

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

**COMMUNITY STRUCTURE OF MACROFOULING ORGANISMS ON
“RIG-TO-REEF” ARTIFICIAL REEFS IN PULAU KAPAS WATERS,
TERENGGANU, SOUTH CHINA SEA**

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KAPAL 18 (TK 1), a subsea template, and KAPAL 43 (TK 2), a mid-span bracing fragments of a decommissioning oil rig structures, were the first “Rig-to-Reef” (R2R) ever placed on the east coast of Peninsular Malaysia waters. They were deployed in 2016 approximately 1.6 nautical miles south-eastern off Pulau Kapas, Terengganu. Any information is valuable to evaluate the potential of R2R artificial reefs (ARs) since there were limited studies on marine organisms at these ARs, and understanding the interactions between sessile and motile organisms can also shed light on predator-prey relationships and the flow of energy through the ecosystem. Therefore, this study aims to determine the present status of the macrofouling community structure at the R2R ARs. The macrofouling biodiversity and abundance were compared, and the relationship between sessile and motile organisms was determined, as well as an evaluation of the short-term changes of macrofouling community structure at the R2R ARs. Surveys were conducted in April, July and October 2019 using photo quadrant and scrapping methods at selected permanent points. Then, images were analysed, and the fouling specimens were identified. Overall, a total of 41 genera from 39 families composed of sessile and motile organisms were identified. The number of genera was found to be higher at TK 2 ARs (41 genera) compared to TK 1 ARs (36 genera). Barnacles, bivalves and

macroalgae mainly dominated the composition of macrofouling. After three years of deployment (April 2019), the total mean density of sessile organisms was higher (4,665.83 ind/m², 11 genera) than the motile organisms (1,154.59 ind/m², 15 genera) for both ARs ($p > 0.05$). The colonisation of the sessile and motile communities after three months intervals in April-July (14 and 13 genera, respectively) and July-October (15 and 14 genera, respectively) did not differ significantly. However, for both intervals, the mean density was substantially higher for sessile organisms (April-July - 5,306.39 ind/m²; July-October - 8,037.35 ind/m²) compared to the motile organism (April-July - 1,362.84 ind/m²; July-October - 1,439.29 ind/m²). The R2R ARs significantly promote the colonisation of macrofouling organisms even after a short period. The colonisation of sessile and motile communities is a fundamental component in the food web that contributes to enhancing fisheries resources.

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**STRUKTUR KOMUNITI ORGANISMA MAKRO TEMPEL PADA TUKUN
“RIG-TO-REEF” DI PERAIRAN PULAU KAPAS, TERENGGANU, LAUT
CHINA SELATAN**

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Serpihan KAPAL 18 (TK 1), sebuah templat dasar laut dan KAPAL 43 (TK 2), sebuah pendakap rentang pertengahan struktur pelantar minyak yang dilupuskan adalah “Rig-to-Reef” (R2R) pertama yang pernah dilabuhkan di perairan Semenanjung Malaysia. Ia telah dilabuhkan pada 2016 lebih kurang 1.6 batu nautika tenggara perairan Pulau Kapas, Terengganu. Sebarang informasi adalah penting untuk menilai potensi tukun tiruan (TT) R2R kerana kajian mengenai organisma marin di tukun tiruan (TT) ini adalah terhad. Selain itu, memahami interaksi antara organisma sesil dan motil dapat memberi pencerahan tentang hubungan mangsa-pemangsa dan aliran tenaga melalui ekosistem. Oleh itu, kajian ini bertujuan untuk mengenal pasti status terkini komuniti “fouling” makro di TT R2R. Biodiversiti dan kebanyakan “fouling” makro telah dibandingkan dan hubungan antara organisma sesil dan motil telah dikenal pasti, beserta dengan penilaian pengkolonian jangka pendek komuniti “fouling” makro di TT R2R yang berbeza saiz di perairan Pulau Kapas. Survei telah dijalankan pada April, Julai dan Oktober 2019 menggunakan teknik fotokuadrat dan pengikisan pada titik terpilih yang kekal dan imej telah dianalisa dan spesimen “fouling” telah dikenal pasti pada klasifikasi taksonomi paling rendah. Secara keseluruhan, sejumlah 41 genera dari 39 famili terdiri daripada organisma sesil dan motil telah dikenal pasti. Jumlah genera tertinggi ditemui di TT

TK 2 (41 genera) berbanding TT TK 1 (36 genera). Komposisi “fouling” makro telah didominasi oleh teritip, dwicangkerang dan alga makro. Selepas tiga tahun dilabuhkan (April 2019), jumlah purata kepadatan organisma sesil (4,665.83 ind/m², 11 genera) lebih tinggi daripada organisma motil (1,154.59 ind/m², 15 genera) di kedua TT ($p > 0.05$). Pengkolonisasi komuniti sesil dan motil selepas selang tiga bulan pada April-Julai (14 and 13 genera masing-masing) dan Julai-Oktober (15 and 14 genera masing-masing) tidak mempunyai perbezaan bererti. Namun, untuk kedua selang, purata kepadatan adalah lebih tinggi secara bererti untuk organisma sesil (April-Julai - 5,306.39 ind/m²; July-Oktober - 8,037.35 ind/m²) berbanding organisma motil (April-Julai - 1,362.84 ind/m²; July-Oktober - 1,439.29 ind/m²). TT R2R secara signifikan menggalakkan pengkolonial organisma “fouling” makro walaupun dalam tempoh yang pendek. Kolonisasi komuniti sesil dan motil adalah komponen asas dalam jaringan makanan yang menyumbang kepada peningkatan sumber perikanan.