

**NUR HAYATI BINTI CHE ZAN @ CHE ZAIN**

**MASTER OF SCIENCE**

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**DISTRIBUTION AND CYCLING OF NITROGEN  
AND CARBON BASED NUTRIENTS IN SETIU  
WETLAND, TERENGGANU**

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**Thesis Submitted in Fulfillment of the Requirements  
for the Degree of Master of Science in the Institute of  
Oceanography and Environment  
Universiti Malaysia Terengganu**

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

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**September 2013**

**Main Supervisor** : **Assoc. Prof. Suhaimi Suratman, Ph.D.**  
**Co- Supervisor** : **Prof. Norhayati Mohd Tahir, Ph.D.**  
**Faculty** : **Institute of Oceanography and Environment**

In this study, the investigation of distribution and cycling of dissolved inorganic nitrogen (DIN) (i.e. nitrite, nitrate, and ammonium), urea, dissolved organic N (DON), particulate organic N (PON), dissolved organic carbon (DOC), particulate organic carbon (POC) and their relationship with chl-a was carried out in Setiu Wetland from Oct 2009-Sep 2010. The concentrations of nitrite, nitrate and ammonium were in the range of 0.16-0.35  $\mu\text{M}$ , 0.87-6.09  $\mu\text{M}$  and 0.69-2.98  $\mu\text{M}$ , respectively. The range of urea concentration was from 0.03-3.02  $\mu\text{M}$ . In addition, the range of concentrations of DON, PON, DOC and POC was between 4-203  $\mu\text{M}$ , 1.00-73.78  $\mu\text{M}$ , 14.35-720.05  $\mu\text{M}$  and 20.39-297.74  $\mu\text{M}$ , respectively. Total DON contributed 54-70% to the TDN pool and total DOC dominated for organic carbon pool with values between 55-75%. Low molecular weight dissolved organic matter (< 30 kDa) (LMW DOM) was also analysed from selected stations along the wetland with percentage of concentrations ranging between 39-92% and 52-87% for LMW DON and LMW DOC, respectively. Based on the regressions plot, there was no significant correlation between the nutrients concentrations with the chl-a levels suggesting that the phytoplankton growth in the study area was not influenced by the

nutrients. It was found that most of the nutrient parameters showed high concentrations at stations S1, S6, S7, S8, S9 and S10 which were located within the anthropogenic activities area such as agricultural, aquaculture and residential areas suggesting that palm oil plantation, fish farming and domestic wastes contributed a substantial amount of nutrients into the wetland environment. With exception of urea, in general, concentrations of other nutrient parameters were relatively high during monsoon season (Oct-Dec) compared to post-monsoon season (Jan-Sep) due to terrestrial run-off from heavy rainfall and release of nutrients from the resuspension of sediments. The results from  $^{15}\text{N}$ -labelled nitrate and ammonium uptake study showed that ammonium was the dominant N form used by the phytoplankton compared to nitrate with the values ranging between 0.71-0.81 nM N  $\text{h}^{-1}$  and 0.07-0.16 nM N  $\text{h}^{-1}$ , respectively. The calculated *f*-ratios revealed that the primary production in Setiu Wetland was attributed to regenerated N in the form of ammonium.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Sarjana Sains.

**TABURAN DAN KITARAN NUTRIEN BERASASKAN NITROGEN DAN  
KARBON DI TANAH BENCAH SETIU, TERENGGANU**

**NUR HAYATI CHE ZAN @ ZAIN**

**September 2013**

**Penyelia Utama : Prof. Madya. Suhaimi Suratman, Ph.D.**

**Penyelia Bersama : Prof. Norhayati Mohd Tahir, Ph.D.**

**Fakulti : Institut Oseanografi dan Sekitaran**

Dalam kajian ini, penyelidikan mengenai taburan dan kitaran nitrogen tak organik terlarut (DIN) (i.e. nitrit, nitrat dan ammonium), urea, nitrogen organik terlarut (DON), nitrogen organik partikulat (PON), karbon organik terlarut (DOC), karbon organik partikulat (POC) serta hubungannya dengan chl-a telah dijalankan di Tanah Bencah Setiu dari Okt 2009-Sep 2010. Kepekatan nitrit, nitrat dan ammonium masing-masing dalam julat 0.16-0.35  $\mu\text{M}$ , 0.87-6.09  $\mu\text{M}$  dan 0.69-2.98  $\mu\text{M}$ . Julat kepekatan urea ialah dari 0.03-3.02  $\mu\text{M}$ . Manakala julat kepekatan DON, PON, DOC dan POC masing-masing di antara 4-203  $\mu\text{M}$ , 1.00-73.78  $\mu\text{M}$ , 14.35-720.05  $\mu\text{M}$  dan 20.39-297.74  $\mu\text{M}$ . Jumlah DON menyumbang sebanyak 54-70% daripada takungan TDN dan jumlah DOC mendominasi takungan karbon organik dengan nilai peratusan sebanyak 55-75%. Jisim molekul rendah bahan organik terlarut (< 30 kDa) (LMW DOM) juga telah dianalisa dari stesen terpilih sepanjang tanah bencah dengan julat peratusan kepekatan di antara 39-92% dan 52-87%, masing-masing untuk LMW DON dan LMW DOC. Berdasarkan plot regresi, tiada korelasi signifikan antara kepekatan nutrien dengan paras chl-a yang mencadangkan bahawa pertumbuhan fitoplankton di dalam kawasan kajian tidak dipengaruhi oleh nutrien.

Adalah didapati kebanyakan parameter nutrien menunjukkan kepekatan yang tinggi di stesen S1, S6, S7, S8 dan S10 yang terletak di kawasan aktiviti antropogenik seperti pertanian, akuakultur dan kawasan domestik yang menunjukkan bahawa penanaman kelapa sawit, penternakan ikan dan sisa domestik menyumbang sejumlah nutrien yang banyak ke dalam persekitaran tanah bencah. Kecuali urea, pada umumnya, kepekatan parameter nutrien yang lain secara relatifnya adalah tinggi semasa musim tengkujuh (Okt-Dis) berbanding musim selepas tengkujuh (Jan-Sep) yang disebabkan oleh peningkatan larian air dari daratan oleh hujan yang lebat dan pelepasan nutrien dari pengampaian sedimen. Keputusan daripada kajian pengambilan nitrat dan ammonium berlabel  $^{15}\text{N}$  menunjukkan ammonium adalah bentuk dominan yang digunakan oleh fitoplankton berbanding dengan nitrat dengan julat nilai masing-masing di antara  $0.71\text{-}0.81 \text{ nM N h}^{-1}$  dan  $0.07\text{-}0.16 \text{ nM N h}^{-1}$ . Pengiraan nisbah- $f$  memdedahkan bahawa pengeluaran primer di Tanah Bencah Setiu adalah hasil daripada penjanaaan semula N dalam bentuk ammonium.