



**UNIVERSITI PUTRA MALAYSIA**

***GONAD DEVELOPMENT AND DIETS OF SILVER SILLAGO  
(Sillago sihama) IN THE MARUDU BAY, SABAH***

**MOHD YUMNIHADI BIN YUSOFF**

**FP 2013 97**

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**This project report is submitted in partial fulfillment of the requirement for  
the degree of Bachelor of Agriculture (Aquaculture)**

**DEPARTMENT OF AQUACULTURE  
FACULTY OF AGRICULTURE  
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**2013**

**CERTIFICATION OF APPROVAL**  
**DEPARTMENT OF AQUACULTURE**  
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This is to certify that I have examined the final project and all corrections have been made as recommended by the panel of examiners. This report complies with the recommended format stipulated in the AKU4999 project guidelines, Department of aquaculture, Faculty of Agriculture, Universiti Putra Malaysia.

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## ACKNOWLEDGEMENTS

I am very grateful and praise be to lord Allah, and 'selawat' to the prophet Muhammad S.A.W. Thanks to God that I successfully finish writing the project report and I am glad to express my deepest appreciation to my supervisor Prof. Dr. Aziz Arshad for his unstopped supports, guidance, advices, and encouragement throughout the preparation of my thesis.

Sincerely, thanks to my final year project coordinator Prof Madya Dr. Yuzine Esa and all my lectures for their support and beneficial knowledge contribution that was given to me during my project implementation. I also wish to thanks the staffs and postgraduate students of Department of Aquaculture, Faculty of Agriculture, University Putra Malaysia, for all their help and cooperation during my study period.

Special thanks to Dr S.M. Nurul Amin, Dr. Roushon Ara and Master student Mohd Azim for being helpful and kind to share me some useful knowledge on understanding of project method from the beginning of the project until finished. I also would like to share this gratefulness with Muhammad Afiq, Izzati, Fatinah, Sofea, Afiq and other friends for their invaluable lesson and support to complete my research study.

Finally, special appreciation to my beloved family especially my mother and my father who are always support, encourage and stand by my side throughout the happiness and hardship until my project is finished.

## ABSTRACT

Studies on the spawning period and diets preference of *Sillago sihama* was conducted from December 2012 to September 2013. The objectives of the study were to estimate the spawning period, diets preference and feeding habits by *S. sihama*. A total of 188 samples of *S. sihama* were collected monthly in the Marudu Bay, Sabah. Each fish sample was dissected to collect the male or female gonad and stomach. No specific breeding period of *S. sihama* was seen throughout the study period. The spawning time was estimated to occurred from the peak to lower GSI value in November-December (1.17%), February-March (2.08%), April-May (2.88%) and July-August (1.11%) and the highest peak spawning time was observed between July to August. The lowest GSI value indicated the spent stage of the gonad while the higher GSI value recorded in February, April, June and July indicated the maturation period of the gonad of *S. sihama*. The diet composition were group into twelve major food items comprised of phytoplankton, seaweed fragment, zooplankton, animal fragment, annelid, nematode, foraminifera, mollusca, shrimp, crab, sand and mud and unidentified item. In term of diet composition, the most preferable food items of *S. sihama* were phytoplankton (26.95%), followed by animal fragment (26.65%), sand and mud (20.73%), nematode (5.75%), unidentified item (5.61%), zooplankton (5.24%), annelid (5.19%), mollusca (1.56%), shrimp (0.78%), seaweed fragment (0.71%), foraminifera (0.42) and crab (0.41%). Phytoplankton, animal fragment, sand and mud and nematode could be regarded as the important diets for *S. sihama*. On the basis of food composition found, it can be conclude that *S. sihama* is omnivorous species.

## ABSTRAK

Kajian ke atas musim pembiakan dan keutamaan diet oleh *Sillago sihama* telah dijalankan dari bulan Disember 2012 hingga bulan September 2013. Objektif kajian adalah untuk menentukan tempoh pembiakan, jenis item makanan serta keutamaan diet dan tabiat pemakanan dan oleh *S. sihama*. Sejumlah 188 ekor *S. sihama* telah dikumpulkan setiap bulan dari Teluk Marudu, Sabah. Setiap sampel ikan dibedah untuk mengambil gonad jantan atau betina. Waktu mengawan untuk *S. sihama* adalah berterusan sepanjang tempoh kajian. Waktu mengawan telah dianggarkan bermula pada nilai GSI tinggi hingga ke takat GSI rendah, iaitu pada November-Disember (1.17%), Februari-Mac (2.08%), April-Mei (2.88%) dan Julai-Ogos (1.11%) dan waktu mengawan paling tinggi adalah di antara Julai-Ogos. Nilai GSI yang rendah menandakan peringkat 'spen' bagi ikan manakala nilai GSI yang tinggi dicatat pada Febuari, April, Jun dan Julai dianggarkan waktu kematangan telur bagi *S. sihama*. Komposisi diet oleh *S. sihama* telah dibahagikan kepada dua belas kategori utama yang terdiri daripada fitoplankton, bahagian rumpai laut, zooplankton, komponen haiwan, annelid, nematod, foraminifera, molluska, udang, ketam, pasir dan lumpur dan bahan yang tidak dikenali. Dari segi peratusan, bahan makanan yang paling utama bagi *S. sihama* adalah fitoplankton (26.95%), diikuti oleh fragmen haiwan (26.65%), pasir dan lumpur (20.73%), nematod (5.75%), bahan yang tidak diketahui (5.61%), zooplankton (5.24%), annelid (5.19%), molluska (1.56%), udang (0.78%), bahagian rumpai laut (0.71%), foraminifera (0.42) dan ketam (0.41%). Fitoplankton, komponen haiwan, pasir dan lumpur dan nematod boleh dianggap diet penting untuk *S. sihama*. Berdasarkan komposisi makanan dijumpai di dalam perut, ia boleh disimpulkan bahawa *S. sihama* adalah omnivor dalam tabiat pemakanannya.

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## LIST OF SYMBOLS AND ABBREVIATIONS

BW	Total body weight
$C_i$	Numerical occurrence
cm	Centimetre
E	East
$F_{pi}$	Frequency of occurrence
GSI	Gonado-somatic Index
GW	Gonad weight
$K_n$	Condition factor
N	North
$N_{Ii}$	number of the stomach, which the food items $i$ are being found
$N_p$	The number of non-empty stomach
$n_i$	The number of $i$ th food items
$m$	The number of food items
m	Meter
RM	Ringgit Malaysia
%	Percentage
$\Sigma$	Sum
°	Degree of magnitude
×	Multiplication
=	Equal
GPS	Global positioning system

## CHAPTER 1

### INTRODUCTION

Silver sillago (*Sillago sihama*) is a marine fish that comes from the family of Sillaginidae in the order of Perciformes. The Sillaginidae comprises of 30 species which can be divided into three genera that include *Sillago*, *Sillaginopsis* and *Sillaginotes*, consist of single species each. *Sillago sihama* belong to the genus *Sillago*. They can be found abundant in the marine and estuarine waters of the Indo-Pacific (Tikochinski *et al.*, 2013). There are about nine species of Silver sillago identified in Indian waters (Dutt and Sujatha, 1983).

The similarities in body and coloration between this Sillaginids make it difficult to distinguished unless the swim bladder examination is conducted (McKay, 1992). The Silver sillago also called as Puntung Damar, Bebulus or Bulus-bulus in Malay, whereas worldwide it is called as Northern Whiting, Silver Sillago and Sand Whiting. In Sabah, especially for local residents in Kota Marudu, this fish is known as Bulus. This species mainly caught in Malaysia by using bottom trawls, cast nets and beach seines. *S. sihama* is a demersal fish, so mostly they will easily attach at the bottom of the nets.

The distribution of this species was considered to be dissimilar moderately sized benthic fishes that live in a population of the similar species within shallow waters of the Indian and Pacific Oceans. This fish is common throughout the Indonesian Archipelago, Philippines and extends as far as south and northern Australia (Sheaves, 2006). This is also a common species caught locally as it is distributed along coastal Peninsular Malaysia and Borneo Island. Ambak *et al.* (2010) stated that, this species are found around Red sea waters and along India to Malaysia, Indonesia and up to Australia. They are also found abundance in Borneo waters including Marudu Bay, Sabah. The fish distribution spreads along the shallow coastal river include estuaries to the open sea. The catching and landing of this species in Marudu Bay is always consistent and available every year.

The *S. sihama* is important to the coastal and also estuarine fisheries especially in Indian waters, since about 60% of all sillaginids species landing in Palk Bay and Gulf of Mannar, India (Jayasankar, 1990). *Sillago sihama* has the potential in becoming a valuable species to be marketed commercially in Southeast Asia as protein sources for human. In Malaysia, the annual catch of Silver sillago is consistent and it is also accepted by the local people. Based on my observation, the price of Silver sillago varies according to places and weather, the normal price of *Sillago sihama* in Peninsular Malaysia is around RM 7 to RM 10 depends on their size, whereas in Kota Marudu, this species sold around RM 5 to RM 7. It is an important fish species in term of economic contribution to the local fishermen community in Marudu Bay, Sabah.

Sabah is the state of Malaysia that is mainly bordered by vast coastline and approximately 4315 km. It has many islands and lagoons, thus making it the longest coastline in Malaysia. This status makes Sabah as a good fisheries site to be exploited. A large number of commercially aquatic species are distributed along that area because it has a large bay surrounded by mangroves forest. Several works have been conducted on aquatic species in Sabah (Awong *et al.*, 2011). However, there is no published report on the Sillaginids species in Sabah especially along Marudu Bay coastal area before.

In the previous study, many researches had been done for *Sillago sihama* especially its biology and distribution in foreign country. Krishnamurthy (1969), who studied on the diets of *S. sihama* fry, found that copepod, mysid and prawn larvae and crustacean were the most preferred prey items, whereas the fingerling preferred polychaetes, crustacean and fish fry for their diets. Besides that, some studies on the biology of *S. sihama* also had been conducted. Krishnamurthy and Kaliyamurthy (2011) did on the biology of Silver sillago based on the age and growth rate, feeding habits, reproduction, productive period and fisheries of this species.

Moreover, there were many researches done on the reproductive biology of the *S. sihama* species in Australia and Indian waters on the basis of macroscopic and microscopic examination. According to Jayasankar (1990), the identification of female and male reproductive system were typically teleostean and having a pair of



gonad (ovaries or testis), whereby each have a duct (oviduct or vas deferens) both of which combine to become a common duct (ovarian duct or sperm duct). Other than diets and reproductive biology, other researched such as genetics identification and morphology of Sillaginidae also had been conducted. Recently, nobody has done a study on culture of this species in Sabah.

In order to identify the diets preferences of this species, the stomach of the fish needs to be dissected and analyzed. Dissection of stomach content is the basic way to identify the type of feeding habits of *S. sihama* (Hajisamae *et al.*, 2003). According to the previous researched on the diet of the Sillaginids species in Indo-Pacific, it contrasted in feeding habit of *S. sihama* in different region. Radhakrishnan (1957) reported that the feeding habit of adult *S. sihama* caught from Palk Bay and Gulf of Mannar, India, was a carnivorous species which consumed on mostly polychaete, crustaceans and fishes.

Based on the previous research on *S. sihama* species, there is no research conducted on the gonad development and diets of the species at Marudu Bay, Sabah except within Indian waters and others countries. The knowledge and information available on the Silver sillago in Borneo coast especially in Marudu Bay is very limited. Hence, the present of collecting and studying on gonad development and diets of this species in Marudu Bay may be of interest. From the gonad analysis, the spawning time of this species will be known as well as their gonad maturity. Thus, the significant of study is to determine the spawning time and the diets of *S. sihama* species in Marudu Bay,

Sabah. It can directly give us some information and knowledge in culture of *S. sihama* in controlled or semi controlled environment for future aquaculture industry.

By the end of this study, the diets preferences and feeding habits of this species whether it is carnivorous, herbivorous or omnivorous and the variation of the diets will be determined. An analysis of the gonad and diets of this *S. sihama* species is important for the population in Marudu Bay and able as reference for the future study on the gonad development and diets of this species. This study is limited only for Silver sillago that are distributed of Marudu Bay waters. Thus, the study purpose based on the following objectives:

1. To estimate the spawning time of *Sillago sihama* by using gonado-somatic index (GSI).
2. To identify the type of food items and diet preference by *Sillago sihama*.
3. To determine the feeding habit of *Sillago sihama*.

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