

THE POPULATION ECOLOGY AND JUVENILE
DEVELOPMENT OF THE SPOTTED SEAHORSE,
Hippocampus kuda Bleeker

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The first part of this study focused on the population ecology of the Spotted Seahorse, *Hippocampus kuda* in the Pulai River Estuary, Johor. A total of 102 females and 103 males were tagged from April 2002 to March 2004, with no significant bias in the sex ratio. The average sightings of seahorses were lower in the wet season (July-August and November-December). The population size of *H. kuda* in the study area was estimated at 438 individuals using the Jolly-Seber method. The mean total length in males and females were similar. Length frequency distribution exhibit a normal, unimodal curve and the modal length for males and females was 15.0 cm. Sexual maturity was reached at 14.0 cm in both sexes. Weight-length relationship was exponential ($W=0.0038L^{2.97}$) and characterized by an isometric growth type. Reproduction was year-round but peak reproductive season could not be determined.

The maximum residency period of seahorses was 103 days with no significant difference in the residency periods between males and females. There was probable migration especially during the wet season. The mean home range size was 32.35 m² and the home range shapes were somewhat elongated. The home range size of males (mean: 39.25 m²) and females' (mean: 25.46 m²) did not differ significantly. No significant association was detected in seahorse's preference for seagrass denseness with regard to sex and size.

The second part of this study was on juvenile development under hatchery rearing conditions. Newborns (mean standard length: 9.33 mm±0.789 S.D.) were raised to 124 days old (mean standard length: 119.35 mm±6.04 S.D.). The growth was characterized by three stages with two inflexion points occurring at Day 21 and Day 76 respectively. The mean growth rate in the first, second and third phases were 0.68 mm/day, 1.16 mm/day and 0.71 mm/day respectively. The growth rate was most rapid in the second stage which was probably influenced by an ontogenetic shift in diet and saltatory behavioural changes into benthic form. Weight-length relationship was exponential ($W=7.14 \times 10^{-6} L^{2.76}$) but the slope, $b=2.76$, reflected a negative allometric growth type. Sexes could be distinguished at around 110 days and the sex ratio was unbiased. The standard length in males and females did not differ significantly.

A morphological staging series divides *H. kuda* juvenile development into eight stages based on the development of coronet, cheek and eye spines, keel and pigment.

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**KAJIAN EKOLOGI DAN PERKEMBANGAN KUDA LAUT, *Hippocampus kuda*
Bleeker**

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Bahagian pertama kajian ini tertumpu pada populasi kuda laut, *Hippocampus kuda* di Kuala Sungai Pulai, Johor. Sebanyak 102 betina and 103 jantan *H. kuda* telah ditanda dari April 2002 hingga March 2004, di mana tiada ratio seks direkodkan. Purata pemerhatian kuda laut lebih rendah semasa musim tengkujuh (Julai-Ogos dan November-Disember). Saiz populasi *H. kuda* di kawasan kajian dijangka sebanyak 438 melalui kaedah Jolly-Seber. Purata panjang badan jantan dan betina adalah sama. Frekuensi taburan panjang adalah normal dan unimodal, dengan panjang modal bagi jantan dan betina tertakluk pada 15.0 cm. Kematangan dicapai pada saiz 14.0 cm dalam kedua-dua jantina. Hubungan berat-panjang adalah eksponensi ($W=0.0038L^{2.97}$) and ia dikategorikan dalam jenis tumbesaran isometrik. Walaupun pembiakan berlaku sepanjang tahun, namun musim pembiakan tidak dapat ditentukan..

Jangka penempatan maksimum kuda laut adalah 103 hari dan tiada perbezaan direkodkan antara jangka penempatan jantan dan betina. Penghijrahan mungkin berlaku pada musim tengkujuh. Purata saiz kawasan yang diperlukan untuk hidup ialah 32.35 m^2 dan kawasan hidup itu berbentuk panjang. Tiada perbezaan diperhatikan untuk purata saiz kawasan hidup bagi jantan (purata: 39.25 m^2) and betina (purata: 25.46 m^2). Tiada hubungan diperhatikan dalam kegemaran kuda laut terhadap kepadatan rumput laut dari segi seks dan saiz.

Bahagian kedua kajian ini adalah mengenai perkembangan kuda laut. Kuda laut yang baru dilahirkan (purata panjang: $9.33 \text{ mm} \pm 0.789 \text{ S.D.}$) dipelihara sehingga usia 124 hari (purata panjang: $119.35 \text{ mm} \pm 6.04 \text{ S.D.}$). Tumbesaran kuda laut tertakluk kepada tiga fasa, dan terdapat dua digit infleksi pada hari ke-21 dan hari ke-76. Purata kadar tumbesaran dalam fasa pertama, kedua dan ketiga adalah 0.68 mm/hari , 1.16 mm/hari and 0.71 mm/hari . Kadar tumbesaran adalah paling tinggi pada fasa kedua disebabkan perubahan diet pemakanan dan kelakuan. Hubungan berat-panjang adalah eksponensi ($W=7.14 \times 10^{-6} L^{2.76}$) namun kecerunan, $b=2.76$, mencerminkan perkembangan allometrik yang negatif. Jantina dapat diperbezakan pada 110 days dan ratio seks adalah sama. Panjang badan jantan dan betina juga adalah sama.

Suatu siri morfologi dilampirkan dan membahagikan perkembangan *H. kuda* kepada lapan fasa, bergantung kepada perkembangan “coronet, cheek dan eye spines, keel dan pigment”. Ratio morfometrik untuk semua bahagian badan, kecuali panjang “trunk”, menunjukkan terdapat satu digit transisi yang berlaku pada 25 mm SL .

Nisbah tumbesaran yang tinggi bagi panjang kepala, lebar kepala, panjang asas sirip pectoral dan dorsal, panjang dan lebar muncung, dan diameter mata pada fasa awal, dan tumbesaran ekor dengan tiba-tiba hanya selepas dua minggu pertama ini semuanya mencerminkan keutamaan organ yang diperkembangkan dahulu adalah penting untuk meninggikan peluang hidup kuda laut.