

HORIZONTAL DISTRIBUTION OF DINOFLAGELLATE CYSTS IN  
SURFACE SEDIMENTS OF SUNGAI GETING, KELANTAN

CHAN KIAN WENG

MASTER OF SCIENCE  
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HORIZONTAL DISTRIBUTION OF DINOFLAGELLATE CYSTS IN SURFACE  
SEDIMENTS OF SUNGAI GETING, KELANTAN

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CHAN KIAN WENG

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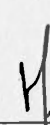
I certify that an Examination Committee has met on 15 January 2008 to conduct the final examination of Chan Kian Weng on his Master of Science thesis entitled "Horizontal Distribution of Dinoflagellate Cysts in Surface Sediments of Sungai Geting, Kelantan" in accordance with the regulations approved by the Senate of Universiti Malaysia Terengganu. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follow:

Zainuddin Bachok, Ph.D  
Faculty of Maritime Studies and Marine Science  
Universiti Malaysia Terengganu  
(Chairperson)

Siti Aishah Abdullah@Christine A. Orosco, Ph.D.  
Faculty of Maritime Studies and Marine Science  
Universiti Malaysia Terengganu  
(Member)


Faizah Shaharom, Ph.D.  
Professor  
Faculty of Agrotechnology and Food Science  
Universiti Malaysia Terengganu  
(Member)

Mohamed Kamil Abdul Rashid, Ph.D.  
Associate Professor  
Faculty of Maritime Studies and Marine Science  
Universiti Malaysia Terengganu  
(Independent Examiner)

  
MOHD. AZMI AMBAK, Ph.D.  
Professor/Dean of Graduate School  
Universiti Malaysia Terengganu

Date: 107 JUL 2008

This thesis submitted to the Senate of Universiti Malaysia Terengganu and has been accepted as fulfillment of the requirement for the degree of Master of Science.

  
\_\_\_\_\_  
MOHD. AZMI AMBAK, Ph.D.  
Professor/Dean of Graduate School  
Universiti Malaysia Terengganu

Date: 07 JUL 2008

## DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UMT or other institutions.



CHAN KIAN WENG

Date: 07 JUL 2008



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ppm	parts per million
ppb	parts per billion
mg/L	milligrams per liter
%	percentage
>	more than
<	less than
HCl	Hydrochloric acid
HF	Hydrofluoric acid
RB	round brown crystal
conc.	concentration
ppm	part per thousand
mg mL <sup>-1</sup>	milligrams per milliliter
mg L <sup>-1</sup>	milligrams per liter
ml	milliliter
1 - 0.5	small simple stop
P	Power of probability
r	Pearson's correlation
S	Student's rank order statistic
SD	Standard deviation
stat.	statistic
stat.	Statistical Table, Probability, upper (one) tail
stat.	Statistical Table, Probability, two-tailed
stat.	Statistical Table, Probability, 2 <sup>nd</sup> degree
stat.	Statistical Table, Probability, 2 <sup>nd</sup> degree, non-central



## LIST OF ABBREVIATIONS

mm	millimeter
cm	centimeter
m	meter
km	kilometer
μm	micro millimeter; micron
μM	micro Molar
g	gram
rpm	revolutions per minute
°C	degree centigrade
%	percentage
>	more than
<	less than
HCL	Hydrochloric acid
HF	Hydrofluoric acid
RB	round brown cyst
conc.	concentration
ppt	part per thousands
mg·mL <sup>-1</sup>	milligram per milliliter
mg·L <sup>-1</sup>	milligram per liter
mL	milliliter
n	small sample size
<i>P</i>	Power of probability
<i>r</i>	Pearson's correlation
<i>r<sub>s</sub></i>	Spearman's rank order correlation
SD	Standard deviation
excl.	excluding
'	Kofoidian Plate Formulae; apical (para)plate
''	Kofoidian Plate Formulae; precingular (para)plate
2a	Kofoidian Plate Formulae; 2 <sup>nd</sup> anterior intercalary (para)plate

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

HORIZONTAL DISTRIBUTION OF DINOFLAGELLATE CYSTS IN SURFACE SEDIMENTS OF SUNGAI GETING, KELANTAN

CHAN KIAN WENG

January 2008

Chairperson : Siti Aishah Abdullah @ Christine A. Orosco, Ph.D.

Member : Professor Faizah Shaharom, Ph.D.

Faculty : Maritime Studies and Marine Science

Surface sediments were collected from 18 sampling points in a Kelantan coastal lagoon, Sungai Geting during pre-monsoon (July) and monsoon (December) seasons in 2004 to study dinoflagellate cyst species composition, abundance, distribution and their relationships to environmental parameters measured. Twenty-one species including one unidentified species of dinoflagellate cysts representing 11 genera of two orders (Gonyaulacales and Peridinales) were identified in the study. Heterotrophic cysts, mainly comprised of Protoperidinioid cysts, not only was the most diversified cyst group, but dominated about 60% of the total cyst composition in both seasons as well. In pre-monsoon, *Spiniferites* spp. indet. and *Votadinium calvum* were almost equally abundant, each representing about 31% of the cyst composition. While in monsoon season, again, *Spiniferites* spp. indet. and *V. calvum* together with round, brown cysts *Brigantedinium* spp. indet. [RB] somewhat equally dominated the cyst composition, with proportion ranging from 16.5 to 21.3%. Other species, including *Alexandrium* sp. was rare. No cyst of *Alexandrium minutum* was found during the study. Species composition of cysts in each sampling point varied little,

with an average of three species per sampling point in both seasons. *Spiniferites* spp. indet. was the most common species, occurring in almost all sampling points. Cyst concentration in sampling points varied between 0 to 72 cysts·g<sup>-1</sup> dry weight sediment, and was not significantly different between pre-monsoon and monsoon seasons. Higher cyst concentration and higher proportion of heterotrophic cysts was found in the inner lagoon compared to outer lagoon during both seasons. Out of the ten environmental parameters investigated which include water depth, % clay and silt, temperature, salinity, pH, DO, nitrite+nitrate, ammonium, nitrite+nitrate+ammonium and phosphate, only water depth was significantly correlated with cyst concentration. Detailed descriptions and illustrations are provided for all cysts except *Spiniferites* spp. indet. and *Brigantedinium* spp. indet. [RB]. With the information provided from this study, knowledge on biodiversity of dinoflagellate cysts can be improved and may help in other aspects including mitigation, monitoring, planning and management of the study area as it is always under pressure of toxic bloom recurrence in the future.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu  
sebagai memenuhi keperluan ijazah Master Sains

TABURAN MELINTANG SISTA DINOFLAGELAT DALAM SEDIMEN  
PERMUKAAN DI SUNGAI GETING, KELANTAN

CHAN KIAN WENG

Januari 2008

Pengerusi : Siti Aishah Abdullah @ Christine A. Orosco, Ph.D.

Ahli : Profesor Faizah Shaharom, Ph.D.

Fakulti : Pengajian Maritim dan Sains Marin

Sedimen permukaan telah dikutip daripada 18 titik penyampelan di sebuah lagun persisiran laut, Sungai Geting, Kelantan pada musim pra-monsoon (Julai) dan monsoon (Disember) tahun 2004 untuk mengkaji komposisi spesis, kelimpahan, taburan sista dinoflagelat dan hubungannya dengan parameter persekitaran yang diukur. Dua puluh-satu spesis, termasuk satu species yang tidak dikenalpasti, mewakili 11 genera daripada dua orders (Gonyaulacales and Peridiniales) telah dikenalpasti. Sista heterotrofik, kebanyakannya terdiri daripada sista Protoperidinioid, bukan saja merupakan kumpulan sista yang paling tinggi kepelbagaiannya, tetapi juga mendominasi lebih kurang 60% daripada jumlah komposisi sista pada kedua-dua musim tersebut. Pada musim pra-monsoon, kelimpahan *Spiniferites* spp. indet. dan *Votadinium calvum* adalah hampir sama, masing-masing mewakili lebih kurang 31% daripada komposisi sista. Manakala pada musim monsoon, sekali lagi, *Spiniferites* spp. indet. and *V. calvum* bersama *Brigantedinium* spp. indet. [RB] mendominasi komposisi sista dengan agak serata, dengan nisbah julat antara 16.5 dan 21.3%. Spesis lain, termasuk *Alexandrium* sp. jarang dijumpai. Sista *Alexandrium minutum* tidak

dijumpai dalam kajian ini. Komposisi spesis sista di setiap titik sampling tidak banyak berbeza pada kedua-dua musim, dengan purata tiga spesis per titik penyampelan. *Spiniferites* spp. indet. merupakan spesis yang paling biasa dijumpai dan hadir di hampir semua titik penyampelan. Kepekatan sista di titik penyampelan berbeza di antara 0 dan 72 sista·g<sup>-1</sup> berat kering sedimen, dan tiada perbezaan yang bermakna di antara musim pra-monsoon dan monsoon. Didapati bahawa, kepekatan sista dan nisbah sista heterotrofik di bahagian dalam lagun lebih tinggi berbanding bahagian luar lagun. Daripada sepuluh parameter persekitaran yang dikaji termasuk kedalaman air, peratus tanah liat dan kelodak, suhu, saliniti, pH, oksigen terlarut (DO), nitrit+nitrat, ammonium, nitrit+nitrat+ammonium dan fosfat, hanya kedalaman air berhubungkait dengan kepekatan sista. Deskripsi terperinci dan ilustrasi diberikan untuk semua sista kecuali *Spiniferites* spp. indet. and *Brigantedinium* spp. indet. [RB]. Dengan maklumat yang diperolehi daripada kajian ini, pengetahuan tentang biodiversiti sista dinoflagellate boleh diperbaiki dan mungkin boleh membantu dalam aspek lain termasuk mitigasi, pemantauan, perancangan dan pengurusan, memandangkan tempat kajian ini sentiasa di bawah tekanan perulangan ledakan bertoxic di masa hadapan.