

EXPERIMENTS IN REARING SIGANUS GUTTATUS (PISCES:  
OSTEICHTHYES, SIGANIDAE) IN SEA-CAGE AND FISHPEN  
WITH REMARKS ON THE AVAILABILITY OF JUVENILE  
SIGANID SPECIES IN COASTAL WATERS OF  
CEBU PROVINCE

---

A Thesis

Presented to

the Faculty of the Graduate School  
University of San Carlos

---

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science in Biology

---

by

Abduraji Sahibul Tahil

March, 1978

198053  
UNIVERSITY OF SAN CARLOS  
LIBRARY

PROPERTY OF USC LIBRARY SYSTEM

OCT 14 1988

APPROVAL SHEET

This thesis entitled "EXPERIMENTS IN REARING SIGANUS GUTTATUS (PISCES: OSTEICHTHYES, SIGANIDAE) IN SEA-CAGE AND FISHPEN WITH REMARKS ON THE AVAILABILITY OF JUVENILE SIGANID SPECIES IN COASTAL WATERS OF CEBU PROVINCE", prepared and submitted by Mr. Abduraji Sahibul Tahil in partial fulfillment of the requirements for the degree of M. S. Biology has been examined and is recommended for acceptance and approval for ORAL EXAMINATION.

Thesis Committee

  
NORBERT TAN, M.S.  
Adviser

  
ENRIQUE SCHOENIG, SVD, Ph.D.  
Member

  
EXUPERANCIO MONTECILLO, M.S.  
Member

-----  
PANEL OF EXAMINERS

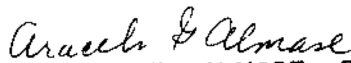
Approved by the Committee on Oral Examination with a grade of Pass.

  
NORBERT TAN, M.S.  
Adviser

  
ALICIA J. TAN, Ph.D.  
Chairman

  
ENRIQUE SCHOENIG, SVD, Ph.D.  
Member

  
EXUPERANCIO MONTECILLO, M.S.  
Member

  
ARACELI G. ALMASE, Ph.D.  
Representative

MEC, Region VII, Central Visayas  
Cebu City

Accepted and approved in partial fulfillment of the requirements for the degree of M. S. Biology.

Comprehensive Examination Passed July 24, 1976.

  
ALICIA J. TAN, Ph.D.  
Dean, Graduate School

February 24, 1978

## ACKNOWLEDGMENTS

My heartfelt gratitudes are offered to Mr. Norbert Rau, Visiting Professor and Consultant in Fishery Biology for his technical advice and continuous guidance, and for taking the photographs, Dr. Fr. Enrique Schoenig, SVD, and Mr. Exuperancio Montecillo of the Department of Biology, University of San Carlos, Cebu City for their suggestions especially on the preparation of the research proposal, and to Dr. Gregorio T. Velasquez, University Professor of Botany at the University of the Philippines, Diliman, Quezon City for confirmation of species identification of the benthic algae used in this study.

I am also very grateful to Dr. D. J. Woodland of the University of New England for his brochures and information on the systematics of siganids, Dr. T. J. Lam, A. Ben-Tuvia, G. Wm. Kissil, D. Popper, R. C. May, T. Lichatowich, C. L. Soh, H. von Westernhagen, H. Rosenthal, U. Horstmann, and J. P. McVey, who have supplied me with valuable information on siganids.

My sincere thanks go to the following persons: Mr. Richardo Abing, Mr. Christopher Guod, Ms. Esther Filipinas, Ms. Pacita Bracero, Ms. Herminia Bas, Ms. Gracita Agunod, Ms. Isabel G. Bajao, Ms. Narcing Cabano, Ms. Norma S. Dedal, Mrs. Laura A. Cueva, Mrs. Lovellie Gaspar,

Mr. Jose Muldong, Jr., Mr. Enrique Avila and Mr. Tony Yap whose invaluable assistance made this study a reality. Much thanks also go to all the fishermen in the areas of investigation for their generosity and information on the seasonal occurrence of siganid species used in this study, and to all my friends and colleagues who in one way or another had assisted me and contributed to the success of this work.

ABDURAJI SAHIBUL TAHIL

## ABSTRACT

Two different groups of juvenile S. guttatus fed with benthic algae were reared in two different culture structures. After 24 weeks of rearing, one group with an average standard length of 7.89cm and weight of 15.49g upon stocking in sea-cage increased in length to an average of 10.31cm and 33.56g in weight. The other group reared in a fishpen for the same number of weeks increased in length from an average of 7.88 to 10.42cm and in weight from 15.47 to 34.47g. There was no significant difference of growth in sea-cage and fishpen. Mortality of 15.8% and 13% were obtained in the cage and fishpen respectively. Maximum temperature change of 7.8°C and salinity 4.69‰ of the experimental area were recorded. Growth comparison showed that S. guttatus is slower in growing than other species of siganids.

Information on seasonal occurrence and/or abundance of the juveniles (fry) of five siganid species in the coastal waters of Cebu province is given. Some advantages on rearing siganids in the fishpen are described, and further improvements are also discussed.

## TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS . . . . .	ii
ABSTRACT . . . . .	iv
LIST OF TABLES . . . . .	vii
LIST OF FIGURES . . . . .	viii
CHAPTER	
I. INTRODUCTION . . . . .	1
II. REVIEW OF LITERATURE . . . . .	5
A Brief Review on Morphology and Taxonomic History . . . . .	5
Ecology . . . . .	11
Fisheries and Commercial Value . . . . .	15
III. MATERIALS AND METHODS . . . . .	19
A. Rearing Experiments . . . . .	19
Experimental Area . . . . .	19
Rearing Structures . . . . .	19
Collection of Juveniles . . . . .	22
Stocking of the Juveniles . . . . .	22
Feeding of the Fish Stocks . . . . .	26
Identification of Food Algae . . . . .	26
Growth Rates Measurement of the Fish Stocks . . . . .	26
Temperature and Salinity Analysis . . . . .	27

	vi
	Page
B. The Availability of Juveniles . . . . .	28
Areas for Investigation . . . . .	28
Field Investigation . . . . .	28
IV. OBSERVATIONS AND RESULTS . . . . .	30
A. Rearing Experiments . . . . .	30
Growth . . . . .	30
Mortality . . . . .	35
Foods . . . . .	45
Temperature and Salinity . . . . .	58
Growth Comparison with other Siganid Species . . . . .	64
B. Remarks on the Availability of Juvenile Siganid Species . . . . .	67
V. DISCUSSION . . . . .	78
VI. CONCLUSIONS . . . . .	90
VII. RECOMMENDATIONS . . . . .	92
VIII. SUMMARY . . . . .	94
LITERATURE CITED . . . . .	98
APPENDICES . . . . .	102
CURRICULUM VITAE . . . . .	121

LIST OF TABLES

Table	Page
1. Mean or extreme and total (for Miscellaneous Meteors only) data on the surface weather observations of Mactan Island, Cebu . . . .	25
2. <u>S. guttatus</u> .. Data of the number of fish suffering from different types of injuries in the fishpen and sea-cage (Pen/Cage) during the experiment . . . . .	41
3. Mean growth measurements of <u>S. guttatus</u> reared in the fishpen and sea-cage (Pen/Cage) recorded every fourteen days . .	80
4. The seasonal occurrence and/or abundance of the juveniles (fry) of five siganid species in the coastal waters of Cebu province . . . . .	86
5. Data of the 24-hour analysis of temperature and salinity changes of the experimental area recorded twice (first and second week) a month, 1977 . . . . .	103
6. Hewlett-Packard (HP 25) Applications Programs for Exponential Curve Fit, Correlation Coefficient, and Paired t Statistics . . .	115

PROPERTY OF USC LIBRARY SYSTEM



LIST OF FIGURES

Figure	Page
1. <u>Siganus guttatus</u> (Bloch) . . . . .	8
2. <u>S. virgatus</u> (Cuvier and Valenciennes) . . .	9
3. <u>S. hexagonata</u> (Bleeker) . . . . .	10
4a. <u>S. spinus</u> (Linnaeus) . . . . .	11
b. <u>S. canaliculatus</u> (Park) . . . . .	11
5. Map of Mactan Island showing the experi- mental area, and area where juvenile <u>S. guttatus</u> were collected for rearing.	20
6. Sea-cage with feeding exit on top, and anchored by stones to the bottom . . .	21
7. Fishpen with feeding and handling exit, the bottom net was mounted and/or buried in the ground with iron clamps . . . .	23
8. Map of the province of Cebu showing the areas investigated for the availability of juvenile (fry) siganid species in the coastal waters . . . . .	29
9. Growth rates of <u>S. guttatus</u> fed entirely with benthic algae in sea-cage and fishpen . . . . .	31
10. Growth increment of the fish stocks ( <u>S.</u> <u>guttatus</u> ) reared in sea-cage and fishpen . . . . .	33
11. Length-Weight relationship curves of benthic algae-fed <u>S. guttatus</u> reared in sea- cage and fishpen . . . . .	34
12. Dead bodies of juvenile <u>S. guttatus</u> . . .	36
13. Close-up view of the mouth of <u>S. guttatus</u> showing the upper lip being ulcerated close to the nostrils by the nylon netting of rearing structure . . . . .	37

PROPERTY OF USC LIBRARY SYSTEM

## Figure

14.	Close-up view of protruded upper lip of <u>S. guttatus</u> . The entire mouth apperture is completely covered by his lips . . . . .	39
15.	Juvenile <u>S. guttatus</u> suffering from protrusion of the upper lip that covers almost completely their mouth opening . . . . .	40
16.	Mortality and growth rates of juveniles <u>S. guttatus</u> reared in sea-cage and fishpen . . . . .	42
17.	Banded barmacuda, <u>Sphyræna jello</u> (Cuvier and Valenciennes) . . . . .	44
18.	<u>Chaetomorpha crassa</u> (C. Agardh) Kutzing . . . . .	46
19.	<u>Cladophora</u> sp. . . . .	46
20.	<u>Gelidiella acerosa</u> (Forskakal) Feldmann et Hammel . . . . .	48
21.	<u>Gigartina tenella</u> Harvey . . . . .	48
22.	<u>Gracilaria salicornia</u> . . . . .	50
23.	<u>Laurencia grevilleana</u> Yamada . . . . .	50
24.	<u>Laurencia undulata</u> Yamada . . . . .	52
25.	<u>Laurencia</u> sp. . . . .	52
26.	<u>Microcladia</u> sp. . . . .	54
27.	Main filament Siphonous . . . . .	54
28.	Brittle star, <u>Ophiothrix</u> sp. (Ophiuroidea). Its soft, like-roe-of-sea-urchin meat on the aboral surface is liked very much by the fish . . . . .	57
29.	Monthly mean diurnal temperature and salinity fluctuations of the experimental area . . . . .	60