UNIVERSITI PUTRA MALAYSIA

POPULATION BIOLOGY OF *Alburnoides* JEITTELES 1861 (ACTINOPTERYGII: CYPRINIDAE) IN IRAN

MAHVASH SEIFALI

FP 2012 3

POPULATION BIOLOGY OF *Alburnoides* JEITTELES 1861 (ACTINOPTERYGII: CYPRINIDAE) IN IRAN

By

MAHVASH SEIFALI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Doctor of Philosophy

February 2012

DEDICATION

I dedicated

This work to my lovely husband Behrouz and sons Alireza and Mohamad Hasan, who has sacrificed so much for me to achieve my goal

and

To my beloved mother

To my sisters and brother

and

To my father and brother soul

Your love, encouragement and patience sustained me through

and

who supported me all those past years that made me whom I am today is very much acknowledged

thank you for your love, understanding, patience and support.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia
in fulfilment of the requirement for the degree of Doctor of Philosophy

POPULATION BIOLOGY OF *Alburnoides* JEITTELES 1861 (ACTINOPTERYGII: CYPRINIDAE) IN IRAN

By

MAHVASH SEIFALI

February 2012

Chairman: Professor Aziz Bin Arshad, PhD

Faculty: Agriculture

The genus *Alburnoides* Jeitteles, 1861 is distributed in some geographically isolated basins viz. South Caspian Sea, Namak, Kor, Kavir, Tigris and Orumyieh in Iran. Six species of *Alburnoides* were reported from the basins of Iran. However, little is known about the morphogeographical variation, genetic divergence, ecological adaptation or biology of this fresh water fish species although it is a widespread taxon in Iran. This is the first report on the genus *Alburnoides* within the Iranian basins. In this study we investigated the taxonomy, morphometric variation, reproductive biology, feeding habits and population dynamic of the Iranian spirlin during four seasons beginning from July 2008 to June 2009.

Morphometric variables analysis of 574 samples from 15 populations of four basins as well as truss network and geometric morphometric study of 802 specimens from 23 populations of five basins in Iran indicated that the populations belonged to three

major groups that are shown by the consistency with their morphological features. The first clad include spirlin populations from south of Caspian Sea basin. The second clad comprised the populations found in the Namak and Kor basins and the final clad is the populations from the Kavir and Tigris basins. Details of morphological data indicated that there was a distinct morphological separation of populations of *Alburnoides* in Iran. The populations from the Namak, Kor, and southern Caspian Sea basins showed a closer morphological relationship than those from the Tigris and Kavir basins.

A total of 115 samples of South Caspian spirlin were used for the feeding habit study. Results showed that they specifically consumed greater amount of diatoms (Bacillariophyceae) as their dominant diet. Other diets including detritus, insects and algae also recorded high frequency of occurrence but lower percentage value indicating that they are a generalized diet. Spirlin has short gut structure that generally adopted for the carnivorous style of feeding. There was no significant in changes in feeding diet of spirlin according to sampling period, however monthly variations of diets revealed that spirlin have a higher ability to select more available and diverse preys in summer and lower ability in spring.

Results on the sex ratio of 471 specimens of *Alburnoides* sp population in the South of Caspian Sea basin from north of Iran was found in to be 1: 1.24 (female: male), which is almost close to 1: 1 (females: male). Study on the ovarian maturity of the spirlin revealed the presence of six different maturity stages. Ovaries were also evaluated to calculate the reproductive indices such as GSI, MGSI and DI. High values of the GSI were observed in the month of June and its distinct low value in

the month of August indicated that the fish spawn during June–July period. The size at sexual maturity of female spirlin was observed at 56-61 mm. In this study the mean fecundity of the 32 females spirlin used in the study was 1722.92 (± 653.88) eggs per fish. The estimated maximum numbers of ova in females was 3042 and the minimum numbers of ova was 668 which were gathered from specimens ranged 82.18 – 110.47 mm in total length.

Studies on age, growth, mortality and population characterization of 1019 specimens of spirlin were conducted for Kesselian stream, south of Caspian Sea. Length frequency data were analyzed by using FiSAT (FAO-ICLARM Stock Assessment Tools) for the estimation of the population parameters. Asymptotic length ($L\infty$), growth coefficient (K) were estimated at 104.48 mm and 1.19/yr. Growth performance index (Ø') was calculated as 4.113. Total mortality (Z) was estimated at 3.40/yr whereas fishing mortality (F) and natural mortality (M) were found to be 2.43/yr and 0.97/yr respectively. The exploitation rate (E) was calculated as 0.71. The present exploitation rate (E = 0.70) indicated that the Caspian spirlin is over exploited in the Kesselian stream.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

POPULATION BIOLOGY OF *Alburnoides* JEITTELES 1861 (ACTINOPTERYGII: CYPRINIDAE) IN IRAN

Oleh

MAHVASH SEIFALI

Februari 2012

Pengerusi: Profesor Aziz Arshad, PhD

Fakulti : Pertanian

Genus *Alburnoides* Jeitteles, 1861 didapati di kawasan lembangan yang secara geografinya terpencil iaitu di selatan Laut Caspian, Namak, Kor, Kavir, Tigris dan Orumyieh. Enam spesies *Alburnoides* telah dilaporkan terdapat di kawasan lembangan tersebut. Walau bagaimanapun, tidak banyak diketahui mengenai variasi morfogeografi, sesaran genetik, adaptasi ekologi atau biologi spesies ikan air tawar ini. Walaupun ianya merupakan takson yang tersebar luas di Iran. Kajian ini merupakan laporan yang pertama mengenai genus *Alburnoides* di kawasan lembangan di Iran. Aspek kajian ini meliputi aspek taksonomi, variasi morfometrik, biologi pembiakan, tabiat pemakanan dan dinamik populasi bagi spirlin dari Iran. Kajian ini telah dijalankan selama empat musim bermula Julai 2008 sehingga Jun 2009.

Analisis pembolehubah morfometrik bagi 574 sampel meliputi 15 populasi dari empat lembangan; serta jalinan ‘truss’ dan penelitian morfometrik geometri bagi 802 spesimen dari 23 populasi di lima lembangan menunjukkan bahawa populasi tersebut terdiri daripada tiga kumpulan utama yang mempunyai ciri morfologi yang konsisten. Kumpulan yang pertama adalah populasi spirlin yang terdapat di selatan Laut Caspian. Kumpulan kedua terdiri dari populasi yang terdapat di Namak dan Kor manakala kumpulan ketiga terdiri dari populasi lembangan Kavir dan Tigris. Data morfologi menunjukkan perbezaan yang jelas di antara populasi *Alburnoides* di Iran. Populasi *Alburniodes* dari Namak, Kor, dan selatan Laut Caspian menunjukkan perkaitan morfologi yang lebih hampir berbanding dengan populasi dari lembangan Tigris dan Kavir.

Sebanyak 115 sampel spirlin dari selatan Caspian telah diambil untuk kajian tabiat pemakanan. Hasilnya menunjukkan spirlin secara spesifiknya memakan diatom (Bacillariophyceae) sebagai diet dominan. Diet lain termasuk detritus, serangga dan alga mempunyai frekuensi kejadian yang tinggi, namun rendah dari segi peratusan bagi menunjukkan ciri diet umum serta ia tidak khusus kepada taksa tertentu. Spirlin mempunyai struktur usus yang pendek, yang mana sesuai untuk tabiat pemakanan secara karnivor. Tiada perubahan yang signifikan bagi diet pemakanan spirlin berdasarkan tempoh masa persampelan. Namun, variasi bulanan diet membuktikan bahawa spirlin mempunyai kemampuan yang lebih tinggi untuk memilih mangsa dengan lebih banyak dan pelbagai pada musim panas berbanding pada musim bunga. Kajian ke atas nisbah jantina bagi 471 spesimen *Alburnoides* sp di selatan Laut Caspian di utara Iran mendapati nisbah 1:1.24 (betina:jantan), iaitu hampir ke nisbah 1:1 (betina:jantan). Pemerhatian ke atas proses kematangan ovari spirlin

menunjukkan kewujudan enam peringkat kematangan. Indeks pembiakan seperti GSI, MGSI dan DI telah diukur ke atas ovari yang dikaji. Nilai GSI yang tinggi direkodkan pada bulan Jun serta penurunan mendadak pada bulan Ogos menunjukkan bahawa aktiviti pembiakan berlaku di antara bulan Jun–Julai. Saiz spirlin betina semasa matang ialah 56-61 mm. Purata bilangan telur bagi 32 spirlin betina yang dikaji ialah 1722.92 (± 653.88). Anggaran jumlah maksimum dan minimum telur bagi individu betina dengan saiz panjang keseluruhan di antara 82.18 – 110.47 mm ialah 3042 dan 668.

Kajian ke atas umur, pertumbuhan, kematian dan ciri-ciri populasi bagi 1019 spesimen spirlin telah dijalankan di sungai Kesselian, selatan Laut Caspian. Data frekuensi panjang telah dianalisa menggunakan FiSAT (FAO-ICLARM Stock Assessment Tools) bagi menganggarkan beberapa parameter populasi. Panjang asimtotik ($L\infty$) dan ko-efisien pertumbuhan (K) adalah 104.48 mm dan 1.19/tahun. Indeks prestasi pertumbuhan (Ø') ialah 4.113. Jumlah kematian (Z) dianggarkan pada 3.40/tahun, manakala kematian akibat aktiviti perikanan (F) dan kematian semulajadi (M) dijangkakan pada 2.43/thn dan 0.97/thn. Kadar eksploitasi (E) adalah pada 0.71. Berdasarkan kepada kadar eksploitasi semasa (E = 0.70), spirlin Caspian telah ditangkap secara berlebihan di sungai Kesselian.

ACKNOWLEDGEMENT

I will always remember all the people who have played significant role in the realization of my degree. I would like to express my deepest gratitude and appreciation to my supervisor Professor Dr. Aziz Arshad for his guidance, and assistance during this study. Also, my sincere thanks to my committee members Assoc.Professor Dr. Siti Khalijah Daud, Professor Dr. Siti Shapor Siraj, Professor Dr. Bahram Hasanzadeh Kiabi and Professor Dr. Hamid Reza Esmaeili for all the advices they have given towards the completion of my study.

I extend my thanks to Dr. S. M. Nurul Amin, Mrs. Faezeh Yazdani, Moghadam, Dr. Asghar Abdoli, Gholamreza Amiri, Kiavoosh Gholzarian, Narges Fardad, Narges Nazari, Shiva Mirali for their assistance.

Lastly, my special thanks to my husband and family for their encouragement, supports, patience, understanding, faith and inspiration given to me during the period of my study in Malaysia. Without their assistance I would have difficulties conducting the experiments.

I certify that a Thesis Examination Committee has met on 10 February 2012 to conduct the final examination of Mahvash Seifali on her Doctor of Philosophy thesis entitled "POPULATION BIOLOGY OF *Alburnoides* JEITTELES 1861 (ACTINOPTERYGII: CYPRINIDAE) IN IRAN" in accordance with the Universities Pertanian Malaysia (Higher Degree) Act 1971 and Universiti Putra Malaysia [P. U. (A) 106] 15 March 1998. The committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

Muta Harah Zakaria, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Annie Christianus, PhD
Senior lecture
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Mazlan Abd Ghaffar, PhD
Professor
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
(Internal Examiner)

Mirosław Przybylski, PhD
Associate Professor
Faculty of biology
Universiti of Lodz, Banacha Poland
(External Examiner)

SEOW HENG FONG, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis is submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the supervisory Committee were as follows:

Aziz Arshad, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Siti Shapor Siraj, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Siti Khalijah Daud, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

Bahram Hasanzadeh Kiabi, PhD
Associate Professor
Faculty of Biological science
Universiti Shahid Beheshti Teharn Iran
(Member)

Hamid Reaza Esmaeili, PhD
Associate Professor
Faculty of Science
University Shiraz Iran
(Member)

BUJANG BIN KIM HUAT, 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 other institutions.

MAHVASH

SEIFALI

Date: 10 February

2012

TABLE OF CONTENTS