



UNIVERSITI PUTRA MALAYSIA

***DIURNAL ACTIVITY BUDGET, STEREOTYPIC BEHAVIOUR AND
RESPONSE TO ENRICHMENT OF CAPTIVE MALAYAN SUN BEARS
(HELARCTOS MALAYANUS R.)***

TAN HWEE MIEN

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By

TAN HWEE MIEN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Veterinary Science

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The knowledge of an animal's behaviour is important in the assessment of both health and ecological requirements. In captivity, the confined environment and daily management are often considered as crucial factors affecting an animal's behaviour, especially the development of stereotypies. The current study was conducted to document the diurnal activity patterns and stereotypic behaviours in captive Malayan Sun Bear (*Helarctos malayanus*), to investigate the effect of enclosure design on the stereotypies observed, and to ascertain if environmental enrichment is able to alleviate stereotypic behaviours.

A 14-day behavioural observation was carried out on 17 adult *H. malayanus* which were either housed in groups of four or five in outdoor enclosures, or in

pairs in barren indoor enclosures. The diurnal activity budgets of the bears were dominated by resting (Zoo-A: indoor = $22.8 \pm 14.8\%$, outdoor = $58.3 \pm 15.6\%$; Zoo-B: indoor = $25.7 \pm 11.0\%$, outdoor = $52.0 \pm 20.1\%$) and locomotion (Zoo-A: indoor = $44.0 \pm 18.7\%$, outdoor = $28.4 \pm 14.2\%$; Zoo-B: indoor = $36.2 \pm 12.3\%$, outdoor = $23.1 \pm 13.5\%$). All bears in this study performed at least one form of stereotypic behaviour, where pacing was the most common form. When comparison was made between the bears housed indoors and those outdoors, the outdoor bears spent significantly more time resting while the indoor bears displayed higher frequency of locomotion, conspecific interaction as well as total stereotypy.

Following baseline data collection, coconut fronds and plastic containers with twigs were then provided as enrichment to the bears for the next 14 days. The enrichment items were then withdrawn over a subsequent 14-day period. Saliva and faeces of the bears were collected for quantification of cortisol hormone. Behavioural and cortisol data were statistically compared between pre-, per- and post-enrichment periods. The enrichment successfully reduced the time spent resting and promoted play behaviour in all groups of bears. However, significant reduction in stereotypic frequency was only observed in the bears housed indoors. The enrichment did not exert a reducing effect on the cortisol in the saliva or faeces.

The present study has revealed that enclosure design has a significant effect on the behaviour and manifestation of stereotypies in captive bears. The response of the bears to the enrichment varied between those housed in enriched outdoor enclosures and those in barren indoor enclosures, where reduction in the frequency of stereotypy was only found in the latter. It is therefore necessary that efforts in *ex situ* conservation of *H. malayanus* must first address the basic management issues and fulfill the primary requirements of the animals. Environmental enrichment using basic materials is an effective tool to alleviate behavioural anomalies especially where the captive environment is compromised.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains Veterinar

POLA AKTIVITI SIANG, KELAKUAN *STEREOTYPY* DAN RESPONS TERHADAP PENGKAYAAN PERSEKITARAN OLEH BERUANG MATAHARI (*HELARCTOS MALAYANUS R.*)

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Pengetahuan tentang kelakuan seekor haiwan penting dalam penilaian kesihatan dan keperluan ekologi haiwan tersebut. Dalam kurungan, persekitaran yang terhad dan pengurusan harian sering dianggap sebagai faktor penting yang menjejaskan kelakuan seekor haiwan, terutamanya perkembangan kelakuan *stereotypy*. Kajian ini dijalankan untuk mendokumentasikan pola aktiviti siang dan kelakuan *stereotypy* dalam beruang matahari (*Helarctos malayanus*) yang dipelihara dalam kurungan, menyiasat kesan rekabentuk kurungan terhadap kelakuan *stereotypy*, dan menentukan sama ada pengkayaan persekitaran dapat mengurangkan kelakuan *stereotypy*.

Pemerhatian kelakuan dijalankan selama 14 hari terhadap 17 ekor *H. malayanus*

dewasa yang ditempatkan sama ada dalam kumpulan empat atau lima individu di dalam kurungan luar, atau berpasangan di dalam kurungan dalam. Aktiviti siang beruang didapati lebih tertumpu kepada berehat (Zoo-A: kurungan dalam = $22.8 \pm 14.8\%$, kurungan luar = $58.3 \pm 15.6\%$; Zoo-B: kurungan dalam = $25.7 \pm 11.0\%$, kurungan luar = $52.0 \pm 20.1\%$) dan pergerakan (Zoo-A: kurungan dalam = $44.0 \pm 18.7\%$, kurungan luar = $28.4 \pm 14.2\%$; Zoo-B: kurungan dalam = $36.2 \pm 12.3\%$, kurungan luar = $23.1 \pm 13.5\%$). Semua beruang yang dikaji menunjukkan sekurang-kurangnya satu bentuk kelakuan *stereotypy*, di mana *pacing* merupakan bentuk yang paling kerap diperhatikan. Beruang yang ditempatkan di dalam kurungan luar didapati menghabiskan lebih banyak masa berehat manakala beruang dalam kurungan dalam menunjukkan frekuensi yang lebih tinggi dalam aktiviti pergerakan, berinteraksi dengan beruang lain, dan jumlah *stereotypy*.

Selepas pengumpulan data garis asas tersebut, pelepah kelapa dan bekas plastik yang berisi ranting kayu disediakan untuk beruang-beruang tersebut sebagai pengkayaan selama 14 hari. Selepas itu, barang pengkayaan ini dikeluarkan daripada kurungan tetapi pemerhatian kelakuan diteruskan untuk 14 hari berikutnya. Sampel air liur dan tinja daripada beruang telah diambil untuk menentukan kuantiti hormon kortisol. Perbandingan secara statistik dijalankan untuk mengesan perbezaan dalam kelakuan dan tahap kortisol pada fasa sebelum, semasa, dan selepas pengkayaan persekitaran. Pengkayaan persekitaran berjaya untuk mengurangkan masa dalam berehat dan menggalakkan kelakuan bermain

dalam semua kumpulan beruang. Akan tetapi, pengurangan dalam frekuensi hanya didapati dalam beruang yang dipelihara dalam kurungan dalam. Pengkayaan ini tidak memberikan kesan pengurangan dalam tahap kortisol dalam sampel air liur ataupun tinja.

Kajian ini telah menunjukkan bahawa rekabentuk kurungan mempunyai kesan ketara terhadap kelakuan, terutamanya kelakuan *stereotypy*, dalam beruang yang dipelihara dalam kurungan. Respons beruang terhadap pengkayaan adalah berbeza diantara individu yang dipelihara di dalam kurungan luar yang diperkaya daripada individu yang ditempatkan di dalam kurungan dalam yang tandus. Oleh sebab itu, isu pengurusan asas dan keperluan utama haiwan adalah amat penting dalam usaha pemuliharaan *ex situ* bagi *H. malayanus*. Pengkayaan persekitaran dengan bahan-bahan asas merupakan satu cara yang berkesan untuk mengurangkan anomali dalam kelakuan haiwan, terutamanya dikalangan haiwan yang dipelihara dalam persekitaran kurungan yang kurang memuaskan.

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I certify that a Thesis Examination Committee has met on 7 September 2010 to conduct the final examination of Tan Hwee Mien on her thesis entitled "Diurnal Activity Budget, Stereotypic Behaviour and Response to Enrichment of Captive Malayan Sun Bears (*Helarctos malayanus R.*)" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Veterinary Science.

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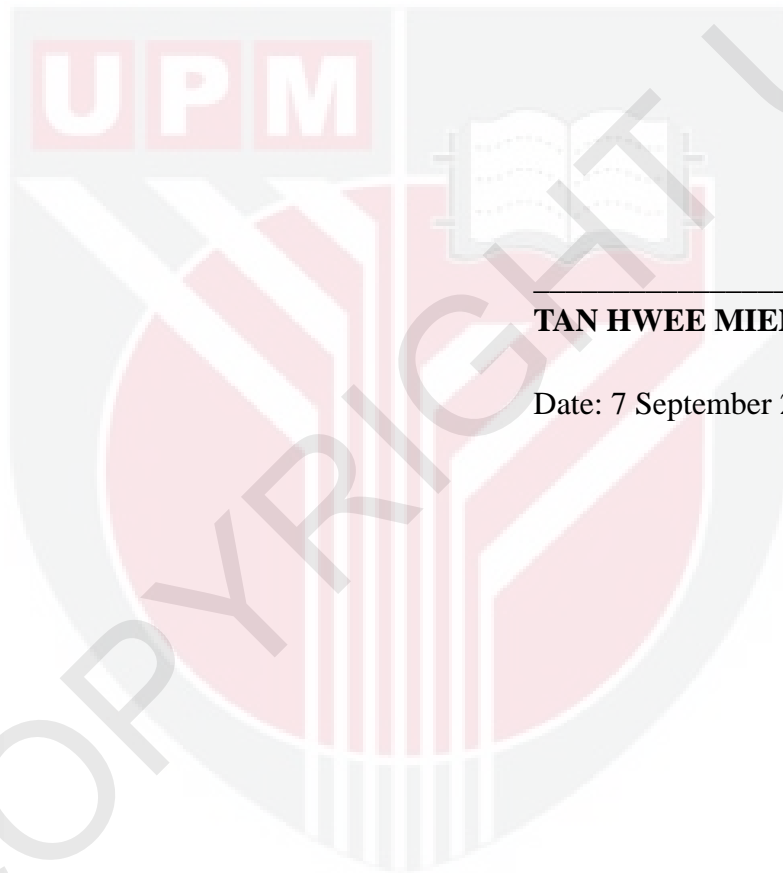
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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Date: 7 September 2010

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CHAPTER 1

INTRODUCTION

The Malayan Sun Bear (*Helarctos malayanus*) is the only native bear species in Malaysia. Although it is protected locally (Wildlife Protection Act 1972) (DWNP 1972), wild populations are steadily declining due to habitat loss and poaching (Servheen, 2001). It has been well established that habitat preservation is among the best methods (Wildt *et al.*, 1997) for species conservation. However, this becomes challenging when there is a high demand for land or forest area for various purposes including human settlement, commercial land development and timber production. In light of these pressures, captive breeding or *ex situ* conservation is a viable alternative to ensure a sustainable population of a species.

Throughout the world, bears are commonly kept in captivity for public viewing and education purposes in zoological parks. In contrast to their natural habitat, captive bears are generally confined in small and barren enclosures with a fixed routine. In such monotonous and non-stimulating environments, bears tend to perform stereotypies (Wechsler, 1991; Forthman *et al.*, 1992). Since stereotypy is often associated with sub-optimal captive conditions, it has been used as an indicator of poor welfare for many wildlife species (Mason, 1991b; Mason, 2006; Mason *et al.*, 2007).

In addition to behavioural observations, quantification of circulating glucocorticoids is also commonly used to assess stress levels in animals (Owen *et al.*, 2004). In recent years, the development of non-invasive methods for evaluation of endocrinological status *via* collection of urine and faecal samples has been successful in providing accurate physiological assessment which is parallel to profiles of blood plasma and serum (Whitten *et al.*, 1998). In contrast, the traditional methods which often involve capture and blood collection potentially influence the endocrinological data that is being assessed (Whitten *et al.*, 1998).

In order to reduce the occurrence of stereotypic behaviour and improve the welfare of captive zoological animals, zoo communities have initiated environmental enrichment strategies (Swaisgood and Shepherdson, 2005). The enrichment programs often involve the improvement of the physical appearance of zoo enclosures which is often barren, predictable and non-stimulating, as well as other changes in husbandry in order to create a more stimulating environment for the animals (Mason *et al.*, 2007). This exercise has been observed to alleviate the frequency of stereotypies that were previously performed by the animals in their former non-stimulating environment (Swaisgood and Shepherdson, 2005). The unpredictable scenario created through enrichment helped the animals cope with captive conditions, which previously deterred their ability to perform natural behaviour repertoires. Therefore, environmental enrichment is vital in the

management of endangered species in captivity for conservation breeding or reintroduction to the wild (Swaisgood *et al.*, 2001).

When compared to other bear species, *H. malayanus* is the least researched species in the ursid family (Pereira *et al.*, 2002). The behaviour of *H. malayanus* has only been described in a few studies (Hewish and Zainal-Zahari, 1995; Vickery and Mason, 2004; 2005). In addition there is a paucity of published information on the influence of environmental enrichment on alleviating stress in captive reared *H. malayanus*. Thus, the objectives of the present study are as follows:

1. To document the diurnal activity patterns and stereotypic behaviours in captive *H. malayanus*,
2. To establish the effect of enclosure design on the stereotypies performed by captive *H. malayanus*,
3. To ascertain if environmental enrichment is able to alleviate stereotypic behaviours through evaluation of physio-behavioural stress profiling.

The hypotheses to be tested are:

1. Stereotypic behaviours are present in captive *H. malayanus* in Peninsular Malaysia.
2. Bears housed in barren indoor enclosures have higher frequency of stereotypy than those housed in relatively enriched, outdoor enclosures.
3. Environmental enrichment is able to reduce stereotypic behaviours.

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