

## ABSTRACT

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

**SPATIAL OCCURRENCE AND SOCIAL STRUCTURE OF INDO-PACIFIC  
HUMPBACK (*Sousa chinensis*) AND IRRAWADDY DOLPHINS (*Orcaella  
brevirostris*) IN THE COASTAL WATERS OF MATANG, PERAK,  
MALAYSIA**

**MUHAMMAD FADHLI BIN MAT SOBRI**

**AUGUST 2024**

**Main Supervisor : Assoc. Prof. Dr. Saifullah Arifin Jaaman @  
Sharman, Ph.D**

**Co-Supervisor : Prof. Zulqarnain Bin Mohamed, Ph.D**

**School/Institute : Institute of Oceanography and Environment**

Malaysia has numerous areas of great biodiversity, such as the Matang Mangrove Forest Reserve (MFFR) in the state of Perak. The appearance of endangered species such as the Indo-Pacific humpback dolphin (*Sousa chinensis*) and the Irrawaddy dolphin (*Orcaella brevirostris*) in Matang waters provided an opportunity to assess the spatial distribution and investigate the social structure which was the aim of this study. Boat surveys were conducted over 44 days, from March 2019 to January 2021, resulting in a total of 69 dolphin sightings. Among these, 40 sightings were Indo-Pacific humpback dolphins, and 29 sightings were Irrawaddy dolphins. Hotspot analysis in QGIS, using the Getis-Ord  $G_i^*$  calculation, identified Area A as a hotspot for Indo-Pacific humpback dolphins and Area B for Irrawaddy dolphins. During dolphin sightings the surface water parameter reading were taken in-situ using multiparameter probe and dolphins' behaviour were also recorded. The behaviour

recorded were based on four categories such as foraging, socializing, travelling, and evading. Four behaviours were recorded during sightings of both dolphins, with foraging (72%) being the most common, followed by socializing (17%), evading (7%) and travelling (4%). The Pearson chi-square test revealed a statistically significant correlation between the hotspot area and the two dolphin behaviours ( $\chi^2$ : 41.35, df: 9, p-value 0.000004). However, there was no correlation between dolphin sighting time and surface water parameter (pH, depth, temperature, salinity, dissolved oxygen and turbidity). Dolphin individuals were identified using the DARWIN software, which identified 72 individuals for the Indo-Pacific Humpback dolphin and 31 individuals for the Irrawaddy dolphin. Using SOCPROG 2.9 version programme, the population for the Indo-Pacific Humpback and Irrawaddy dolphin was estimated to have 86 individuals (95% CI=70-109) and 33 individuals (95% CI= 28-52), respectively. Regarding the social structure of each dolphin, the half weight index (HWI) was calculated in the SOCPROG programme and then projected into a hierarchical cluster index and social network diagram to understand the connectivity between each dolphin individual. From huge supercluster both species have difference number of groups, Indo-Pacific humpback dolphin have 8 groups and Irrawaddy dolphin have 3 groups. The studies on both dolphins show how important the Matang waters are for the conservation of biodiversity.

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

**TABURAN SPATIAL DAN STRUKTUR SOCIAL LUMBA-LUMBA PUTIH  
(*Sousa chinensis*) DAN LUMBA-LUMBA EMPESUT (*Orcaella brevirostris*) DI  
PESISIRAN PANTAI MATANG, PERAK MALAYSIA**

**MUHAMMAD FADHLI BIN MAT SOBRI**

**OGOS 2024**

**Penyelia** : **Prof. Madya Dr. Saifullah Arifin Jaaman @ Sharman, Ph.D**

**Penyelia Bersama** : **Prof. Zulqarnain Bin Mohamed, Ph.D**

**Pusat Pengajian/Institut** : **Institut Oseanografi dan Sekitaran**

Malaysia memiliki banyak kawasan biodiversity seperti Hutan Simpanan Paya Bakau Matang (MFFR) di negeri Perak. Kemunculan spesies terancam seperti ikan lumba-lumba Putih (*Sousa chinensis*) dan ikan lumba-lumba Empesut (*Orcaella brevirostris*) di perairan Matang memberi peluang untuk menilai ruang taburan dan menyelidik struktur sosial, yang memberi asbab kepada kajian ini berlaku. Tinjauan menggunakan bot dilakukan selama 44 hari, dari Mac 2019 hingga Januari 2021, dengan keseluruhan jumlah penglihatan ikan lumba-lumba sebanyak 69 kali. Antaranya, 40 penglihatan adalah ikan lumba-lumba Putih dan 29 penglihatan adalah ikan lumba-lumba Empesut. Analisa hotspot dalam QGIS dengan menggunakan pengiraan Getis-Ord  $G_i^*$ , mengenal pasti Kawasan A sebagai tempat tumpuan untuk ikan lumba-lumba Putih dan Kawasan B untuk ikan lumba-lumba Empesut. Semasa penglihatan ikan lumba-lumba, pada waktu yang sama bacaan parameter air di permukaan diambil di kawasan itu menggunakan probe multi-parameter dan tingkah laku ikan lumba-lumba juga direkod. Tingkah laku yang direkodkan adalah berdasarkan empat kategori seperti mencari makanan, bersosial, pergerakan, dan mengelak. Empat tingkah laku direkodkan semasa penglihatan kedua-dua spesies ikan

lumba-lumba, mendapati mencari makanan (72%) menjadi yang paling kerap, diikuti bersosial (17%), mengelak (7%), dan pergerakan (4%). Ujian chi-square Pearson menunjukkan korelasi yang signifikan secara statistik antara kawasan hotspot dan dua tingkah laku ikan lumba-lumba tersebut ( $\chi^2$ : 41.35, df: 9, nilai p: 0.000004). Walau bagaimanapun, tidak ada korelasi antara masa penglihatan ikan lumba-lumba dan parameter permukaan air (pH, kedalaman, suhu, saliniti, oksigen terlarut, dan kekeruhan). Individu ikan lumba-lumba dikenal pasti menggunakan perisian DARWIN, yang mengenal pasti 72 individu untuk ikan lumba-lumba Putih dan 31 individu untuk ikan lumba-lumba Empesut. Dengan menggunakan program SOCPROG versi 2.9, populasi ikan lumba-lumba Putih dan ikan lumba-lumba Empesut dianggarkan mempunyai 86 individu (95% CI=70-109) dan 33 individu (95% CI=28-52). Berkenaan dengan struktur sosial, setiap ikan lumba-lumba, indeks berat separuh (HWI) dikira dalam program SOCPROG dan kemudian diintegrasikan ke dalam indeks kumpulan hierarki dan gambar rajah rangkaian sosial untuk memahami hubungan antara setiap individu daripada ikan lumba-lumba. Daripada “Supercluster” besar ini setiap spesis didapati ada bilangan kumpulan yang berbeza, ikan lumba-lumba putih 8 kumpulan dan lumba-lumba Empesut 3 kumpulan. Kajian ke atas kedua-dua ikan lumba-lumba ini menunjukkan betapa pentingnya perairan Matang untuk pemeliharaan biodiversiti.