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HARMFUL ALGAE NEWS

An IOC Newsletter on toxic algae and algal blooms

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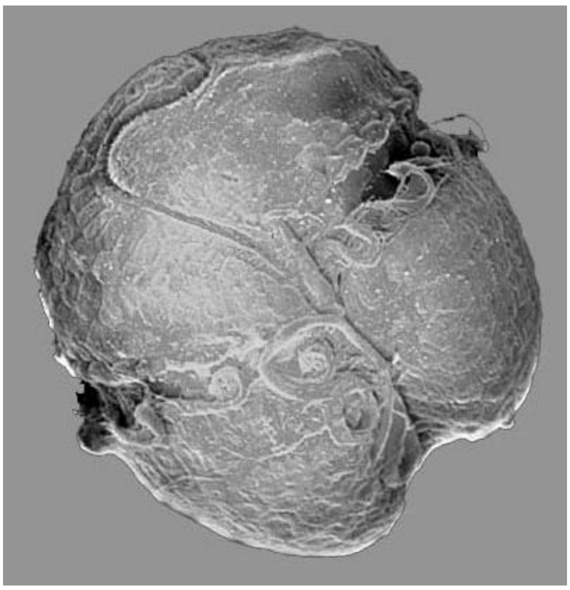
HAB XII - RESPONSES TO THE CONFERENCE

Taxonomy at the XIIth ICHA, Copenhagen 2006

The era of big taxonomic novelties for harmful species has apparently come to an end. Small but significant revolutions animated the taxonomic sessions at past HAB Conferences, ranging from the decision to use the genus name *Alexandrium* in place of other synonyms (Enrique Balech, Lund, 1989) to the finding of a harmful member in the so far inoffensive family Dictyochophyceae (Bente Edvardsen, Cape Town, 2004), and to the first cues of pseudo-cryptic species in *Pseudo-nitzschia* (Nina Lundholm, St. Pete's Beach, 2002). There were no big surprises this time but, as ever, a number of new species were presented, including a cyanobacterium (**Tuong Giang Nguyen Ngoc**), a raphidophyte (**Elif Demir)**, several possible *Gambierdiscus* species (**Pat Tester**) and even a so far mysterious dinoflagellate (**Jennifer Wolny**), to remind us once more that our knowledge of microalgal diversity is still in progress.

It has become more and more evident over the years that species cannot always be delimited and identified with visual techniques, but also that other evidence is needed to support molecular information. The differences between *Karlodinium*



Scanning electron microscopy is not enough to tell which species of Takayama *is this.*

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Dinophysis news

Light micrograph of a well-fed live Dinophysis acuminata *cell using the ciliate* Myrionecta rubra *as prey (Photo courtesy of Myung Gil Park)*

Any biologist accustomed to observe live populations of *Dinophysis* spp. has been entranced by the variability of their morphology (size and shape of their large hypothecal plates) and their cellular contents. Through the growing season of *Dinophysis acuminata*, the most ubiquitous and persistent species of the genus in temperate coastal waters, cells can appear thin and quite empty, or swollen with digestive vacuoles. The size composition of the population can range from homogeneous to a bimodal distribution of large and small cells or even to a complex array of small, intermediate and large cells. A large part of the size and shape complexity within a given locality can be explained by complex polymorphic life cycles [1], where large cells can go through a depauperating division *sensu* von Stosch [2], and produce two dimorphic offspring (with dissimilar halves) that further lead to the formation of small gamete-like cells.

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armiger and *K. veneficum*, which bloom together along the Spanish Mediterranean coasts, required an array of methods for accurate classification (**Esther Garcés**). Even trickier is the case of the *Alexandrium tamarense / catenella / fundyense* species complex (**Santiago Fraga**), where a mismatch exists between morphological and molecular information. Within this trend, several papers focused on new molecular approaches to detect cryptic, pseudo-cryptic or simply difficult to distinguish species (**Sonja Djerks**, **Mirelle Chinain, Laurence Myriam Elandoussi**, **Wayne Litaker**, **Sarah McDonald**, **Katherine Hubbard**, **Antonella Penna** and many others).

The opposite also seems to exist: shape may evolve faster than some molecular markers. Two autotrophic dinoflagellates blooming under the ice in northern areas, the freshwater *Peridinium aciculiferum* and the brackish *Scrippsiella hangoei*, differ in morphology, habitat, and physiology but share identical nuclear ribosomal DNA (SSU, ITS1- 2, 5.8S and LSU). Mitochondrial cytochrome b (COB) sequences indicate a recent evolutionary divergence (**Ramiro Logares**). Both species are evolutionarily related to heterotrophic *Pfiesteria*-like species. Interestingly, *P. aciculiferum* produces allelopathic substances, and there is some evidence that *S. hangoei* produce toxins. It remains to be determined how the chloroplasts originated in the autotrophic species.

Despite the absence of big surprises, never before in this conference series did the discussion reach such peaks of pervasive disagreement and constructive criticism as in the workshop on taxonomy. The topic that raised the tone of the discussion is certainly not new: are there few or many microalgal species? Is phytoplankton genetic diversity meaningful or just 'philosophical dirt' [1]? Who is right, the splitters – those who go on separating known taxa into more species – or the lumpers – those who unify apparently distinct taxa under a same name? Is there any sense in establishing species that cannot be told apart in the light microscope - and at times not even in the electron microscope?

The first contribution to the debate came from **Tom Fenchel**, who provided an overview of his ideas, based on his scientific experience with ciliates but extrapolated to all aquatic microbes [2, and references therein]. Indeed for these organisms a limited number of species are found which are apparently ubiquitous in ecologically comparable systems. According to Fenchel, genetic diversity often does not correspond to any morphological or physiological peculiarity, being in this case the result of an accumulation of neutral mutations, whereby molecular differences between species only indicate how much time has passed since they diverged. In these views, the questions raised by evidence of cryptic and pseudo-cryptic diversity in aquatic microbes could be dismissed as much-ado-about-nothing.

An alternative perspective was presented by **Miguel De Salas**, who introduced the group of naked dinoflagellates belonging to the genera *Karenia*, *Karlodinium* and *Takayama*, once all known under the name *Gymnodinium*. These genera have not stopped 'expanding' since their establishment, but unfortunately differences between taxa are in most cases subtle and only revealed under certain observational conditions. The actual distribution of all these newly established species will hardly be revealed unless a whole array of techniques is applied, ranging from cultivation to molecular biology and electron microscopy. But does species identification really matter in such problematic cases? The opinions of the participants in the workshop were as different as the interdisciplinary nature of our conference allows. Most 'taxonomy-producers' emphasised the advantages of a better taxonomic resolution in terms of the definition of actual ecological and biogeographic patterns of diversity. Yet when a species is split into several almost indistinguishable species, life becomes very complicated for the 'taxonomy users', who need to identify phytoplankton in the light microscope in monitoring projects, or who have long used the 'old names' for organisms in physiological experiments, or who need to associate a given toxin with a certain species.

That splitting species introducing new names may actually turn out to be useful was largely supported by the examples provided by **David Mann** in his plenary talk. Differences in morphological details noticed by Dr. Lothar Geitler [3] a century ago formed the basis to name a wide set of 'varieties' within the benthic freshwater diatom *Cocconeis placentula*, of which only those illustrated by Hustedt [4] were subsequently reported, allowing information to be recorded that would have been lost without names to attach to the data. A host of new definitions of species crypticity was also clarified in this talk, among which the term semi-cryptic for those morphologically undistinguishable species that can be identified only when their provenance is known. The acknowledgement that the geographic origin matters is a good step forward, and an even better one will be to recognise the taxonomic importance of the ecological characteristics of different entities. It will finally return to the picture the relevance of the environment in the origin of species. We should certainly acknowledge that taxonomy is a science aimed at identifying meaningful natural groups and tracing evolutionary patterns, rather than a name-giving exercise. New species are scientific hypotheses that need to be tested with further research – that would be impossible without naming them – rather than to be reduced on the basis of 'horror diversitatis' (fear of diversity) which finds a contrasting analogy with the well known 'horror vacui'(fear of emptiness). (A simple and wise thought is that information attached to separate names can always be unified in the light of further knowledge, whereas the opposite is impossible).

These days taxonomy is facing questions that are much more challenging than those posed by the introduction of electron microscopy. The boost of information on the cell data-center, the DNA, is likely to make a difference in solving the taxonomic questions posed above. Information being acquired in this field is producing some exciting results on genetic diversity patterns. This is likely to attract more people to the field, possibly allowing us to accumulate biological data in parallel with molecular data. Certainly, the assumption that genetic variation is meaningless and that it overestimates the actual diversity goes against this trend: why should students be attracted by meaningless diversity patterns? We should rather let these studies flourish, promoting research into cryptic and pseudocryptic diversity: in a few years the ground for this discussion will be much sounder, while rapidly developing technology will have solved all identification problems.

References

1. That was the joking way phytoplankton was defined by Johannes Müller in the 1840's, i.e. much before its function was discovered. Smetacek V. *et al*., 2002. *In*: Phytoplankton Productivity. Carbon Assimilation in Marine and Freshwater Ecosystems, Williams, P.J. le B., *et al.* (Eds.) Blackwell, p. 350.
2. Fenchel, T., 2005. Aquat. Microb. Ecol. 41: 49.
3. Geitler, L., 1927. Arch. Protistenk. 59: 506.
4. Hustedt, F., 1930. *Die Kieselalgen Deutschlands, Österrreichs und der Schweiz under Berücksichtigung der übrigen Länder Europas sowie der angrenzenden Meeresgebiete. 1. Teil*. Akademische Verlaggesellschaft, Leipzig. 920 pp.

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Variability is more obvious when live *Dinophysis* cells are examined by epifluorescence microscopy. The first notable difference between phototrophic *Dinophysis* spp. and other dinoflagellate genera is that they fluoresce orange. This is because - like small (10-15 µm) cryptophyte flagellates, cyanobacteria and *Myrionecta rubra* (=*Mesodinium rubrum*) - they have reddish accessory pigments called phycoerythrins. *Dinophysis* cells can exhibit an intense orange colour covering the whole cell, or only partially (preferentially in the peripheral part of the cell), or even have parts that fluoresce with a different colour. The distinctive fluorescence characteristics of phototropic *Dinophysis* spp. led to a study of their ultrastructure and description of their peculiar plastids with 2 membranes [3], distinct from the conventional peridinin-containing plastids of other dinoflagellates. The beauty of it all lies in the fact that in this morphological variability of *Dinophysis* spp., one can read a great deal about the previous history of the population, and about the physiological status of the individual cells [1, 4].

A key observation by Hansen [5] was that the heterotrophic *Dinophysis* (*Phalacroma*) *rotundata* can feed on the ciliate *Tiarina fusus* after piercing its lorica with a feeding peduncle and sucking its contents, a feeding mechanism known as "myzocytosis" [6]. It seemed logical to imagine that other species of *Dinophysis* could feed on other ciliates in a similar way, and a few year later, remains of ciliates were found in the digestive vacuoles of *D. acuminata* and *D. norvegica* [7]. But nobody had seen in nature what the potential prey of *Dinophysis* might be. During the last 15 years, many biologists were curious to find out what was the nutritional source of phototropic species of *Dinophysis*, and tried to grow them in all sorts of enriched media, with or without additions of small prey [8]. In the luckiest cases, picked cells, incubated in cell culture plates go through 4 or at most 6 divisions, and when transferred to fresh medium, small cells start to appear and the culture does not progress in a conventional way [9]. This is high-risk research, and nobody likes to have a Ph D student working for months on a topic that may produce inconclusive observations.

Advances in molecular biology were applied to *Dinophysis* issues. Janson [10] found that portions of the ribosomal DNA that code the plastids of *D. acuminata* are identical to those with the same function for the plastids of the cryptophyte *Teleaulax amphioxeia*. The hypothesis of kleptoplastidy came into conflict with the idea that *Dinophysis*' cryptophyte-like plastids are constitutive [11], i.e., the result of an evolutionary association between a "domesticated" cryptophyte prey and a eukaryotic cell.

Attention was diverted to the potential cryptophyte prey, but nobody managed to grow *Dinophysis* on them. Takahashi *et al*. [12] confirmed the cryptophyte-like sequence of the plastids of several DSP toxin-producing *Dinophysis* spp., and even developed molecular probes that, as a very innovative early warning system, could be bound to the cryptophytes with a plastid sequence like that of *Dinophysis* spp. plastids, and detect the prey before the build-up of *Dinophysis* populations.

On the first day of the XII International Conference on Harmful Algae (Copenhagen, 4-8 September 2006) the audience was astonished and delighted with the presentation of a Korean group (**Myung Gil Park**). Their video showed voracious *D. acuminata* cells attacking the ciliate *Myrionecta rubra* with their feeding peduncles. The cells of *Dinophysis* became fatter and fatter as myzocytosis proceeded, and empty cells of *M. rubra* were finally left with the appearance of unrecognizable bubbles. *M. rubra* was cultured with the addition of *Teleaulax* sp.

The findings of Park *et al*. [13] contitute a real breakthrough that opens new avenues for research on *Dinophysis* spp., so far hampered by the lack of established cultures. Far from being the final solution, their results have raised lots of new questions: Is *Myrionecta* the main (or the only) prey in natural populations of *Dinophysis* spp? Can *Dinophysis* survive on other nutritional sources when *Myrionecta* is not available? Do *Dinophysis* perform photosynthesis with stolen plastids from *Myrionecta*, or does the ciliate act only as an exogenous nutritional source? How does feeding on *Myrionecta* affect the toxin content of *Dinophysis* cells?. Inspiration to answer some of these questions can come from recent findings on the feeding behaviour of *Myrionecta* [14]: the ciliates do not use kleptoplastids from the *Teleaulax* cells they ingest, as suggested by Gustafson *et al*. [15], and they do have permanent endosymbionts. But cultures of *Myrionecta* could only be established when small amount of *Teleaulax* spp were provided.

Blooms of *Dinophysis* spp. and the subsequent detection of lipophilic toxins (okadaic acid and derivatives, pectenotoxins) in shellfish above regulatory levels constitute the most persistent "pest" for shellfish growers in regions of Atlantic Europe, Japan, New Zealand, and Chile. *Dinophysis* is a cosmopolitan genus, and problems associated with their proliferation arise practically in any shellfish cultivation area that search for the cells and their toxins with the appropriate methods. During this conference, seven oral presentations and over fifty posters focused on or included aspects of *Dinophysis* spp. and their toxins.

Reports of the occurrence of *Dinophysis* spp. associated with DSP outbreaks were given for new regions in Southern Brasil (**Celia Villac**), the Atlantic coasts of Morocco (**Btissam Ennaffah**) and Croatia (**Zivana Nincevic**). The application of advanced analytical methods (LC-MS) is leading to the detection of pectenotoxins in most *Dinophysis* blooms where the presence of these toxins is explored (**Elizabeth Cañete**, **Zouher Amzil**, **Bengt Lundve**), and to the identification of new analogues (**Trine Torgersen**).

The use of resins that adsorb lipophilic toxins *in situ* (SPATT) in Canada (**Corinne Garnett**), Galicia (**Gemita Pizarro**) and Scotland (**Jean-Pierre Lacaze**) showed that they can act as early warning systems when concentrations of *Dinophysis* are extremely low, and that *Dinophysis*-related toxins can be present in the water column for weeks when cells are no longer detected. Crucial questions here will be to determine if the toxins are actively liberated by healthy *Dinophysis* cells, and in what state (free, attached to adsorbing particles) the water-borne toxins detected by SPATT occur. An important observation (**Kirsten Johansen**) is that a large proportion of toxins can be liberated by the cells during common (nets, pumps) concentration procedures.

Important questions on ecology and oceanography of harmful species, identified in the Science Plan and in the Open Science Meetings of the SCOR-IOC GEOHAB programme, were addressed in the Baltic, and in the Iberian Peninsula and South African upwelling systems.

The fine scale distribution of several *Dinophysis* spp. in relation to the physical structure of the water column was explored in the Baltic Sea (**Heidi Hällfors**), and the Galician Rías (**Beatriz Reguera**). The former confirmed that distributions are species-specific, and the latter showed the importance of considering the stage in population growth to interpret different aggregation pattern in the water column. Quantification of vacuolated cells was used also in the Baltic (**WF Carvalho**) and Galicia (**Sonsoles González-Gil**) as a proxy to identify conditions associated with mixotrophic behaviour. **Lourdes Velo** applied an artificial neural network approach to predict *D. acuminata* blooms in Southern Spain from weekly cell counts obtained from monitoring programmes.

The importance of cross-shelf and longshore transport of *Dinophysis* populations in the South African (**Grant Pitcher**) and Galician (**Laura Escalera**) upwelling systems was explored. **Sanna Sopanen** in the Baltic, and **Sobrino-Gonçalves** in Portugal tackled the difficult subject of species-specific selection and ingestion rates of *Dinophysis* by different copepod species.

References

1. von Stosch, H.A., 1964. Helgoland. Wiss. Meer. 10: 140-152.
2. Reguera, B. & S. González-Gil, 2001. J. Phycol. 37: 318-333.
3. Schnepf, E. & M. Elbrächter, 1988. Botanica Acta 101: 196-203.
4. Reguera, B., *et al*., 2003. Mar. Ecol. Prog. Ser. 249: 117-131.
5. Hansen, P.J., 1991. Mar. Ecol. Progr. Ser., 69: 201-204.
6. Schnepf, E. & G. Deichgräber, 1984. Naturwissenschaften 71: 218-219.
7. Jacobson, D.M. & R.A. Andersen, 1994. Phycologia 33(2): 97-110.
8. Maestrini, S.Y., 1998. *In*: Anderson, D.M., *et al*. (eds.), Physiological Ecology of Harmful Algal Blooms.(Springer-Verlag), pp. 243-266.
9. Nishitani, G., *et al*., 2003. Plankton Biol. Ecol. 50: 31-36.
10. Janson, S., 2004. Environ. Microbiol. 6: 1102-1106.
11. Hackett J.D., *et al*., 2003. J. Phycol. 39: 440-448.
12. Takahashi, Y., *et al*., 2005. Mar. Biotech. 7: 95-103.
13. Park, M.G., *et al*., 2006. Aquat. Microb. Ecol. 45: 101-106.
14. Hansen, P.J. & T. Fenchel 2006. Mar. Biol. Res. 2: 169-177.
15. Gustafson, D.E., *et al*., 2000. Nature 405: 1049-1052.

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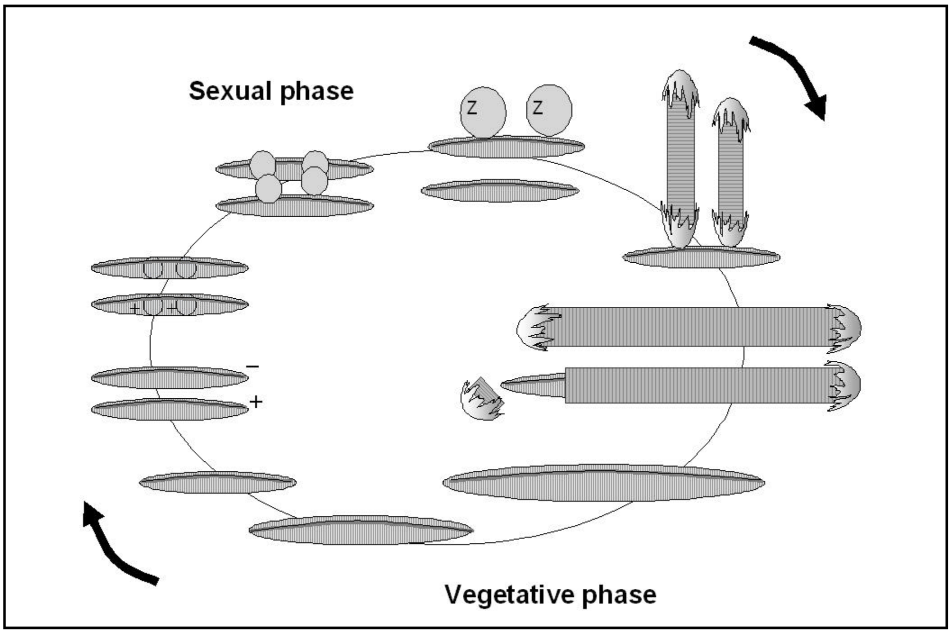
Phytoplankton life histories: a step forward

Understanding of evolutionary history, population structure and ecology of plants and animals is largely based on the knowledge of their life histories. However, what do we know about the life cycles, mating systems, formation of resting stages and other aspects of the life cycles of protists? A lively EC-funded workshop [1] provided an overview of our 'knowledge' and 'ignorance' on this topic. This workshop acted as catalyst for further research programmes (e.g. SEED) aimed at a better characterization of the life histories of marine phytoplankton organisms. Considering that toxic or harmful species are known in almost all phytoplankton classes, the Conference is an ideal forum for an update on new findings, innovative approaches and experimental studies on phytoplankton life cycles in general.

The very first approach for life cycle studies implies working in the laboratory with cultures. This might be considered as a limit – like studying an animal in the cage of a zoo – but it is the only way by which we can link together the different life stages in a coherent sequence of events. Up to now, the vast majority of studies have focused on phototrophic organisms: once they are provided with light and nutrients, they can – at least theoretically - grow. The cultivation of heterotrophic or mixotrophic protists is much more tricky, requiring the design and testing of a suitable diet that allows for their growth and life- cycle completion. **Kristin Gribble** presented for the first time detailed information on the sexual process – gamete formation, conjugation, production of a planozygote and a cyst – in a *Protoperidinium* species, *P. steidingerae*.

Protoperidinium are amongst the most abundant heterotrophic dinoflagellates and include a notable number of species capable of producing resting cysts. Elucidating the process of cyst formation and the morphology of the different life cycle stages will provide important information for a better refinement of the morpho-taxonomy of this genus. It will also open new avenues for experimental work aimed at understanding the triggers for encystment and excystment, which might be regulated by factors different from those active in phototrophic species.

When thinking about phytoplankton life histories, the switch between vegetative (capable of duplication) and resting stages immediately comes to mind. Those are indeed crucial points in an organism's life history, and have considerable implications for their ecology: the formation of resting stages might contribute to bloom termination, while vegetative cells germinating from spores or cysts are released in the water column and might provide the source for a subsequent bloom. Unfortunately, a proper quantification of these transition points is hampered by objective observational limits. Several posters addressed the role of resting stages in population dynamics (e.g. **Mitshiro Yoshida**, **Silvia Angles, Isabel Bravo, Cecilia Satta**). **Akira Ishikawa** has designed a 'plankton emergence trap' allowing the quantification of cyst germination, for which there are almost no field data; the authors found that germination of *Alexandrium catenella* cysts is continuous throughout the year, without any seasonal pattern, in contrast to the bimodal pattern recorded for the blooms. The formation of resting stages is not a prerogative of dinoflagellates, but is recorded in many other taxa. **Karin Rengefors** provided evidence for the formation of temporary and sexual cysts in the freshwater *Gonyostomum semen*, a raphidophyte responsible for skin irritation. **Shigeru Itakura** searched for differences in seeding mechanisms between diatoms and dinoflagellates: can different environmental conditions trigger the preferential germination of species belonging to one of the two groups?



The life cycle of a pennate diatom

No resting stages are known up to now for species of the diatom genus *Pseudo-nitzschia*, which nevertheless can produce regular and recurrent blooms in coastal areas. **Domenico D'Alelio** explored cell size variation in *Pseudo-nitzschia multistriata* over several years to find evidence for the occurrence of sexual reproduction. The occurrence of sexual events might be inferred by finding of auxospores and/or by the appearance of populations with a large cell size, which are produced following the sexual phase. Interesting questions can be addressed by the painstaking measurement of thousands of cells: does the bloom represent the occasion in which conjugation probabilities are higher? Is the bloom constituted by cells in the same size range? *P. multistriata* cell size gradually decreases over time and populations of different size succeed year after year, suggesting that sex in this species occurs every 1 or 2 years.

There other aspects of life cycles that are still poorly understood and/or quantified but interesting information is piling up. As an example, **Bente Edvardsen** showed that several species have haplo-diploid life cycles within the haptophyte genus *Chrysochromulina*. This means that both haploid and diploid stages are capable of growth. This life cycle is different from that recorded in diatoms, where cells are diploid and the haploid stage is represented by the gametes, or in dinoflagellates, where cells are haploid and the only diploid stage is the planozygote (and the cyst, if produced). What are the implications of these differences in the evolution of protists? What are the differences between the two stages in the haptophyte life cycle? At times they are surrounded by scales of different morphology, at times they look the same.

Protists might have mating systems (broadly speaking, the number of sexes) of different complexity. Again, this is an aspect with considerable implications, spanning from population genetics to evolutionary biology. A cell may require a mate of opposite mating type to perform conjugation, or it may be able to mate with cells of the same mating type; this makes a difference. In order to define the mating system of a certain species, multiple crossing experiments should be carried out to test if sexual reproduction can occur within a clonal strain, if strains of two opposite mating types have to be crossed, or if the system is even more complex. There were a few contributions in which crossing experiments were carried out (e.g. **Cátia Carreira**, **Setsuko Sakamoto, Domenico D'Alelio**). Obtaining a convincing answer might be tricky if we rely only on morphology. In dinoflagellates, the evidence for sexual reproduction can be provided by the formation of cysts (assuming that they are the product of sexual reproduction). However, we know that not all planozygotes necessarily transform into cysts, and thus the lack of cysts does not imply the lack of conjugation. We might have conjugation followed by the formation of a planozygote that does not encyst, or our experimental settings might not be adequate to induce the sexual phase. We are faced with similar problems in diatoms, where the morphological evidence for sexual reproduction is provided by the formation of auxospores. Here again, the positive result is solid, but the negative one might be biased due to a sub-optimal experimental design, or to the fact that our strains are not in the right size window for sex. But do not get depressed: difficulties stimulate creative thinking!

Reference

1. Garcés, E., *et al*., 2002. *LIFEHAB: Life History of Microalgal Species Causing Harmful Blooms* (European Commission, Brussels), www.icm.csic.es/bio/projects/lifehab, 1- 189 pp.

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The Gundestrup Cauldron

The XII Conference on Harmful Algae convened in Copenhagen attracted 550 participants from 56 countries (EU with Norway and Croatia 230, USA 99, Japan 52, China 23; countries not represented in earlier conferences are Bangladesh, Kuwait, Madagascar, Namibia, Nigeria, Senegal, Turkey, and UAE)

Denmark has given us the Gundestrup cauldron, constructed from plates, like an armoured dinoflagellate – like other cauldrons of northern myth, it is a metaphor of the heavens, and, like these conferences, a source of inspiration. Denmark has also given us an epic poem, whose hero *Beowulf* may have used allelopathy to overcome the monster Grendel[1]; A list of famous Danes includes Tycho Brahe ("Ne frustra vixisse videar" – Will I not have lived in vain) – readers who attended the conference may have noticed his image as they entered the town hall reception – he rejected the heliocentric view of Copernicus, and, as a result, some Danes still hang their heads in shame; Ole Rømer, who devised an early temperature scale (in 1701, later improved by Fahrenheit in 1724, and still in use in North America); Eugenius Warming, a pioneer of community ecology and ecophysiology (he called it *epharmosis*), who offered the world's first ecology course[2]; Wilhelm Johannsen, who coined the word *gene* (in 1909), and focused attention on the genotype-phenotype duality. Denmark has also given us Shakespeare's *Hamlet*, Vikings, comedian Victor Borge, and *pølsevogn* (sausage wagons).

Barrie Dale frequently asks "What happened to the epidemic?" (right out loud). He refers to the persistent notion that HABs are *spreading*. I think he means people are quieter about this now, that it is an idea whose time has passed, like that of the Vikings, who brought the clam *Mya arenaria* back across the Atlantic [1], and spread Baltic plankton to the Black Sea via Russian rivers [2]. Barrie was obviously too busy selling bric-a-brac to pay proper attention. Presented here were the first reports of toxic *Pseudo-nitzschia* in the Chesapeake (**Holly A. Bowers**; **Anne Thessen**), the first yessotoxins in Portuguese bivalves (**Susana S. Gomes**), the first bioluminescent *Alexandrium* bloom in Finnish waters (**Tore Lindholm**), the first records of *Gymnodinium catenatum* and *Pyrodinium bahamense* in Angolan waters (**Isabel Rangel**), the former also a recent arrival in Brazil (**Celia Villac**), the first azaspiracids in Moroccan waters (**Hamid Taleb**). Spreading is still alive and well.

"In recent years massive outbreaks of ... species ... have attracted much public atttention. However, since ... outbreaks are often sporadic and of short duration, they tend to catch the scientific community off guard and discourage systematic long term studies. ... Many "basic" questions remain a matter of debate. For instance the time/space scale of such episodes; the extent to which ... outbreaks are favoured by climatic triggers, physical forcing, or disequilibrium conditions linked with eutrophication and/or overfishing; the design of appropriate data sets and monitoring protocols. Among the many unresolved challenges confronting researchers, the tasks of tracking the complex life stages of these organisms, identifying their function in benthicplanktonic coupling, and assessing their proper role and importance in food web models, are not the least."

All very familiar; the passage is from a CIESM report [3] about jellyfish. There have been frequent warnings in recent years that the future of the oceans belongs to jellyfish (jelly barrens, to match the urchin barrens of the seabed). There have been 'jelly tides' in the Black Sea (*Mneniopsis*), the Sea of Japan (*Nemopilema*), the Benguela Current (*Chrysaora*, *Aequorea*), the Gulf of Mexico (*Aurelia* and *Chrysaora*, Australian *Phyllorhiza*), the Mediterranean (*Pelagia* and *Rhizostoma*), Hawaiian waters (*Carybdea* spp). Like so many ecological puzzles, these plagues are variously attributed to overfishing, global warming, eutrophication, in short to planetary mismanagement. In such scenarios, the toxins will certainly have a chance to be vectored by jellies (**Florence M. Boisson**), and events like the turtle mortality in El Salvador (**Sergio Licea-Durán**) to increase in frequency.

Ruthless reductionists have modelled phytoplankton cells as spheres whose surfaces are porous, or perforated with pores, and which lead lives of nutrient sucking simplicity[3]. So, how many pores does a cell need to suck up its nitrate or phosphate rations? Surprisingly, the flux of nutrients into such cells by classical diffusion theory is proportional to the radii of the pores, not their surface areas, and only a very small fraction of surface is needed to maximize uptake rates[4]. "Thus many hundreds of different transport (or receptor) systems can be accomodated on the surface of the cell, each adsorbing particles of a specific kind with an efficiency approaching that of a cell whose entire surface is dedicated to one such task." [4]. So unless the rest of the surface is *simply* defensive (armour) or offensive (say trichocysts), there is plenty of space for other activities.

We are gradually learning how diverse these other activities are (allelopathy, quorum sensing, mating signals, ...). This diversity can be a "source of irritation" [5] because it forces one to abandon the relative safety of the physicochemical paradigm with its few free parameters, and enter the world of complex systems, to move from models of single populations to webs and networks; the ocean is not a guppy tank [6]. For others, the diversity (idiosyncrasies of taxonomy, natural history, and life cycles) provides a refuge from the irritations of reductionist models[5]! These opposing attitudes were apparent here in the conference *dialogue* between **Bill Sunda** and **Ted Smayda**. Parsimony is not in Smayda's tool-box, or at least was not deployed in this debate. Smayda's efforts to extend Margalef's mandala are evidence that he is not opposed to the search for patterns. Did HAB science grow as a result of Sunda's conjectures and Smayda's refutations? Bryan Magee once asked Karl Popper: "If science grows by conjectures and refutations, then why wasn't Newton's theory abandoned with Mercury's anomalous perihelion in 1820?" If you want to know Popper's reply, read Imry Lakatos' lectures[6], or write to the editor! We need feedback at the HAN office. Richard Levins stressed that however false, inadequate, and incomplete models are, they can provide qualitative and general insights; they are heuristic devices, and both mandalas and differential equations should find places in the ecologists' tool-box; both make trade-offs between generality, realism, and precision (Levins again).

Most of the ingredients which make HAB ecology difficult and fascinating were already broached at Takamatsu [7]. At that conference for example, Smayda was "not ready to embrace this view", that nutrients and water quality were of overwhelming importance in the generation of HABs, and he stressed that altered grazing patterns provoked by aquaculture and fishing, as well as climatological and geological cycles and the greenhouse effect, could enter the equation; those were trenchant comments at that time. So already 25 years ago the bottom-up vs top-down argument was on the simmer. Recently, emphasis has shifted from nutrient control to predator control. With increasing frequency, we hear views like "the bottom-up perspective has not been successful in predicting many patterns and features of pelagic communities, nor why specific organisms, morphologies, and life histories occur when and where they do" [8], or, "efforts to control activities that affect higher trophic levels (such as fishing) will have far larger impacts on community dynamics than efforts to control, for example, nutrient input, ... "[9]. What is at issue here is not whether eutrophication or overfishing or climate change or anything else *cause* HABs, but the "impoverished notion of causation that characterizes modern biological ideology" [10]. What is the cause of tuberculosis? Is it the tubercle bacillus, or unregulated industrial capitalism?

There were some novelties – we had sessions called "Ecophysiology & autoecology" – I am not too sure of the difference, but given the complexity of life in the real world which these conferences reveal, I wonder if either is of much relevance outside the guppy tank. Parallel sessions seem now inevitable, but we lose a great deal – claustrophobic poster sessions are also becoming the rule, but there is no obvious solution to the problem. One of the highlights of Lund was Max Taylor's summing up, which requires a rare talent, hard to emulate. He hit all the right notes. Victor Borge made people laugh by hitting carefully chosen wrong notes on the piano, immaculately timed. But offensive humour and rankling conceit do not achieve the same effect. "Ecology has no aims, but ecologists have" wrote Charles Adams[7]; some of those aims are too obvious to need advertisement.

Nearly six years ago, it took 32 hours to travel from Vigo to Hobart (great circle distance 18046 km) for HAB2000, about 564 km h^{-1} on a great circle route; this year, the travel time Vigo-Copenhagen (2140 km) for some of us was 34 hours, or 63 km h^{-1}. Luckily a strategically placed *pølsevogn* caught our attention on arrival. If the declining trend in velocity with time is real and linear, those of us who live in Vigo should consider setting out for Hong Kong about now - or are we already too late?

Footnotes

[1] Perhaps the psychoactive components of ergot infected barley.

[2] His influential textbook, *Plantesamfund ...*, was published in 1895. German and English editions followed.

[3] " … organisms envisioned as nutrient-requiring packets of chlorophyll, … " (Max Taylor 1990 at Lund).

[4] This is for spherical cells. For long thin cells like *Pseudo-nitzschia*, fluxes are more proportional to length.

[5] "Not all naturalists want to do science; many take refuge in nature's complexity in a justification to oppose any search for patterns." (Robert McArthur, *Geographical Ecology*).

[6] Lakatos, I. & P. Feyerabend, 1999. *For and Against Method* (Univ. Chicago Press).

[7] Adams, C.C., 1913. *Guide to the Study of Animal Ecology* (Macmillan, NY).

References

1. Petersen, K.S., 1992. *Nature* 359: 679.
2. Olenin, S. 2002. *CIESM Workshop Monograph* 20: 29-33.
3. CIESM 2001. *Workshop Series* 14 (F. Briand, ed.), 112 pp.
4. Berg, H.C., 1983. *Random Walks in Biology* (Princeton UP).
5. Smetacek, V. & F. Pollehne, 1986. *Ophelia* 26: 401-428.
6. Bakun, A., 1996. *Patterns in the Ocean*: *Ocean Processes and Marine Population Dynamics* (California Sea Grant).
7. Okaichi, T., *et al*. (eds.), 1989. *Red Tides*: *Biology, Environmental Science, and Toxicology* (Elsevier).
8. Verity, P.G., *et al.*, 2002. *Environmental Conservation* 29: 207-237.
9. Halpern, B.S., *et al*. 2006. *Science* 312: 1230-1232.
10. Lewontin, R.C., 2000. *It Ain't Necessarily So*: *the Dream of the Human Genome and Other Illusions* (New York).

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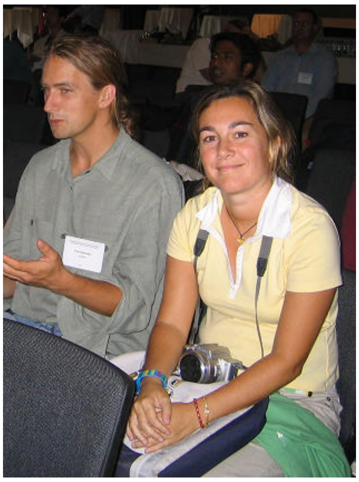
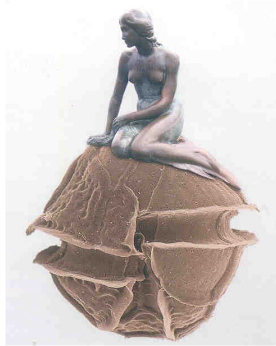
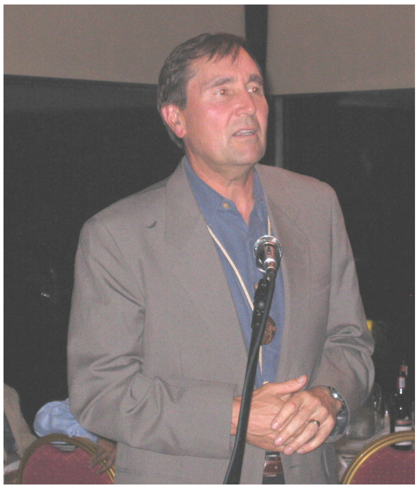


Photos by L. Velo & M. Lion





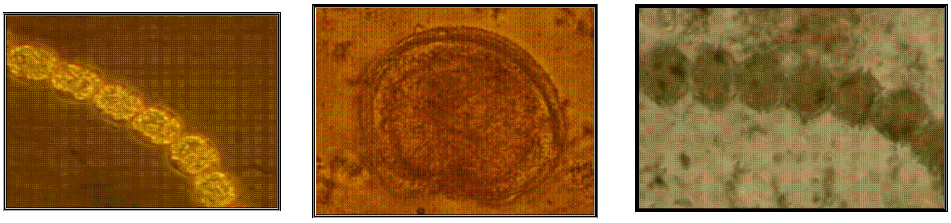
Yasumoto Lifetime Achievement Award to Dr. D.M. Anderson.

A present was given to Prof. T. Yasumoto on behalf of ISSHA.

Barry Dale in action during the ISSHA auction.

• Angola

First Records of *Gymnodinium catenatum*, *Gambierdiscus toxicus* and *Pyrodinium bahamense* on nothern Luanda coast, Angola



From left to right: Chain of Gymnodinium catenatum, Gambierdiscus toxicus *and chain of* Pyrodinium bahamense *(400x).*

Angola has two marine ecosystems, the cold Benguela Current and the warm Angola current. Only a few studies have been undertaken of the phytoplankton on the Angola coast. However, according to taxonomic assessments carried out by different authors between 1953 and 2002, *Prorocentrum balticum*, *Gyrodinium spirale*, *Alexandrium* spp. and *Chatonella* spp. have been detected on the Luanda coast, sometimes in association with mortality of resources [1-3]. There are great disparities in the information available about HABs within the southern Africa region, and though some harmful species are found throughout the region, others appear confined to particular areas.

From July 2003 to October 2004, 343 samples were collected at 4 stations on the northern Luanda coast from Fishing Harbor to Santiago Bay (Fig. 1).

The samples were collected at 4 different depths (5, 10, 15 and 20m) and then fixed with 2% formol. Thermometers and a portable refractometer (Atago S/Mill) were used to measure temperature and salinity. Counts were made by the Utermöhl method with phase contrast. A total of 206 phytoplankton species were identified. The most frequent were: *Prorocentrum micans*, *Thalassiossira rotula*, *Leptocylindrus danicus*, *Cylindrotheca closterium*, *Skeletonema costatum*, *Navicula distans*, *Thalassionema nitzschioides* and *Leptocylindrus minimus*. These species were most abundant at Station 2 (Cacuaco) and at 20m depth. Six harmful species were found amongst those identified, namely: *Alexandrium tamarense*, *Chattonella antiqua*, *Dinophysis acuminata*, *Gambierdiscus toxicus*, *Gymnodinium catenatum*, and *Pyrodinium bahamense*. Three of these were not recorded before on the Angola coast: *Gambierdiscus toxicus*, *Gymnodinium catenatum* and *Pyrodinium bahamense*.

The highest phytoplankton density were recorded in October, 2003 ($212 \cdot 10^5$ $cell \cdot L^{-1}$) and in September, 2004 ($132 \cdot 10^5$ $cell \cdot L^{-1}$) when the weather was changing from winter to summer. The lowest values were observed during the winter (May to September) (Fig. 2).

Both years, the high densities of harmful algae bloom occured in August at St1, following by St3, St4 and the lowest density at St2. In 2003 and 2004, *Pyrodinium bahamense* and *Gymnodinium catenatum* were dominant and caused blooms with maximum densities of the $349 \cdot 10^5$ $cell \cdot L^{-1}$ and $212 \cdot 10^5$ $cell \cdot L^{-1}$ respectively. *Gambierdiscus toxicus* occurred in 2004 at all stations. The highest density was $208 \cdot 10^5$ $cell \cdot L^{-1}$ at St3. In August 2003 and 2004, the high density of harmful species, coincided with temperatures around 20ºC and salinity at or above 32. Minimum densities occured with temperatures above 22ºC and salinity below 32.

Gambierdiscus toxicus produces ciguatoxins. These are generally confined to tropical and subtropical waters and form part of the natural biota of coral reefs, [4]. Luanda is tropical, and the occurrence of this species can be considered normal. *Gymnodinium catenatum* can cause paralytic shellfish poisoning (PSP) occurs in Portuguese

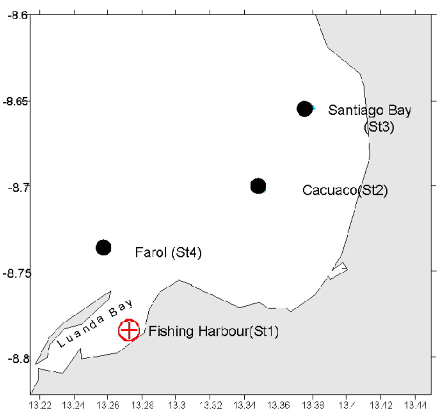


Fig. 1. Station positions (St1- 8º47´07´´S, 13º16´25´´E; St2- 8º42´23´´S, 13º20´07´´E; St3 8º39´73´´S , 13º20´50´´E; St4 – 8º44´30´´S, 13º15´56´´E).

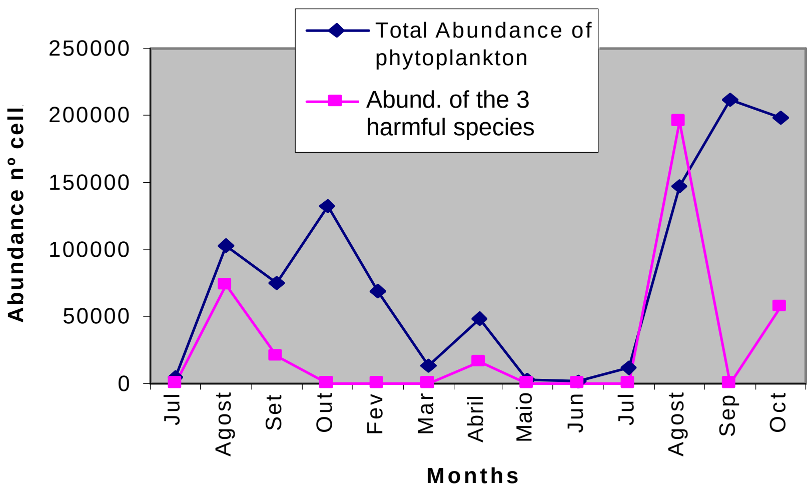


Fig. 2 Phytoplankton and harmful species density from July 2003 to October 2004 on northern Luanda coast.

waters where temperature and salinity average 15°C and 36, respectively. In Morocco, *G. catenatum* occurs at temperatures of 14.8 -17.2°C and salinity of 33.6-36.6 [5]. In the region, species of *Gymnodinium*, are known in South Africa, and cause mortalities of fish and sub- and intertidal fauna [6]. *Pyrodinium bahamense* causes PSP and fish mortality in several parts of the world. This species has bloomed in eastern Indonesian waters (Kao Bay) with high temperatures (30.9-31.5°C) and low salinity (29.2-30.1) [7]. Our data for temperature and salinity are quite different.

References

1. Silva, E.S. 1953. *Trabalhos da Missão de Biol. Mar.* 4: 75-90.
2. Paredes, J.F., 1962. *Mem. Jun. Inv. Ultr, 2ª ser*, 33: 89-114.
3. Rangel, I.M., 2004. *Harmful Algae News* 26: 8-9.
4. Turquet, J., *et al*. 2001. *In*: *Hamful Algal Blooms 2000*, Hallegraeff, G.M., *et al*. (eds.), IOC of UNESCO, 58-61.
5. Joutei, L.T., 1997. *In*: Harmful Algae, Reguera, B., *et al.* (eds.), Xunta de Galicia & IOC of UNESCO, 66-67.
6. Pitcher, G.C., 1998. *Harmful Algal Blooms of the Benguela Current* (Sea Fisheries Research Institute Cape Town), 20 pp.
7. Wiadnyana, N.N., *et al.*, 1996. *In*: Harmful and Toxic Algal Blooms, Yasumoto, T., *et al.* (eds.) IOC of Unesco, 53-56.

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• Italy

BENTOX-NET, a Research and management initiative on *Ostreopsis* spp. and other benthic microalgal blooms on the Italian coast

Ostreopsis ovata (Fig. 1), *O. siamensis* and other congeneric species are typical components of the ‘ciguatera community’, i.e. the association of benthic microalgae found along with *Gambierdiscus toxicus* s.l. in tropical waters. These dinoflagellates colonise benthic macroalgae and seagrasses or attach directly to the substrate, whereas only rarely are they found in the plankton.

The presence of *Ostreopsis ovata* was reported at Villefranche sur Mer (NW Mediterranean Sea) in the 1970s (Max Taylor, pers. comm.) but massive blooms of this species have recently become a threat at several sites along the Italian coasts (Fig. 2). Two distinct species, both producing palytoxin-like toxins, have so far been identified in the northwestern Mediterranean basin: *O. ovata* and *O.* cf. *siamensis* [1]. Blooms of *Ostreopsis* spp. were first recorded along Tuscany coasts in 1998, when thick mucilaginous layers hosting thousands of cells covered both biotic and abiotic substrates [2, 3, 4]. During blooms, mucilage flocs and cells may detach from substrates and float in the water column [5]. In the last 3 years, bloom events have been reported from several other sites in summer and autumn (Fig. 2).

The impact of these blooms on the ecosystem may be serious, with hypoxia, anoxia and benthic invertebrate kills. In addition, skin irritations, fever, respiratory affections and conjunctivitis have caused the hospitalisation of several hundred people. These symptoms have been explained with the presence of a palytoxin-like substance produced by *O. ovata* in both the water [6] and aerosol. In addition to *Ostreopsis* spp., at least two other potentially toxic species may abound on macrophytes, i.e. *Prorocentrum lima*, which produces okadaic acid, and *Coolia monotis*, which produces toxins whose effects on humans are unknown.

The dynamics and consequences of *Ostreopsis* blooms observed in Italian seas and recently along the Spanish coast [7] can hardly be compared to other HAB cases, and pose many questions as to their management during the high risk phases and over longer time scales. Many scientific questions need to be answered to clarify the phenomenon and its possible expansion in coming years, ranging from the exact identification of the species involved, their geographic provenance, physiology, ecology, bloom dynamics, possible role in the trophic web, to the toxins, their production, fate in the trophic web and in the medium. These researches require a multidisciplinary approach. In addition, given the relevance of these phenomena to human health and economic activities, it is crucial that research and management are conducted in a coordinated and integrated way.

To this end, the network BenTox-net (**BEN**thic potentially **TOX**ic microalgae **NET**work) has been

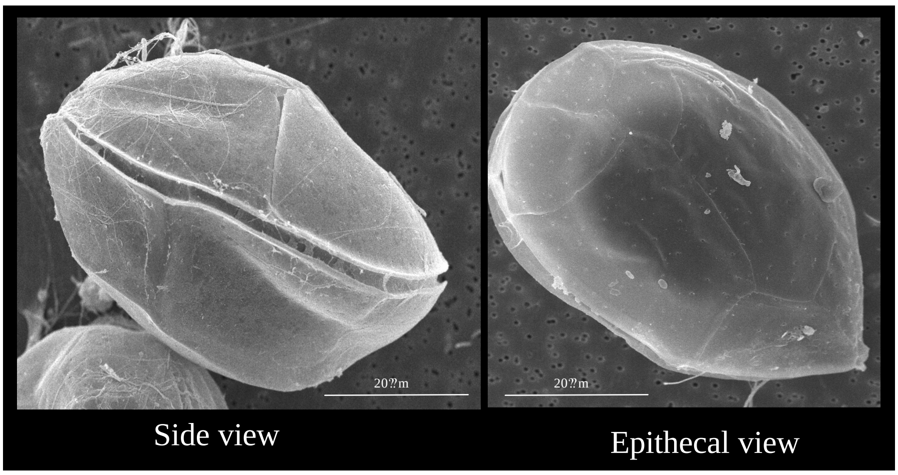


Fig. 1. Ostreopsis ovata *SEM, left: side view; right: apical view. Pictures taken by Maria Grazia Giacobbe and Magda Vila.*

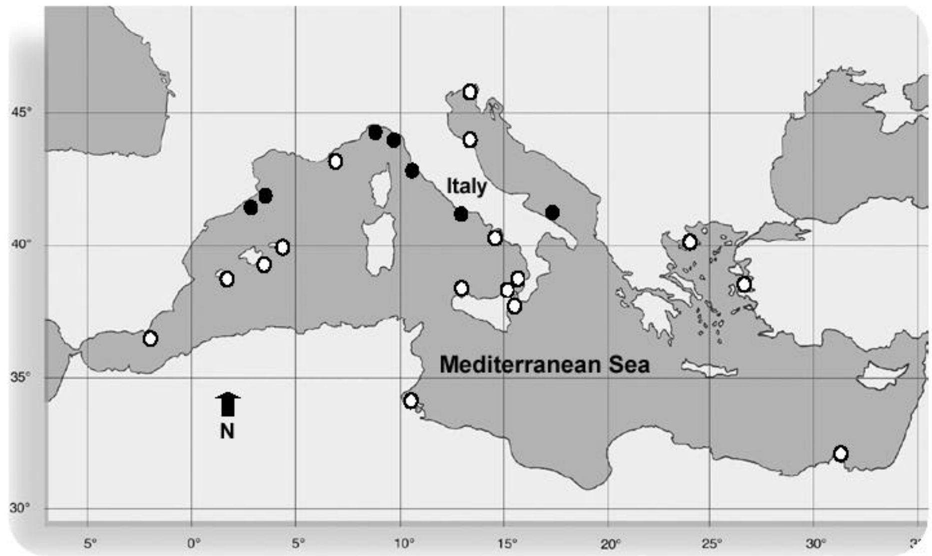


Figure 2. Map of Mediterranean localities where Ostreopsis *spp. have been detected. Full circles mark sites where problems have been reported.*

established among scientists from various Italian laboratories. Participants to the network cover a wide range of expertise including taxonomy, toxin chemistry, genetics and ecology of harmful and non-harmful microalgae. BenTox-net aims are the following:
- to establish communication among research groups working on potentially toxic benthic microalgae;
- to set up intercalibrated sampling and analytical procedures, allowing comparison of data gathered at different sites by distinct groups;
- to continue or establish monitoring activities in areas susceptible to benthic blooms;
- to create links with local agencies that are in charge of bloom management as for environmental quality, public health, seafood protection, tourism and recreational activities in coastal areas;
- to establish an alert strategy tailored on the needs and expertise available in different Italian regions;
- to refine communication strategy with the press and public, to avoid misinformation or unjustified alarms;
- to prepare and submit research projects and secure their funding by public institutions of different nature;
- to train local agencies personnel on methods for sampling and identification of potentially toxic micro-organisms;
- to produce scientific and reach-out papers to be published in national and international newsletters and scientific journals;
- to organise scientific and technical meetings with different participants and target audiences, to promote the delivery of information and research and management activities related to harmful benthic microalgal blooms.

BenTox-net is a bottom-up initiative driven by the need for integrated and effective action in response to the threat posed by this new type of harmful algal blooms. BenTox-net is established based on spontaneous and voluntary participation of the scientists and respective research groups in the list below. At present, no other funds and resources exist beyond those available at the individual Institutes. This hardly allows for basic activities to be set up as response to alert situations in case of blooms. However, the level of protection offered is very limited at this stage, considering the lack of scientific knowledge at local scale and in general. An optimised monitoring and management strategy requires preliminary investigations with extended and frequent sampling over long periods of the year, coupled with ecological, physiological, molecular and toxin chemistry studies. This can only be achieved with support and resources obtained through the search for funding, which will have high priority among the activities of the network.

The Principal Investigators of the 19 groups so far participating in the network are listed below. The network is open to further participation and will shortly seek links with Mediterranean partners.

Roberta Congestri, Università Tor Vergata, Roma.
Antonella Penna, Università degli Studi di Urbino, Pesaro.
Adriana Zingone, Stazione Zoologica A. Dohrn, Napoli.
Maria Grazia Giacobbe, IAMC-CNR, Messina.
Cecilia Totti, Università Politecnica delle Marche, Ancona.
Patrizia Ciminiello, Ernesto Fattorusso, Università degli Studi di Napoli Federico II, Napoli.
Antonella Luglié, Università degli Studi di Sassari, Sassari.
Antonella Bottalico, Università di Bari, Bari.
Michele Scardi, Università Tor Vergata, Roma.
Mauro Bastianini, ISMAR CNR,Venezia.
Claudio Grillo, ARPAL, La Spezia.
Roberto Poletti, Centro Ricerche Marine, Cesenatico.
Rossella Pistocchi, Università di Bologna.
Monica Casotti, ARPAT, Massa Carrara.
Carmela Caroppo, IAMC-CNR Taranto.
Rossella Barone, Università di Palermo.
Marina Cabrini, OGS Trieste.
Aurelia Tubaro, Università di Trieste.
Luisa Mangialajo, Università di Genova.

References

1. Penna, A., *et al*., 2005. *J. Phycol.* 41: 212-225.
2. Sansoni, G., *et al*., 2003. *Biol. Ambien.*, 17: 17-23.
3. Simoni, F., *et al*., 2004. *Biol. Mar. Medit.*, 11: 530-533.
4. Simoni, F., *et al*., 2004. *Harmful Algae News*, 26: 5-7.
5. Bianco I., *et al*., 2006. *Biol. Mar. Medit.*, 13(1): 947-950.
6. P. Ciminiello, *et al*., 2006. *Anal. Chem.*, 78: 7153-7159.
7. Vila, *et al*., Proceedings of the 12th International Conference on Harmful Algae (submitted).

R. Congestri, Università Tor Vergata, Roma, Italy.

A. Penna, Università degli Studi di Urbino, Pesaro, Italy.

A. Zingone, Stazione Zoologica A. Dohrn, Napoli, Italy.

GEOHAB
Global Ecology and Oceanography of Harmful Algal Blooms

Stronger focus on sustained observations of harmful algae

The IOC has for more than a decade given attention to activities aimed at developing capacity in research, sustained observations and management of harmful microalgae through its Harmful Algal Bloom Programme and the Global Ocean Observing System. Recently, new initiatives have been taken to strengthen focus on operational marine observations for harmful algae and relevant parameters.

Rapid developments in technology and a strong focus in the international community on operational marine observation systems have made it relevant to publish a new manual on real-time coastal observing systems for marine ecosystem dynamics and harmful algal blooms. The manual is expected to be released by UNESCO Publishing early 2007. Editors are Marcel Babin, Colin Roesler, and John Cullen.

The WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) has an expert team in the Services programme area focused on Marine Accident Emergency Support (MAES) - largely dealing with marine pollution emergency response and search and rescue operation support. JCOMM/MAES is now also exploring how they might be able to support operational harmful algal bloom warnings and what their team can offer, and what JCOMM observations are required. JCOMM will explore this topic at their next meeting 29-31 January 2007, in Angra dos Reis, Brazil.

The Scientific Steering Committee (SSC) for the IOC-SCOR science programme GEOHAB (Global Ecology and Oceanography of Harmful Algal Blooms, www.geohab.info) has opened a dialogue with the GOOS Regional Alliances to address the inclusion of, and approach to, observation systems to detect harmful algal blooms and associated environmental conditions in regional GOOS components.

The GEOHAB SSC wishes to facilitate GOOS in making measurements that could help in understanding and forecasting HABs. Also, the SSC seeks to encourage regional and national observation systems to deploy advanced species-specific sensors that can detect HAB organisms, as well as other environmental sensors that will help us understand HAB initiation, development, and collapse. Sensors in this latter category include remote sensing of parameters such as ocean colour, sea surface temperature, sea surface salinity, currents and fronts, etc., as well as in situ measurements of fluorescence, sub-surface temperature and salinity, water column structure, nutrients, and other parameters relevant to HABs.

In some national or regional observing systems HAB applications have been invoked as a major justification for such observing systems. However, in most cases it appears that little of the observing infrastructure is specific to HABs. Clearly, information about temperature and currents is extraordinarily useful for HAB applications, but insufficient to make accurate forecasts.

The GEOHAB SCC considers that information exchange between the HAB and GOOS communities is very important to interact actively in development of operational systems for routine HAB observations.

Harmful Algae News will keep you updated on developments within these new initiatives.

IOC Training Courses

Open for applications: IOC Identification Qualification in Harmful Marine Microalgae, University of Copenhagen, 2007

The IOC Science and Communication Centre on Harmful Algae, University of Copenhagen, Denmark has organized more than 20 international training courses in taxonomy and biology of harmful microalgae. The 2007 course includes an examination at the end of the course with an IOC Certificate of Proficiency in Identification of Harmful Algae issued to participants who pass the examination. The course includes 90 hours of teaching and is divided into two parts, each consisting of 45 hours of teaching. The first part of the course is an internet teaching programme, while the second part is a practical workshop in species identification (scheduled tentatively for 20-30 August 2007). The course is organised by the University of Copenhagen, Denmark. Details at: www.ioc.unesco.org/hab/train.htm

FANSA News

The 7th IOC Regional Science Planning Workshop on Harmful Algal Blooms in South America (FANSA) was held in Lima, Peru, between the 21st and 23rd, June, 2006, as a continuation of periodical meetings occurring since 1994. The IOC-FANSA meeting was supported by IOC (UNESCO) and hosted by Instituto del Mar del Perú (IMARPE) (local contact: Dr Sonia Sánchez). The Workshop was opened by the President of the Board of IMARPE, Rear Admiral Hugo Arévalo Escaró, who welcomed participants and thanked IOC for continued support of scientific and operational analyses of HABs in South America. He was followed by Dr. Leonardo Guzmán, Chairman of IOC—FANSA, who gave a brief overview of the working group, the expectations of previous workshops, and future objectives. The Minister of Production of Perú, Mr. David Lemor Bezdin, emphasized the importance of strengthening regional capacity to face HAB problems associated with serious problems in Public Health, fisheries resources and marine ecosystems.

Twenty six representatives from Argentine (1), Brazil (2), Chile (2), Ecuador (2), Uruguay (2) and Perú (17) attended the WS. Mónica Lion (IOC-IEO Science and Communication Centre on Harmful Algal, SCCHA, Vigo, Spain) acted as IOC observer. Additional time was dedicated to revision of the HAB-FANSA website by L. Guzmán, S. Méndez and L. Proenca, editors of this IOC initiative. The Workshop consisted of four sessions: 1) State of HAB problems within the region and novelties in participant countries; 2) State of the scientific knowledge, management of HABs and its effects within the region: comprehension level and operational actions; 3) Information networks, training activities, scientific information exchange, local development and actions for public education and information dissemination, 4) Workshop recommendations. The Workshop resulted in eighteen recommendations:

· The need for taxonomic training on different taxonomic groups to strengthen monitoring programmes.

· To organize a second UNESCO Knowledge Portal e-Learning Training Course on Taxonomy and Biology of Harmful Marine Microalgae.

· The HAB-FANSA website should include the scientific and operational capacities available within each FANSA country.

· The FANSA countries agreed to revise and complete the available information on HAB thematic maps prior to its official presentation.

· Members of the FANSA WG should stimulate other regional researchers to contribute with material and suggestions to the HAB website.

· An agreement to invite the IOC-ANCA group to integrate the HAB website, to establish mechanisms to favour integration, and for at least one representative of each WG to attend the ANCA/ FANSA meetings.

· Agreement to contribute validated data up to 2000, through the focal point of each FANSA country, to upgrade HAEDAT (once the new electronic format becomes available).

· Agreement to encourage cooperation among different experts on shared topics of interest, as in the case of *Alexandrium*, *Pseudo-nitzschia* and *Dinophysis* blooms.

· The IOC-IEO SCCHA from Vigo, Spain, should continue training courses to update and improve marine toxin determinations on shellfish for human consumption.

· Specific training courses on official techniques to determine biotoxins in food of marine origin, conducted by regional specialists, were suggested.

· To progress in the accreditation of Marine Toxin Analytical Laboratories (ISO 17025), IOC coordination and support to perform during 2007 an inter-calibration exercise for PSP determination (AOAC, 2000) between the EU Reference Laboratory on Marine Toxins and the Official Laboratories of FANSA countries was requested.

· The IOC Executive Secretary should inform each FANSA country of its capacity to maintain financial support prior to planning future actions of FANSA.

· Each national representative should inform its IOC National Focal point about IOC budget restrictions to be presented at the IPHAB Panel.

· Reinforce educational, training and dissemination campaigns on HABs, oriented to different population sectors.

· Developments of issues, and progress reached in specific topics by each country should be suggested for the preparation of the agenda.

· To explore the feasibility to organize a specific workshop on problems associated with *Alexandrium* in the region, prior to the next IOC FANSA WS.

· The next IOC FANSA WS will be held in Mar del Plata, Argentina, hosted by the Instituto de Investigación Pesquera (INIDEP).

Leonardo Guzmán,
Chair FANSA.

ISSHA President's Corner

ISSHA
International Society for the Study of Harmful Algae

The International Society for the Study of Harmful Algae (ISSHA) sponsored the 12th International Conference on Harmful Algae, held in Copenhagen (4-8 September 2006), and held there on 7th September its Fifth general assembly. The picture in the bottom shows the executive and attending council members. Over 200 ISSHA members attended this meeting.

Pat Tester (President) opened the meeting. The minutes from the previous assembly were approved and different council members summarized the activities and achievements of ISSHA in the last year. **Nina Lundholm** (Treasurer) presented the financial statement, covering the period November 2004 to August 2006. **Don Anderson** (Chair of the Travel Awards Committee) thanked a list of sponsors and the members of his committee that allowed the review of 60 applications and the partial support of 35 applicants from 16 countries to attend the conference.

Jane Lewis (Chair of the Publications Committee) announced a new ISSHA-IOC publication: "Manual on Aquatic Cyanobacteria" (by Gertrude Cronberg & Heléne Annadotter), recalled the affiliation of ISSHA to the IOC-UNESCO Newsletter Harmful Algae News, and recognized the efforts of Tracy Villareal (ISSHA Secretary) to maintain and revise the ISSHA website.

Barrie Dale (Chair of the Awards Committee) reviewed the rules for the Awards. Over 100 students were considered for the best poster and oral presentation at the XII ICHA. The awards were announced during the conference Mermaid Banquet. The Yasumoto Lifetime Achievement Award was given to **Dr. Donald M. Anderson** (Woods Hole Oceanographic Institution, USA), for a life successfully dedicated to the study of *Alexandrium* spp. (physiology, population dynamics) and a vigorous managerial and cooperative interaction with the HAB community, both at a national and international level (see p. 9). Awards to the best oral presentation was given to **Tilman Jens Alpermann** (Alfred Wegener Institute, Germany) and the first and second awards for the best poster to **Katherine Hubbard** (University of Washington, Seattle, USA) and **Jabulani Ray Gumbo** (University of Pretoria, South Africa) respectively.

Henrik Enevoldsen, on behalf of his Co-chairs (P. Tester and A. Zingone), gave an update on HAB-MAP, the ISSHA initiative to compile regional summaries of the occurrence of toxic and ichthyotoxic marine microalgae, for 11 areas of the world. Data are now available for the Mediterranean and South America.

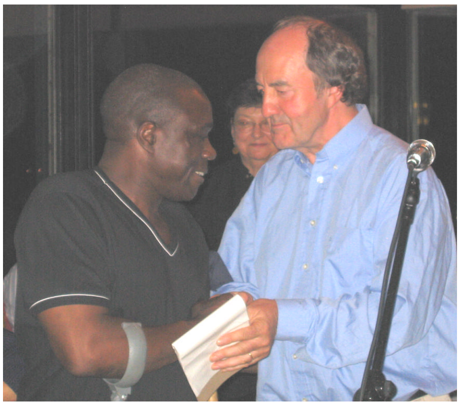
Presentations were given in support of the venue for the 2010 International HAB Conference, by Yves Collos (for Montpelier, France), Jane Lewis (for Edinburgh, Scotland), and Kalliopi Pagou (Hersonissos, Crete). Members voted on the venue during the General Assembly. Crete was elected as the venue for 2010.

Once again, the President remimded ISSHA members of the advantages of society membership, invited them to contribute with suggestions for new initiatives, and thanked them for their participation.

For the first time in ISSHA's existence, an auction to raise funds for the society was organized the evening following the assembly. The auction was not only a financial success, but also great entertainment thanks to the great communication skills of Barrie Dale (see p. 9.).

T.J. Alpermann, Award to best oral presentation.

K. Hubbard, Best poster presentation.



J.R. Gumbo, 2nd prize for poster presentations.

Photo by L. Velo

Eighth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB-VIII), UNESCO, Paris, 17-20 April 2007

The Panel (IPHAB) was formed in 1991 to set priorities for and ensure the financial resources for implementation of a global HAB Programme. A primary task is still to identify the required resources, so that the international community jointly can continue to implement activities on capacity building, international cooperative research, and communication networks. The membership of the IPHAB is open to Member States of IOC which have declared to the Secretary IOC their involvement or intention to participate in the development and implementation of the HAB Programme on a global, regional, or national scale. The Provisional Agenda and other documents for the Session is available at the IPHAB home page at http://ioc.unesco.org/hab/act2.htm.

The major focus of the Eighth Session of IPHAB is tentatively, capacity building, the GEOHAB Research Programme, HAB Databases, formulation/endorsement of specific objectives for regional activities, and HAB observations and their inclusion in components of the Global Ocean Observing System, GOOS. The Agenda is furthermore open to the priorities of Member States. Based on its discussions the IPHAB will recommend to the IOC Assembly a work plan for the IOC HAB Programme for 2008-2009.

Patricio Bernal, Assistant Director-General, UNESCO, Executive Secretary, IOC.

Future events

MARCH 2007

6th International Conference on Molluscan Shellfish Safety - ICMSS 07

March 18th- 23rd, 2007. Blenheim, New Zealand.

New Zealand is hosting the 6th International Conference on Molluscan Shellfish Safety in Blenheim.

An extensive programme is being planned, which promises a unique opportunity to share information on all aspects of molluscan shellfish safety from management of environmental contamination to innovation in laboratory methods. This conference brings together shellfish industry, regulators and research scientists from all points on the globe to provide a comprehensive programme on managing the safety of shellfish. The programme will comprise plenary lectures, scientific sessions, poster sessions, and field visits that reflect the latest trends in research and development in the shellfish sector.

More details can be found at: www.nzfsa.govt.nz/icmss07.

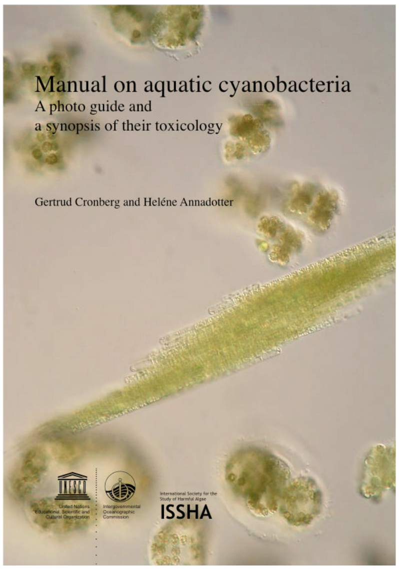
New Release

Manual on aquatic cyanobacteria

A photo guide and a synopsis of their toxicology, Gertrud Cronberg & Heléne Annadotter, Lund University, Sweden

Potentially harmful cyanobacteria occur widespread in the aquatic environment and this manual treats their taxonomy, identification, and toxicology across freshwater, brackish and marine environments.

Published August 2006, 110 pages
ISBN 87-990827-0-5
Order at: www.issha.org



HARMFUL ALGAE NEWS

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