THE CHANGES IN SPECIES COMPONENTS AND THE DENSITY OF TOXIC ALGAE IN CONCENTRATED MOLLUSC CULTURE AREA IN BAN SEN – VAN DON – QUANG NINH

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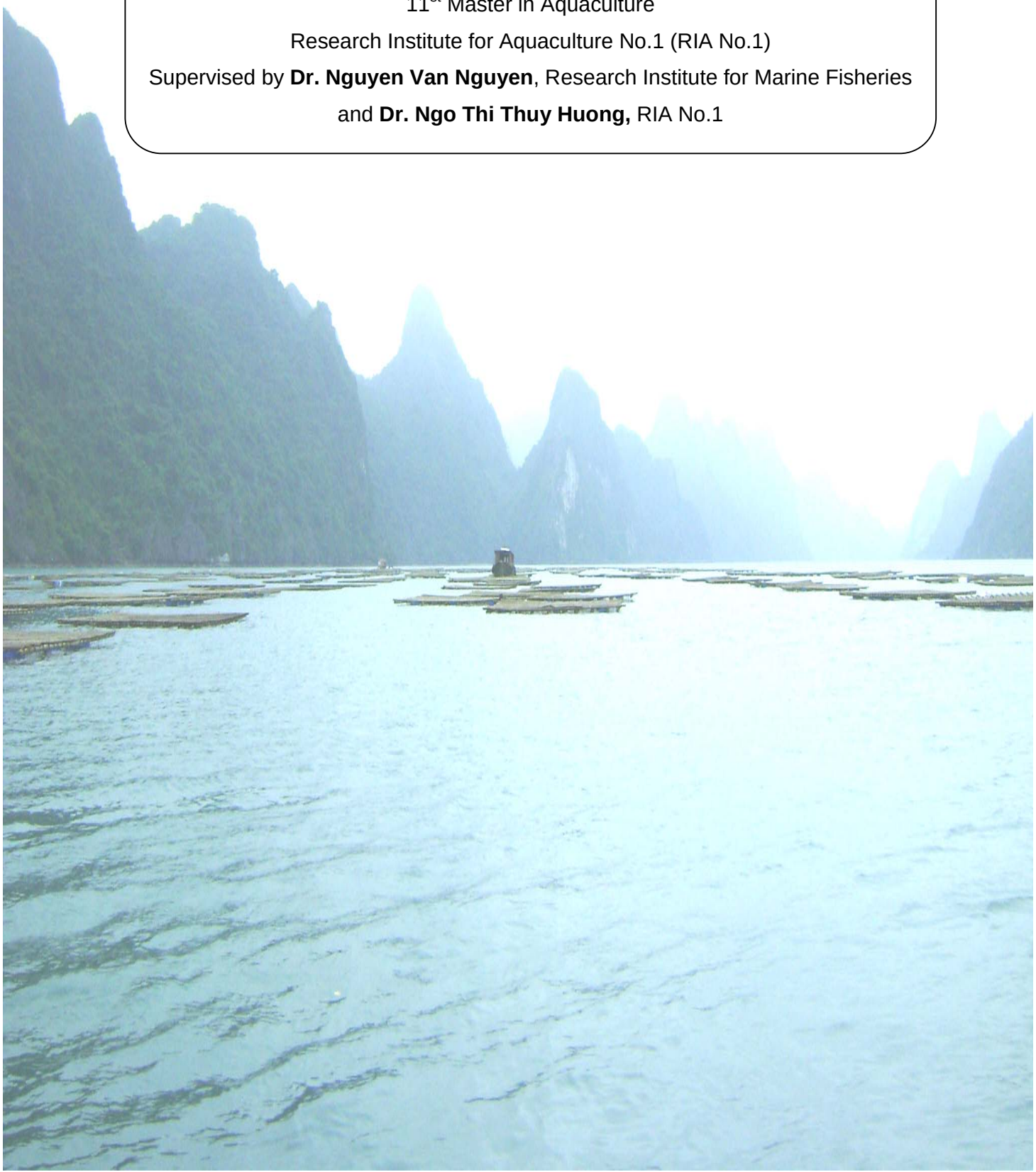


Servey and determine the sample collection area

Mollusc concentrated cultivation area in Ban Sen

Van Don is an archipelago around the northeastern of Bai Tu Long Bay with 2800 ha open-water aquaculture, including ponds, lagoons, tidal flat, in which approximately 1530 ha of mollusc culture, mainly pearl oyster, snout otter clam, oysters and snail, with 400 households involved. In 2008, production of mollusc in Van Don was about 500 tones, which was produced by 500 households and 15 companies (Vietnam Fishery, 2008) and production of snout otter clam in 2009 was about 800 – 1000 tones.

One of the advantages of mollusc culture is that the farmers do not have to supply the artificial food, only based on the availability of natural food. Thus, mollusc culture has been expanding quickly; even the poor farmers can afford that because of low investment cost. Recently, the natural resources of molusc has been rising due to the recruitment of artificial seeds accidentally from mollusc culture hatcheries and farms. Therefore, it helps eliminate hunger and reduce poverty, step to step supporting people in Van Don to enrich themselves legally and promote socio-economic development in a sustainable way.

In addition, mollusc is very useful in term of aquatic environment clearance because they are filter-feeders that get the food by filtering water. Some of other species take up their food by sweeping the bottom for debris and tacked algae or even feed on the prey which is much bigger than algae. A remarkable character is that some filter-feeders remove more algae than they need for feeding purposes. The amount of pseudofaeces may exceed the amount of the assimilated food many fold. As a result, the total activity of bivalve molluscs in removing algal biomass from the water column and in making water clearer is far beyond just the tropic needs of bivalves.

.Phytoplankton is important food source for molluscs which is directly related to their growth rate. Therefore the abundant and components of this phytoplankton community play a crucial role in the growth and development of this shellfish.

As mentioned above, by filter-feeding mode, water filtering capacity of molluscs is very high; it can reach 500 liters per day per individual. They can clean environment quickly and are considered as an important factor to keep the environmental ecology in balance, especially in polluted areas. However, in the polluted water environment, the toxic algae can develop quickly which often results in algal bloom or the red tide and/or brown tide in some areas. Simultaneously, cultured shellfish can be intoxicated by the toxic substances secreted from toxic algae and can be harmful for human beings (from paralytic, diarrheal, amnesic, and neurotoxic to death in humans) from consuming these mariculture products. To evaluate the possibility of shellfish intoxication due to the occurrence of toxic algae, it is necessary to initiate the research "***The changes in species components and the density of toxic algae in concentrated mollusc culture area in Ban Sen – Van Don – Quang Ninh*****".** Thank you very much for households and companies whose mollusc culture on Ban Sen has helped me complete internship program.

Internship program helped author gain more knowledge on mollusc and evaluate the potential intoxication hazard of cultured molluscs caused by toxic algae blooms in Ban Sen, Van Don in order to warn consumers of the intoxication possibility by consuming these molluscs.Thank you so much for EU - ASIA LINK PHASE 2 project helped me to complete this internship program.

Sample collection in farms

Sample analysis

Sampling and reserved methods

Sampling and analyzsis methods of toxic algae were done according to Hallegraeff *et al*. (2004).

Qualitative

Qualitative samples of toxic algae were collected by lowering a plankton net (mounth opening of 30 cm in diameter, mesh size of 20 µm) down to about 20 cm above the bottom and dragging several time from bottom to surface.

Collected samples was stored in a 100 ml PP bottle, immediately preserved with 2% formaline.

Quantitative

Quantitative samples were collected by a plastic bucket (20 L) and filtered through a plankton net.

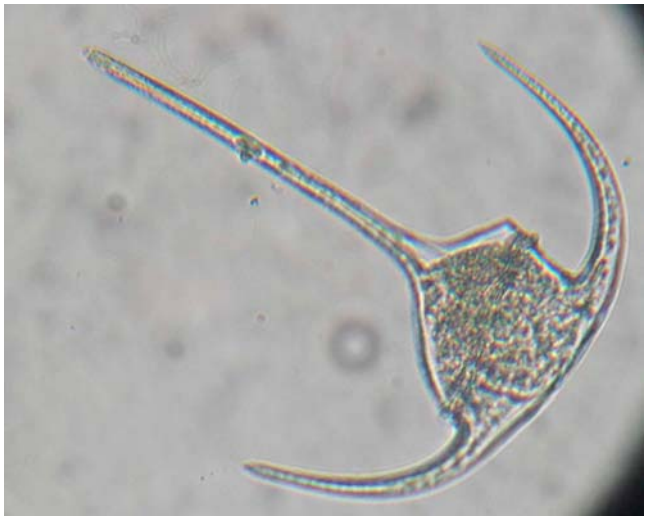
Then collected samples was stored in a 100 ml PP bottle, immediately preserved with 2%

In laboratory, both the qualitative and quantitative samples were settle down, siphone and condensed into 5 – 10 mL. stored at 20 – 25 ^{0}C without the direct light.

PICTURES OF SAMPLES

Dinophysis caudata Kent

Ceratium fusus (Ehrenberg) Dusaidin



Ceratium trichoceros (Ehrenberg) Kofoid

Ceratium furca Ehrenberg

Sample analysis methods

Study the change of species components of toxic algae

Toxic algae were identified according to Dang Dinh Kim (1999), Duong Thi Thuy (1997 – 2000), Chu Van Thuoc (2002), Andersen (1996), Adachi and Fukuyo (1979), Anderson et al. (1995)...

Study the change of toxic algae density

Toxic algae were determined by counting with Sedgewich Rafter counting chamber. The volume of counting chamber is 1 mL with compartment size of 50 mm x 20mm x 1mm = 1000 mm^3 . Toxic algae density (X) in water column was calculated as follows:

$X = A \times 10^4/a$ *(cells/L)*

A: number of cells counted in 100 compartments

a: concentrated coefficent

Data analysis

Data were analyzed by using statistic and Excel 2007 software.

RESULT AND DISCUSSION

I. The change of species components of toxic algae in Ban Sen – Van Don – Quang Ninh

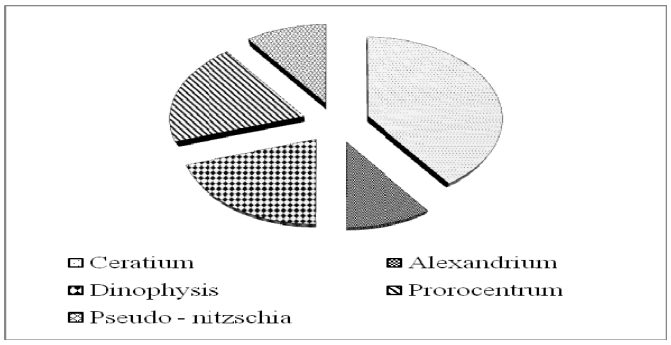


Figure 3-1: Species components of toxic algae

According to results, 10 algal species belonging to 5 genera, 5 families, 4 orders and 2 phyla (index 6-1) were identified in the study area that can be harmful for cultured mollusc. During April to July, 9 species of 4 genera, 4 families 3 orders and 1 class belonging to the phylum Dinophyta were found while just only one species of the phylum Bacillariophyta was found in April and May in both cultivated and control areas, that is *Pseudonitzschia seriata*. Hence, the main toxic algae species observed in this area were belonging to the phylum Dinophyta. This result is similar to that of Nguyen Van Nguyen, (2003).

There were 6 species of the phylum Dinophyta were found in April and May, 5 species in June and July. *Prorocentrum mexicanum* and *Alexandrium acatenella* were just observed in April and *Ceratium trichoceros* in June and July.

Most of species were belonging to the genus *Ceratium* (4 species), followed by the genus *Prorocentrum* and *Dinophysis* (2 species each), and the genus *Alexandrium* và *Pseudo – nitzschia* were least each (Figure 3-1)

. Changes of toxic algae density in Ban Sen – Van Don – Quang Ninh

1. *Changes of toxic algae density of genus Ceratium*

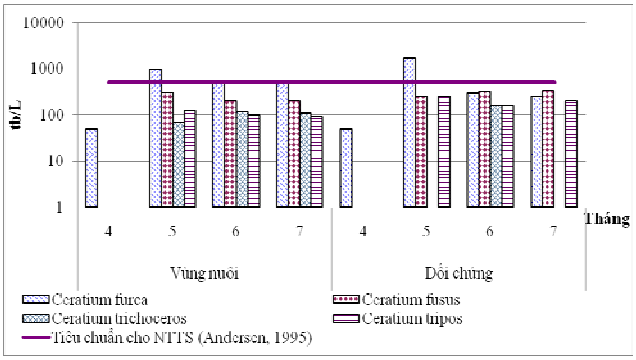


Figure 3-2: Changes of toxic algae density of genus *Ceratium*

Note: Standard: Standard for aquaculture (Andersen, 1995)

The density of genus *Ceratium* was higest in May (70 – 1750 cells/L) and lowest in April (0 – 50 cells/L). In June and July, density fluctuation of *Ceratium* was low, from 90 – 480 cells/L (figure 3-2). It must be notice that in May *Ceratium furca* desity was quite high, reach 1000 cells/L in cultivated area and 1750 cells/L in control area. (figure 3-2). The reason for the differences between study sites and control is that cultured molluscs filter the algae for their food including toxic algae as *Ceratium furca*. This may cause intoxication to cultured mollusc during May.

2. Change of toxic algae density of genus Dinophys

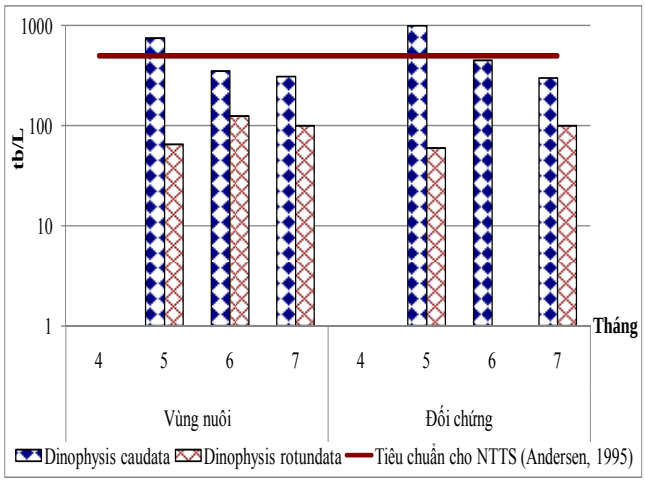


Figure 3-3: Changes of toxic algae density of genus *Dinophysis*

Note: Standard: Standard for aquaculture (Andersen, 1995)

Dinophysis was not seen in April but they had highest density in May (60 – 1000 cells/L) and evenly in June and July (100 – 450 cells/L; fFigure 3-3). In the genus *Dinophysis,* species *Dinopphysis caudata* had hishest density in May with 1000cells/L, exceeding the safety threshold for aqautic animals (Andersen, 1995). *Dinophysis* is considered as the main group which secrete the toxin causing Diarrhetic Shellfish Poisoning (DSP) problem in human being. It plays an important role in regional flora of algae. In this genus, *D. caudata* is the most important and popular species. It is considered the main cause of DSP in the world, such as in Mediterranean (Aubry *et al*., 2000; Sidari, 1995; Tubaro *et al*., 1995; Ounissi & Frehi, 1999), in California (Lechuga-Deveze & Morquecho, 1998) and in Atlantic (Mendez, 1991). For this reason, *D. caudata* may be the most problematic species that cause DSP accumulation in mollusc cultured in Ban Sen, Northern sea of Vietnam, especially in May.

3. Changes of toxic algae density of genus Prorocentrum

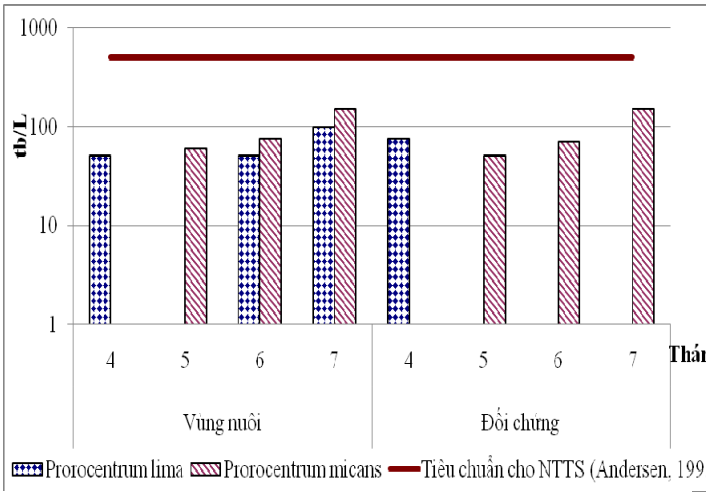


Figure 3-4: Changes of toxic algae density of genus *Prorocentrum*

Note: Standard: Standard for aquaculture (Andersen, 1995)

Density of *Prorocentrum* was low in the study area and tended to lightly increase from April to July. Density varied from 50 cells/L (April) – 150 cells/L (July) and has been observed throughout the study period. *Prorocentrum lima* is the genus which causes DSP problem, howerver, its density in the study area was very low, therefore the risk for reared aquatic animals as well as human who consume those products are low..

According to Andersen and Kristensen (1995), when the density of *Dinophyceae* is 500 cells/L, the area must be warned and not allowed for exploitation of aquatic animals. Thus, based on the date collected, this study area needed to be warned and ban to exploit aquatic animals as well as harvested cultured molluscs in May, because the density of *Ceratium furca* and *Dinopphysis caudata* was exceeded the safety threshold (Andersen, 1995)

4. *Changes of toxic algae density of genus* Pseudo-nitzschia

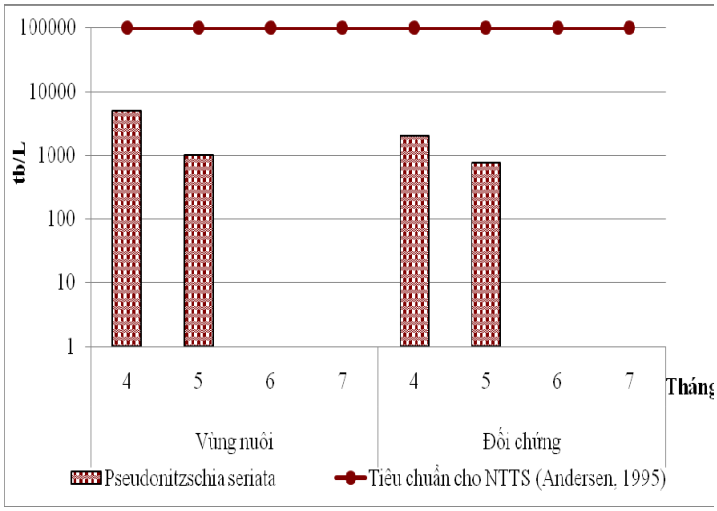


Figure 3-5: Changes of toxic algae density of genus *Pseudo nitzschia*

Note: Standard: Standard for aquaculture (Andersen, 1995)

Density of *Pseudo-nitzschia seriata* varied very much, from 750 – 5000 cells/L in April and May. The highest density was observed in April (5000 cells/L), then decreased in May (1000 cells/L), especially no *Ps. seriata* was found in June and July. According to Andersen và Kristensen (1995), if density of *Pseudonitzschia seriasta* is as high as 10^5 – 2.10^5 cells/L, the area need to be warned and not allow to exploit aquatic animals. Thereby, density of *Ps. seriata* during time-course of investigation is in within the safety thresold.

5. Changes of toxic algae density by season

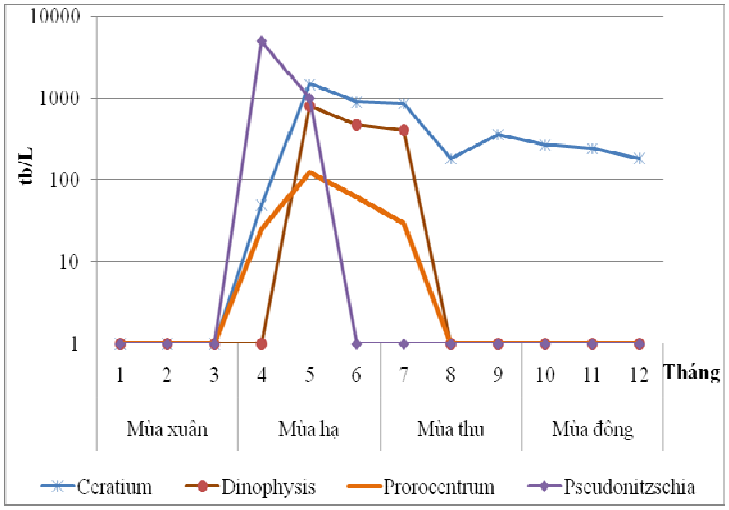


Figure 3-6: Change of toxic algae density by season

Acording to the result of toxic algae density in mollusc cultured area in Ban Sen and refered to the data of thesis of Cao Truong Giang (2010) we can conclude that toxic algae had not appeared in spring but rapidly increase during the summer months, as the temperature and light intensity is higher, special in May, it exceeded the safety threshold for aquatic animals and tended to decline during autumn which was then totally absent in winter time, exclude *Ceratium* (**Error! Reference source not found.**)

CONCLUSIONS

Ten toxic algae species were determined in the study area in which the phylum Dinophyta had 9 species, Bacillariophyta had only 1 species. *Ceratium* was the most diverse genus with 4 species found. *Prorocentrum* and *Dinophysis* had 2 species each, *Alexandrium* and *Pseudo-nitzschia* had only 1 species each.

The density of toxic algae of the genus *Ceratium* and *Dinophysis* was higest in May and exceeded the safety threshold: Density of *Dinophysis caudata* was 1000 cells/L and of *Ceratium furca* was 1750 cells/L. Therefore, the cultured area needed to be warned and not allow to expoit during this time period. Density of *Ceratium* and *Dinophysis* in other months of the year was in within the safety threshold and did not harm to the cultured species.

The genus *Prorocentrum* and *Pseud – nitzschia* had low density throughout the study time, 0 – 150 cells/L and 750 – 5000 cells/L, respectively.

Density of toxic algae rose in summer and reduced in autumm and was absent in winter, especially in spring.

PERSPECTIVES

The research was just based on the morphology of toxic algae for classification. There should be more specific studies as follows:

- Investigation of the toxins secreted by toxic algae on molluscs (by biochemical methods) at havesting time in order to measure the algal toxin accumulated in different kinds of mollusc. From those data, the policy makers can issue the regulation on exploitation and harvesting time of shellfish more accurately and warning consumers about the risk of eating the contaminated products.

- Isolate and produce biomass of the toxic algae, then evaluate the possibility of their toxins excretion and their adverse effects to economic importance of marine species and the last but the most importance is its impacts to food safety issue.