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DISTRIBUTION AND ECOLOGY OF THE MALAYSIAN MAHSEER (GENUS: TOR) IN KENYIR LAKE, MALAYSIA

LIENG SOPHA

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DISTRIBUTION AND ECOLOGY OF THE MALAYSIAN MAHSEER (GENUS: *TOR*) IN KENYIR LAKE, MALAYSIA

By

LIENG SOPHA

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DISTRIBUTION AND ECOLOGY OF THE MALAYSIAN MAHSEER IN LAKE KENYIR, MALAYSIA.

by

LIENG SOPHA
October 1999

Chairman: Prof. Dr. Hj. Mohd. Azmi Bin Ambak
Faculty: Faculty of Applied Science and Technology

A study on distribution and ecology of the Malaysian mahseer (*Tor soro* Cuvier & Valenciennes and *Tor tambroides* Bleeker) was carried out in lotic and lentic habitats in Lake Kenyir, Malaysia.

The fish distribution and habitat profile of the Malaysian mahseer were studied to investigate the ecological condition and their relationship with the environment and to determine the present spatial distribution and abundance in the lake system. The results showed that there is a habitat selection by fish of different sizes, (fingerling 2.0 - 7.0 cm, juveniles 7.1 - 20.0 cm and adults >20.0 cm TL) in relation with size of stream, water depth, current velocity, substrate, water temperature, water transparency, dissolved oxygen, and habitat types.

The adults of *Tor tambroides* were most abundant in deeper parts or pools in upstream reaches of large streams (26-60 m width) of Sg. Tembat and Sg. Terengganu and medium-sized stream (12-25 m width) of Sungai Kiang. The

juvenile were found in all sizes of sampled streams in the lake. The adult of *T. soro* were found in less abundance in small and medium-sized streams of Sg. Buluh Nipis II, Sg. Mandak I and II, Sg. Siput, and Sg. Lancang. However, the juveniles and fingerlings were mostly found in the small stream reaches and were most abundant at water depths ranging from 10 to 187 cm with velocity ranging from 1 to 118 $cm.s^{-1}$. The adults occurred in habitats where the water depth was about 5.4 m and current velocity ranged from 1 to 66 $cm.s^{-1}$. The fingerling and juvenile of both species were frequently found in streams where pools represented from 3 to 9%, runs 5 to 32%, riffles 61 to 91% of the total area. The fingerlings and juveniles were mostly found in habitats where boulders were predominant followed by bedrock, sand, gravel, cobble and pebble. The adults mostly occurred in habitats where the substrate comprised of boulders and rock. The young mahseers were frequently found in clear-running water, while the adults occurred in slow-running and more turbid water as compared to the young mahseer. The temperature profile ranged from 23.0 to 25.3°C. the dissolved oxygen varied from 6.7 to 8.8 $mg.l^{-1}$. The water hardness of the mahseer habitat nullifies the effect of toxic metals to the fish.

The microhabitat and macrohabitat analysis of habitat use and preference of *T. soro* in the two small stream reaches of Sg. Buluh Nipis II and Sg. Mandak II showed that *T. soro* preferred depths between 52 cm and 120 cm and water velocity between 0 and 35 $cm.s^{-1}$. Different size classes of *T. soro* used different mean depths at both sites. The seasonal use of depth and velocity by *T. soro* were significantly different at both sites ($p<0.05$). *T. soro* preferred sand and gravel as substrate. *T. soro* preferred cover up to 70% and the fish of all size had similar preference for cover at both sites ($p>0.05$). *T. soro* generally aggregated in groups

ranging from 1 to 7 fish and were found to associate with *Acrossocheilus dearatus* (C & V) and *Osteochilus vittatus* (C & V). The adults of *T. soro* were found in pools. The juveniles were quite well spread in all habitat types, pools, runs and riffles, while the fingerlings were most abundant in riffle habitat.

It was found that *T. soro* fed mainly on algae and other available fauna and flora at the stream of Sg. Buluh Nipis II. Examining their feeding apparatus, the teeth of *T. soro* (7.0 -26.0 cm in TL) and *T. tambroides* (17.0 - 25.0 cm in TL) were not developed on the lower and upper jaw, but there is a presence of pharyngeal teeth on the upper and lower pharyngeal arch. Their mouths were protracted and slightly inferior. The lips of both fish species were thick. Being a typical cyprinid, both fish species had no conventional stomach and possessed an extended long intestine. The fish employed suction feeding in adaptation with their feeding apparatus. The relative length of gut (R.L.G.) for the *T. soro* with the size range from 7.0 to 26.0 cm in total length has been found to vary from the lowest 0.77 to the highest 2.85. The value of R.L.G. for *T. tambroides* with size ranging from 17.0 to 25.0 cm in total length also varies, ranging from 1.11 to 2.50. Both fish species were omnivores as evident from gut content analysis and the relative length of gut.

It could be concluded that the mahseer is a highly territorial fish species. The physical and chemical parameters are significant in determining spatial distribution and abundance of the Malaysian mahseer and also important in the application of habitat-based management of the mahseer population in Lake Kenyir.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia
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TABURAN DAN EKOLOGI MAHSEER MALAYSIA DI TASIK KENYIR, MALAYSIA

Oleh
LIENG SOPHA

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Pengerusi: Prof. Dr. Hj. Mohd. Azmi Bin Ambak

Fakulti: Fakulti Sains Gunaan dan Teknologi

Satu kajian terhadap taburan dan ekologi ikan kelah (*T. soro* Cuvier & Valencies dan *T. tambroides* Bleeker) telah dijalankan di habitat lotik dan lentik di Tasik Kenyir, Malaysia

Kajian terhadap taburan ikan serta profil habitat ikan kelah telah dijalankan untuk mengkaji keadaan ekologi ikan kelah serta perhubungannya dengan persekitaran dan untuk menentukan taburan spatial dan kelimpahan terkini di dalam sistem tasik. Hasil kajian mendapati terdapat pemilihan habitat oleh ikan yang berbeza saiz (fry 2.0 - 7.0 cm, juvenil 7.1 - 20.0 cm dan dewasa >20.0 cm panjang total) terhadap saiz anak sungai, kedalaman, kelajuan arus, substrat, suhu air, kejernihan, oksigen terlarut dan jenis habitat.

Ikan Kelah dewasa banyak terdapat di kawasan yang lebih dalam atau lubuk di bahagian hulu (20-60 cm lebar) sungai Tembat dan Sungai Terengganu serta di kawasan sungai yang mempunyai kelebaran sederhana (12-25 cm lebar) di Sungai

Kiang. Ikan juvenil dijumpai dalam pelbagai saiz di kawasan persampelan. Kelimpahan ikan dewasa adalah rendah di sungai kecil dan sederhana di sungai Buluh Nipis II, Sungai Mandak I dan II, Sungai Siput dan Sungai Lancang. Walaubagaimanapun, kebanyakkan ikan fri dan juvenil di dapati di sungai kecil dan kerap terdapat di kawasan yang mempunyai kedalaman berjulat di antara 10 hingga 187 cm dengan kelajuan arus di antara 1 hingga 118 $cm.s^{-1}$. Ikan dewasa dijumpai di habitat dengan kedalaman 5.4 cm dengan kelajuan arus berjulat dari 1 - 66 $cm.s^{-1}$. Fri dan juvenil bagi kedua-dua spesies kerap dijumpai di kawasan sungai di mana lubuk mewakili di antara 3 hingga 9%, runs diantara 5 hingga 32%, jeram di antara 61 hingga 91% daripada keseluruhan kawasan. Fri dan juvenil banyak dijumpai di habitat di mana terdapat banyak balak diikuti dengan kawasan berbatu, berpasir, gravel, cobble dan pebble. Ikan dewasa dijumpai di kawasan air perlahan dan keruh berbanding dengan ikan yang muda yang kerap dijumpai di kawasan air jernih. Secara keseluruhan, suhu di kawasan kajian berjulat diantara 23.0 hingga 25.3 °C dengan nilai oksigen terlarut di antara 6.7 hingga 8.8 $mg.l^{-1}$.

Berdasarkan analisis mikrohabitat dan makrohabitat bagi *T. soro* di kawasan sungai kecil di Sungai Buluh Nipis II dan Sungai Mandak II, *T. soro* lebih memilih kawasan yang mempunyai kedalaman di antara 52 cm hingga 120 cm dengan kelajuan arus di antara 0 hingga 35 $cm.s^{-1}$. Kajian juga menunjukkan bahawa saiz ikan yang berbeza menggunakan kawasan min kedalaman yang berbeza di kedua-dua kawasan. Pemilihan kawasan kedalam dan arus bagi setiap musim oleh *T. soro* di dapati mempunyai perbezaan yang bererti di kedua-dua kawasan ($p<0.05$). *T. soro* lebih memilih kawasan berpasir dan gravel sebagai bahan substrat. *T. soro* dari

pelbagai saiz di dapati gemar tinggal di kawasan yang mempunyai tempat berlindung yang hampir meliputi 70% di kedua-dua kawasan ($p>0.05$). *T. soro* kebiasaannya tinggal berkumpulan dalam kelompok di antara 1 hingga 7 ekor dalam satu kumpulan bersama dengan *Acrossocheilus dearatus* (C & V) dan *Osteochilus vittatus* (C & V). *T. soro* dewasa dijumpai di kawasan lubuk manakala ikan juvenil lebih tersebar hampir ke semua habitat seperti jeram dan lubuk manakala anak jejari banyak terdapat di kawasan jeram.

Ikan *T. soro* memperolehi makanan daripada alga dan lain-lain flora dan fauna yang terdapat di kawasan Sungai Buluh Nipis II. Ikan *T. soro* (7.0 - 26.0 cm panjang total) dan *T. tambroides* (17.0 - 25.0 cm panjang total) mempunyai mulut inferior dengan bibir yang tebal. Ia tidak mempunyai gigi di bahagian rahang atas dan bawah tetapi mempunyai gigi faring di bahagian atas dan bawah kawasan faring. Kedua spesies ini tidak mempunyai perut tetapi mempunyai usus yang panjang. Spesies ikan ini memakan secara menghisap sebagai satu adaptasi terhadap struktur mulutnya. Panjang relatif usus *T. soro* berjulat di antara 0.77 hingga 2.85 bagi ikan yang bersaiz di antara 7.0 hingga 26.0 cm panjang total. Panjang relatif usus *T. soro* berjulat di antara 1.11 hingga 2.50 bagi ikan yang bersaiz di antara 17.0 hingga 25.0 cm panjang total.

Secara keseluruhannya, ikan kelah adalah ikan yang bersifat territorial. Taburan dan kelimpahan ikan kelah banyak bergantung kepada parameter fizikal dan kimia. Pengetahuan parameter ini sangat penting dan berguna dalam pengurusan populasi ikan kelah berdasarkan habitat di Tasik Kenyir.

LIST OF ABBREVIATIONS

°C	Degree Celsius
%	Percentage
uS/cm	Microsimon/ centimetre
cm	Centimeter
C.V.	Cuvier and Valenciennes
E	East
$\bar{E}$	Expectation Frequency
FFRC	Freshwater Fisheries Research Centre
GPS	Global Position System
ha	Hectare
Kg	Kilogram
m	meter
m^3	Cubic meter
mg	Milligram
mg/l	Milligram per litter
N	North
O	Observation Frequency
ppm	Parts per million
R.L.G.	Relative Length of Gut
SD	Standard Deviation

Sg.	Malaysian language abbreviation for "Sungai" means River
SL	Standard Length
TL	Total Length
TWL	Top Water Level
US$	Unit of the Currency of the United States

CHAPTER I

INTRODUCTION

Background of the Study

Fishes are important to mankind as a source of protein (Biswas, 1993, Philip et al., 1993). In Malaysia fish and other seafood are the major diet which makes up at least 20% of the per capita consumption of all protein. This is almost equal to the amount of protein taken from other meats such as poultry, pork, beef and mutton which together contribute about 23% of the required protein (Ishak et al., 1986). Thus, fish is a vital source of food.

Fish is not only a source of vital protein to the population, it also provides employment for the rural people, gaining some of foreign exchange and creating opportunity for recreation (Khan, 1992). In 1996, the fisheries sector produced 1,239,434 tones of total fish production valued at RM3.84 billion contributing about 1.54% to the national Gross Domestic Product (GDP). In this total production, the marine fisheries landed 1,125,689 tones or 90.90% of the total production, the inland fisheries landed 3,683.21 tones or 0.30% of the total production and aquaculture production was 109,062 tones or 8.80% of the total production. Exclusively, ornamental fish production ornamental 278,462,210

pieces. These fisheries provided direct employment to 99,578 people consisting of 79,616 fishermen and 19,902 aquaculturist. This employment constituted about 1.18% of the total labor force in the country (DoF, 1998). Thus the fisheries sector plays a significant role in providing protein and employment, especially in rural areas, as well as supports the country economic growth.

Although recreational fisheries have not been well developed, Malaysia has the potential for recreational fisheries development, both marine and inland. The existing recreational fishing is still in the form of some nature preservation, the development and management of sport fish is very rudimentary. In fact, its potential is enormous (Ambak, 1984). The Malaysian coastline is 3,400 km with about 160,000 square nautical miles of inshore and offshore (Anon, 1989). However the development of marine sport fisheries needs more precaution and more complicated than freshwater. On the other hand, freshwater sport fisheries have received high popularity in the world. Besides this, many natural or man-made freshwater water systems in Malaysia exist in many forms with existing-sport fish that can be promoted to sport fisheries. Reservoirs estimatedly cover an area of about 91,680 ha (Anon, 1983). In Peninsular Malaysia alone, there are 15 major reservoirs (DoF, 1982). Disused mining pools cover 16,680 ha (Arumugam, 1991). There are more than 100 river systems in the country (Baluyut, 1983). Large tracts of freshwater and peat swamp forests cover some 2.5 million ha (Parish and Davies, 1991). These are the available natural resources potential. With these natural resources, recreational fisheries have existed in many places and anglers throughout the country have caught many species. There are many media including New Straits Times, Rod and Line, and Pancing discussed about fisheries recreation, experiences, guides,