GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Alexandrium minutum***

Alexandrium minutum 简体中文 正體中文 **System:** Marine

Kingdom	Phylum	Class	Order	Family
Plantae	Pyrrophycophyta	Dinophyceae	Gonyaulacales	Goniodomataceae

Common name red tide phytoplankton (English), red tide dinoflagellate (English)

Synonym
Alexandrium ibericum , E. Balech 1985
Alexandrium lusitanicum , Balech
Pyrodinium minutum , (Halim) Taylor�
Alexandrium minutum , Halim, 1960 NIMPIS, 2006

Similar species *Alexandrium andersoni, Alexandrium angustitabulatum, Alexandrium camurascutulum, Alexandrium hiranoi, Alexandrium lusitanicum, Alexandrium tamarense, Alexandrium tamutum*

Summary Alexandrium minutum is a small dinoflagellate that forms algal blooms in many coastal regions around the world. It was originally described from a red tide in the Alexandria harbour. Toxins produced in high concentrations by these single-celled organisms are responsible for many global cases of paralytic shellfish poisoning (PSP) in humans. Toxins may also affect other components of the ecosystem including mammals, birds, fish and zooplankton.

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Species Description
Alexandrium minutum is a toxic single-celled armoured dinoflagellate that is well characterised morphologically in Balech, 1995. Cells are spherical in shape and small-sized, 15 to 29 um in diameter. The cell is green-brown in colour with a theca (clear protective covering). Small details on this theca differentiate *A.minutum* from other *Alexandrium* species. Cysts of *A. minutum* are from spherical to slightly flattened in shape and from circular (25–35 um diameter) when seen from above to oval (28–35 um long, 20–30 um wide) in lateral view. The most common cell content is granular material and a more or less condensed yellow–orange accumulation body. Nevertheless, globular content is also observed in some cysts (Bravo *et al*., 2006).

Habitat Description

Alexandrium minutum is found in warm, temperate, coastal and estuarine waters. It has been reported over a number of geographical areas and in a wide range of coastal hydrographic regimes (i.e. Hallegraeff *et al*., 1988; Yoshida *et al*., 2000; Usup *et al*., 2002; Vila *et al*., 2005). *A. minutum* is the most widespread toxic PSP species in the Mediterranean Sea, and is one of the two main causative organisms responsible for the incidence of PSP in Southeast Asia (Vila *et al*., 2001; Lim *et al*., 2006). It seems to be restricted to coastal enriched sites, particularly harbours, estuaries or lagoons (Giacobbe *et al*., 1996, Vila *et al*., 2005). In the field *A. minutum* has been related to low salinities and nutrient-rich freshwater inputs in such way that the existence of local freshwater outflows seems to be an important factor in the ambient where this species blooms (Cannon 1990, Erard-Le Denn 1993; Vila *et al*., 2005). However, the euryhaline and eurytherm character of this species is well known and has been proved from culture experiments (Grzebyk *et al*., 2003, Cannon 1996). The growth rate of *A. minutum* increases with increasing temperature and irradiance (Lim *et al*., 2006); nevertheless it has shown that it is also possible reach relatively high growth rates (up to 0.5 div day-1) at 12ºC after a period of adaptation (Cannon 1996). Cysts in bloom areas are associated with fine organic estuarine and coastal sediments, e.g. along the Catalan coast (NW Mediterranean Sea) blooms are associated with local accumulation of cysts in confined water areas (Garcés *et al*., 2004, Bravo *et al*., 2006).

Reproduction

Reproduction in *A. minutum* is asexual and sexual. *A. minutum* reproduces asexually by binary fission. In sexual reproduction, gametes fuse to produce resting cysts. Cysts fall into sediment and lie dormant until conditions are favourable. They then germinate to produce vegetative cells (Probet *et al*., 2002). Blooms of *A. minutum* generally occur in spring, when the water column is stable, nutrients availability is high and conditions are suitable for germination of cysts. Growth is influenced by temperature, light and nutrient availability (NIMPIS, 2002).

Nutrition

Trophic status: Primary Producer

General Impacts

Alexandrium minutum produces toxins which are toxic to some zooplankton and fish and can reduce copepod reproduction. The toxins are bioaccumulated in zooplankton, shellfish and crabs, the consumption of which can lead to paralytic shellfish poisoning (PSP) in humans and other mammals. The toxins responsible for this disease are neurotoxins, which in humans may cause muscular paralysis, neurological symptoms and, in extreme cases, death (Hallegraeff, 1993; Van Dolah 2000). Due to the potential for disease outbreak the occurrence of algal blooms near shellfish farms usually results in their closure, which results in economic losses. Prohibition of wild harvesting will also impact on local tribe or populations that rely on shellfish as a food source (Magda Vila., pers.comm., 2007).

Management Info

Preventative measures: The monitoring of coastal waters for the presence of harmful algae normally involves microscopic examinations of phytoplankton populations. These procedures are time consuming and require a great deal of taxonomic experience. A study by Galluzzi and collegues (2004) outlined the use of molecular tools to help detect the presence of target microorganisms in marine field samples. In the study they developed a real-time PCR-based assay for rapid detection and quantification assay of all toxic species of the *Alexandrium* genus in both fixative-preserved environmental samples and cultures. Quantification results were compared with standard microscopy counting methods. The two methods gave comparable results, confirming that real-time PCR could be a valid, fast alternative procedure for the detection and quantification of target phytoplankton species during coastal water monitoring. \r\n
A two year study was undertaken for the Department of Environment and Heritage (Australia) by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to identify and rank introduced marine species found within Australian waters and those not found within Australian waters.
All of the non-native potential target species identified in this report are ranked as high, medium and low priority, based on their invasion potential and impact potential. *Alexandrium minutum* is identified as one of ten potential domestic target species most likely to be spread to uninfected bioregions by shipping. *A. minutum* is also identified as one of ten most damaging potential domestic target species, based on overall impact potential (economic and environmental). A hazard ranking of potential domestic target species based on invasion potential from infected to uninfected bioregions identifies *A. minutum* as a 'high priority species' - these species have a reasonably high invasion potential and their impact potential is the highest of all the potential domestic target species.
For more details, please see Hayes *et al.* 2005.
The rankings determined in Hayes *et al.* 2005 will be used by the National Introduced Marine Pest Coordinating Group in Australia to assist in the development of national control plans which could include options for control, eradication and/or long term management.
Following an algal bloom in the Penzé River, France in 1997, *Alexandrium* cells were observed to be infected by sporocysts of the parasite *Parvilucifera* (Apicomplexan) (Erard-Le Denn *et al.,* 2002). The parasite was also reported from Spain infecting *A. catenella* during a bloom in Tarragona harbour (Delgado, 1999) and from scandinavian waters infecting *Dinophysis* (Norén *et al*., 1999). The parasite was found to infect laboratory cultures of several other dinoflagellate species, and estimates of parasite-induced mortality indicate that this parasite is capable of removing a significant fraction of dinoflagellate biomass in a short time, raising the possibility of its use as a biological control agent of toxic dinoflagellate blooms (Delgado, 1999; Erard-Le Denn *et al*., 2002). However, the effect of this parasite on natural population of A. minutum populations did not induce to the bloom decrease at least in two bloom episodes (Probet, 1999; Vila *et al*., 2005).

Pathway

The red-tide dinoflagellate may be accidentally transferred with ballast water (Hallegraeff and Bolch 1992, NIMPIS, 2002).The red-tide dinoflagellate may be accidentally transferred with transfer of rocks, sand and shellfish (Laabir and Gentien, 1999, NIMPIS, 2002). There is a potential risk of infection of new areas by the translation of sediments rich in cysts due to draining of sediments from areas recurrently affected by *A. minutum* blooms (e.g. harbours) (Magda Vila., pers.comm., 2007)

Principal source: NIMPIS 2002. *Alexandrium minutum* reproduction & life cycle. National Introduced Marine Pest Information System (Eds: Hewitt C.L., Martin R.B., Sliwa C., McEnnulty, F.R., Murphy, N.E., Jones T. & Cooper, S.)
Vila M, Giacobbe MG,*et al.*., 2005. A comparative study on recurrent blooms of *Alexandrium minutum* in two Mediterranean coastal areas. Harmful Algae 4 673–695

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Review: Dra. Magda Vila Reig, Departament de Biologia Marina i Oceanografia Institut de Ciències del Mar, CMIMA Barcelona, Catalunya, Spain

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ALIEN RANGE

[1] ATLANTIC - NORTHEAST
[2] AUSTRALIA
[1] DENMARK
[1] EGYPT
[1] IRELAND
[1] MALAYSIA
[2] MEDITERRANEAN & BLACK SEA
[1] NEW ZEALAND
[1] PORTUGAL
[1] SPAIN
[1] SWEDEN
[1] TAIWAN
[1] TURKEY
[1] UNITED KINGDOM
[1] UNITED STATES

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HAE-DAT, undated. IOC-ICES-PICES Harmful Algae Event Data Base: HAE-DAT
Summary: HAE-DAT is a meta data base containing records of harmful algal events. HAE-DAT contains records from the ICES area (North Atlantic) since 1985, and from the PICES area (North Pacific) since 2000 (in prep.). IOC Regional networks in South America and North Africa are preparing to start contributing.
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Summary: The North European and Baltic Network on Invasive Alien Species (NOBANIS) has developed a network of common databases on alien and invasive species of the region. By establishing a common portal access to IAS-related data, information and knowledge in the region is facilitated. The NOBANIS network has a national contact in each of the participating countries - Denmark, Estonia, Finland, Faroe Islands, Germany, Greenland, Iceland, Latvia, Lithuania, Norway, Poland, Sweden and the European part of Russia.
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