UNIVERSITI PUTRA MALAYSIA

DIVERSITY AND FEEDING GUILDS OF FISH POPULATIONS IN PENGKALAN GAWI – PULAU DULA SECTION OF TASIK KENYIR TERENGGANU, MALAYSIA

IZHARUDDIN SHAH BIN KAMARUDDIN

FP 2011 30
DIVERSITY AND FEEDING GUILDS OF FISH POPULATIONS IN PENGKALAN GAWI – PULAU DULA SECTION OF TASIK KENYIR TERENGGANU, MALAYSIA

By

IZHARUDDIN SHAH BIN KAMARUDDIN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

April 2011
DEDICATION

I dedicated this thesis to my wife Wan Ainal Yaqin Wan Zulkifli, my son Afif Hasif Izharuddin Shah, to my beloved parents Mak Abah Klang, Mama Papa Kuantan, and to my brothers and sisters.
This study was conducted to evaluate the species diversity and feeding habits of fish population in the Pengkalan Gawi – Pulau Dula section of Tasik Kenyir Terengganu. Samples were collected monthly from February 2008 to January 2009 (12 months) at three sampling stations designated as Station A (Pulau Dula), Station B (Sungai Ikan) and Station C (Pulau Pupi). Fish sample were collected using gill nets measures 100 m long, 3 m deep and having a stretch mesh size of 6.35 cm (2.5 inches). A total of 274 individuals fish comprising 13 species from 5 families were collected during the study period. The mean values for the Shannon-Weaver index, Pielou Evenness index and Margalef Richness index were 1.41±0.23, 0.81±0.13, 3.53±0.62 respectively.

Six most dominant species namely Barbodes schwanenfeldii, Notopterus sp., Hampala macrolepidota, Hemibagrus nemurus, Channa micropeltes and Pristolepis faciatus
were selected for the study on the stomach contents. Among the wide and variety prey consumed, Aquatic insect was the most important food item fed by the fish species in this ecosystem. The Aquatic insect food item was abundant in the stomach of *H. nemurus* thus it was categorized as insectivore fish species. Four other species comprising *B. schwanenfeldii, Notopterus* sp., *H. macrolepidota* and *P. faciatus* consumed on balance dietary component mostly Aquatic insect, Fish food item, Plant materials and Phytoplankton. The stomach content of *C. micropeltes* was found with high percentage of Fish food item and it was classified as piscivore fish species with the highest Trophic Level value of 3.56±0.63.

In terms of spatial distribution, Shannon-Weaver index value in Pulau Dula was the lowest when compared to the other stations. This station was inhabited by 9 species with 72 individuals fish, while Sungai Ikan was inhabited by 11 species with 128 individuals and Pulau Pupi was inhabited by 7 species with 74 individuals fish. All of the six most dominant species were present at each station and most of them were found in abundance specifically in one station, indicated that they were limited to one particular habitat. Temporally, the three most dominant species included *B. schwanenfeldii, Notopterus* sp. and *H. macrolepidota* were present in the monthly samples throughout the study period.

The results of this study indicated that most of the species found were similarly reported in other studies in Tasik Kenyir. It is hoped that the results will be useful in contributing towards management of the lake in a sustainable manner for future generations.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KEPELBAGAIAN DAN TABIAT PEMAKANAN BAGI POPULASI IKAN DI SEKSEN PENGKALAN GAWI – PULAU DULA DI TASIK KENYIR TERENGGANU, MALAYSIA

Oleh
IZHARUDDIN SHAH BIN KAMARUDDIN

April 2011

Pengerusi : Mustafa Kamal Abdul Satar, PhD
Fakulti : Pertanian

Kajian ini dijalankan untuk menilai kepelbagaian spesis dan tabiat pemakanan bagi populasi ikan di Seksen Pengkalan Gawi – Pulau Dula di Tasik Kenyir, Terengganu. Sampel ikan dikumpul pada setiap bulan bermula dari bulan Februari 2008 sehingga Januari 2009 (12 bulan) di tiga stesen penyampelan yang dinamakan sebagai Stesen A (Pulau Dula), Stesen B (Sungai Ikan) dan Stesen C (Pulau Pupi). Sampel ikan ini dikumpul dengan menggunakan pukat insang berukuran 100 m panjang, 3 m labuh dan saiz mata pukat berukuran 6.35 cm (2.5 inci). Sebanyak 274 individu ikan merangkumi 13 spesies dari 5 famili telah dikumpulkan sepanjang kajian ini dijalankan. Nilai min bagi indeks Shannon-Weaver, indeks Pielou Evenness dan indeks Margalef Richness adalah masing-masing dengan nilai 1.41±0.23, 0.81±0.13 dan 3.53±0.62.
Enam spesis paling dominan seperti *Barbodes schwanenfeldii*, *Notopterus* sp., *Hampala macrolepidota*, *Hemibagrus nemurus*, *Channa micropeltes* dan *Pristolepis faciatus* dipilih bagi mangkaji kandungan isi perut ikan. Diantara pelbagai jenis mangsa yang dimakan, Serangga akuatik merupakan jenis makanan yang paling penting yang dimakan oleh ikan di dalam ekosistem ini. Makanan Serangga akuatik mempunyai kelimpahan tertinggi di dalam kandungan isi perut *H. nemurus* justeru ia dikategorikan sebagai spesis ikan insektivor. Empat spesis lain merangkumi *B. schwanenfeldii*, *Notopterus* sp., *H macrolepidota* dan *P. faciatus* mengambil komponen pemakanan yang seimbang dimana kebanyakannya adalah terdiri daripada Serangga akuatik, Makanan jenis ikan, Kandungan bahan tumbuhan dan Fitoplankton. Kandungan isi perut *C. micropeltes* pula didapati mempunyai peratusan tertinggi bagi Makanan jenis ikan dan ianya dikelaskan sebagai spesis ikan pisivor dengan nilai Trophic Level tertinggi iaitu 3.56±0.63.

Dari segi taburan mengikut ruang, nilai indeks Shannon-Weaver di Pulau Dula merupakan yang terendah apabila dibandingkan dengan stesen-stesen yang lain. Stesen ini didiami oleh 9 spesis dengan 72 individu, manakala Sungai Ikan didiami oleh 11 spesis dengan 128 individu dan Pulau Pupi didiami oleh 7 spesis dengan 74 individu ikan. Kesemua enam spesis ikan dominan hadir di setiap stesen dan kebanyakan mereka ditemui tertumpu hanya di satu stesen dengan kelimpahan yang tinggi, ini menggambarkan bahawa mereka adalah terhad di dalam satu habitat tertentu sahaja. Dari segi masa pula, tiga spesis paling dominan termasuk *B. schwanenfeldii*, *Notopterus*
sp. dan *H. macrolepidota* hadir di dalam sampel bulanan sepanjang tempoh kajian dijalankan.

Keputusan kajian ini menunjukkan bahawa kebanyakan spesis yang ditemui turut juga dilaporkan didalam kajian lain di Tasik Kenyir. Diharap, agar keputusan ini berguna dalam menyumbang kepada pengurusan yang mampan di Tasik Kenyir untuk generasi yang akan datang.
ACKNOWLEDGEMENTS

I would like to express my gratitude to my supervisor Dr. Mustafa Kamal Abdul Satar who supervise me in completing this thesis. I also express my gratitude to the committee members Dr. Annie Christianus and Assoc. Prof. Dr. Siti Khalijah Daud.

Great appreciation is expressed to Prof. Dr. Sharr Azni Harmin and Assoc. Prof. Dr. Mohd. Salleh Kamarudin as heads of the department for giving their full support on this study.

My sincere appreciation also goes to En. Junaidi Jaafar (from Department of Land Management, UPM) who assisted me during the entire sampling period. I am very thankful to En. Muhammad Abdullah, En. Jasni Mohd Yusoff, En. Perumal Kuppan, En. Rozhan Zakaria, En. Eduardo de Peralta and En. Lirong Yu Abit.

I would also like to thank to Pn. Emlia Tamber, Cik Tina, Pn. Asiah, En. Najib Hamzah, En. Abd Wahid, En. Farid and En. Nasrul Salim for the endless supports during the study.

I would like to take this opportunity to thank peoples at Tasik Kenyir; En. Hishamuddin, En. Lan and En. Din Thambi, Tuan Haji Samad, En. Fauzi, En. Jamal, Pn. Norizan and En. Zukaimi.

I also express my appreciation to the Malaysian Ministry of Science and Technology (MOSTI) for funding the research. My appreciation also goes to Kemajuan Terengganu Tengah (KETENGAH) and Department of Fisheries Malaysia (DOF) for the research and sampling approval.
I certify that a Thesis Examination Committee has met on 19 April 2011 to conduct the final examination of Izharuddin Shah Bin Kamaruddin on his thesis entitled “Diversity and Feeding Guilds of Fish Populations in Pengkalan Gawi – Pulau Dula Section of Tasik Kenyir Terengganu” 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 Science. Members of the Thesis Examination Committee were as follows:

**Mohd Salleh bin Kamarudin, PhD**  
Associate Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Aziz bin Arshad, PhD**  
Associate Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Che Roos bin Saad, PhD**  
Associate Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Mazlan bin Abd. Ghaffar, PhD**  
Professor  
Faculty of Science and Technology  
Universiti Kebangsaan Malaysia  
(External Examiner)

---

**BUJANG KIM HUAT, PhD**  
Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Mustafa Kamal bin Abdul Satar, PhD**  
Lecturer  
Department of Aquaculture/Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Annie Christianus, PhD**  
Lecturer  
Department of Aquaculture/Faculty of Agriculture  
Universiti Putra Malaysia  
(Member)

**Siti Khalijah binti Daud, PhD**  
Associate Professor  
Department of Biology/Faculty of Science  
Universiti Putra Malaysia  
(Member)

---

**HASANAH MOHD GHAZALI, PhD**  
Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
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.

IZHARUDDIN SHAH BIN KAMARUDDIN

Date: 19 April 2011
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>DEDICATION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>viii</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>ix</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>xi</td>
</tr>
<tr>
<td>LISTS OF TABLES</td>
<td>xv</td>
</tr>
<tr>
<td>LISTS OF FIGURES</td>
<td>xvii</td>
</tr>
<tr>
<td>LISTS OF ABBREVIATIONS</td>
<td>xviii</td>
</tr>
</tbody>
</table>

## CHAPTER

<table>
<thead>
<tr>
<th>1 INTRODUCTION</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 LITERATURE REVIEW</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Reservoir</td>
<td>5</td>
</tr>
<tr>
<td>2.2 Species Diversity of Fish</td>
<td>6</td>
</tr>
<tr>
<td>2.3 The Important of Species Diversity</td>
<td>8</td>
</tr>
<tr>
<td>2.4 Factor Influencing Distribution of Fish Species</td>
<td>10</td>
</tr>
<tr>
<td>2.4.1 Habitat Types and Conditions</td>
<td>10</td>
</tr>
<tr>
<td>2.4.2 Water Quality</td>
<td>11</td>
</tr>
<tr>
<td>2.4.3 Eutrophication</td>
<td>11</td>
</tr>
<tr>
<td>2.4.4 Introduction of Exotic Species</td>
<td>12</td>
</tr>
<tr>
<td>2.4.5 Human Activities</td>
<td>13</td>
</tr>
<tr>
<td>2.5 Measuring Species Diversity</td>
<td>14</td>
</tr>
<tr>
<td>2.6 Fish Feeding Habits</td>
<td>15</td>
</tr>
<tr>
<td>2.6.1 Herbivores</td>
<td>15</td>
</tr>
<tr>
<td>2.6.2 Carnivores</td>
<td>16</td>
</tr>
<tr>
<td>2.6.3 Omnivores</td>
<td>17</td>
</tr>
<tr>
<td>2.6.4 Planktivores</td>
<td>18</td>
</tr>
<tr>
<td>2.6.5 Detritivores</td>
<td>19</td>
</tr>
<tr>
<td>2.7 Factors Affecting Fish Feeding Habits</td>
<td>20</td>
</tr>
<tr>
<td>2.7.1 Abiotic Factors</td>
<td>21</td>
</tr>
<tr>
<td>2.7.2 Biotic Factors</td>
<td>22</td>
</tr>
</tbody>
</table>
2.8 Methods of Determining Feeding Habits
2.8.1 Occurrence Method
2.8.2 Numerical Methods
2.9 Water Quality Parameters
2.9.1 Temperature
2.9.2 Dissolved Oxygen
2.9.3 pH
2.9.4 Turbidity
2.9.5 Nitrate-Nitrogen
2.9.6 Ammonia-Nitrogen
2.9.7 Phosphorus-Orthophosphate

3 MATERIAL AND METHODS
3.1 Site Description
3.2 Study Location and Study Duration
3.3 Data Collection and Sampling
3.3.1 Sampling Stations
3.3.2 Fish Sampling Technique
3.3.3 Field Analyses of Samples
3.3.4 Water Quality Analyses
3.3.5 Laboratory Analyses of Samples
3.4 Data Analyses
3.4.1 Species Diversity of Fish
3.4.2 Feeding Habits of Fish
3.4.3 Condition Factor of Fish (K)
3.4.4 Length-Weight Relationship

4 RESULTS
4.1 Species Diversity of Fish
4.1.1 Spatial Species Diversity
4.1.2 Temporal Species Diversity
4.2 Feeding Habits of Fish
4.2.1 Spatial Feeding Habits of Fish
4.2.2 Temporal Feeding Habits of Fish
4.3 Length-Weight Relationship and Condition Factor of Fish

5 DISCUSSION

6 CONCLUSION