

# HABIT

## Harmful algal blooms species in thin layers

### The Challenge

Harmful algal blooms (HAB) are a global problem. The HABIT project researches the development and dispersion of Harmful Algal Bloom populations in sub-surface micro-layers. Very little is known about the nutrition, behaviour and trophic relationships within thin layers of phytoplankton and research into these topics has been slow and sporadic. There is a need to quantify the role of small scale physical processes in maintaining harmful phytoplankton in discrete thin layers. Research also needs to define the essential chemical and biological interrelationships which control the development of harmful populations within these layers.

HABIT focused on a group of phytoplankton, the Dinophysis group of species, which has the most serious impact on the economic development of the European coastal zone. Although knowledge on Dinophysis ecology is still relatively poor compared with other HAB species, it is generally agreed that one major factor controlling the build-up of populations lies in the hydrodynamic regime.

It is recognised that thin layers of dinoflagellates (and other HAB taxa) can require retention zones structures on the coastal shelf for populations to develop with a high-density. These zones were investigated as incubators for thin layers of Dinophysis. State of the art 3D physical models were utilised so that the formation, persistence and movement of these structures can be modelled and predicted. In this way, the origins of economically devastating HAB events can be identified and information given to policy makers and managers. **Prediction of naturally occurring HAB events is the only mitigation action possible.**

### Project Objective

The overall objectives of HABIT were to resolve fundamental patterns in the occurrences of Dinophysis and quantify the processes that are important in governing their distribution. HABIT measured and quantified the physical and biological parameters important in the maintenance of these layers. The central theme was to research the development and dispersion of HAB populations in sub-surface micro-layers.

### Key Points

- To investigate the maintenance and persistence of high density thin layers through studying interactions between fine scale physical diffusion and net growth and trophic relationships within them
- To investigate the precise role of small scale structures on the coastal shelf as incubators for accumulations of Dinophysis

#### EATiP Thematic Area of Relevance

**TA1:** Product Quality, Consumer Safety and Health

**TA2:** Technology and Systems

**TA3:** Managing the Biological Lifecycle

**TA4:** Sustainable Feed Production

**TA5:** Integration with the Environment

**TA6:** Knowledge Management

**TA7:** Aquatic Animal Health and Welfare

**TA8:** Socio-Economics and Management

#### Key Words

Harmful Algal blooms (HABs), occurrence, distribution, monitoring

#### Project Information

**Contract number:**

3932

**Contract type:**

Specific Targeted Research Project

**Action line:**

SUSTDEV-2004-3.III.4.4 Harmful algal blooms in European marine and brackish waters

**Duration:**

39 months (01/06/2005 - 31/08/2008)

**Coordinator:**

Dr. Robin Raine - Martin Ryan Institute, National University of Ireland Galway, Ireland

**Tel:**

+353 91492271

**E-mail:**

robin.raine@nuigalway.ie

**Project website:**

No longer live



- To utilise physical models to examine the formation and persistence of gyres on the shelf, to predict their transport, and as a consequence HAB events at the coast.

## Output Highlights

During the project, sub-surface thin layers of harmful algae were observed along the Atlantic seaboard of Europe from Spain up to Ireland. Key scientific findings were:

1. The inadequacies of conventional sampling methodology in identifying, sampling and examining the behaviour of sub-surface thin layers
2. The role of coastal gyres and coastal jets in transporting thin layers of harmful algae onto the coast
3. The effect of medium scale physical processes such as upwelling/downwelling in controlling the geographic distribution of thin layers
4. The role of small and fine scale processes such as horizontal shear in maintaining thin layers of much less than 5 m thickness

The findings have significantly increased our ability to predict the occurrence of harmful blooms, particularly off southwestern Ireland. It is now possible to double the forecast range, currently extending 5-6 days ahead.

### The Full Report:

The final summary report is being published on the EC Cordis website. Copies of the report are also available from the project co-ordinator, Dr. Robin Raine.

## Next Steps – Suggested Actions/Follow On



### RTD

- The value of integrating European research in the field of HABs has been recognised for some time.
- The results of the project are applicable to any HAB species, many of which occur and accumulate in thin layers.



### Networking

- This project established a network of marine scientists on the western coast of Europe, thus contributing to national and European initiatives. On a global scale, HABIT is endorsed by GEOHAB, the UNESCO/SCOR programme on Harmful Algal Blooms which aims at fostering international collaboration on HAB research. HABIT was part of the implementation of the GEOHAB Core Research Project on HABs in the Stratified Environment. The network established in HABIT has also been involved in collaborative work since the end of the project.

## Related Publications/Projects

Gentien, P. Donaghay, P., Yamazaki, H., Raine, R., Reguera, B. and T. Osborn. 2005. Harmful Algal Blooms in Stratified Environments. *Oceanography*, 18, 172-183.

Hongqin Xie, Pascal Lazure, and Patrick Gentien. 2007. Small scale retentive structures and Dinophysis. *Journal of Marine Systems*, 64, 173-188

Velo-Suárez, L., González-Gil, S., Gentien, P., Lunven, M., Bechemin, C., Fernand L., Raine R. and B. Reguera. 2008. Thin layers of *Pseudo-nitzschia* spp and the fate of *Dinophysis acuminata* during an upwelling-downwelling cycle in a Galician Ría. *Limnology and Oceanography* 53(5), 1816-1834.

GEOHAB 2008. – Global Ecology and Oceanography of Harmful Algal Blooms, GEOHAB Core Research Project: HABs in Stratified Systems. P. Gentien, B. Reguera, H. Yamazaki, L. Fernand, E. Berdalet and R. Raine, (Eds.). IOC and SCOR, Paris. 59 pp.

Velo-Suárez, L., B. Reguera, E. Garcés and T. Wyatt. Vertical distribution of division rates in coastal dinoflagellate (*Dinophysis* spp.) populations: implications for modelling. *Mar. Ecol. Prog. Ser.*, 385, 87-96.

R. Raine, G. McDermott, Joe Silke, K. Lyons, G. Nolan and C. Cusack. 2010 A Simple Short Range Model for the Prediction of Harmful Algal Events in the Bays of Southwestern Ireland. *Journal of Marine Systems*, in the press.

Farrell, H., L. Fernand, P. Gentien, M. Lunven and R. Raine. Observations of transport of *Dinophysis acuta* in a coastal jet along the coast of Ireland. *Proceedings of the XIII International Conference on Harmful Algae*, Hong Kong, 2008.