

IBRAHIM SAID AL-ANBOURI

MASTER OF SCIENCE

2012

**OTOLITH BASED AGE AND GROWTH STUDIES ON THE INDIAN
OIL SARDINE, *Sardinella longiceps* (VALENCIENNES, 1847) FROM
MUSCAT, SULTANATE OF OMAN.**

IBRAHIM SAID AL-ANBOURI

**MASTER OF SCIENCE
UNIVERSITI MALAYSIA TERENGGANU
MALAYSIA**

2012

**OTOLITH BASED AGE AND GROWTH STUDIES ON THE INDIAN
OIL SARDINE, *Sardinella longiceps* (VALENCIENNES, 1847) FROM
MUSCAT, SULTANATE OF OMAN.**

IBRAHIM SAID AL-ANBOURI

**Thesis Submitted in Fulfillment of the Requirement for the
Degree of Master of Science in the Faculty of Fisheries and Aqua-Industry
Universiti Malaysia Terengganu**

March 2012

DEDICATION

“I humbly thank Allah Almighty
the Merciful and the Beneficent
who gave me success”

“I would like to dedicate this thesis to my family
father, mother, brothers and sisters and especially to my lovely wife”

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu
in fulfillment of the requirement for the degree of Master of Science.

**OTOLITH BASED AGE AND GROWTH STUDIES ON THE INDIAN
OIL SARDINE, *Sardinella longiceps* (VALENCIENNES, 1847) FROM
MUSCAT, SULTANATE OF OMAN.**

IBRAHIM SAID AL-ANBOURI

March 2012

Main Supervisor : Mohd Azmi Ambak, Ph.D.

**Co- Supervisor : Shama Zaki Abdul Haleem, Ph.D.
N. Jayabalan, Ph.D.**

Faculty : Fisheries and Aqua-Industry

The Indian oil sardine *Sardinella longiceps* is a commercially important small pelagic resource in the Indo-Pacific region. Although, this species forms a considerable proportion in the fish catches of Oman, no detailed studies on the biological characteristics of this fish have been attempted. Hence, a study was carried out to investigate growth parameters using analysis of otolith dimension and length frequency, population parameters using analysis of otolith dimension and length frequency, age at 1st maturity using analysis of otolith dimension and gonad maturation and spawning season analysis of otolith dimension and gonad maturation. Samples of *S. longiceps* were collected at random twice a month from artisanal catches mainly by beach seine of 47 mm stretched mesh size along the Muscat coast for a period of one year from October 2008 to September 2009. Altogether, 1307 fish were collected for biological analysis and 2080 fish were used for length frequency investigation. A total of 20 otoliths were collected every month between January and

September 2009 from various size ranges of fish. A total of 186 sagittal whole otoliths were investigated for aging which examined under different light microscopy. The study identified two types of seasonal growth, daily and sub-daily increments. The daily increments were examined and counted with and without sub-daily rings. The high growth rate was obtained as 5.0 yr^{-1} when the sub-daily ring was not considered in reading, suggesting longevity of approximately 7 months of growth considered as fast growing and short longevity species. Unlikely, the otolith study showed that species had a reasonable growth rate at $K= 2.4 \text{ yr}^{-1}$ when sub-daily ring treated as daily ring, suggesting 16 months of its life span. However, length frequency distribution showed a lower growth rate as $K= 1.2 \text{ yr}^{-1}$.

Some reproductive parameters like spawning season based on back-calculation (when sub-daily increment was included in the analysis) and GSI were determined. They indicated that spawning season was occurred twice a year, the minor one from December to March and the major one from June to September. The length and age at first maturity of *S. longiceps* along the coast of Muscat, Oman was obtained as 181 mm and 10 months of growth respectively. Further, the annual instantaneous rate of mortality (Z), exploitation rate (E) and allowable size of the catch as a management tools were estimated based on both techniques. The total mortality (Z) and exploitation rate (E) were determined as 2.44 yr^{-1} and 0.30 suggested by otolith microstructure, whereas 4.11 yr^{-1} and 0.46 were calculated by the mean of length frequency respectively. Although

the given techniques provided significant variation in age and growth, the otolith microincrement technique has been approved among scientists and has contributed to provide a reliable and accurate estimate of aging in tropical fisheries than any other technique. Thus, the sagittal otolith was chosen to provide some management plan in Muscat.

Both techniques agreed that species may live for more than one year. The present investigation showed that oil sardine stock was below the optimum level of exploitation. It was concluded that from present study, the current exploitation of oil sardine in Oman Sea is not being well exploited. As a management plan, maintain the fishing effort activity, develop gear selectivity and protect spawning seasons were essential and effective management for fisheries strategy. Furthermore, minimum/appropriate size of the catch was suggested to be as 190 mm (TL) to sustain the oil sardine fisheries over time. Results of the study helped to provide some useful information for the better management of the Indian oil sardine stock in Muscat.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Master Sains.

KAJIAN PERTUMBUHAN DAN UMUR BERASASKAN OTOLITH KEATAS IKAN TAMBAN “ INDIAN OIL SARDINE”, *Sardinella longiceps* (VALENCIENNES, 1847) DARIPADA MUSCAT, OMAN.

IBRAHIM SAID AL-ANBOURI

Mac 2012

Penyelia Utama : Mohd Azmi Ambak, Ph.D.

**Penyelia Bersama : Shama Zaki Abdul Haleem, Ph.D.
N. Jayabalan, Ph.D.**

Fakulti : Perikanan dan Aqua-Industri

Ikan tamban India, *Sardinella longiceps* adalah sumber pelagik kecil yang penting secara komersil di kawasan Indo-Pasifik. Walaupun spesies ini merupakan sebahagian besar tangkapan ikan di Oman, tiada sebarang kajian terperinci dijalankan mengenai ciri-ciri biologinya. Oleh yang demikian, satu kajian telah dijalankan untuk mengetahui umur, pertumbuhan dan mortaliti ikan ini berasaskan otolith dan data frekuensi panjang. Sampel *Sardinella longiceps* di ambil dua kali sebulan secara rawak daripada tangkapan ikan artisanal (menggunakan pukot tarik pantai, bermata pukot 47 mm) di sepanjang pantai Muskat selama setahun, dari Oktober 2008 hingga September 2009. Sebanyak 2080 ekor ikan telah digunakan untuk kajian frekuensi panjang dan 1307 ekor ikan digunakan untuk analisis biologi. Sebanyak 20 otolith di ambil setiap bulan antara Januari dan September 2009. daripada pelbagai julat saiz. Sejumlah 186 sagitta otolith digunakan untuk pemeriksaan penentuan umur di bawah mikroskop bercahaya. Kajian ini mengenalpasti dua jenis pertumbuhan

bermusim, iaitu pertumbuhan harian dan pertumbuhan sub-harian. Gegeleang pertumbuhan harian di kira dengan gegeleang sub-harian dan tanpa gegeleang sub-harian. Apabila gegeleang sub-harian tidak diambil kira, kadar pertumbuhan di anggarkan sebanyak 5.0 per tahun, yang bermaksud ikan ini cepat besar tetapi hayat ikan ini hanya menjangkau 7 bulan. Apabila gegeleang sub-harian di ambil kira, kadar pertumbuhan, K , di anggarkan sebanyak 2.4 per tahun, yang bermaksud ikan ini cepat besar dan hayat ikan ini menjangkau 16 bulan. Namun begitu, apabila taburan frekuensi panjang dianalisa, kadar pertumbuhan, K , adalah lebih rendah, iaitu 1.2 per tahun.

Parameter reprodktif seperti musim mengawan telah juga ditentukan melalui kaedah 'back-calculation' dan GSI. Hasil kajian menunjukkan musim mengawan (dan bertelur) sebanyak dua kali setahun, yang utama dari Jun hingga September dan yang minor dari Disember hingga Mac. Panjang dan umur kali pertama matang adalah 181 mm dan 10 bulan bagi *Sardinella longiceps* di pantai Muskat, Oman. Anggaran mortaliti, Z , kadar eksploitasi, E telah juga di buat untuk memudahkan pengurusan ikan ini. Kajian struktur-mikro otolith menunjukkan nilai jumlah mortality (Z) = 2.44/tahun dan kadar eksploitasi (E) = 0.30. Kajian frekuensi panjang menunjukkan nilai jumlah mortality (Z) = 4.11/tahun dan kadar eksploitasi (E) = 0.46. Walaupun terdapat pelbagai teknik yang digunakan untuk menentu umur dan pertumbuhan ikan, penggunaan struktur-mikro otolith diakui oleh saintis sebagai yang tepat dan terbaik,

khususnya untuk perikanan tropika. Kaedah ini adalah baik untuk pengurusan perikanan tamban di Muskat.

Hasil kajian ini menunjukkan ikan tamban India boleh mencapai jangka hayat melebihi 1 tahun dan kadar eksploitasi masih bawah para optimum. Plan pengurusan untuk ikan ini boleh mencadangkan peningkatan aktiviti tangkapan, 'develop gear selectivity', dan mengawal tangkapan semasa musim mengawan. Saiz yang boleh di tangkap dicadangkan pada 190 mm sebagai langkah pengurusan mapan ikan ini. Hasil kajian ini adalah penting dan boleh menyumbang matlumat untuk pengurusan ikan tamban India yang lebih baik di Muskat.