

# Allelopathic effects of *Zostera marina* and *Zostera noltii* on the growth of the toxic dinoflagellate *Alexandrium catenella*



Mohamed Laabir<sup>1\*</sup>, Micheline Grignon-Dubois<sup>2</sup>, Bernadette Rezzonico<sup>2</sup>, Philippe Cecchi<sup>1</sup>, Manuel Rouquette<sup>1</sup> and Estelle Masseret<sup>1</sup>

<sup>1</sup>UMR 5119 UM2-CNRS-IFREMER-IRD Ecosystèmes Lagunaires, Université Montpellier 2, Place Eugène Bataillon, 34095 Montpellier Cedex 05, France.

<sup>2</sup>Phytochimie et Valorisation de la Biomasse (PhyValBio), Université Bordeaux I, 351, cours de la Libération, 33405 Talence cedex, France.

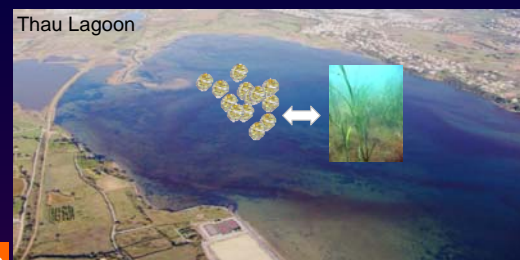
\*Mohamed.laabir@univ-montp2.fr

ECOLAGUNES Project

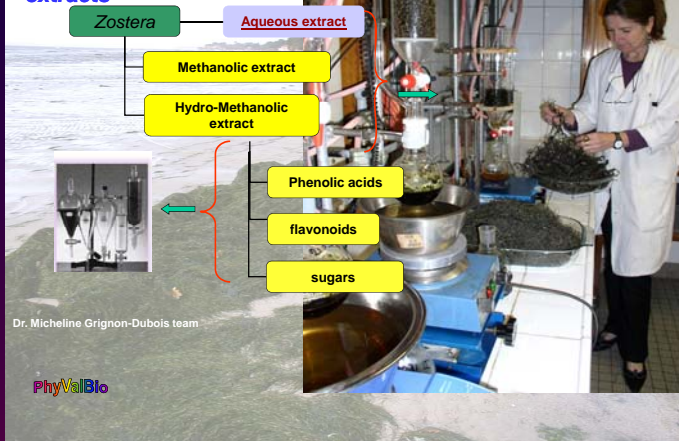
## Introduction

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In the Thau lagoon (a French Mediterranean coastal lagoon), a bloom (85000 cells.l<sup>-1</sup>) of *Alexandrium catenella* occurred for the first time in November 1998. Later similar episodes appeared regularly in spring and autumn reaching high cell concentrations (5\*10<sup>6</sup> cells.l<sup>-1</sup>) that induced the closing of shellfish farms. Allelopathy is a process implying secondary metabolites excreted by plants and micro-organisms which affects the competitive efficiency of the coexistent organisms. *Zostera marina* and *Zostera noltii* produce bioactive molecules as zosteric acid, a sulphated natural product able to prevent settlement of some marine bacteria, algae, barnacles and tube worms at non-toxic concentrations. These seagrass species contain also rosmarinic acid which have been reported to have a number of biological activities *in vitro*, such as antiviral, including human immunodeficiency virus 1, antibacterial, antioxydant, anti-inflammatory and anticarcinogenic. Water-soluble extract of *Z. marina* leaves inhibited the growth of micro-algae and many marine bacteria.



## Preparation of the tested extracts



## Objectives

The present study investigates non-nutrient relationship between two dominant seagrass species and *A. catenella* a toxic dinoflagellate blooming worldwide which is often responsible of paralytic shellfish poisoning events. Aqueous and methanolic crude extracts were prepared from two seagrasses, *Z. marina* and *Z. noltii* which were collected on the beaches of Arcachon lagoon. The potential allelopathic effects of different concentrations of these extracts have been tested on the growth of *A. catenella* (strain collected in Thau in 2003) by using bio-essays.

## Methods

*A. catenella* was grown in batch cultures using ESAW medium (Harrison et al. 1980) under appropriate light (100 μmoles.m<sup>-2</sup>.s<sup>-1</sup>) and temperature (20 ± 1 °C) conditions. To test allelopathic effect of *Zostera* species, target species was cultivated in culture medium with different concentrations of the extracts. Nutrients were added at (t0) in order to control the nutrient concentrations in the different tested treatments, including controls.

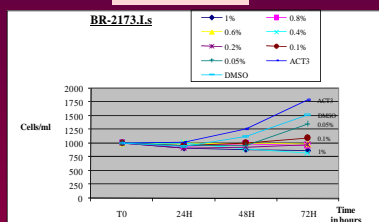


## Results

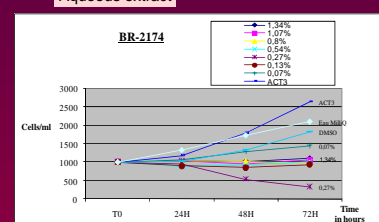
### Extracts from *Zostera noltii*

### Inhibition of *A. catenella* growth

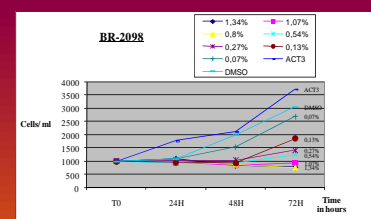
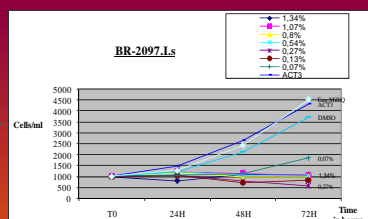
#### Methanolic extract



#### Aqueous extract



### Extracts from *Zostera marina*



## Inhibition of photosynthetic activity

Recent results (no shown here) clearly indicate that methanolic extract (BR.2173.I.S) of *Z. Noltii* have also a significant negative effect on the photosynthetic activity of *A. Catenella* (Phytopam fluorescence measurements during microcosm's experiments).

Our observations using photonic microscope showed that cells which stopped to divide in the presence of very low concentrations of the tested extracts presented morphological anomalies and lysis.

These results highlighted the strong inhibition effect exerted by natural extracts of *Zostera* sp. on the growth of *A. catenella*, even at very low concentrations. Extracts from leaves of *Zostera* species originated from Thau lagoon will be tested. Additional experiments will be dedicated to test the effect of continuous release of allelochemicals from the fresh seagrass tissues on the growth and the physiological activity of *A. catenella*. Because of the severe economic and public health caused by harmful microalgae, the allelopathic substances from *Zostera* detritus may be considered as potential candidates to mitigate the effects of harmful algal blooms on shellfish aquaculture in lagoons.