change may be affecting HABs and their impacts;
b. identify and promote research on critical topics/aspects of the broader field of HAB research to advance our knowledge of the impacts of climate change on the global scale;
c. attract and retain new expertise from other scientific disciplines;
d. evaluate the use of new technologies for the collection and analysis of long term data on appropriate parameters;
e. develop the HAB component of global climate observing systems;
f. foster framework activities to facilitate identifying and responding to climate change-driven effects on HABs, including risk assessment with associated , probabilities and uncertainties.;
g. develop best practice recommendations for research and monitoring to fill critical knowledge gaps;

Development of a Global HAB Status Report: IOC will with partners (such as IAEA, ICES, PICES, etc) develop a periodic Global Harmful Algal Bloom Status Report to:

a. provide a global status and overview of HAB events and their societal impacts;
b. provide a global overview of the occurrence of toxin producing microalgae;
c. assess the status and probability of change in HAB frequencies, intensities, and range expansions resulting from global change;

Harmful Algae and Desalination of Seawater: IOC will work with partners to organize a meeting on impacts and management of toxic and harmful algal blooms (HABs) at desalination plants and related seawater facilities in Muscat, Oman, 16-17 April 2014 to:

a. Review the state of knowledge on the impact of HABs on desalination plants and other facilities that utilize large volumes of seawater in commercial or industrial applications
b. Explore the engineering and operational strategies that are used, or could be used to mitigate the impacts of HABs and other planktonic threats to these types of facilities
c. Produce a manual of operations containing information on HABs and their impacts and a series of recommendations on plant design and operations in areas potentially impacted by HABs
d. Explore the potential risk for human health from chronic exposure to HAB toxins in drinking water, with due attention to approaches used to remove cyanobacterial toxins in freshwater from drinking water reservoirs.
e. Produce a report summarizing the conference and its findings and recommendations including research priorities to fill knowledge gaps and to inform policy decisions in this subject area.

HABs in a Changing World: A New Global Approach to HAB Research to Meet Societal Needs: Based on the synthesis of SCOR-IOC GEOHAB (www.GEOHAB.info), a follow-up international program will be developed on the foundations of the GEOHAB Science Plan, focusing on understanding HABs in the context of global sustainability, with the new name of GlobalHAB. A GlobalHAB Scientific Steering Committee will be established with partner organizations and will develop an Addendum to the GEOHAB Science Plan extending the scope to include human and ecosystem health, and socio-economic impacts of HABs to enhance sustainable management of the oceans and coastal zone, and will develop an Implementation

Plan that describes a decadal program focused on HABs in a Changing World.

Ciguatera, A Plan for Improved Research and Management: IOC will assess the establishment of a coordinated IOC-FAO-WHO effort on CFP to combine the capabilities of those agencies and that of ecologists, toxin chemists and medical researchers to:

a. Develop a coordinated ciguatera strategy
b. Improve organism detection and sampling strategies
c. Improve toxin detection
d. Improve epidemiological data collection, reporting and assessments

IPHAB recommends that the IOC and its Member States make the CODEX Committee for Fish and Fishery Products and its member countries aware that IPHAB prioritizes efforts on ciguatera, and also recommends the World Health Organization to assess if there is a basis for classifying CFP as a neglected tropical disease.

Acronyms

ANCA
IOC HAB working group for Central America and Caribbean Sea
FANSA
IOC HAB working group for South America
HANA
IOC HAB working group for North Africa
IAEA
International Atomic Energy Agency
ICES
International Council for the Exploration of the Seas
PICES
North Pacific Marine Sciences Organization
SCOR
Scientific Committee on Oceanic Research
WESTPAC/HAB
HAB Project of the IOC Sub-Commission for the Western Pacific

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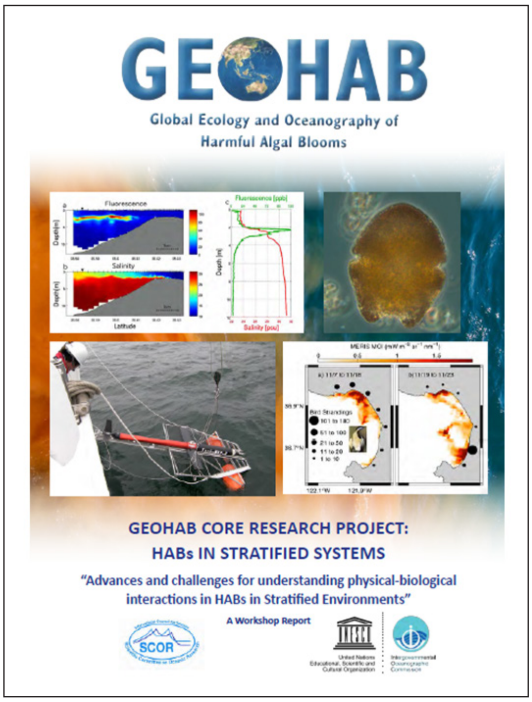

This publication can be downloaded from www.geohab.org

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