HARMFUL ALGAE NEWS

An IOC Newsletter on toxic algae and algal blooms No. 12/13

Florida red tides

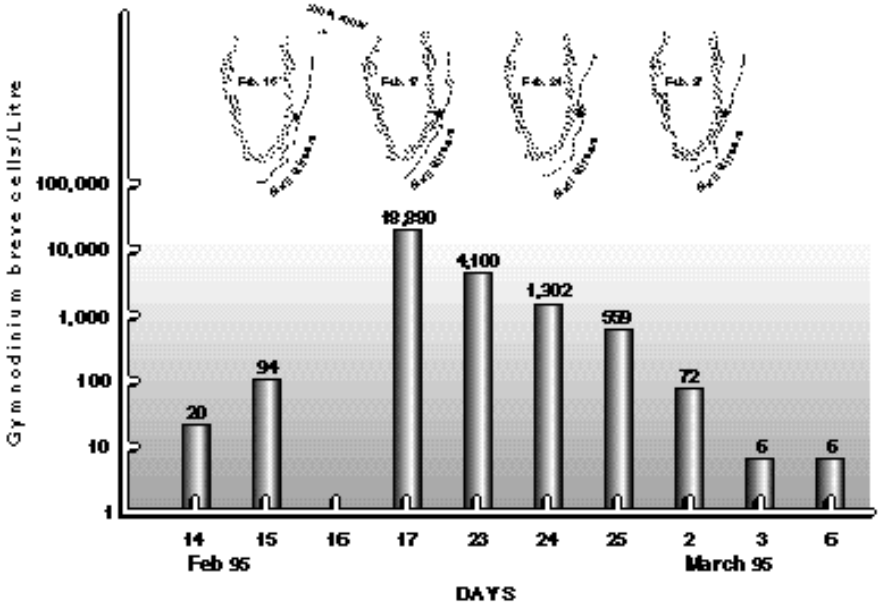
Red tides in Florida caused by *Gymnodinium breve* start 18 to 74 km offshore and take several weeks to develop in coastal waters. Typically *G. breve* is present all year in Gulf of Mexico(1) and Gulf Stream waters(2) 10-100 cells L^{-1}. When counts are above 5,000 cells L^{-1}, a bloom is either developing or one is in progress. At a count of 5,000 cells L^{-1} in inlets, bays, or lagoons, open shellfish-growing waters are closed to harvest by the Florida Department of Environmental Protection.

Gymnodinium breve blooms can become entrained in the Florida Current–Gulf Stream system and transported from Gulf of Mexico to Atlantic waters. Although most *G. breve* blooms remain in the Gulf, four occurrences of this species have been documented along the Atlantic coast of Florida(3,4,5). In each of these instances the blooms were short-lived (± 1 month). In fall and winter 1987-88, a large *G. breve* red tide bloom persisted along the coast of North Carolina for 4-5 months(6). This occurrence was the first record of *G. breve* north of Florida, a range extension of more than 800 km. The Florida Current–Gulf Stream system was the suggested transport mechanism for *G. breve* cells from a late summer/fall bloom off the southwest coast of Florida. The estimated transit time for cells around the peninsula northward to the North Carolina coast was 22-59 days.

1994-1995 outbreak

Although the 1994-95 Florida *Gymnodinium breve* red tide was reported in the national press as the most virulent red tide ever, this outbreak started off as a typical red tide on the west coast of Florida in September 1994. In the initial stages of a red tide, *Gymnodinium breve* concentration of 250,000 cells L^{-1} can kill fish; cell counts in waters where fish were dying 26 km off Cape Sable were 280,000 cells L^{-1}. Cell counts made by the Florida Department of Environmental Protection personnel along the west coast of Florida, from Tampa Bay to Sanibel Island, ranged from normal to 4,700,000 cells L^{-1}. The red tide was atypical, however, in three aspects: 1) extensive fish kills occurred in open waters off the Florida Keys, 2) two unconfirmed cases of neurotoxic shellfish poisoning were reported from consumption of surf clams in closed waters, and 3) the red tide was transported from Gulf to Atlantic waters in February 1995. The extensive fish kills, which were reported in January and February, covered over 5,000 km^2 of open water westward from the Florida mainland to the Dry Tortugas. Dead and dying fish included grunts, snappers, groupers, mullet, tarpon, cobia, sharks, and other fishes. Octopi, stone crabs,

(Cont'd. on p. 2)



Gymnodinium breve *cell counts near West Palm Beach, Florida (26.55 N, 80.00 W) and the position of the western edge of the Gulf Stream.*

Note on an unknown poison

HAN issue N° 5 (page 1) carried an account of a toxic event of unknown aetiology in French coastal waters, which lasted from November 1992 until May 1993. No toxic organism had been identified at the time, although the mouse test suggested the presence of PSP. But the toxin was unstable, and chemical analysis failed to detect it. Further details have been made available by Françoise Marco(1) of the Laboratoire côtier in Toulon. Mussels from Toulon screened by J. Minet of the Faculté de Pharmacie, Rennes, revealed a flora dominated by *Bacillus cereus*. Other common pathogens (*Salmonella*, *Staphylococcus*, *Clostridium*) were absent. Acetone extracts of a pure strain of *B. cereus* injected into mice provoked the same symptoms as mussel extracts.

The Editors

(1) Marco, F. *La Gazette des microbes*, October 1994, 63.

Trichodesmium bloom in Gulf of Mexico, summer 1995

During a recent cruise in the Gulf of Mexico on board the University of Texas' R/V *Longhorn*(1), blooms of *Trichodesmium* were observed like never before (c.f. Sargasso Sea, Arabian Sea). What follows is a preliminary and purely observational report on this major but episodic event. The study of the abundance and composition of dissolved organic matter in the Gulf of Mexico was the primary goal of this cruise, and unfortunately we were not set up to do primary production measurements or even chlorophyll estimates.

Colonies of the cyanobacterium (2-3 mm size bundles of trichomes) could be seen with the naked eye in the surface water of every station that we occupied. It would not be wrong to surmise that the entire Gulf of Mexico surface water was blooming with this cyanobacteria, possibly the dominant primary producer during this period. The abundance of *Trichodesmium* increased as the cruise progressed, from < 10 colonies per bucket of surface water during the Texas-Florida leg, to > 100 colonies per bucket of surface water during the Florida-Texas leg of the cruise. It appeared from swimmer observations that *Trichodesmium* was concentrated in the upper 3 meters of the water column, and underwater aggregates became abundant towards the latter part of the bloom.

Towards the latter part of the return leg (Florida to Texas), the water became visibly thick with the bloom. In the late evenings, we could practically smell the emissions (Dimethylsulphide) from decaying *Trichodesmium* in the air. The surface water attained a brownish color, and sea conditions remained flat calm for several days. Several plankton tows were made using a small hand net and several litres of this exclusively *Trichodesmium* sample were concentrated for biochemical analysis. From observing how viscous these samples were, it is suggested that the exudates/lysis products of the *Trichodesmium* were responsible for prolonging the calm weather we had by enhancing surface wave dampening. It is noteworthy that *Trichodesmium* blooms occur in the warm (summer) nutrient poor tropical/subtropical ocean only under very calm conditions.

On the morning of 20 August, in 27° 14.441 N, 94° 14.032 W, we observed a gigantic accumulation of the bloom along a windrow ≈ 100 m wide and extending from horizon to horizon. Occasionally there were streaks of pink-red colour on the brown bloom where the phycoerythrin pigment from dying cells must have leached out. Satellites over this region must have picked up such mesoscale features as well as general and substantial increase in chlorophyll fluorescence over the entire Gulf of Mexico during the month of August, accompanying an increasing abundance of *Trichodesmium* in surface waters. Discussions with the ship's crew who have a decade of experience sailing these waters indicated that *Trichodesmium* bloom sightings in this region are not an uncommon phenomena during the summer.

It is suggested that such episodic blooms of this nitrogen fixer go largely unnoticed because of their brevity, and not only bring in large pulses of organic matter into the system, but may also shift the system temporarily from one that is N-limited to one that is P-limited. The role of *Trichodesmium* blooms, that are episodic but large scale events in the world ocean, must somehow be incorporated into the study of oceanic C and N cycles. Otherwise we will continue to miss a key element in the global elemental cycles puzzle.

Acknowledgments: The captain and crew of R/V *Longhorn* of the University of Texas helped enthusiastically with both observation and sampling. Ship-time and research support was provided by a National Science Foundation grant to Ronald Benner and John Hedges.

(1) Cruise# 648; 2-22 August 1995; Port Aransas, Texas to Key West, Florida and return, following an almost straight line transect across the entire Gulf of Mexico.

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(Cont'd from p. 1, "Florida red tides")

and top snails also suffered mortalities. Coincident with these mortalities were several stranded dead dolphins and sea turtles. At times, floating dead fish were estimated to be one every 1 to 3 m of water and they varied in size from 15 cm to over a meter. Fish kills off the Florida Keys have been reported in 1878, 1880, 1916?, 1946/47, 1953/54, 1972 and 1976.

The two cases of probable neurotoxic shellfish poisoning occurred 2 January when two 39-year-old men, visiting Florida, consumed surf clams collected at Sanibel Island; dead fish were beached near the collection site. Within an hour, both men felt tingling in their tongues and finger extremities. Two hours later, one of them was nauseated, weak, and dizzy. During the following few days, they continued experiencing nausea, muscular pains, anxiety, and diarrhea. They were treated in the Lee County Health Park Medical Center, but NSP was not then and has not since been confirmed by medical personnel as the cause of their illness.

During the 1994-95 Florida west coast red tide, concern over the possibility of *G. breve* cells being transported to the Atlantic prompted sampling off West Palm Beach, Florida from September 1994 through early March 1995 (Fig. 1). In February, coincident with fish kills in southwest Florida waters, a water sample about 12 km off the Florida Keys on the Atlantic side had almost 10 million cells L^{-1}. This high count prompted further concern about transport of a red tide bloom in the Gulf Stream. Samples from September-December 1994 ranged from 0-6 cells L^{-1}, but by mid-February cell counts rose to nearly 20,000 cells L^{-1} at the West Palm Beach sample sites where the continental shelf is very narrow and the Gulf Stream can move close to shore. By early March the cell counts were once again below 10 cells L^{-1}. The cell counts were proportional to the degree of Gulf Stream influence in the West Palm Beach area (Fig. 1). As the western edge of the Gulf Stream impinged on the sampling area and formed a meander (17-20 Feb.), *G. breve* cell counts increased. As the Gulf Stream moved offshore, away from the sampling site, the cell numbers decreased (27 Feb.). Fourteen days later, *G. breve* cells were noted in outer

shelf samples from Onslow Bay, North Carolina.

The red tide along the west coast of Florida reappeared in April with observations of human respiratory irritation and *G. breve* concentrations above background. Shellfish harvesting areas were closed again from Pinellas to Lee counties. Respiratory irritation and fish kills affected communities as far north as Tarpon Springs. Venice to Tarpon Springs were still affected in early June. A patch of red tide (10^6 *G. breve* cells L^{-1}) about 18 km west of Anclote Key near Tarpon Springs was detected in early May and this offshore bloom no doubt inoculated Tarpon Springs and Clearwater inshore waters. If a red tide remains offshore when inshore concentrations of *G. breve* decrease to below background levels, the offshore population can reinoculate inshore areas and red tide conditions may be reestablished.

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IOC Training course on detection methods for algal toxins

Participants in the training course held at University of Trieste, 3-12 September 1995.

A training course on chemistry and toxicology related to harmful algal blooms was held at the Department of Biomedical Sciences of the University of Trieste (Italy), from 3-12 September 1995. It was sponsored by IOC, UNEP, WHO, FAO and Italy.

The purpose of the course was to impart to the participants theoretical and practical knowledge about the methods of detecting the toxins that are produced by microalgae and that are responsible for the most widespread intoxications (DSP, PSP and ASP).

During the course, basic information was also provided on the taxonomy and distribution of these microalgae. Seven different methods were demonstrated for use by the participants. In particular, DSP-contaminated samples were analyzed by the participants, using three different methods: the mouse bioassay, an ELISA assay and the protein phosphatase inhibition assay.

The HPLC method for DSP toxin was demonstrated by Dr. C. Casadei (Centro di Ricerche Marine di Cesenatico, Italy). PSP-contaminated mussels were analyzed using the AOAC mouse bioassay. The same samples, as well as other contaminated specimens (i. e. urine of PSP patients) were analyzed also by a receptor assay. An ELISA assay for PSP was demonstrated. The results obtained by each participant were compared and a satisfactory correlation was found. The practical aspects of all the applied methods were emphasized to enable the participants to perform the analyses in their laboratories. Furthermore, all the participants presented a status report on harmful algal blooms in their countries. The participants' general impression of the course was very positive.

Thirteen scientists from 12 countries participated in the course, organized by Dr. Aurelia Tubaro and Prof. Roberto Della Loggia (University of Trieste, Italy), Prof. Giorgio Honsell (University of Udine, Italy) and Dr. Helle Ravn (Intergovernmental Oceanographic Commission of UNESCO, Paris, France). Invited lecturers were Prof. T. Yasumoto (Tohoku University, Japan), Dr. A. D. Cembella (National Research Council of Halifax, Canada), Dr. M. L. Fernandez (European Community Reference Laboratory of Vigo, Spain), Dr. J. S. Ramsdell (Marine Biomedical and Environmental Science, South Carolina, USA).

A visit to the mussel farms of the Gulf of Trieste concluded the activities of the training course.

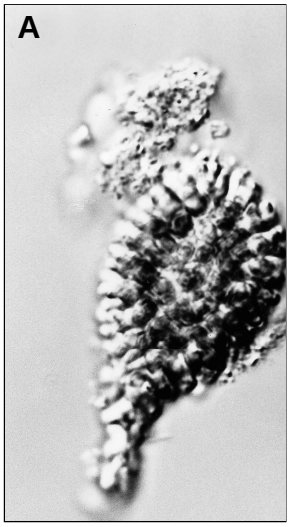
Raphidophycean in southern Brazil

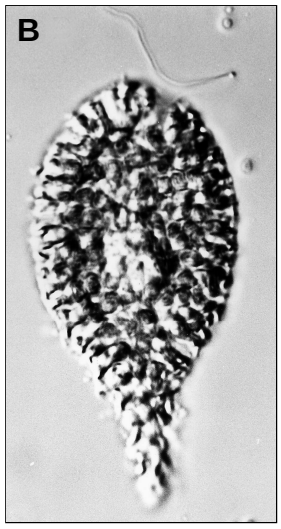
During a routine sampling program in the estuarine region of the Patos Lagoon (32° 10' S; 52° 06' W), conducted on 4 May 1995, cells of *Chattonella* sp. were observed for the first time in southern Brazil. Also present was the raphidophycean *Fibrocapsa japonica*, though this species was previously observed in live samples from coastal shelf waters off southern Brazil (Odebrecht, unpubl.). The phytoplankton community was dominated by the diatoms *Leptocylindrus minimus*, *Pseudo-nitzchia pseudodelicatissima* (confirmed by Ø. Moestrup, using electron microscopy), cf. *Cylindrotheca closterium* and nanoflagellates (> 10^5 cells l^{-1} and 10^6 cells l^{-1} respectively). The presence of several dinoflagellates (*Ceratium furca*, *C. tripos*, *Dinophysis caudata*, *D. acuminata*, *Scripsiella* sp., *Gymnodinium splendens*, *Gyrodinium spirale*, *Polykrikos*, *Noctiluca scintillans*, *Protoperidinium* spp.), the ciliate *Mesodinium rubrum* and the silicoflagellate *Dictyocha fibula* indicate that low turbulence conditions prevailed in the water column.

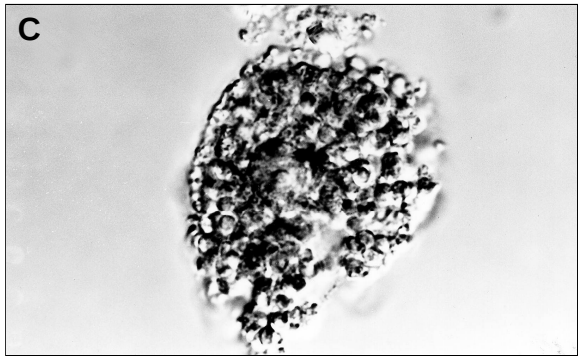
Water temperature and salinity during the study were 19°C and 19.5 respectively, typical of autumn conditions when the estuary presents euhaline conditions. Chlorophyll *a* concentration was 15,2 mg m^{-3}, and concentrations of nitrate + nitrite (0.9 µM), ammonia (2.4 µM), phosphate (1.25 µM) and silicate (35.2 µM) resulted in Si:N and N:P ratios of 10 and 2.8, respectively, which indicate that nitrogen could be the main nutrient limiting phytoplankton growth.

Counts of cells in Lugol-fixed surface samples, using an inverted microscope, indicated *Chattonella* abundance of 9,000 cells l^{-1} (lanceolate organisms, Figure A, B). However many cells (34,000 cells l^{-1}) were rounded, contracted and/or disrupted (Figure C), so the actual concentration was probably higher. The abundance of the species *Fibrocapsa japonica* was 48,000 cells l^{-1}, thus together the raphidophycean species summed approximately 100,000 cells l^{-1}.

Although live material is considered necessary for reliable identification of raphidophycean species (Throndsen, 1993), the shape and large size of the more intact organisms (mean length 60.1 µm, min.-max. 44-95 µm; mean width 28.9 µm, min.-max. 20-40 µm; mean length/width 2.12, min.-max. 1.37-3.67; n=77) indicate that these probably were *C. antiqua*, the largest known species of *Chattonella*, recorded from Japanese waters (Fukuyo *et al.*, 1990).







Lanceolate form of Chatonella: *(A) 56 µm x 27 µm, (B) 72 µm x 34 µm, and (C) disrupted organism from the estuarine region of Patos Lagoon, southern Brazil. Pictures taken with Nomarski interference contrast, 400 x magnification, at the Botanical Institute, Copenhagen, during the IOC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microplankton, August 1995.*

There are no indications so far of a harmful effect of the raphidophycean species in southern Brazil, although shellfish mortality has been associated with harmful algae in this area on several occasions (Garcia *et al.*, 1994; Odebrecht *et al.*, 1995). In Guanabara Bay, Rio de Janeiro (22° 50' S; 43° 10' W), raphidophyceans (probably *Chattonella*) were observed in June/July 1978 forming a typical red tide (17,000 cells ml^{-1}), though no fish mortality was observed (Sevrin-Reyssac *et al.*, 1979).

In the Patos Lagoon, problems related to harmful algal blooms might be expected in the future, since anthropogenic eutrophication is increasing, and efforts to establish shrimp and fish culture are underway. Thus, phytoplankton monitoring programmes and detailed studies must be enhanced in this area.

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Mussel production and toxic algal blooms in Santa Catarina State, southern Brazil

Various possible causes have been suggested for the global increase in recent years of harmful algal blooms (HABs), ranging from atmospheric ozone layer depletion to increase in scientific awareness concerning HAB events and their effects (Carreto, 1994; Hallegraeff 1993). Not only increase in the occurrence area, but also in frequency, toxicity and quality, have been observed. In a global distribution map, the Brazilian coast is regarded as a non-occurrence area for all of the known phycotoxins. This does not mean that the Brazilian coast is free from toxic algal bloom events and related human poisoning problems (Odebrecht *et al*., 1995; García *et al*., 1994; Yunes *et al*. 1994). The lack of historical data on toxic algal blooms in Brazil arises from the fact that most of the observed cases were not reported, or when published, they did not lead to scientific concern.

An important factor of concern is the wide programme to stimulate mussel production in Santa Catarina State (south Brazil) as an economic alternative for artisanal fishing communities, faced with problems of a fall in captures and competition with the industrial fleet. The programme, which began in 1989, consists of the spread of mariculture benefits, technology transfer, stimulation of cooperative formation, and selection of areas suitable for the activity (Agropecuaria Catarinense, 1993). As a result, cultivated mussel production, mainly *Perna perna*, increased from 190 to approximately 5000 ton.year^{-1}, in 6 years, turning Santa Catarina into the largest producer of cultivated mussels in Brazil. Although obvious benefits have been generated, possible HAB events and their impact on community health were not considered in the initial programme despite at least one official case of shellfish poisoning registered in Santa Catarina (Zenebon and Pregnolatto, 1992). The event occurred in 1990 when various cases of diarrhea in the population were registered in Florianópolis (Santa Catarina State's capital) as a result of DSP poisoning.

The mouse bioassays (Zenebon and Pregnolatto, 1992) and the presence of *Dinophysis acuminata* (unpublished data) confirmed the presence of DSP in the water. Other unofficial evidence is found among several regular mussel consumers who suffered poisoning symptoms (DSP), suggesting that DSP is widespread. In some littoral areas, people do not consume mussels during August and September (austral winter), either because it can be dangerous or, as it is said, they do not taste as well as in other seasons. In an attempt to minimize possible public health and economic losses, a HAB monitoring programme in Santa Catarina was developed at the Universidade do Vale do Itajaí (UNIVALI). Apart from natural and methodological difficulties, a crucial element has been for authorities to acknowledge that the problem exists. So far, all actions directed to face the issue have come from universities rather than from public health or environmental offices. It seems that it will take a while until the situation is properly assessed and the population fully benefits from the programme to stimulate mussel production in Santa Catarina.

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Harmful algal blooms in South-East Asia: *Common problems and networking*

Red tides can extend over wide areas, often involving the waters of adjacent countries. South-East Asia, which is currently undergoing rapid economic growth, is one of the regions negatively impacted by toxic red tides / harmful algal blooms. Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam compose the Association of South-East Asian Nations (ASEAN). Geographically, however, the region includes Laos and Cambodia, which have not yet applied for membership of the association.

Since 1993, ASEAN has implemented a marine science programme in collaboration with Canada. A red tide component which partly aims to train personnel in undertaking monitoring and research programmes and educating the public on the phenomenon, includes an "ASEAN–Canada Red Tide Network". A fax-based "Awareness Network" serves to inform member nations of the occurrences of harmful algal blooms / red tides through the regional coordinator*. Authorized country anchors and alternate anchors feed and receive data and information to and from the network. An "Information Network" provides materials useful for the understanding and the management of HABs in the region.

Pyrodinium bahamense var. *compressum* remains the major Paralytic Shellfish Poisoning (PSP) causative organism in the region. To date, in the Philippines alone, it has caused about

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a hundred deaths and 1,618 illness cases, and has affected nine bays all over the country based on accounts from 1983 (Corrales and McLean, 1995). The organism has also been reported in Sabah (Malaysia), and in Brunei Bay and several bays in Indonesia, causing negative impacts on many occasions in most of these areas. Occurrences of the harmful species of *Chattonella* sp., *Alexandrium* sp., *Dinophysis* sp. and *Gymnodinium* sp. have also been noted in many countries in the region. Blooms of *Noctilluca scintillans* and *Trichodesmium erythraeum* have been observed in several areas, with Thailand reporting the most frequent occurrence. Other red tide organisms found in the Gulf of Thailand are *Ceratium* spp., *Cochlodinium* spp., *Mesodinium rubrum* and diatoms, *Coscinodiscus* spp., *Rhizosolenia* spp., *Chaetoceros* spp., *Bacteriastrum* spp., *Skeletonema costatum* and *Nitzchia* spp. (Piumsomboon *et al.*, 1995).

ASEAN members have expressed their desire to continue the HAB networking beyond the ASEAN–Canada programme implementation period (1993-1996) and be further linked to the rest of the world. The need to undertake regional collaborative research on a major HAB problem has also been recognized. Foremost and the ultimate goal of these efforts should be the development and implementation of the seafood safety programme in all the countries of the region in order to meet the requirements of seafood importing countries. These efforts and cooperation will be significant to the regional maintenance of food security and economic growth; and fundamental to the sustainable utilization of the region's marine resources.

* at present: Rhodora A. Corrales

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Phycotoxins on the internet: an update

Harmful Algae News No. 8 (1994) indicated how to subscribe to an electronic mailing list called "Phycotoxins" which deals with local, national and international issues concerning all aspects of toxic phytoplankton. There are currently about 250 subscribers and the topics are wide-ranging, from reports of toxic blooms to discussions of laboratory techniques.

Here is updated information on how to join the list:

- send an e-mail message to: Lists@scotia.dfo.ca
- the 'subject' line can be left blank
- in the body of the message, write: "subscribe phycotoxins" on a line by itself (leave out the quotation marks, of course).

This mailing list is managed by Bill Silvert (Silvert@scotia.dfo.ca) and is located at the Habitat Ecology server of the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, Canada. The server also has a World Wide Web page which provides access to the archives of postings to the mailing list as well as links to other sites relevant to phycotoxins research. Following is a sample of the type of information available from the BIO server on phycotoxin issues (the URL is: http://biome.bio.dfo.ca/science/toxins.html):

- Phycotoxins mailing list archive
- IOC Science and Communication Centre on Harmful Algae
- *Harmful Algae News* ON-LINE
- Domoic Acid and *Pseudo-nitzschia* Bibliography
- Canadian Federal Food Inspection Paper (July 1995)
- Phycotoxin Research in the Habitat Ecology Section at BIO
- PSP Toxins in Whelks

There are two other mailing lists that may also be of interest. ALGAE-L is maintained by Mike Guiry (mike.guiry@seaweed.ucg.ie) at the National University of Ireland, Galway, Ireland. It has discussions about any and all aspects of algae, but seems to be of interest especially to cyanobacterial fans. DIATOM-L is maintained by Roger Sweets (sweets@ucs.indiana.edu) at Indiana University, Bloomington, Indiana, USA. This list has had recent queries on domoic acid and *Pseudo-nitzschia*. Be prepared to receive cross-listings if you subscribe to all of these lists.

To subscribe to ALGAE-L:

- send an e-mail message to: Listserv@irlearn.ucd.ie
- leave the 'subject' line blank
- in the body of the message, write: "subscribe algae-l yourfirstname yourlastname" (without the quotation marks)

To subscribe to DIATOM-L:

- send an e-mail message to: Listserv@iubvm.ucs.indiana.edu
- leave the 'subject' line blank
- in the body of the message, write: "subscribe diatom-l yourfirstname yourlastname" (without the quotation marks)

Dr. Stephen S. Bates, Department of Fisheries and Oceans, Gulf Fisheries Centre, PO Box 5030, Moncton, New Brunswick E1C 9B6, Canada; tel.: (1-506) 851 3982; fax: (1-506) 851 2079; e-mail: batess@gfc.dfo.ca

Seventh International Conference on Toxic Phytoplankton

The Seventh International Conference on Toxic Phytoplankton was held 12-16 July, 1995, in Sendai, Japan. More than 270 participants from 36 countries attended. Sixty talks and 151 posters were scheduled along with 5 evening round-table discussions/demonstrations, an afternoon excursion to the Matsushima Islands and the conference banquet.

The presentations were divided into a number of topics, the largest of which dealt with toxin chemistry, toxin production, and new methods for identifying toxins or toxic species. A variety of methods, including chemical and molecular techniques, are being used and new methods, or applications of old ones, are being devised and tested. Perhaps the most exciting new method for a taxonomist is the use of oligonucleotide probes to identify species of *Pseudo-nitzschia* in field samples and in near real-time. The method could be used for other toxic taxa, as well.

Another large topic was that of regional blooms and toxicity events. These are being reported from many places now, sometimes based on observations over several years. One new area where PSP toxins were found in shellfish was King George Island, Antarctica. Mortalities of fish and other marine organisms are also being reported from more areas. These are caused by a variety of organisms, principally dinoflagellates, and with kills often due to hypoxia as blooms decay.

Bloom dynamics provided another theme for lively discussion. A number of factors – including initiation of blooms by cyst germination; effects of temperature, salinity, and nutrient levels; local hydrographic conditions; and cell cycles – are all known contributors to bloom formation and maintenance.

The diatom genus *Pseudo-nitzschia* was poorly known until 1987 when *P. multiseries* was shown to produce the powerful neurotoxin, domoic acid. It was strictly an eastern Canadian phenomenon until 1991, when domoic acid appeared on the US West Coast. The Lund and Newport meetings in 1989 and 1991 featured papers that discussed domoic acid and detection methods, but they were few and primarily by Canadian authors. In Nantes (1993), there were three presentations from the US West Coast and mention of a *Pseudo-nitzschia* sp. from New Zealand. In Sendai, 16 papers/posters from 11 geographic regions treated *Pseudo-nitzschia* spp., primarily distributions, but also domoic acid production and food web effects. Domoic acid is no longer a strictly North American problem, although no human illnesses have been reported outside of eastern Canada and Washington State.

Other topics discussed included the effects of toxic species on aquaculture (*Dinophysis*, *Alexandrium*, and *Heterocapsa* spp.); monitoring/management programmes (with the exception of the Bay of Fundy, the other programmes discussed are relatively short-lived); bacteria/symbiosis (stationary phase dynamics and bacterial occurrences, co-occurrence of bacteria and toxin producers); heterotrophic and mixotrophic dinoflagellates (*Gymnodinium breve*, *Dinophysis* spp., *Chrysochromulina polylepis*, *Alexandrium* spp.); cyanobacteria (microcystins); and interactions between toxin producers and other organisms (domoic acid, bacteria, *Heterosigma*, *Gymnodinium sanguineum*, *G. catenatum*, and *Alexandrium* spp.).

At one workshop, the taxonomy of unarmoured dinoflagellates provided interesting discussion since the distinction between species is not as clear as originally thought. Although proposals were made for a more accurate classification, it was decided to continue as is until taxonomists have more time to study the species through live mounts and SEM (scanning electron microscopy). There were a number of beautifully hand-carved dinoflagellates to complement the session.

At the business meeting, it was decided to hold the conference after Vigo (June 1997) in Hobart, Tasmania, probably in January 2000. It was also decided to start the organization process for a formal society for the study of harmful algae, something that was suggested in Lund in 1989 and again in *HAN* No. 2 (1992). Max Taylor volunteered to do the initial organization (*see pages 12-13 of this issue*).

The conference was held in a small part of the large Sendai Civic Auditorium. It was well-organized and our Japanese hosts did a splendid job of making the conference a pleasant and successful one.

Rita Horner, School of Oceanography, University of Washington, Seattle, WA, USA.

Jennifer Martin, St. Andrews Biological Station, Department of Fisheries and Oceans, St. Andrews, N.B., Canada.

First report of *Gymnodinium catenatum* from Atlantic Morocco

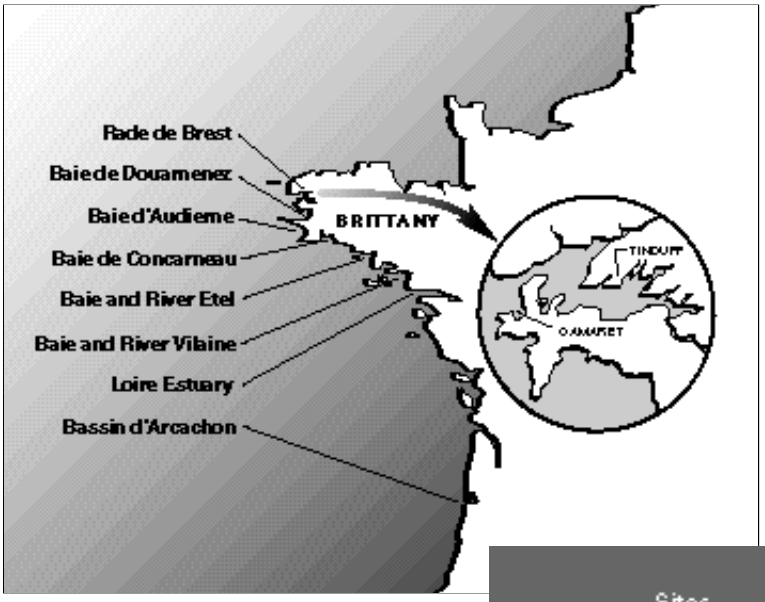
The first red tide records on the Atlantic coast of Morocco date from 1966[1]. Since then, they have appeared several times in late summer and early autumn. The years 1971, 1975 and 1982 were marked by shellfish contamination in mussels and clams, with PSP levels exceeding the international norm of 400 M.U. Consumption of shellfish was banned on those occasions. The toxic species responsible for the episodes were not identified.

In October-November 1994, a bloom appeared on the coast between Larache (35° 12' N) and Essaouira (31° 30' N) and led to human poisoning in the Casablanca area, where 74 people were hospitalized and 4 died. PSP levels in some shellfish samples reached 28,000 M.U.[2]

The species identified as responsible for this outbreak was the dinoflagellate *Gymnodinium catenatum*, which was observed in chains 6 to 32 cells long during the first two weeks of November. Maximal concentrations of about 30,000 cells/l were found near Casablanca (33° 39' N). The bloom occurred after some days of heavy rainfall and decreased surface salinities following the dry months of May to September. Surface temperature in October was about 17°C, the optimal temperature for growth of *G. catenatum*[3].

Ichthyotoxic events associated with *Gymnodinium* cf. *nagasakiense* on the Atlantic coast of France

A series of important blooms of the dinoflagellate *Gymnodinium* cf. *nagasakiense* occurred along the Atlantic coast of France, between May and August 1995, with sporadic developments remaining until September. Blooms were associated with spectacular kills of worms, urchins, gastropods, shellfish and later, fish. The blooms affected a long stretch of the French coast from the north coast of Brittany to the Arcachon Lagoon (Bassin d'Arcachon), primarily southern Brittany and around the Loire estuary (see map above). Important blooms of this dinoflagellate were already observed in this area in 1987, but cell densities (maximum 3 x 10^6 cells/L) and damages reported were lower.



The first dense population of *G*. cf. *nagasakiense* (3 x 10^4 cell/L) associated with common phytoplanktonic species was observed in the Concarneau Bay on 9 May. Subsequently, the cells spread rapidly along the northwest coast of Brittany, reaching Audierne Bay (22 May), Camaret (30 May), Douarnenez Bay (6 June) and the Brest Roads (Rade de Brest) (12 June); and extending southward to the Loire estuary (19 June). Populations tended to monospecificity, and densities reached 9 x 10^5 cells/L in coastal zones, and 6 x 10^6 cells/L in shallow areas. The highest concentration (48 x 10^6 cells/L) was observed in dense patches of a seawater tank at a scallop hatchery in the Brest Roads, on 27 June.

At the same time, massive mortalities of urchins, *Echinocardium cordatum*, worms *Arenicola* and later the bivalve *Donax vittatus*, were observed on beaches of Douarnenez Bay (densities of *G*. cf. *nagasakiense* were higher than 10^6 cells/L), and the whole trout production of a fishfarm in this bay died. In Concarneau Bay, wild and reared bivalves and gastropods died: *Cardium*, *Venerupis*, *Tellina*, *Glycimeris*, *Ostrea*, *Crassostrea*, *Solen*, *Mytilus*, *Patella*, *Haliotis*, *Littorina* etc. Mortalities of fish (congers and finfish) were reported. Shellfish kills accompanying *G*. cf. *nagasakiense* blooms extended to the Loire estuary, including the Etel and Vilaine rivers and bays. In the south of the Loire estuary, mortalities occurred in reared and wild mussel (100% in some places) and oyster beds, and provoked great quantities of stranded fish (congers) and finfish (*Pleuronectes*, *Solea*, eels). Surviving shellfish remained weaker.

Losses were important for shellfish producers, in scallop hatcheries, shellfish and fish nurseries. As a consequence severe reduction in future production is likely to occur. Anoxia was probably the first cause of mortalities in shallow areas and in the deeper layers during the blooms, but aeration in farm basins did not prevent damage. During this event, a second cause of mortality was also suspected: the toxicity of *G*. cf. *nagasakiense* cells. Consequently, the haemolytic property of seawater contaminated by *G*. cf. *nagasakiense* development was studied. The results of the haemolytic test conducted on horse red blood cells suggest between 800 and 1600 equivalent Haemolytic Units of Saponin/L, to be the toxic limit inducing mortalities of shellfish (see table below). These observations concerned scallop larvae in the metamorphosis stage, with a low metabolism excluding feeding and filtration. The highest values of haemolytic capacity measured in this study was 8000 eq. HU/L, in a seawater sample containing 4.4 x10^6 cells/L, sampled in Douarnenez Bay (6 June). The haemolytic property of seawater was not always correlated to the density of *G*. cf. *nagasakiense* cells in the samples.

Sites	Cell densities/L	Haemolytic Units/L	Losses
Baie de Douarnenez, 6 June	4,400,000	8,000	worms, urchins
Camaret, near fish farm, 13 June	311,900	1,600	no
Tinduff hatchery basin, 27 June	4,000,000	800	no*
Concarneau shellfish farm, 20 June	1,000,000	1,600	shellfish

** in this case, metamorphosing scallop larvae*

Even though blooms of *G*. cf. *nagasakiense* are now a common occurrence along the coast of France during

(Cont'd on p. 9)

A safe and clean coast for Europe

All too often, local governments are taken by surprise when decisions are taken which have a major impact on their regions. This is true with regard to planned development as well as unforeseen disasters such as oil spills. For this reason, a series of workshops was held over the last few months in several European coastal cities. The results of these workshops will culminate in an action plan to be agreed upon during the ECOTOP Conference in Lille, 3-4 April 1996.

Europe's coasts are under siege. We're all familiar with the sight of burning or wrecked oil tankers and oiled seabirds; and news reports about near or actual marine disasters are increasingly common – ferry accidents, poison bags washing ashore, nuclear waste transport and disposal, to name a few. It has been reported that since 1981, the Belgian coast (only 65 kilometers long) narrowly avoided major environmental disasters on at least 43 occasions (*see insert*). However, there is a more systematic destruction of the coastal and estuarine environment which rarely gains press attention. With 50% of Europe's population living in coastal areas, and an increasing number of tourists flocking to European beaches, the competition for space and natural resources is intensifying. Every day, approximately 30 hectares of sand dunes and beaches disappear as a result of human activities. At the same time, the coastal environment is endangered by activities originating far away from their sites of impact. Agricultural runoff, litter deposition, oil spills and intentional discharges, discarded fishing gear, and the transport and disposal of hazardous materials at sea have long-range, transboundary impacts.

A wide variety of public and economic interests are directly affected by coastal disasters. Coastal towns and provinces, governmental coastal authorities, environmental and conservation organizations, tourist interests, and the fishing and insurance industries all benefit from preventing coastal disasters. However, there is little cooperation amongst these diverse groups to do so.

The prevention of coastal and estuarine disasters is commonly undertaken through two influence lines: political and diplomatic consultations and environmental protest actions. But so far, not enough has been achieved through these channels. Even when potentially strong and far-reaching resolutions are adopted, there is often a lack of consistent action in implementing them. This may be explained in part by the insufficient participation of a broad base of local and regional coastal authorities in developing conservation initiatives. Yet it is inevitably local governments which shoulder the cost of cleaning up messes after the fact.

For this reason, the European Union for Coastal Conservation (EUCC) has launched a project called European Regions for a Safe and Clean Coast (ERSCC), sponsored by the EC and several partner organizations. Its primary purpose is to enhance cooperation and facilitate the exchange of information between local and regional governments on the one hand, and scientific and ecological experts, non-governmental organizations, industry representatives, and intergovernmental organizations on the other.

Between August and November 1995, a series of workshops were held under the auspices of ERSCC. These workshops took place in Norway, Italy, Spain, the UK and The Netherlands, with different coastal problems emphasized in each workshop.

Vital information was gained concerning the role that local governments can (and in many cases, do) play, and the tools they need to do so, in addressing the problems described above. Most of the workshops proposed a series of recommendations aimed at solving these problems at the source. These will be presented at a pan-European conference to be held 3-4 April during ECOTOP '96 in Lille.

The Lille conference will try to bring together all existing coastal networks and platforms of local and regional authorities, individual coastal municipalities, provinces and regions, national authorities and services, and international non-governmental networks. In short, it is expected that the key players in coastal management will be present to lend their experience, and benefit from the experiences of others, in ensuring a sustainable future for European coasts.

Kelly Rigg, European Union for Coastal Conservation (EUCC), PO Box 11059, 2301 EB Leiden, The Netherlands; fax: (31-71) 512 4069.

Environmental disasters narrowly avoided

The following information is from an article in the Belgian newspaper Belgisch Dagblad *from 20 October 1994, written by Eddy Surmont.*

Between 1981 and 1994, at least 43 environmental disasters along the Belgian coast were narrowly avoided, according to oceanographer Thierry Jacques. During a presentation at a symposium in Oostende in October 1994, Dr Jacques reported that a total of 135 "incidents" occurred, 43 of which were considered to have presented a real environmental danger. Of these, 14 were ships that had run aground, 9 were collisions involving petroleum tankers, and at least 20 were accidents involving chemical tankers or ships with chemical cargoes. Each of these could have resulted in enormous environmental and economic consequences.

(Cont'd from p. 8, "Ichthyotoxic events")

the summer, a development of such magnitude this year and the resulting damage were unexpected.

This event was monitored following the phytoplankton monitoring network REPHY of IFREMER coastal laboratories: Concarneau, La Trinité, Nantes, La Rochelle, La Tremblade, Arcachon. The studies on toxicity were performed in the Laboratoire d'écologie pélagique of Brest, and information on local events provided by colleagues from the Comité local des pêches of Tinduff hatchery and SEMMI fishfarm.

Geneviève Arzul, Evelyne Erard-Le Denn, IFREMER, BP 70, 29280 Plouzané, France.

Catherine Belin, IFREMER, BP 1105, 44311 Nantes Cedex 03, France.

Elizabeth Nézan, IFREMER, 13 rue de Keroze, 29900 Concarneau, France.

Role of vascular land plants in late-Devonian oceanic anoxic events and biotic crises

During the mid- to late Devonian period, vascular land plants began to have an increasing impact on weathering processes and global geochemical cycles. This was a consequence of: 1) the advent of arborescence (tree-sized stature) which increased the depth of soil formation and surface area of chemical weathering and 2) evolution of the seed habit, which freed vascular land plants from reproductive dependence on moist habitats, and allowed colonization of drier upland areas. There was thus a major increase in the areal extent of deeply-weathered soils. These developments led to profound changes in fluvial particulate and nutrient fluxes, and to eutrophic conditions and anoxic events in the coastal ocean. These late Devonian events are recorded in black shales, many of which contain large amounts of algal remains.

Among marine organisms, about 21% of families and 50% of genera were eliminated during this interval. This was one of the "Big Five" mass extinctions of the Phanerozoic. This biotic crisis was unusual in two respects. It spanned an interval of about 30 million years, and extinctions were largely restricted to tropical marine invertebrates. High latitude and cold water species survived disproportionately.

The origin of the Late Devonian biotic crisis is unknown. Much recent research has been devoted to the possibility of a bolide impact, because evidence for such an event at the Cretaceous/Tertiary boundary has spurred considerable interest in bolides as a general mechanism for mass extinctions. Minor iridium anomalies and small concentrations of microspherules have been identified at or near the Frasnian/Framennian (F/F) boundary at several locales. However, siderophile-element ratios are incompatible with those of meteorites, and such anomalies are more likely the product of changes in redox conditions or concentration of metals by cyanobacteria. Other mechanisms have been proposed, e.g. climate change associated with global tectonics oceanic overturn, and sea-level elevation changes, although none of these theories have successfully accounted for the unique aspects of the Late Devonian biotic crisis: duration and selectivity.

The Late Devonian is also characterized by an unusual combination of major excursions or permanent shifts in a variety of sedimentologic and geochemical systems. Laminated organic-rich black shales record episodic development of widespread oceanic anoxia in many cratonic sequences during this interval. Marine evaporites of this age exhibit a +8 to +10 ‰ δ^{34} S excursion as a consequence of large-scale bacterial reduction of dissolved sulfate in association with burial of large quantities of organic carbon. Deposition of organic-rich black shales sequestered large quantities of carbon in the sedimentary reservoir, drawing down atmospheric CO_2 levels from *ca.* 12-16 PAL in the Early and Middle Paleozoic to *ca.* 1 PAL in the Permo-Carboniferous. Changes in atmospheric chemistry are reflected in +3 to +4 ‰ shifts in marine carbonate δ^{13} C and δ^{18} O values during the Late Devonian. The δ^{13} C shift resulted from increased burial of isotopically light organic carbon, causing carbon remaining in the dissolved inorganic reservoir to become isotopically heavier whereas the δ^{18} O shift was probably the result of cooling of tropical seawaters by *ca.* 10-12°C. Global cooling is recorded in continental glacial deposits of Late Devonian age.

Vascular land plant evolution

Although land plants appeared in the Late Ordovician or Early Silurian and vascular plants diversified in the Late Silurian and Early Devonian, full colonization of land surfaces is likely to have been a protracted process that continued through the Devono-Carboniferous. Initially, the impact of land plants on their physical environment was negligible owing to small size, limited biomass, and shallow depth of rooting. Land plants exerted a progressively stronger influence as they increased in size and became abundant and geographically widespread. In this regard, two evolutionary developments are of major significance: 1) the advent of arborescence and 2) the appearance of seeds.

Close temporal relationships exist between the advent of arborescence and the seed habit on the one hand, and Late Devonian anoxic and extinction events on the other. The correspondence is especially good between the appearance of seeds and black shales and extinctions of the Hangenberg Event, a temporal lag of less than 1 m. y. within the Late Famennian. The relationship between arborescence and earlier anoxic events is not as sharply defined because the development of tree-sized stature was a protracted event. It may be significant, however, that the onset of persistent oceanic anoxia in the Late Givetian coincided with the advent of large progymnosperms, and that the Kellwasser Event at the F/F boundary coincided with the peak abundance of archaeopterids. With regard to both trees and seeds, it is important to note that first appearances are less important than increases in abundance and biomass, which are harder to quantify but far more important in terms of geochemical consequences.

Development of modern weathering patterns

The appearance of arborescence and the seed habit resulted in large increases in the depth and geographic extent of "modern" soils (as opposed to pre-Devonian microbial protosoils; and precipitated a series of secondary effects during the Late Devonian. Transient effects are related to increased particulate and nutrient fluxes resulting from short-term environmental disturbances. Although dense vegetative cover generally exerts a stabilizing influence on landscapes, sparse vegetation is likely to be destabilizing owing to a low resistance to wildfires, drought, and landslides, all of which would lead to mechanical disruption of thin juvenile soils. Episodic disturbances of this type during the progressive development of mature soil profiles would be likely to cause regionally or globally elevated fluxes of particulates and nutrients.

Indirect evidence of elevated Late Devonian nutrient fluxes is provided by

high concentrations of marine algal matter in coeval black shales, implying high rates of primary productivity, and by enigmatic fossils of wide geographic but restricted stratigraphic occurrence, e.g. *Protosalvinia*, which may be the product of algal blooms. Widespread anoxia and eutrophication commonly result from pulses of nutrients to shallow epicontinental seas, as in modern semi-restricted marine basins such as the Black and Baltic Seas.

Long-term effects of the development of "modern" soils derive from the increased intensity of chemical weathering due to vascular land plants, approximately 7 times greater than that due to pre-vascular land plants. Changes in weathering processes are reflected in coeval shifts in the composition of clay mineral assemblages and in carbonate mineralogy. The dominant components of clay mineral assemblages shift from illite-chlorite in the pre-Late Devonian to smectite-kaolinite in the post-Devonian, reflecting an overall increase in the intensity of pedogenic chemical weathering. Carbonate sediments exhibit an abrupt step-wise decrease in dolomite abundance during the Late Devonian, from 40-80% in the Early-Middle Paleozoic to 30% in the Permo-Carboniferous, probably as a consequence of sequestering of Mg in smectites and reduced riverine Mg/Ca ratios. Thus, land plant evolutionary events have probably played a key role in determining the rate and direction of changes in terrestrial weathering processes, fluxes of particulates and nutrients to marine areas, and global atmospheric and oceanic chemistry.

T. G. Algeo, Department of Geology, University of Cincinnati, OH 45221, USA.

ERRATA FOR *HAN* NO. 10/11

In the last issue of HAN, under the title "Satellite imagery", it was suggested that Trichodesmium blooms occur in the Baltic. This is not so, and the article should have said *Nodularia spumigena*, which is a frequent bloom species there. We thank Susanna Hadju of Stockholm University for drawing attention to this error.

The Editors

VIII International Conference on Harmful Algae

Vigo, Spain, 25-29 June, 1997

First Announcement

The above mentioned conference will be hosted by the Instituto Español de Oceanografía (Spanish Oceanographic Institute), the Ministerio de Sanidad y Consumo, Laboratorio Comunitario de Referencia (Ministry of Health, European Union Reference Laboratory), and the Conselleria de Pesca, Marisqueo y Acuicultura de la Xunta de Galicia (Ministry of Fisheries, Shellfisheries and Aquaculture of the Galician Government).

Contributions are invited on all aspects of toxic and harmful algae (including brackish and freshwater cyanobacteria, and ciguatera agents). Papers which address the following problems will be especially welcome:

- Empirical and model studies of the population dynamics of harmful algae blooms, including the coupling of physical and biological processes, harmful algae-zooplankton interactions, growth patterns etc.;
- Ecophysiological, biochemical and toxicological aspects of harmful and toxic algae species;
- Problems related to monitoring, aquaculture, public health and the management of harmful algae events and their economic impacts.

Travel information
Vigo is the most populous city of Galicia (NW Spain), and lies about 1 hour by road from the province's capital, Santiago de Compostela, and 2 hours from Oporto in Portugal. Santiago and Oporto both have international airports, and there is a daily (except Sundays) air link between Vigo and Paris, as well as several daily flights between Vigo, Madrid and Barcelona.

*Please provide the following information **before 15 March 1996***:

Name: .....

Affiliation: .....

Full mailing address: .....

.....

Tel.: ..... Fax: .....
(country code) (city code) (number) *(country code) (city code) (number)*

E-mail: .....

I intend to present: (i) a paper ☐ (ii) a poster ☐

on the following topic: .....

Tentative title(s): .....

For further information, contact:

Beatriz Reguera,
Conference Coordinator,
VIII International Conference on Harmful Algae,
Instituto Español de Oceanografía,
Aptdo 1552, 36280 Vigo, Spain.

The Second Announcement will be sent in May 1996.

Unfinished business from Nantes and Sendai:

An international society for the study of harmful algal blooms

by F.J.R. "Max" Taylor

One of the primary concerns of those of us who look to the future of the study of HABs is continuity and a non-governmental umbrella to bring together scientists and others who work in this highly multidisciplinary area. So far, this initiative has been kept alive remarkably well by the series of seven or eight conferences that have focused on this area of research. They have been supported by a relatively stable, but arbitrarily appointed, International Advisory Committee. The volumes that have been published as proceedings of these and related meetings serve as a central archive of the scope and progress of this field and provide an invaluable unifying resource and key to the articles in the primary literature. Whenever I have a student who wants to begin a study in any aspect, I use the proceedings as a first reference. Unfortunately, these volumes have become very expensive, especially for libraries and those that don't attend the conferences, and so it is very welcome news to learn of IOC-UNESCO's plans to publish the Sendai proceedings.

The conferences have happened largely due to willingness to take on this onerous task by a succession of sacrificing organizers, most recently Dr Patrick Lassus in Nantes and Prof. Takeshi Yasumoto in Sendai, together with their faithful local helpers. The next one will be in Vigo, Spain, in 1997, followed by Hobart, Tasmania, in the auspicious year 2000. However, can we count on such generosity forever? Some offers in the past were made only after a blank silence when requests were made.

There is little doubt that the field will remain a dynamic, highly multidisciplinary and exciting area of scientific endeavor and it needs an organization that reflects the direct desires of those active in the area of study. It would also be beneficial if high priority research areas could be identified (for funding purposes) and scholarships and prizes could be awarded. An important feature to remember is that this society can do whatever the membership collectively wants it to do: endorse new approaches, create a journal (unlikely at present and we are very fortunate to have the *Harmful Algae News* to communicate with), offer travel assistance, give awards, etc. Such an initiative has been supported by the IOC-HAB Programme as an essential step towards preserving this as a multidisciplinary research area.

At the conference on red tides and other harmful algal blooms in Nantes, the statutes associated with the formation of an international society was presented in writing by Dr Ted Smayda, ably assisted by six other colleagues. There was a near-unanimous endorsement that such a society should be formed, but there were three problems that prevented a resolution of the proposal at the conference: participants were caught unawares and hadn't thought the implications through, there was not enough time to consider such an important proposal, and the scope and officers of such a society were not defined. A call for officers was made, but who was to vote on such persons?

In my mind there is no question that this is an initiative that should not die. In my scientific lifetime I have watched this area grow from simple phenomenological investigations (by those faced with such an outbreak) to a multidisciplinary effort involving time series field studies aimed at anticipating such events (whose scope expands annually), and laboratory experiments aimed at elucidating the autocology of harmful species, and the chemistry and toxicology of natural products. In addition, public health authorities and epidemiologists have become involved. Aquaculture has added a significant dimension, both in terms of avoidance of impact and increasing the risk of human exposure. From the observed pattern so far, it is my opinion that there is no coastline in the world that does not experience one or more of the phenomena that we term HABs, absence of reports being a reflection of absence of awareness. This does not mean that some areas are not worse than others, not that eutrophication, climate change or introductions might not aggravate such problems. These are important questions that such a society should focus upon.

So, to summarize, the Nantes conference voted for the formation of a society and started to vote for officers, but the issue was not resolved, largely due to a lack of clarity as to who should vote. What has become clear is that the officers of a society can only be chosen, as usual, by the membership of such a society and so the first step is to establish such an entity.

The scope of the society has not been formally defined, although at Sendai there was a vote by the International Organizing Committee for Conferences to include both benthic phenomena, leading to ciguatera and related problems, and freshwater and marine cyanobacterial blooms. My own view is that this decision should be driven by the scientific benefits: if inclusion leads to better science, so be it, even if the community gets less cosy. In reality, while country representation is obviously influenced by where the conferences are held, the degree of participation by subdisciplines, such as pharmacology or epidemiology, fluctuates dramatically. The society can appoint section leaders whose responsibility would be to report on advances in all areas.

Various suggestions for the name of the organization were made, including the Society for Harmful Algal Blooms (which sounds like we support and/or promote such events), the International Harmful Algal Bloom Society (IHABS, The Smayda committee choice) or my own suggestion, the International Society for the Study of Harmful Algal Blooms (ISSHAB), a search for acronyms involving HABs having failed to produce anything catchy. Toxic is nice but too exclusive. Members will be asked to suggest alternatives (it would be helpful if they had acronyms like DOOM; DEATH; APOCALYPSE; SAVIOURS OF SOCIETY, etc.).

In order to progress further I have been asked to informally act as the *animateur*, i.e. the individual charged with bringing life (not caricature) to this con-

(Cont'd on p. 14)

Society use Only
Membership No
Section(s)
Dues received, current?

Application for founding membership in International Society for the Study of Harmful Algal Blooms (ISSHAB)

Name: .....

Affiliation: .....

Address: .....

Fax: ..... *E-mail*: .....

Are you on the mailing list for *Harmful Algae News*?	Yes	No
If not, do you wish to be added?	Yes	No
Are you in the IOC Directory of HAB Experts?	Yes	No
If not, do you wish to be in the next edition?	Yes	No

Please indicate, to a maximum of four, which of the following potential sections (to be confirmed, with chosen leaders, at future meetings), you are most interested in:

- ☐ I. Taxonomy/ genetics-cycles,
- ☐ II. Ecology (marine planktonic),
- ☐ III. Ecology (marine benthic, ciguatera),
- ☐ IV. Ecology (freshwater, including cyanobacteria),
- ☐ V. Biogeography/Introductions,
- ☐ VI. Toxicology,
- ☐ VII. Pharmacology,
- ☐ VIII. Epidemiology/Public Health etc.

(Regional sections will be added later)

Information on your background experience will be requested. Meanwhile, would you rate yourself as:

- ☐ very experienced
- ☐ moderately experienced
- ☐ beginning professional research in the field
- ☐ a graduate student in the field
- ☐ an enthusiastic amateur
- ☐ other

Please enclose a cheque or money order for US$ 20.00 to:

Henrik Enevoldsen
IOC Science and Communication Centre on Harmful Algae,
University of Copenhagen, Botanical Institute,
Dept. of Mycology and Phycology,
Øster Farimagsgade 2D, DK-1353 Copenhagen K., DENMARK.
Tel: (45) 3313 4446; fax: (45) 3313 4447
E-mail: henrike@bot.ku.dk

(Cont'd from p. 12, "ISSHAB")

cept. I do so happily – aided considerably by the *Harmful Algae News* to communicate with you (thanks to IOC-UNESCO and Tim Wyatt, the Editor) and by Henrik Enevoldsen, IOC, who will provide initial help with informal Membership registration and fee accountancy – as I firmly believe in this as a project with lasting value. The process I suggested, and which was endorsed by a planning session of the Sendai conference committee, is an initial membership registration in this and the next issue, to produce a core of serious foundation members, followed by a call for nominations of officers (President, Secretary, Treasurer, with written agreement of their willingness to serve) and a vote (by members only), so that at the next conference my role will have been completed successfully and we will have three key officers and a membership identified. Objectives and procedures will be the focus of the plenary meeting in Vigo.

Let's go!

F. J. R. "Max" Taylor, Department of Oceanography, University of British Columbia, Vancouver, B.C., Canada.

(Cont'd from p. 7, "Gymnodinium catenatum")

This species may have been transported across the Gulf of Cadiz from the Iberian Peninsula, where blooms occurred in Galicia in September and Portugal in October the same year. Alternatively, it may be autochthonous to Moroccan coastal waters[4], with resting cysts germinating under favourable climatic conditions, and may have been responsible for the PSP events of 1971, 1975 and 1982. Cyst distribution studies could provide support for this hypothesis.

References

(1) Essaid el Feydi, A. 1977. L'intoxication paralytique par les fruits de mer. Thèse no. 44, Fac. med. phar., Rabat, 106 pp.
(2) Inst. Scient. Pêches Marit., Casablanca, 1994, Internal Reports.
(3) Blackburn, S.I. *et al.*, 1987. *J. Phycol.*, 25:577.

Tahri Joutei Laila, Institut scientifique des pêches maritimes, 2 rue Tiznit, Casablanca 01, Morocco.

ANNOUNCEMENT

NATO Advanced Study Institute

Jointly with SCOR and IOC

"The Physiological Ecology of Harmful Algal Blooms"

Bermuda Biological Station
27 May to 6 June 1996

A NATO Advanced Study Institute (ASI) on the Physiological Ecology of Harmful Algal Blooms will be convened at the Bermuda Biological Station for Research (BBSR), 27 May to 6 June 1996. This activity is organized by a working group co-sponsored by SCOR (Scientific Committee for Oceanic Research) and IOC (Intergovernmental Oceanographic Commission) of UNESCO. Funding for the meeting is provided by NATO, SCOR and IOC.

The objectives of the ASI will be to assess our understanding of the fundamental physiological and ecological issues underlying harmful algal blooms (HABs), to identify inadequacies, impediments, and promising areas for future research, and to advance and disseminate new approaches and technologies. The ASI will follow the format specified by NATO, which requires a 10-day meeting involving many different types of activities (e.g. lectures, field and laboratory demonstrations, group discussions). Efforts will be made to summarize major advances in two main areas: (1) The ecology of critical groups of toxic phytoplankton (= "Autoecology"); and (2) the ecophysiological processes and mechanisms that affect toxic bloom formation and the production of phycotoxins (= "Ecophysiological Processes and Mechanisms"). It is hoped that one outcome of this approach will be the elucidation of critical factors that regulate blooms of related species as well as of toxic species in general.

If you feel you can contribute to this ASI and wish to participate, please return the completed "Application" (on facing page) to: Don Anderson at the address given below. Funds for travel will be provided to some participants, but selection will in part be determined by the extent to which each individual can provide his or her own travel funding. Other criteria that will be considered in participant selection include restrictions on the number of non-NATO participants, the need to balance attendance among NATO countries as much as possible, and the need to provide opportunities for students as well as advanced workers. The number of participants at the workshop will be restricted as well, as organizers are targeting 80 to 85 participants given the facilities at the BBSR.

Since it is likely that there will be more than this number interested in participating, a steering committee will select participants on the basis of the above constraints, as well as the expertise that they will bring to the workshop, their willingness to help with demonstrations or lectures, their relevance to the physiological ecology theme, and funding support. The ecophysiology theme is rather narrowly defined and thus not all HAB disciplines will be appropriate for the meeting.

For further information, please contact:

Donald M. Anderson, ASI Director,
Biology Department, MS #32,
Woods Hole Oceanographic Institution,
Woods Hole,
MA 02543-1049, USA.
Fax: (1-508) 457 2134
E-mail: danderson@whoi.edu

Deadline for submission of applications is **1 February 1996**. Participants will be notified soon thereafter.

APPLICATION

NATO Advanced Study Institute

Jointly with SCOR and IOC

"The Physiological Ecology of Harmful Algal Blooms"

Bermuda Biological Station

27 May to 6 June 1996

Name: ..... **Nationality:** .....

Institutional affiliation:.....

Address: .....

.....

Tel: ..... **Fax:** ..... **E-mail:** .....

Educational status: .....
(student, professor, postdoc, industry, researcher, other)

Gender: (for accommodation purposes) .....

Scientific interests: (brief sentence) .....

Your proposed contribution to this ASI:
(Examples include demonstrations of techniques, posters, group discussions, videos, models, etc. Oral presentations will be by invitation only. If you have no specific contribution, indicate *"plan to participate as student".*)

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Funding: On-site costs for the ASI will be US$ 900 for housing and meals. Indicate below the amount of financial support you are requesting to travel to and attend the ASI. This information will be considered in selecting participants, as space and budget are both limited.

I am prepared to contribute $ _____ from my own sources, and request $ _____ for travel, plus $ _____ for housing and meals.

If you have proposals pending that might provide financial assistance, please provide details, including the date when you will know of final decisions on funding:

.....

To assist the committee that will be selecting participants, please submit a short curriculum vitae. If you are a student, please substitute a statement of interest or qualifications and furnish the name of your professor.

All students and lecturers must attend the entire Advanced Study Institute. A non-refundable deposit will be required upon acceptance to the ASI. Notification of your participation will be in early February 1996.

Please return this form no later than 1 February 1996 to Donald M. Anderson, MS #32, Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA. Fax: (1-508) 457 2134.

New HAB Publication Series

"Amnesic Shellfish Poisoning (ASP)" has just been published as Volume 1 of the new HAB Publication Series in *IOC Manuals and Guides* No. 31.

During the Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, a Task Team on Aquatic Biotoxins was established. The Task Team on Aquatic Biotoxins was formed in order to initiate, catalyze and activate interaction between relevant organizations and Member States with interest in the chemistry and toxicology of algal toxins. This document is a product of the collaboration between organizations and IOC Member States participating in the Task Team on Aquatic Biotoxins.

In this manual, a review is provided of the chemical and toxicological aspects of Amnesic Shellfish Poisoning (ASP). The document contains information on chemical structure, chemical data, on where to obtain standards and reference materials, origin and occurrence, chemical analysis, mouse bioassay, epidemiology, mechanisms of action, symptoms and therapeutics. The practical use of the document has been highlighted in agreement with the Members of the Task Team on Aquatic Biotoxins.

Volume 1 in this series is a supplement to the IOC Manual on Harmful Marine Microalgae (in preparation).

Other volumes on Paralytic Shellfish Poisoning (PSP), Diarrhetic Shellfish Poisoning (DSP) and other important toxins are planned to be printed in the future.

This document is free of charge and can be obtained by contacting: Dr Helle Ravn, The Harmful Algal Bloom Programme Office, Intergovernmental Oceanographic Commission (IOC) of UNESCO, 1, rue Miollis, 75732 Paris Cedex 15, France; fax: (33-1) 40 56 93 16; e-mail: hab.ioc@unesco.org

Future events

IOC/SAREC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Phytoplankton, University of Mauritius, Mauritius, 5-14 February 1996. Lecturers include Dr F.J.R. Taylor (Univ. of British Columbia) and Dr Jacob Larsen (Univ. of Copenhagen/IOC Centre). Organized by the IOC Science and Communication Centre on Harmful Algae, Copenhagen, and co-sponsored by SAREC (Swedish International Development Agency) and DANIDA (Danish International Development Agency).

IX International IUPAC Symposium on Mycotoxins and Phycotoxins, Rome, 27-31 May 1996. Contact: Istituto Superiore di Sanità, Segreteria per le Attività Culturali, Viale Regina Elena 299, 00161 Rome, Italy.

Third IOC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microalgae, University of Copenhagen, Denmark, 15-26 July 1996. This advanced course will focus on identification and preparation techniques supplemented by lectures on different aspects of the biology of harmful algae. Teaching staff will include: Dr Yasuwo Fukuyo (Univ. of Tokyo), Prof. Øjvind Moestrup (Univ. of Copenhagen), Dr Rhodora Corrales (Univ. of the Philippines), Dr Jacob Larsen (Univ. of Copenhagen/IOC Centre), Dr Enda Graneli (Univ. of Lund). Organized by the IOC Science and Communication Centre on Harmful Algae and the Botanical Institute, Dept of Phycology, and co-sponsored by DANIDA (Danish International Development Agency). Priority will be given to applicants from developing countries.

For application forms, contact: the IOC Secretariat, or the IOC Science and Communication Centre on Harmful Algae, Botanical Institute, Ø. Farimagsgade 2D, DK-1353 Copenhagen K, Denmark; fax: (45-33) 13 44 47.

1st European Phycological Congress, Cologne, 11-18 August 1996. There will be a session on "Red tides and algal-bacterial interactions" convened by Drs Malte Elbrächter and Karen Steidinger. Congress Secretariat: Prof. Dr Michael Melkonian, Botanisches Institut, Universität zu Köln, Albertus-Magnus-Platz, D-50923 Köln (Germany); tel.: (49-0) 221 470 2475; fax: (49-0) 221 470 5181; e-mail (internet): mmelkon@biolan.uni-koeln.de

14th International Diatom Symposium, 2-8 September 1996, Tokyo, Japan. Convener: Dr Hiromu Kobayasi, Tokyo Diatom Institute, Honcho 3-8-9-813, Koganei-shi, Tokyo 184 Japan. Contact: Shigeki Mayama, Department of Biology, Tokyo Gakugei University, Konagei-shi, Tokyo 184, Japan; e-mail: mayama@u-gakegei.ac.jp; tel.: (81-0) 423 25 211; fax. (81-0) 423 24 9832.

Fifth Canadian Workshop on Harmful Marine Algae, St. John's, Newfoundland, Canada, September 1996. (*More information will be given in next issue of HAN.*)

Literature for developing country libraries

Limited copies of the following titles are available from IOC's HAB Centre in Denmark, to libraries of marine science institutions *in developing countries only*:

- ***Proceedings of the Sixth International Conference on Toxic Marine Phytoplankton***. P. Lassus *et al*. (eds.), 1995.
- ***The Genus Alexandrium Halim (Dinoflagellata)***. E. Balech, 1994.
- ***Marine Phytoplankton. A Guide to Naked Flagellates***. C. Thomas *et al*. (eds.), 1994.
- ***Marine Phytoplankton. Identifying Marine Diatoms and Dinoflagellates***. C. Thomas *et al*. (eds.), 1996.

Applications must be submitted and signed by the responsible librarian, and should indicate why the requested title is of specific interest to your institution and its ongoing research or teaching. *No requests from individuals will be honoured*. Address applications to:

IOC Science and Communication Centre on Harmful Algae,
University of Copenhagen,
Botanical Institute,
Dept. of Mycology and Phycology,
Øster Farimagsgade 2D,
DK-1353 Copenhagen K, Denmark;
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HARMFUL ALGAE NEWS

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