Unknown poison found in French Atlantic shellfish

In early November 1992, water samples taken in the framework of REPHY (French Phytoplankton Surveillance Network), near mussel ropes in the centre of the Pertuis Breton, showed high numbers of a Dinophysis species not normally common on French coasts, particularly at this time of year. Mouse tests for DSP (Diarrheic Shellfish Poison) were immediately carried out, but the rapidity of death and the symptoms observed suggested the presence of PSP (Paralytic Shellfish Poison).

On 13 November, sales of shellfish from the affected area were banned as a precautionary measure. On 16 November, results of chemical analyses by HPLC (high performance liquid chromatography), carried out by the National Centre for Veterinary and Food Research (CNEVA), Paris, appeared to confirm the presence of PSP toxins, but in amounts below the internationally recognized toxic threshold, 80 µg of PSP/100 g meat. The toxic profile moreover, did not correspond to that of cultured and wild stocks of the PSP-producing dinoflagellate, Alexandrium minutum.

During this period, no known PSP-producing species of phytoplankton was detected in water samples. Nor did sediment samples, taken on 23 November from under mussel ropes in the Pertuis Breton, show cysts of any known toxic species. As from 10 December, toxic effects could no longer be detected.

A new toxicity episode began on 26 January 1993. PSP mouse tests carried out on rope-grown mussels from the Pertuis Breton showed intense toxicity (survival time 1 to 3 minutes), even though no species known to be toxic could be detected in the water. Toxicity spread to oysters in the Bassin de Marennes-Oléron and to mussels in the Bassin d’Arcachon, leading to the decision to impose closing orders. Twenty-four hours after obtaining results which were positive for supposed PSP, further tests carried out on the same acid extracts gave negative results, showing that the poison is unstable and that it is not PSP toxin (which is stable).

More complete chemical analyses on the same extracts confirmed the absence of PSP toxin in the samples. Further conclusions as to its origin, however, remain difficult.

Subsequently the contamination rapidly diminished. All areas were reopened on 17 February.

The organism responsible for the production of poison has still not been identified. The molecular structure of the toxin is still unknown.
World record of PSP in Southern Argentina

An unusual PSP toxicity outbreak was recorded in southern Chile and southern Argentina during spring and summer of 1991 and 1992 (G. Lemebey, HAN N° 2). Its intensity, duration and extension resulted in a high number of human intoxications (some people died), and in a high mortality of fish, penguins and other marine bird species in the region. All evidence showed that the Alexandrium catenella bloom began during November 1991 in the western end of the Magellan Strait, and then spread southwards and eastwards. In the southern Argentine region, the highest toxicity values (127,200 μg STX eq/100 g Mytilus edulis) were detected in February, near Ushuaia city (Benavides et al., CTMFM, p. 19, 1992). To my knowledge, this is the highest toxicity value recorded for a PSP outbreak, and it is also higher than the saturation value reached in experimental intoxications of Mytilus edulis (V.M. Bricelj et al., Toxic Marine Phytoplankton, 269-274, 1990). This extreme value seems to be a consequence of the high toxicity of the Alexandrium catenella population (325 pg STX eq/cell) as well as of the high cell concentrations detected, which produced discolorations and luminescence.

In the southern Chilean region, the first bloom of this species was detected in 1971. However, P.A. Segers (La Semana Médica, Buenos Aires, 1117-1119, 1908) described the intoxication and massive death of native people near Ushuaia, due to bivalve consumption in 1886. It is possible that this species might then have been a common and occasionally prominent component of the phytoplankton community from the region.

The scenario of the present outbreak was characterized by periods of unusually calm and high insolation, and the occurrence of near surface pycnoclines. Recent data have indicated that the decrease of the ozone layer is a world phenomenon, and significant in this southern region of South America, near the ‘Antarctic ozone hole’ (R. Stolarski et al., Science, 256, 342, 1992). There is agreement among scientists that the change in the specific composition of phytoplankton communities is one of the expected effects of the increase of the UV radiation (UVR) (R.C. Smith et al., Science, 255, 952, 1992). A well-adapted species seems to be Phaeocystis pouchetii, which produces surface blooms in the marginal ice-edge zone around Antarctica during spring/summer. As mentioned elsewhere for several dinoflagellates, including Alexandrium catenella, P. pouchetii produces mycosporine-like amino acids that diminish the damage produced by UVR (Marchand et al., Mar. Biol., 109, 391-395, 1991). On the other hand, small UV doses produce a significant decrease in the survival of most of the zooplankton species examined and could reduce the fecundity of marine copepods (Karanas et al., Mar. Biol, 65, 125-133, 1981).

Li'l Abner might call the UVR increase a 'Whammy' (T. Wyatt, HAN N° 1). However, this is not sufficient to explain this massive outbreak detected in the southern region. The UVR doses received by a planktonic population depend on the incident UVR with depth in the water column and on the 'residence time' of a population within the UVR photic zone. Therefore, overall effects, integrated through the water column and over large geographic areas, are difficult to estimate.

We are ignorant of the ultimate cause which triggered this unusual bloom, although it seems that we are dealing with an event resulting from the hazardous combination of several environmental factors. Is the increase of UVR one of them?

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Nuisance blooms in Argentina reservoirs

The Paso de las Piedras reservoir in Buenos Aires Province, Argentina, is the sole water supply for the two large towns of Bahía Blanca and Punta Alta. Blooms of blue-green algae, Gloetrichia echinulata, Anabaena spiroides and Microcystis spp. are common in summer and autumn, and give the water a bad taste and smell. Some of these blooms are also potentially toxic. Cell counts made on tap water in Bahía Blanca have revealed up to $1.6 \times 10^3$ cells ml$^{-1}$ showing that the conventional sand filtration and chlorination procedures are ineffective. The photograph below shows coils of A. spiroides (arrow marks a heterocyst).

Alexandrium fraterculus in Uruguayan waters

High levels of PSP were recorded in Uruguayan coastal waters in February 1992, as reported in HAN N° 2, p. 5. The species responsible was identified at that time as Alexandrium catenella. Subsequent consultation with Dr. E. Balech and Dra. R. Akselmann of Argentina has led to a re-identification, and it is now believed that we were dealing with Alexandrium fraterculus. It is also worth pointing out that the first toxic episode recorded in Uruguayan waters, in 1980, was attributed initially to Gymnodinium sp. This is now thought to have been A. fraterculus (Balech, pers. comm.).

Thus up until now, three species have been associated with toxic events with PSP in Uruguay: A. fraterculus, A. excavatum, and Gymnodinium catenatum.

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Chain of Alexandrium fraterculus.

(Gymnodinium kills farm fish in India)

About 5 tons of fish were found dead in a 7-acre brackish water fish farm at Kodi, Karnataka State, on the southwest coast of India during 11-15 December 1989. This fish farm had stocked Tilapia, Ethaturus and Cynops using wild seeds collected during high tide. No information was available on the stocking density in the pond at the time mortality occurred. Mortality was observed in all three varieties of fish stocked. On 11 December 1989 when mortality was first observed, a variant of Gymnodinium nagasakiense 22 μm long, 12 μm wide was observed at a concentration of 4 × 10⁶/L. Concentration came down to 7.4 × 10⁶/L on 13 December and 2.1 × 10⁶/L on 15 December. Inlet water was examined during high tide on 15 December and the same Gymnodinium species was observed at a concentration of 2.4 × 10⁶/L. Pond water collected on 11 December was centrifuged and cells deposited from 2 L were extracted with ethanol and dried by flash evaporation. The residues, resuspended in 0.1% Tween 60 in physiological saline, were lethal to mice on intraperitoneal injection. This confirms the toxicity of G. nagasakiense which we recently reported in this region (J. Shellfish Res., 11(2): 477-8, 1992).

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Note: G. nagasakiense (also called ‘type 65’ following an event in Omura Bay, Japan, that year) is morphologically identical to Gyrodinium aureolum, responsible for fish kills in Europe. Fukuyo, Y. et al. (in: ‘Red Tide Organism in Japan’, 1990) maintain that it is synonymous with Gymnodinium mikimotoi described by Oda from Cohaska Bay, Japan in 1935. Patensky, F. et al. (J. Phycol., 24: 408, 1988) provide a recent account of these problems.

(Cont’d from p. 1, ‘Pyrodinium bloom’) Habe) collected from the coastal water of Daram Island reached a maximum toxicity of 3,844 μg/100 g of shellfish meat.

In order to protect public health, the National Inter-Agency Committee on Environmental Health, upon recommendation from its Red Tide Task Force, imposed temporary bans on the harvesting, transporting and marketing of all kinds of shellfish from Carigara, Maqueda and Villareal Bays, and from the Samar Sea, immediately after the bloom was detected.

The issuance of auxiliary invoices, a requirement of the Department of Agriculture for the transportation of fishery products from one place to another, was suspended to prevent the movement of contaminated shellfish to other areas. Other quarantine measures, such as the establishment of checkpoints in strategic places like airports, piers and bus routes, were instituted.

Due to the adverse effect of the phenomenon on the livelihood of marginal fishermen, shellfish farmers, shellfish farm workers and vendors, the Office of the President declared several municipalities of the provinces of Leyte and Samar as disaster areas and released 5 million pesos (approximately US $196,850) for alternative livelihood projects of the affected fishermen.

As of this writing, motile Pyrodinium cells are still present in plankton samples collected from the two areas.

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¹Carigara Bay is about 550 km from Manila Bay, site of the Pyrodinium event reported in HAN N° 3, p. 1.
Pseudonitzschia pseudodelicatissima
... in Scandinavian coastal waters

From early July to mid-October 1992 massive blooms of the pennate diatom Pseudonitzschia (Nitzschia) pseudodelicatissima (Hasle, G.R., 1993, Nova Hedwigia, Deiheit 106, in press) were reported in the coastal waters of Denmark.

The first - and the only - time thus far that this species has been associated with the neurotoxin domoic acid was in the Bay of Fundy, Canada, in 1988. In late September, the species here comprised 99% of the total number of phytoplankton cells and the concentration reached 1.2 × 10⁵ cells per litre. Domoic acid was detected in both soft shell clams, Mya arenaria and blue mussels, Mytilus edulis. It was necessary to close some areas of the bay to mussel harvesting, since the concentration of domoic acid reached levels above 20 µg per g of whole mussel tissue. Pseudonitzschia pseudodelicatissima was taken into culture and shown to produce domoic acid (Martin, J. et al., 1990, Mar. Ecol. Prog. Ser., Vol. 67, pp. 127-182).

There are now three species in the genus Pseudonitzschia (Hasle, op. cit.). Known to produce domoic acid are: Pseudonitzschia australis Frenguelli, P. pseudodelicatissima and P. pingens f. multiseris (Hasle, op. cit.).

Under the light microscope Pseudonitzschia pseudodelicatissima may be identified by the width of the cell (1.5-2.5 µm) and the presence of a central interspace. The cells are linear and symmetrical along the longitudinal axis when seen in valve view. Electron microscopy is necessary for a critical identification. It reveals that the cell has 30-46 interstriae in 10 µm, 16-26 fibulas in 10 µm, and very characteristic poroids, which are covered by a distinctly perforated membrane (Fig. 1) (Hasle, G.R., 1965, Skr. Ugit Norske Vidensk. Akad. i Oslo I, Ser. n°. 18, pp. 1-29; Lundholm, N. and Skov, J., 1992, unpubl.).

The blooms in the Danish coastal waters were rather extensive (Fig. 2). The first reports of high cell numbers were from the Limfjord (280,000 cells per litre, 13 July) and the Isefjord (2.2 × 10⁶ cells per litre, 14 August), where it comprised 40% of the total number of cells in the plankton. During August the cell numbers increased to 2.8 × 10⁶ cells per litre in many areas, often representing 80-90% of the total cell number. In some areas the cell numbers decreased during September, while in others they continued to increase. In certain areas high cell concentrations seemed to occur in deeper water (7-18 m). Thus in the Lillebeld, on 8 September, 0.7 × 10⁶ cells per litre were found at 1 m, and a maximum of 14 × 10⁶ cells per litre at 14 m. During October the bloom decreased, although some areas still had high concentrations (e.g. 1.6 × 10⁶ cells per litre in Aarhus Bay, 7 October).

During the bloom, Pseudonitzschia pseudodelicatissima dominated in most areas, while the bluegreen alga Nodularia spumigena was reported to dominate in certain areas of Lillebeld. The summer of 1992 in Denmark was warm with practically no precipitation.

When cell numbers in an area reached 1 × 10⁷ cells per litre, the Ministry of Fisheries closed the area to harvesting of shellfish and it was not reopened until the level was low and stable.

At the end of July the first area (the Isefjord) was closed. Soon after (2 August) certain localities of the Limfjord were closed as well. By 29 August the whole Limfjord was closed. On the east coast of Jutland in Lillebeld, the bloom of Pseudonitzschia pseudodelicatissima coincided with DSP in mussels, and this area was closed from 9 August. On 23 August the southern part of the Isefjord was reopened, and later the northern part. Most localities of the Limfjord were reopened 20 October, and all were open by 22 October. In the first two weeks of November the last areas in the Lillebeld were reopened to shellfish harvesting.

Domoic acid was found neither in water samples (Helle Ravn, National Environmental Research Institute, pers. comm.) nor in blue mussels (Mytilus edulis) or oysters (Crassostrea gigas) (Ministry of Fisheries, Denmark and Matts Hagelton, Dept. of Food Hygiene, Swedish University of Agricultural Sciences, Uppsala, Sweden). Cultures of Pseudonitzschia pseudodelicatissima have now been established, and this facilitates further investigations on this species.

Apart from Danish waters, high cell numbers were reported from Norwegian coastal waters (Hasle, G.R., pers. comm.) and the west coast of Sweden.

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Fig. 1: Pseudonitzschia pseudodelicatissima. Fibulae, interstriae and striae with poroids covered by a perforated membrane are visible, ×24000, electron microscopical wholomount, material from Øresund, Denmark.
North Pacific coast of USA:
Toxic diatom blooms and domoic acid

Domoic acid (DA)-producing blooms of _Pseudonitzschia australis_ were first recognized on the Pacific coast of the United States at Monterey Bay, California in the late summer of 1991. This toxic event was signalled by the death of several brown pelicans and Brandt's cormorants in mid-September of 1991. DA was found in bird tissues and linked to feeding on northern anchovy, and ultimately to _P. australis_ cells upon which the anchovy had been feeding\(^3\). At the time of these seabird deaths, no DA measurements were being made, but plankton samples indicated that _P. australis_ abundances were approximately 6.5 to 20 x 10⁴ cells/L\(^2\). Measurements of DA levels at the University of California at Santa Cruz (UCSC) showed that toxin was present throughout November. Plankton analysis showed a peak of _P. australis_ abundance in late November, with cell counts reaching > 1 x 10⁴/L (Fig. 1a). Cells from the November bloom were isolated and shown to produce DA in culture\(^3\). No seabird deaths were associated with this November peak, probably because the anchovy were no longer congregated near the shore.

However, there was also an occurrence of DA poisoning to the north in Washington State during November, when fishermen had consumed DA-contaminated razor clams\(^4\). In addition to the razor clams, DA was also detected in the viscera of Dungeness crabs from the north Pacific coast\(^5\). Although no plankton samples were collected in Oregon and Washington during this event, it seems likely that the events in California and those further north were linked.

A toxic bloom of _P. australis_ reappeared in 1992 during our monitoring program. In net-collected plankton samples, DA was detected from 10 to 20 November 1992. _P. australis_ densities reached a maximum of approximately 4 x 10⁴ cells/L during this bloom\(^6\). Although DA was measured in top smelt collected during the November bloom, and cormorants were observed diving and feeding on these fish, no seabird deaths were reported during this period. Interestingly, and unlike the 1991 event, DA was not detected in California mussels, which are sampled by the California Department of Health Services as part of a PSP and DA monitoring program\(^7\). Therefore, questions remain about whether this species is an appropriate ‘sentinel’ organism to detect DA toxicity on the Pacific coast.

In our preliminary examination of archived plankton samples at UCSC, we confirmed that there were massive blooms of _P. australis_ in the winter of 1977, but the species had been misidentified as _P. seriata_\(^8\). Thus, although blooms of _P. australis_ have previously been present, there is no evidence of toxicity in Monterey Bay prior to 1991. During our monitoring of the plankton in February 1992, we also found _P. pungens_ f. _multiseriatus_\(^8\), but no toxin was detected in net-concentrated plankton samples during this period.

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Monitoring Galician coastal waters

In March 1992, the autonomous government of Galicia, northwest Spain, in collaboration with the Spanish Institute of Oceanography (IEO) began a new monitoring system to:

- determine the presence and abundance of organisms already known to be toxic;
- determine the composition and biomass of phytoplankton populations with the aim of forecasting the appearance of future toxicity;
- determine the atmospheric and hydrographic conditions associated with the appearance of particular species of phytoplankton, with a view to developing predictive indices;
- determine the nutrient concentrations associated with phytoplankton populations, and to relate these and their delivery to the rías with the appearance or increase in frequency or biomass of taxonomic groups which may cause problems as a result of their toxicity or abundance, and
- create a data base on phytoplankton populations and environmental conditions which can be used by any marine research team, especially those interested in toxic phytoplankton and marine biotoxins.

Two kinds of stations have been established: (i) primary stations are situated in the rías where aquaculture is most intensive, and (ii) secondary stations lie along the coast not covered by the primary ones. Sampling at the former is done by laboratory personnel, and at the latter by collaborating organizations and aquaculture companies operating in the region. Samples are taken weekly at all stations throughout the year.

Oceanographic conditions are determined, at primary stations only, by profiling the water column with a CTD (conductivity, temperature, depth) system provided with sensors for pressure, temperature, salinity, pH, dissolved oxygen, and optical transmission.

Integrated water samples are taken using Lindahl’s (1986) technique, and net samples of phytoplankton with half-sized bongo nets with 10 μm mesh. Phytoplankton biomass is quantified by vertical profiles of in vivo fluorescence using a fluorometer integrated with the CTD system. Pigments are also determined in the integrated samples by the spectrofluorometric method of Neveux et al. (1987). An autoanalyser is used to measure nitrate, nitrates, phosphates, silica, and ammonia levels in the integrated samples.

Data management and the issuance of reports are handled by a development of the MS-DOS system (for the local network Novell Netware) in Clipper and C languages (compatible with dBASE). It has a modular structure with the following features:

- general management and issuance of reports, charged with processing and synthesizing information arriving from other units;
- collection and processing of CTD data and associated sensors;
- reading and processing spectrofluorometric data;
- management of taxonomic list and cell counts;
- management of photomicrograph data;
- internal transfer of data from the different units to the central computer;
- transfer of weekly reports by fax and modem;
- management of historical data base stored on optical disc, and selective extraction of information required by other research groups.

Normally, the establishment of monitoring programmes must be justified in economic terms. Justification here is the enormous socio-economic importance of marine resources in Galicia and the requirement for systematic and detailed attention to the phytoplankton community in order to forecast toxic and noxious episodes.

Monitoring of the marine environment is always costly, but its profitability varies in an important way as a function of the planning and objectives. Thus it can be very expensive if it is only aimed at keeping alert to toxic phytoplankton and some parameters which reflect environmental conditions, but very profitable if the data obtained are of high quality, and are immediately available to research groups as backup information to their programmes, and if a good data base is created.

An important factor to bear in mind, based on the experience acquired during the seventeen years throughout which the IEO was responsible for the control of red tides, is that it is difficult to combine the requirements of a monitoring programme of this kind with the simultaneous development of research programmes by the same team. For this reason, it was decided that the basic monitoring work would be done by a team of technical staff, and that the role of the biologists would be limited to exhaustive quality control of the determinations carried out. Thus our team consists of two biologists and five technicians. The biologists are responsible for the taxonomic lists and supervision of the techniques and equipment used, the preparation of reports, and the interchange of information with research centres. The technicians undertake the sampling, cell counting and processing, and analysis of the samples.

Since research is essential if the quality of monitoring is to be maintained, we have established collaboration with the four marine research institutes and the three universities which exist in Galicia. These institutions assist us by training personnel, updating techniques and procedures, and by intercalibration; in exchange, they receive the information we obtain from the monitoring as well as samples or data which aid their research projects.

The viability and profitability of this monitoring programme is confirmed after almost one year of operation by the quantity of important information which has been acquired, the prompt transmission by fax or modem of the weekly reports of oceanographic conditions and phytoplankton in Galician coastal waters, and by the enthusiasm and collaboration of the research centres.

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* We have added the Sutherland et al. reference below, which is a more accessible and updated description of a pipe sampler.


Mediterranean invasion by the toxic seaweed

* Caulerpa taxifolia *

The green, toxic macroalga * Caulerpa taxifolia* (Vahl) C. Agardh is native to the shores of all tropical oceans. Recently it has been used in tropical seawater aquaria, in part because its toxins keep them free from both epibions and the attention of herbivores. The Oceanographic Museum at Monaco made extensive use of it in its public displays, and in 1984, the alga was found growing on the shore just below the Museum. This did not engender concern, as it was assumed that * C. taxifolia* would be unable to survive the Mediterranean winter.

The discovery, in 1989, of *C. taxifolia* growing in a much used anchorage for pleasure boats, Cap Martin, 1.5 km to the east, took algalogists by surprise. Further spreading has now occurred, probably by both drifting of fronds and/or swarms over distances up to 500 m, while larger scale spreading, over hundreds of km, may be due to the movement of boats with the alga entangled in their anchors and fishing nets. Dumping from other aquaria is also suspected in at least one case. The alga survives local winter water temperatures of 11-13°C, suffering slight depigmentation and die-back in the colder, near-surface waters. Growth and spreading take place from June to December, when temperatures exceed 18°C.

Over 26% of the 16 km stretch of coast west of the Franco-Italian border (including Monaco) is colonized. Further isolated centres are present between the Italian port of Imperia and the French port of Toulon, but a 3-5 m² patch at Saint-Cyprien was cleared, with apparent success, by the divers who discovered it. So far, new centres have been reported at the Spanish port of Palma de Mallorca, where 1.5 ha are covered, and at the Italian port of Livorno.

At least eight seaweed species have already been accidentally introduced into the Mediterranean. They include the Chlorophyceae * Codium fragile* (Suringer) Hariot, the Fucoxophyceae * Colpomenia peregrina* (Sauvageau) Hamel, *Undaria pinnatifida* (Harvey) Suringar, *Laminaria japonica* Arescough and *Sargassum muticum* (Yendo) Fensholt, and the Rhodophyceae *Asparagopsis armata* Harvey, *Acrothamnion preissii* (Sonner) Wollaston and *Chrysymenia wrightii* (Harvey) Yamada. Unlike any of them, however, *C. taxifolia* colonizes all types of substrate, from rock to mud, and all types of coast except for the most exposed, whether polluted or not. The depths affected are from the surface to 52 m, but between 5 and 15 m, colonization is most vigorous. Both from observations of the patch below the Oceanographic Museum and from work on a much larger scale since 1989, Boudouresque, Meinesz and co-workers estimate that *C. taxifolia* is increasing exponentially by a factor of 6 per year, in biomass of 2-3.5 kg/m² (wet weight), representing 3.5-10 g/m² of caulerpenytoxin.

In the Mediterranean, *C. taxifolia* contains larger amounts than in its original habitat of both oxytoxin and the sesquiterpenic toxin, caulerpenyne. In addition, four new sesquiterpenes, termed Taxifolial A, B, C and D, have been isolated and characterized from Mediterranean material. Early fears, by some Côte d’Azur fishermen’s organizations, that herbivorous fish and urchins could be rendered toxic to humans through incorporation of these toxins from *C. taxifolia*, now seem unfounded, as the herbivores have not switched to eating the invader, even when their original food is eliminated. Vigilance is required, however.

As well as tolerating temperatures lower than in its original range, and producing more toxin, Mediterranean *C. taxifolia* grows fronds 20 to 65 cm long, compared with only 2 to 15 cm in its original habitats. This has led to suggestions that the invader may have evolved new genotypic traits (cold tolerance, larger size, more abundant and diverse toxins) which are helping it to outcompete existing species and resist grazing. *C. taxifolia* has already invaded meadows of the seagrass, *Posidonia oceanica*, already declining under pressure from coastal pollution and reclamation. In the Monaco-Cap Martin area, sparser *Posidonia* beds have succumbed to *C. taxifolia*, but denser beds appear to be resisting it, at least for the present. *Posidonia* meadows represent a key biotope in the Mediterranean littoral. The *Posidonia* and its attached animals and plants provide food, shelter and important nursery grounds for commercial fish, shellfish and urchins. As *C. taxifolia* bears no epibions and does not represent food for existing animals, the effect of their stands on coastal fisheries is likely to be severe. Nevertheless, it remains to be seen to what extent decomposition of old, toxic fronds might support detritivore communities, and to what extent these fronds may pose a problem when they eventually wash up on tourist beaches.

Even in France, some aquarium shops are still supplying *C. taxifolia* to decorate the increasingly fashionable tropical marine aquaria. To reduce the rate at which distant centres of spreading are established, it would seem essential to ban this practice immediately in all Mediterranean countries, and as rapidly as possible to target information at seawater-aquarium dealers and owners about the danger of discharging *C. taxifolia* (and water with which it had been in contact) into the sea or into coastal rivers and drains.

Even with these precautions, it would seem possible that much of the Mediterranean coast (and perhaps nearby Atlantic ones) will be colonized in the next 10 to 20 years, and much of the existing biota replaced. Although some invading species lose their dominance with time, not all do so, and there is no evidence yet to suggest that *C. taxifolia* will. No time should be lost establishing an infrastructure to help inhabitants of the Mediterranean littoral, particularly those dependent on inshore fishing, prepare for the likely ecological, economic and social changes.

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Selected references:


ICES - IOC Study Group meeting on harmful algae

The ICES-IOC Study Group (SG) on the dynamics of harmful algal blooms (HABs) met in Charleston, North Carolina (USA), 8-11 February 1993, to continue discussions and programme development begun in Vigo (Spain) in 1992 (see HAN Nr 2, p. 7). On this occasion, two days of the meeting were held jointly with the ICES Shelf Seas Oceanography Working Group.

Drs. Henrik Enevoldsen, HAB Programme Coordinator, IOC, and Bernt I. Dyberv, Chairman of the IOC-FAO ad hoc Intergovernmental Panel on HABs gave accounts on the development and organization of the HAB Programme.

The SG participants agreed that it would be advantageous for both IOC and ICES if cooperation on HABs could be increased between the two organizations. This would require a more coherent organization of the question within ICES. Until now, problems related to HABs have been dealt with by several groups. However, HABs are special and, in many parts of the world (including the ICES area), they are of immense importance, causing damage to ecosystems, fisheries, aquaculture and human health.

In view of the importance of HABs from the scientific and the management viewpoints and in order to facilitate contacts with other organizations, it was proposed that there be a special body within ICES to take care of HAB problems.

In accordance with this proposal it was decided to recommend to ICES that the Study Group on Dynamics of Algal Blooms be transformed into a working group on harmful algal blooms, and some preliminary terms of reference were drafted.

Other plans discussed for the future were the holding of two workshops, one in which modelling approaches to HABs would be developed, and another in which different techniques for the in situ estimation of algal division rates would be compared.

Perhaps the most important result of this meeting was the fruitful interaction that took place between the ‘subcultures’ of biology and physics with their distinctive approaches to problem solving. It was agreed that this interaction should become an integral part of the proposed new ICES working group on HABs.

The Editor

Future events

AUGUST 93

IOC Training Course on the Taxonomy of Harmful Marine Phytoplankton, 16-28 August, Copenhagen, Denmark.

OCTOBER 93

Sixth International Conference on Toxic Marine Phytoplankton, 18-22 October, Nantes, France. Contact: Cité des Congrès, 5 rue Valmy, 44041 Nantes Cedex 10, France; tel: (33) 4037 4130; fax: (33) 4037 4075.

Eleventh International Symposium of the World Association of Veterinary Food Hygienists (XI WAVFHV), 24-29 October, Bangkog, Thailand. Contact: Dr. Vanda Sujari, Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand; tel: (66-2) 5797539; fax: (66-2) 5797871/5790524; telex: 21957 RECOFT TH.

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, 2nd session, 14-16 October, Paris, France. Contact: IOC Secretariat, Paris (see address below).

NOVEMBER 93

Environmental Management of Enclosed Coastal Seas (EMECS) - Change of dates from 19-21 July to 10-13 November, Baltimore, Maryland, USA. Contact: Helene Tenner, EMECS Secretariat, Tawes State Office Building, Taylor Avenue, Annapolis, Maryland 21401, USA; tel: (1-410) 974 5047; or Dorothy Peterson, Sea Grant College, University of Maryland, USA; fax: (1-301) 314 9581.

12th Biennial International Estuarine Research Conference, 14-18 November, Hilton Head, SC, USA. A session will focus on all aspects of phytoplankton blooms. Individuals wishing to present papers or posters should send their abstract and fee of US $20 (made out to ERF93 Conference) to: Kevin Sellner, Benedict Estuarine Research Laboratory, ANS, Benedict, MD 20612, USA; tel: (1-301) 274 3134; fax: (1-301) 274 3137; omnet: benedict.lab.

HARMFUL ALGAE NEWS

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