

**SITI JALILAH BINTI MOHAMAD DOCTOR OF PHILOSOPHY 2019**

**SEASONAL AND HABITAT-RELATED  
VARIATION IN REPRODUCTIVE  
HORMONES AND THE GONADAL  
DEVELOPMENT OF CLIMBING  
PERCH, *Anabas testudineus*  
(BLOCH, 1792)**

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UNIVERSITI MALAYSIA TERENGGANU**

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**SITI JALILAH BINTI MOHAMAD**

**Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of  
Philosophy in the Institute of Tropical Aquaculture and Fisheries Research  
Universiti Malaysia Terengganu  
2019**



## **DEDICATION**

I dedicated this thesis to:

Maa, Kak, Abe, Adik and Kak Dah for their unwavering love and support. Thank you for always being there for me!

**ABSTRACT**

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the Degree of Doctor of Philosophy

**SEASONAL AND HABITAT-RELATED VARIATION IN REPRODUCTIVE HORMONES AND THE GONADAL DEVELOPMENT OF CLIMBING PERCH, *Anabas testudineus* (BLOCH, 1792)**

**SITI JALILAH BINTI MOHAMAD**

**2019**

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**: In memory of Associate Professor Safiah Jasmani, Ph.D**  
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The present study was carried out to investigate the relationship between seasons and habitats on the growth performance, level of reproductive hormones and the gonadal development of climbing perch, *Anabas testudineus*. A total of 2880 *A. testudineus* was caught from three natural habitats (Paddy field, irrigation canal, and swamp) from the four different states of Peninsular Malaysia in dry and rainy seasons. The body size of *A. testudineus* sampled during rainy season from the irrigation canal were biggest compared to dry season and other habitats (males,  $12.84 \pm 1.17$  cm of total length and  $32.38 \pm 4.4$  g of body weight; females,  $13.70 \pm 1.83$  cm in total length and  $52.84 \pm 12.54$  g in body weight). Results indicated that frequent rainfalls with higher level of dissolved oxygen and pH, increase the body sizes of *A. testudineus*, while increases in the water temperatures resulted into a smaller body size of the fish. Besides that, all the analyses point out that this fish was categorized as seasonal breeder which corresponds to the rainy season. The gonadal development of *A. testudineus* peak during the rainy season, which was in September and October in the states of Kedah and Perlis, and November and

December in the states of Kelantan and Terengganu. With increasing 11-ketotestosterone (11-KT), testosterone (T), and  $17\beta$ -estradiol ( $E_2$ ) levels, the gonadosomatic index (GSI) increased in parallel with gonad proliferation in male and female *A. testudineus*. This finding suggests that majority of this fish spawn during the end of the rainy season or at the beginning of the dry season between September to February. Furthermore, water parameters which are always constant in the irrigation canals, in both dry and rainy seasons indicated that *A. testudineus* lives in this habitat have a better reproductive performance due to high level of reproductive hormones with highly developed gonadal compared to other habitats. In conclusion, this study implied that a close interaction was found between environmental cue and the levels of reproductive hormones which further infer that the pattern of gonadal growth and reproduction of this fish species are affected by habitat and season.

**ABSTRAK**

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

**KAITAN MUSIM DAN HABITAT KE ATAS VARIASI HORMON PEMBIAKAN  
DAN PERKEMBANGAN GONAD IKAN PUYU,  
*Anabas testudineus* (BLOCH, 1792)**

**SITI JALILAH BINTI MOHAMAD**

**2019**

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Kajian ini dijalankan untuk mengkaji hubungkait di antara musim dan habitat ke atas tumbesaran, paras kepelbagaian hormon pembiakan dan perkembangan gonad ikan puyu, *Anabas testudineus*. Sejumlah 2880 ekor sampel ikan *A. testudineus* telah diperolehi dari tiga habitat semulajadi (sawah padi, terusan pengairan dan paya) dari empat buah negeri yang berbeza di Semenanjung Malaysia pada musim panas dan hujan. Saiz badan ikan *A. testudineus* semasa musim hujan bagi sampel yang berasal dari terusan pengairan adalah yang terbesar jika dibandingkan dengan musim kemarau dan habitat lain (jantan,  $12.84 \pm 1.17$  cm panjang dan  $32.38 \pm 4.4$  g berat badan; betina,  $13.70 \pm 1.83$  cm panjang dan  $52.84 \pm 12.54$  g in berat badan). Hasil kajian ini menunjukkan bahawa taburan hujan yang tinggi kerap, paras oksigen terlarut dan pH yang tinggi adalah faktor utama yang menyumbang kepada peningkatan saiz badan ikan *A. testudineus*, sementara peningkatan suhu air pula akan mengakibatkan saiznya menjadi lebih kecil. Selain itu, semua analisis menunjukkan bahawa ikan ini dikategorikan sebagai pembiak bermusim yang bertindakbalas dengan

musim hujan. Kemuncak perkembangan gonad ikan *A. testudineus* berlaku pada musim hujan, iaitu pada bulan September dan Oktober di Negeri Kedah dan Perlis, dan pada bulan November dan Disember di negeri Kelantan dan Terengganu. Dengan peningkatan 11-ketotestosterone(11-KT), testosterone (T) and  $17\beta$ -estradiol ( $E_2$ ), perkembangan aktif gonad juga turut meningkatkan indeks gonadosomatik (GSI) pada ikan *A. testudineus* jantan dan betina. Penemuan ini menunjukkan bahawa majoriti ikan ini bertelur pada akhir musim hujan atau pada permulaan musim panas iaitu di antara bulan September hingga Februari. Tambahan pula, parameter air yang stabil di dalam terusan pengairan pada kedua-dua musim panas dan hujan menunjukkan bahawa ikan *A. testudineus* yang hidup di habitat ini mempunyai prestasi pembiakan yang lebih baik disebabkan oleh paras hormon pembiakannya yang lebih tinggi dan perkembangan gonadnya yang lebih baik jika dibandingkan dengan habitat lain. Kesimpulannya, kajian ini telah menunjukkan bahawa, terdapat hubungan rapat di antara isyarat persekitaran dan paras hormon pembiakan dan seterusnya mencadangkan corak perkembangan gonad dan pembiakan spesis ini dipengaruhi oleh habitat dan musim.