

**Ecobiology and Fisheries of an Economically
Important Estuarine Fish,
Sillago sihama (Forsskal)**



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**Ecobiology and Fisheries of an Economically Important
Estuarine Fish, *Sillago sihama* (Forsskal)**

**Thesis submitted for the degree of
Doctor of Philosophy
In
Marine Science
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JUNE 2008

*THIS THESIS IS DEDICATED
TO MY BELOVED
PARENTS AND MY
DAUGHTER, NISREEN*

CERTIFICATE

This is to certify that the thesis entitled (Ecobiology and Fisheries of an Economically Important Estuarine Fish, *Sillago sihama* (Forsskal)) submitted by Ebtisam Faisal Saeed Shamsan for the award of the degree of Doctor of Philosophy in Marine Science is based on original studies carried by her under my supervision.

The thesis or any part therefore has not been previously submitted for any degree or diploma in any universities or institutions.

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STATEMENT

As required under the University Ordinance 0.19.8 (vi), I state that the present thesis entitled “**Ecobiology and Fisheries of an Economically Important Estuarine Fish, *Sillago sihama* (Forsskal)**” is my original contribution and the same has not been submitted on any previous occasion. For the best of my knowledge, the present work is the first comprehensive work of its kind from the area mentioned.

The literature related to the problems analyzed and investigated has been appropriately cited. Due acknowledgements has been made wherever facilities and suggestions has been availed of.

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1.1. Introduction

Aquatic environment provides numerous resources that support human life in different ways. Food remains the basic need of humankind for survival. Organisms of all the trophic levels are available in aquatic system. Those of second, third and higher trophic levels are known to be rich in protein in terms of quantity and quality, particularly in eight essential amino acids required by man (Burton, 1965). That gave the aquatic system its potentiality to produce high quality food which can fulfill human demands. Ever since man realized how to obtain his food from sea, the importance of the seafood increased significantly. Traditionally fish has been cheaper than meat. It is a source of cheap and nutritious food besides being a major foreign exchange earner. Approximately 363,000 million tonnes of organic material are produced in the world oceans each year (Weihaupt, 1979) but only a small fraction of this is recovered by way of fisheries for direct consumption.

Out of the entire aquatic organisms that are used as a food, man is interested in the tertiary production (fish in particular) for several reasons. It provides protein-rich food for millions all over the world, which can be expected to help in correcting the state of malnutrition when it is consumed in sufficient quantities. It has other commercial uses as animal food, raw materials (Bond, 1979) and source of drugs

and pharmaceuticals (Pandey and Shukla, 2005). Fish oil has more polyunsaturated fatty acids, which is beneficial in lowering the cholesterol level of blood and probably reduces risk of heart attacks (Stansby, 1985). Hence, fish has a very special consideration in human civilization from time immemorial. Growing of the awareness of the fish nutritional values brought it to the fore to be one of the most important diets to be served on table.

The food demands are increasing constantly because the population of the earth is growing all time. To meet this demand we not only required to increase the food production but also use them in a sustainable manner. The exploitation of wild stocks of aquatic organisms has increased considerably to meet this demand. The fish production has reached a plateau and no further increase from coastal water is possible. The scope for increasing fish production from marine sources now lies in the deep sea and far off near fishing areas. As wild populations have been exploited to their maximum limits leading to over fishing, attention naturally turns to fish farming or aquaculture. Such culture can be very efficient way to produce protein food (Odum, 1996).

Fisheries have evolved rather parallel to agricultural farming in the history of human civilization. The world fisheries have changed rapidly during the last few decades. New technology, creation of Exclusive Economic Zone (EEZ) and the 1982 UN Convention on the Law Of the Sea (UNCLOS) and other developments have brought about drastic changes in the management of fisheries and resulted in enhanced

access and significant expansion of effort and production. From only 20 million tones in 1950s, world fisheries production grew to 112 million tones in 1995 (Ahmed *et al.*, 1999b). Indian total fish production remains around 6.18 million tones (Das and Mishra, 2006)

Modern fisheries science has emerged as a result of a very beautiful blending of many basic sciences such as biology, ecology, hydrology, meteorology, pathology, economics, and commerce and so on. The common aim of these all is the fish as food for humankind (Srivastava, 1999). This need was felt only in the last few decades of the nineteenth century when we started understanding our limitations in the exploitation of the available natural fish resources. Looking at the pressure of unemployment currently faced by many countries of the world, fishery can play an important role in the rural economy. It can provide immense job-potential to unskilled rural population. Indian fisheries sector today provides employment to over 11 million people, directly or indirectly. Another great role is in the alleviation of the suffering of the malnutrition among the poor countries of the world. Fisheries can play important role in this case as well.

A large portion of fish production in the last two decades came from aquaculture and culture based fisheries. According to FAO (1997), in a number of Asian countries such as China, India and Bangladesh, cultured fish and aquatic products represent between 25 % and 50 % of total national fisheries production. Aquaculture today has come to mean controlled production; controls at different levels and various levels or

types of manipulation of fin fish in terms of quantity and quality, with reasonable prices. Aquaculture has emerged as a major frontier of fish production in the developing countries both for domestic consumption and for export (Nammalwar, 1997).

Augmentation of finfish production in India can be achieved by carrying out aquaculture on scientific basis such as understanding of the interaction of various environmental parameters in the culture system, influence of water quality: temperature, salinity, pH, dissolved oxygen ...etc on the candidate species cultured, habitat productivity and seed stock availability in space and time. Information on many biological aspects of the fish such as food and feeding habits, reproductive cycle, maturation and spawning period, fecundity, behavior, growth rate, population dynamics and so on are also required to manage wild stock and in the culture practices.

The exploitation of fisheries resources in Indian Ocean has exceeded the natural rate of renewal, resulting in over fishing (Ansari *et al.*, 2006). In such situation, the conservation and fishery management became the need of the hour. Fishery management is the mechanism required to stimulate, control and regulate developmental processes in fisheries; so as to ensure proper and balanced utilization of various fisheries resources and to provide the maximum benefit without causing damage to the resources and the environment (Sivasubramanian, 1999).

Any scientist concerned with any aspect of the fisheries should understand the fish feeding activity, which is the dominant activity of any animal's entire life. This understanding would help to improve the fish catch. Furthermore knowing how food is a limiting factor and how it may be divided among competing animals for culture help to develop a rational method of exploiting a population. Study on the nutritional requirements is also helpful in aquaculture in order to obtain the best growth at least period (Royce, 1972).

Many aspects of the reproductive process are commonly used either to catch the fish easily or to protect them if they are unduly vulnerable. The great fluctuation in the abundance of fish due to failure of the young to survival can also be explained. It is essential and needed prior to the measures adopted for conservation and propagation of a particular fish species. Knowledge of spawning period is one of the most important requisites in fishery management and its rational exploitation. Fecundity of a species is defined as the number of eggs released by an individual fish during a spawning season. It can be used to assess the reproductive potential of a population

Age and growth, length-weight relationship and condition factor data are valuable in describing the general life history of fish. They are more valuable from a management viewpoint, when they can be compared with similar data from other population (Carlander, 1969). Growth varies with sex, age, condition factor and number of biotic and abiotic factors. The main objectives of age and growth determination are, to find out the

year classes which support the fishery, to estimate the mortality rate and to assess the recuperation of a given stock under natural or exploited condition (Bal and Rao, 1984).

The biochemical constituents of any fish species denote its nutritional and energy status. The biochemical composition varies from species to species, within the same species and within the same individual. Knowledge on the biochemical changes of the fish is essential for understanding of the metabolism of different populations for providing an estimation of the energy content and for understanding the biochemical circulation of elements.

India is located between 8° 4' and 37° 6' north latitudes, and 67° 7' and 97° 25' east longitudes. It has a coastal line of 8129 km, comprising estuaries, creeks, lagoons, swamps and mudflats, which have to be utilized for culture of different species of shellfish as well as finfish. In addition to prawns the important cultivable species of fin fishes from estuaries, brackish waters, backwaters and coastal waters of India are: Milk fish, *Chanos chanos*, grey mullets, *Mugil cephalus*, *Liza spp*, pearlspot, *Etroplus suratensis*, Sandwhiting, *S. sihama*, Rabbit fish, *Siganus javus*, *S.canaliculates*, Sea bream, *Lethrenus spp*, Sea bass, *lates calcarifer*, Grouper, *Epinephelus tauvina*, *E. hexagonatus* and Red snapper, *Lutjanus spp*. Their abundance and seed resource availability in different seasons have been reported (Tampi, 1968).

Goa with about 105 km long coastline has vast resources of marine shellfish and finfish (Ansari, 2004). Fish is a protein rich food and for the state of Goa it assumes special significance as it forms one of the chief components in the diet of 90 % of the population.

The family Sillaginidae (Whittings) is a highly esteemed food fish in Indian waters from Hooghly River in the East Coast to Goa on the West Coast (Sujatha, 1987). Thirty-one species belonging to three genera (two of which are monotypic) are recognized by McKay (1992). Out of these, 11 species of the family Sillaginidae recorded in India. *S. sihama* is the most dominant species. It forms one of the most important fishes, which command high price in different states of the country. It inhabits estuaries and coastal waters, feeding on benthic organisms particularly crustacean and polychaetes. Its euryhalinity, fast growth and seed abundance make it ideal for coastal marine aquaculture (Ramamurthy & Dhulkhed, 1975; Bal and Rao, 1984 and Jayasankar, 1991). Furthermore, in recent past, many experiments conducted in coastal ponds and pens indicated that this species can be successfully cultured along with many suitable species of Milk fish, Grey mullets, Rabbit fishes, Pearl spot and prawns (Ramamurthy *et al.*, 1978; James *et al.*, 1984b; Nammalwar, 1997).

S. sihama is considered a highly esteemed fish in Goa, due to which it commands high price in the local market. Despite its food value, local demand and fast growth no attempt has been made to study the general biology and culture potential of *S. sihama* from Goa waters. For this

reason, *S. sihama* was selected to study its ecology, biology and fisheries in one of the main estuaries of Goa (Zuari Estuary).

1.2. Literature review

Several studies have been made on different species of the family Sillaginidae. Celand (1947) studied the economic biology of *S. ciliate* from the Australian waters. Age and rate of growth of *S. sihama* were determined in Japanese waters by Mio (1965). Larvae of *Stolephorus spp.* and *S. sihama* were collected during the survey of larvae and juvenile conducted in the coastal waters off the northwestern of Taiwan by Chan *et al.* (1985). Seasonal changes of the species components of several fishes including *S. sihama* has also been reported from Manpeng Island, Taiwan by Lin *et al.* (2000).

The commonest fish species including *S. sihama* and the ecological role of mangrove ecosystems in the capture fisheries of Gazan creek, Kenya was recorded by Ntiba *et al.* (1993). Study has been conducted by Koike and Inada (1995) in Japan in which the characteristic patterns of different species including *S. sihama* has been reported.

The analysis of bilateral characters of two marine teleosts fishes, *Saurida undosquamis* and *S. sihama* collected from the Red sea coast of Yemen by Al-Hassan and Shwafi, (1997) has been reported. Distribution and variation of eggs and larvae of *S. sihama* were reported from Bohai Sea, China by Jiang *et al.* (1988; 1998). In Philippine *S. sihama* has been reported as the second most abundant species after

Ambassis spp. (Kato *et al.*, 1996; Kohno *et al.*, 1999). Relative abundance of juveniles and sub adults of finfish including *S. sihama* in Korangi creek, Sindh creek and back waters and Hor lagoon, Pakistan was reported by Ahmed and Abbas (1999); Ahmed *et al.* (1999a); Ayub and Ahmed (2001).

The food and feeding habits and feeding structure of the sandwhiting *S. sihama* and *S. analis* from Strille North Queensland, Australia has been studied by Gunn and Milward (1985). Food and feeding habits and diet of *S. sihama*, a species whose juvenile occur regularly in Kwazulu-Natal estuaries was investigated by Weerts, *et al.* (1997). Reports available on the reproduction of *S. sihama* are very limited. The spawning of *S. sihama* cultivated in the laboratory was studied by Kuma and Nakamura (1978). This record indicated that the spawning may occur in almost equal frequency irrespective of the spawner's size. Total amount of eggs laid during spawning period; however, seems to be dependent primarily on the size or age of female.

Among the family Sillaginidae, *S. sihama* is the most dominant species in Indian waters. This species form minor but commercially important fisheries along the Indian coast. There were no comprehensive studies made on the general biology and fisheries of the Indian sandwhiting *S. sihama* except for few reports.

Estuarine ecosystems are very productive because they receive a high input of nutrients from the river and adjacent land. One of the important

roles of the estuaries is to provide a nursery ground for the young ones of many aquatic organisms. A significant contribution has been made on the studies of physico-chemical and biological characteristics of Estuarine ecosystem of Goa, particularly Zuari estuary (Dehadrai, 1970; Bhargava *et al.*, 1973; Parulekar *et al.*, 1973; Parulekar and Dwivedi, 1974; Gangadhara Rao *et al.*, 1976; Rao 1977; Parulekar *et al.*, 1980; De Souza *et al.*, 1981; Qasim and Gupta, 1981; Devassy, 1983; De Souza and Gupta, 1986; Ansari, 1988; Ingole and Parulekar, 1998; Sarma *et al.*, 2001). The Seasonal variability in the physico-chemical features, zooplankton standing stock and faunal composition in the Mandovi-Zuari estuarine system were studied by Padmavati and Goswami (1996). An attempt to evaluate the interrelationship between various parameters and role of salinity and mixing on phytoplankton biomass and diversity, have been made by Krishna Kumari and John (2003).

The earliest attempts on the biology of Indian sandwhiting *S. sihama* around Mandapam and Rameswaram Island in the Gulf of Mannar and Palk Bay have been made by Radhakrishnan (1957). In this study various biological aspects such as relationship of body measurements to total length, age and rate of growth, food and feeding habits, reproduction and fishery and fishing methods were discussed. Krishnamurthy and Kaliyamurthy (1978) have studied the age and growth of *S. sihama* from Pulicat Lake with observations on its biology and fisheries.

Poor information available on the morphometry and interrelationship between various body measurements in *S. sihama*. The available references in this aspect were reported by Radhakrishnan (1957); Jayasankar (1991b) and Reddy (1991).

The importance of the study of food and feeding habits, to evaluate the ecological role of the fish species has been emphasized by many workers. A few scientists have dealt with the aspect of food composition and feeding habits of Sillaginids in India. Chacko *et al.* (1953) studied the food and feeding habits of *S. sihama* in Pulicat Lake; Chacko and Srinivasan (1954) reported the feeding habits of *S. sihama* inhabiting the Vansanthara Estuary. Chacko (1949) gave a detailed account of the food of *S. sihama* in Korapusha Estuary, Kerala. Palekar and Bal (1959) recorded the food and feeding habits of *S. sihama* inhabiting Karwar coast. Krishnamurthy (1969) reported that the polychaete formed the dominant items of the food of *S. sihama* from Pulicat Lake. A study on the food and feeding habits of the sandwhiting *S. sihama* from Nethravati Estuary, by Gowda *et al.* (1988a) revealed that the main food of this fish consists of crustacean and polychaete.

The study of reproductive biology is essential and needed for the conservation and propagation of a particular fish species. There has been very little work carried out on the reproduction of *S. sihama*. Palekar and Bal (1961) studied the maturation, spawning season, fecundity and age at first maturity of the Indian whiting *S. sihama* from Karwar waters. James *et al.* (1976) made an attempt on the induced

breeding and cultural possibilities of *S. sihama* in brackish water of south Kanara. Gowda *et al.* (1988b) has been worked on growth, and condition factor and sexuality of *S. sihama*. Studies of the eggs and early larvae of the sandwhiting *S. sihama* from Mandapam waters were carried out by Bensam (1990). Fecundity of sandwhiting *S. sihama* from Karwar waters related to total length, body weight of fish and weight of ovary was recorded by Reddy, (1991). Jayasankar (1991b) reported the Sillaginid fishes of Palk Bay and Gulf of Mannar with an account on the maturation and spawning.

There are only few attempts made on the determination of the age and growth rate of the species *S. sihama* in India. Radhakrishnan (1954; 1957) attempted to study the possibility of age determination by the study of otolith of tropical fish. Reddy and Neelakantan (1992.) used the length frequency distribution to ascertain the age and growth of this species from Karwar waters. Gowda *et al.* (1988b) studied the growth, condition factor and sexuality of Indian sandwhiting *S. sihama*.

Information available on the length-weight relationship and condition factor of *S. sihama* was limited to Gowda *et al.* (1988b), Jayasankar (1991a), and Reddy (1991). Recently, Annappaswamy *et al.* (2004) have studied the length–weight relationship of the sandwhiting *S. sihama* in Mulki estuary, Mangalore.

Studies on the biochemical composition and nutritional values of fishes from Indian waters have been carried out by many workers. The earlier studies dealt with the proximate biochemical composition of several teleost fishes were by Basu and De (1938); Chari (1948); Nair (1965); Parulekar and Pal (1969); Raja (1969). The study was also carried out during recent years (Bumb, 1992; Rattan, 1994; Antony and Antony, 2001; Kosygin *et al.*, 2001; Das and sahu, 2001; Shekhar *et al.* 2004). There is no information available on the biochemical composition of *S. sihama* from Indian coast.

study of the seed resource of the Indian sandwhiting *S. sihama* in Indian waters was made by Mohan (1980); Sudarshan and Neelakantan (1980); James *et al.* (1984a; 1984b); Kaliyamurthy (1984); Ramamohana *et al.* (1984); Bensam (1987) and Reddy and Shanbhogu (1990).

The suitability of *S. sihama* for culture in both brackish and fresh waters was recorded by Ramamurthy and Dhulkhed (1975), James *et al.* (1976), Dhulkhed and Ramamurthy (1977), Kaliyamurthy *et al.* (1977) and Joseph (1980).

Salient features of taxonomic value are mentioned, along with comparison and contrast with similar stages of allied species described. The nature of the seed ground and availability and abundances around Calicut area (Kerela) have been described qualitatively and quantitatively by Lazarus and Nandakumaran (1988). Of cultivable

Planktonic eggs and early larvae of *S. sihama* have been identified from Mandapam, based on similarities in the ripe ovarian eggs as well as other characters; by Bensam (1990).

From the foregoing accounts it is very clear that there is a paucity of detailed information on the fishery biology of *S. sihama* in general and Goa in particular. Considering its food value and preference by the local people a problem on the ecobiology and fisheries of *S. sihama* of Goa coast was selected for the present study. The study was aimed to improve our understanding of different aspects of biological features in relation to ecobiological parameters. Additional information on edibility and nutritional value and culture possibilities of *S. sihama* in the brackish waters of Goa has been discussed.

Objectives:

1. To study the morphometrics relations of an economically important species *S. sihama*.
2. To study the ecobiology of this species, for the fishery management and culture possibilities.
3. To study the dynamics of proximate biochemical constituent to elucidate its nutritional status.

1.3. Systematic Position

Perch-like fishes are all the more typical or less specialized bony fishes. Most have two dorsal fins, which may or may not be united at least basally. The ventral have not more than six rays and are usually, although not always, thoracic. There is no weberian apparatus. All these characters place this fishorder perciformes

Fins with spines. Ventral thoracic with 1 spine and not more than 5 rays. Caudal rays do not overlap hyporal. Second infraorbital not united with preoperculasuborder percoidei

Body elongate, slightly compressed, tapering from middle of spinous dorsal fin to head and tail. Head conical, pointed, tapering with small terminal or slightly inferior mouth. Perch with a small, sharp spine; small villiform teeth on roof of mouth restricted to anterior part of vomer, none on palatines. end of upper jaw slides below preorbital bone.

Two separate dorsal fins; the first with 9 to 12 slender spines, its origin above middle of pectoral fin; the second with 1 spine and 16 to 26 rays, its base about twice that of first dorsal fin. Pelvic fin origin slightly behind origin of pectoral fin; anal fin with two weak spines; caudal emarginate. Lateral line slightly arched; small ctenoid scales covering the body, cheek and top of the head. Swim bladder absent, poorly developed or highly complex, with anterior and lateral extensions and tapered posteriorly to form 1 or 2 slender extensions that project well into the

caudal region. Colour is silvery grey or green, sometime with black spots
.....family Sillaginidae

1.3.1 Key to genera of Sillaginidae

Snout and head not depressed; second dorsal spine not elongate; eyes normal, 17 to 22 % of head length; swim bladder present.
.....Sillago

Snout and head greatly depressed; second dorsal spine very elongate; eyes small, 3 to 11 of head length, and almost covered by adipose tissue; swim bladder vestigial or absent.Sillaginopsis

Snout and head not depressed; second dorsal spine not elongate; eyes normal; swim bladder present, lateral line scales 129-147
.....Sillaginodes

1.3.2 Distinctive characters of species *Sillago sihama*

Body elongated, snout pointed, upper head profile slightly convex; mouth small, terminal, villiform teeth present in jaws and on vomer; 2 or 3 (usually 2) series of scales; on cheeks; a small, sharp spines on opercle; gill rakers on lower limb of first arch 7 to 9. First dorsal fin higher than second and with 11 weak spines; second dorsal fin with 1 spine and 20 to 23 soft rays; anal fin with 2 spines and 21 to 23 soft rays. Lateral line with 50 to 84 scales; 5 to 6 scale rows above lateral line and 9 to 10 below the lateral line. Swim bladder with 2 postcoelomic extensions.

Colour: back light brown, lower ventral flanks and belly whitish to silvery, without dark blotches. Both dorsal and caudal fins dusky, other fins pale.

1.3.3. Synonyms

Atherina sihama Forsskal, 1775

Pltycephalus sihama Bloch and Schneide, 1801

Sillago acuta, Cuvier, 1817

Sillago sihama, Ruppell, 1827

Sillago erythraea, Cuvier, 1829

Sillago malabarica, Cantor, 1849

Sillago sihama, Day, 1889

1.3.4. Name

English: Sandwhiting or ladyfish.

Local (Konkani): Muddosi

The name of the species "*sihama*" was given by the Swedish scientist Peter Forsskal, who did the taxonomical classification of animals of Arabia Felix (Happy Arabia, today's Yemen, Red Sea region) and used the Arabic names as a species names. This name was taken from the Arabic word "sahma", which means arrow.

1.3.5. Classification

Kingdom: Animalia

Phylum: Chordata

Subphylum: Vertebrata

Superphylum: Osteichthyes

Class: Actinopterygii

Subclass: Neopterygii

Superorder: Acanthopterygii

Order: Perciformes

Suborder: Percoidei

Family: Sillaginidae

Genus: Sillago

Sepices: sihama

1.4. Geographical Distribution

Most of the species are tropical, but some species occur in the temperate water of southern Australia and northeastern Asia (Hayward, 1997). The family Sillaginidae has a wide distribution in the Indo-Pacific region, (Day, 1889; Weber and Beaufort, 1931; McKay, 1992) reported occurrence of Sillaginids in the western part of the Indo-pacific region from Red sea, to coast of Africa, Madagascar through India to coasts of China, Japan, Philippines, Indo-Australian Archipelago and Australia to

Bougainville islands. Cleland (1947) reported *S. ciliata* from the Australian waters.

S. sihama reported as a new species for Mediterranean, Labenon coast (Mouneimne, 1977) and Turkish water (Guncu *et al.*, 1994). *S. sihama* has also reported in coast of Africa (Ntiba *et al.*, 1993), coasts of China (Jiang *et al.*, 1988), Japan (Koike and Inada, 1995) and Philippines (Kohno *et al.*, 1999). In India all along the west coast and the east coast (Bal and Rao, 1984).

The first report of the family Sillaginidae in Indian waters was by Day (1876). He recorded 3 specie of the genus Sillago: *S. domina*, *S. sihama* and *S. maculata*. Devanesan and Chidambaram (1948) reported the occurrence and distribution of *S. sihama* in Ganjam District, Pukkilipeta, Bimilipatnam, Uppada, Madras, Tranquebar and Sethubavachathram, Mukkur, Pamban and Tuticorin on the east coast and Hosdurg, Cannanore, Valapad, Calicut and Tannur on the west coast of India.

Palekar and Bal (1955) identified 1 more species *S. chandropus* from Karwar waters. Anther species *S. panijus* was recorded from Chilka Lake by Rajan *et al.* (1968). Mckay (1976) reported two genera and five species of the family Sillaginidae from Indian waters with description of a new species *S. vencenti*. Later Dutt and Sujatha (1980) recorded seven species of Sillago from Indian waters: *S. sihama*, *S. parvisouamis*, *S. macrolepis*, *S. argentifasciata*, *S. maculata*, *Sillaginopodys chandropus*

and *Sillaginopsis panijus*. Dutt and Sujatha (1982; 1984) described two more species of sandwhittings: *S. soringa* and *S. intermedius*.

There are a number of characters involved in the differentiation of species of Sillaginidae. The shape of the swim bladder in the family Sillaginidae is of taxonomic value and help to distinguish between species. As a continuation of occurrence and description reports of family Sillaginidae, Jayasankar (1991) has been reported 6 species of Sillagos: *S. sihama*, *S. indica*, *S. vincenti*, *S. argentifaciata*, *S. soringa* and *Sillaginopodys chandropus* from Palk Bay and Gulf of Mannar. Recently Antony *et al.* (2005) prepared an inventory of the ichthyofauna of mangrove ecosystems. They noted down the guidelines for identification of the families using mangrove ecosystem as breeding, nursery, feeding and hiding grounds. *S. sihama* (family Sillaginidae) was included.

1.5. Habitat

The family Sillaginidae inhabits shallow sandy bottoms of shores and bays, creeks, and estuaries. It is notably absent in oceanic islands and coral reef environments, although at least two species visit sandy reef flats: *S. sihama* and *S. ciliata* (Woodland and Slack Smith, 1963).