

**COASTAL UPWELLING AND PHYTOPLANKTON BIOMASS IN
TERENGGANU AND PAHANG COASTAL WATERS**

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**Thesis Submitted in Fulfilment of the Requirement for the
Degree of Master of Science in the Institute of Oceanography and Environment
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DEDICATION

Alhamdulillah

To He who had given me dreams to look forward to.

To my parents

Abah and Mak

To my siblings

Chaq, Ngah, Chik, Arwah Abang, Tam and Mad

and

To all my friends

This humble work is a sign of my appreciation to you!

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

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Oceanographic cruises were conducted to investigate the dynamical relationship between hydrography, current circulation and phytoplankton biomass at the east coast of Peninsular Malaysia (ECPM) and elucidate the structure of upwelling at the ECPM especially in the vicinity of Tioman Island. Physical observations in the upwelling area were analysed with respect to local wind forcing. Chlorophyll *a* and nutrients measurements were discussed based on different seasonal influence. In addition to field data measurement, satellite images were used to demonstrate the presence of upwelling and examine the spatial patterns of phytoplankton biomass at the ECPM. The outcome of this study showed that the southwesterly monsoon wind, which induced coastal upwelling, was the major mechanism that shaped the hydrographic character and the relatively high phytoplankton biomass found at the study area. Results also showed that the waters off Tioman Island had relatively cooler temperature and higher phytoplankton biomass due to nutrient enhancement than Terengganu. The presence of this character was in response to strong northward upwelling and freshwater intrusion in both areas. In the vicinity of Tioman Island, there was a small but distinguishable cooler-upwelled

water and slightly stronger current at the north of the island. This feature appeared to be caused by the interaction of multiple dynamical processes including coastal upwelling, island circulation and topographic variations in this area. Overall, the interaction of physical processes between wind-induced upwelling, coastal current and island circulation were believed to be the key drivers in regulating the hydrography and horizontal as well as vertical distribution of phytoplankton biomass.

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**JULANGAN PESISIR PANTAI DAN BIOJISIM FITOPLANKTON DI
PERAIRAN PANTAI TERENGGANU DAN PAHANG**

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Pelayaran oseanografi telah dijalankan untuk mengkaji hubungan dinamik di antara hidrografi, pergerakan arus dan biojisim fitoplankton di pantai timur Semenanjung Malaysia (ECPM) dan menguraikan struktur julangan air di kawasan ECPM terutamanya di sekitar Pulau Tioman. Kajian fizikal di kawasan julangan air dibuat bersandarkan kepada keadaan angin setempat. Klorofil *a* dan nutrien dibincang mengikut pengaruh musim. Sebagai tambahan kepada data lokasi, imej satelit digunakan untuk menunjukkan kewujudan julangan dan mengkaji taburan biojisim fitoplankton di ECPM. Hasil kajian menunjukkan angin barat daya yang mendorong julangan pesisir pantai adalah faktor terpenting yang membentuk karakter hidrografi dan kewujudan biojisim fitoplankton yang agak tinggi di kawasan kajian. Dapatan kajian menunjukkan kawasan di perairan Tioman mempunyai suhu yang lebih sejuk dan biojisim fitoplankton yang lebih tinggi hasil peningkatan nutrien berbanding Terengganu. Hal ini mungkin disebabkan oleh julangan air utara yang kuat dan kemasukan air tawar di dua kawasan berikut. Di sekitar Pulau Tioman, terdapat julangan air sejuk yang kecil tetapi jelas dan arus yang agak kuat di utara pulau tersebut. Kewujudan ini disebabkan oleh interaksi beberapa proses dinamik

seperti julangan pesisir pantai, pergerakan arus pulau dan kepelbagaian topografi di kawasan ini. Secara keseluruhan, interaksi fizikal di antara angin yang menjana julangan, arus pantai dan pergerakan arus pulau dipercayai sebagai faktor yang mengawal hidrografi and taburan biojisim fitoplankton.