# FIVE-SPOT HERRING HILSA KELEE AND OTHER MARINE CLUPEOID RESOURCES OF SOUTH INDIA\*

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#### ABSTRACT

The clupeoid resources of the Indian Ocean are not much better known in 1970 than they were in 1960 when the International Indian Ocean Expedition was planned. The fivespot herring, *Hilsa kelee*, is not well-known nor utilised in the areas where it occurs. It closely resembles the American menhaden that supports the largest fishery in North America. It is marine and not anadromous like *Hilsa ilisha*. There is little similarity between the two species although they are presently in the same genus. The English name, five-spot herring, is not often used. None of the names in Tamil, Malayalam, Singhalese, Marathi, Kannarese, Telugu, Bengali or Urdu are commonly used. Of the clupeolds in the Indian Ocean, *Hilsa kelee*, has the greatest range. It occurs from Natal to the Malay Archipelago and Western Indonesia. In the central part of its range from the Gulf of Aden to Burma it occurs commonly and is seasonally abundant, especially in Pakistan, South India and Sri Lanka and from Bengal to the Burma Coast.

Sardines and anchovies also are potential resources of the Indian Ocean. Sardines, genus Sardinella, principally the oil sardine, produce most of India's catch of herringlike fishes. The rainbow sardine, genus Dussumieria, a round herring and not a true sardine is an offshore and deeper-water species that shows up abundantly in some years. Anchovies are the least known group of clupeoids that may prove to be the greatest potential fishery resource of the region. Their small size, short life span, erratic schooling behaviour and offshore distribution have hindered the development of a fishery and limited their utilization.

Clupeoid or herringlike fishes require specialised fisheries that often depend on large vessels with mechanical and electronic equipment, including aircraft, for search, detection and catching operations. These fishes are small, bony, oily and usually require processing to be wholly acceptable for food. Five-spot herring, sardines and anchovies are potential resources of the Indian Ocean that may develop into productive fisheries. This realization will depend first on recognition of the species; secondly on knowledge of seasonal and geographical distribution and abundance and thirdly on the technology of finding, catching, handling and processing.

This report represents a step towards recognition, identification and description of the more abundant clupeoids to assist in the accumulation of information on their seasonal and geographical distribution.

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### INTRODUCTION

HERRING, sardines, and anchovies are abundant fishes contributing nearly 40 per cent of the world's marine fishery production of 50 million metric tons. Production in the Indian Ocean and adjacent seas was only 1/2 million tons in 1968, mainly oil sardines from the Malabar Coast of India. Unless the Indian Ocean is substantially different from the other oceans of the world, this production represents a small part of its clupeoid potential. The coastal and pelagic clupeoids, including 50 species, are among the least known fishes of the region. The Indian shad, *Hilsa illisha*, is an outstanding exception. Scores of publications representing work by the Central Inland Fisheries Research Institute have described the spawning runs and the fishery for Indian shad in the Indus, Ganges, Brahmaputra, Godavari, and Lake Chilka. The Central Marine Fisheries Research Institute now is studying the oil sardine, *Sardinella longiceps*, principally to learn more about the life-cycle and the causes of the great fluctuations in abundance along the Malabar Coast. Also underway are studies of choodai, the common name for a number of *Sardinella* species and the rainbow sardine, *Dussumieria acuta*. Of the remaining species, little other than taxonomic descriptions and meager information on their life history and abundance is known. The clupeoid resources of the Indian Ocean are not much better known in 1970 than they were in 1960 when the International Indian Ocean Expedition was planned.

The five-spot herring, *Hilsa kelee*, is not well known nor utilised in the areas where it occurs and I became interested because it closely resembles the American menhaden of the Western Atlantic Ocean. The two species are similar in morphology and biology. Both are principally herbivores and form a lower level in the trophic scheme providing forage for many carnivorous fishes. Because menhaden support the largest fishery in the United States it may be speculated that the fivespot herring may be a potential resource of the Indian Ocean. I participated in the International Indian Ocean Expedition in February and March 1964 as part of the U.S. Program in Biology, National Science Foundation.

The objectives of this brief survey were to obtain specimens of five-spot herring, examine landings for their occurrence, gather information on their biology from fishery scientists, and conclude from this information if a potential marine resource existed in the region. The first three objectives were partially accomplished during my two months in India. In reference to the last objective only a speculative conclusion was reached. Five-spot herring are seasonally abundant in South India and no suitable method for their location or capture is being used. Until selective fishing is employed, the magnitude of the resource will remain unknown.

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#### DESCRIPTION AND IDENTITY

Five-spot herring, Hilsa kelee (Cuvier), has been described by many scientific names. Whitehead (1965) lists the synonymy that includes the generic changes and 6 species names that occur commonly in the literature ; blochii, brachysoma, brevis, durbanensis, kanagurta, and platygaster. Of these, kanagurta, has been the most widely used in India and Pakistan.

The genus Hilsa does not easily accommodate H. kelee and the four anadromous species ; H. ilisha, H. macrura, H. reevesii, and H. toli. Whitehead placed them in separate subgenera and implied that this near relationship was a concession not wholly supported by structural similarities. The distinction of the marine five-spot herring from the anadromous Hilsa is critical to a discussion of the clupeoid resources of the Indian Ocean. Hilsa is the common name for the anadromous species and the most important and popular food fish of India, Pakistan, and Burma. More studies have centered around the hilsa fishery than any other species of the region. As a consequence consideration of H. kelee as a separate resource has been neglected. The five-spot herring is a wholly distinct marine resource that must be examined apart from the anadromous Hilsa.

Although known to science for more than a century and a half (Russell, 1803; Cuvier, 1829), the five-spot herring, *Hilsa kelee*, has received little attention by fishery workers. Nearly all of the accounts of distribution, abundance, and life history of the species have been limited to incidental or occasional comments in reports of the Indian shad, *Hilsa ilisha*.

#### DISTRIBUTION AND ABUNDANCE

Five-spot herring occur commonly from Natal, South Africa to the Gulf of Siam. They are marine shoaling fishes that do not ascend rivers to spawn although they are frequently associated with bays, deltas, and lower estuaries. These localities are the more productive fishing grounds for many coastal species and as there is no fishery for a five-spot herring, they are caught incidentally with other fishes. It is difficult to judge the abundance of a fish caught incidental to other more wanted species<sup>\*</sup>.

The areas of greater abundance appear to be in the Persian Gulf and Gulf of Oman; the Indus Delta and the Gulf of Kutch; throughout South India from the Gulf of Cambay near Bombay to the Ganges Delta, including Sri Lanka; and in the Gulf of Martaban near Rangoon.

Seasonal abundance is more difficult to determine than geographical distribution because of the virtual termination of fishing during the monsoons. Some five-spot herring are caught in all months of the year with the principal landings occurring from December to April. My observations and collections were made during February and March 1964. Fish catches were examined at 14 localities from Bombay to Vizakhapatnam. Otter trawl and hook and line catches were checked at Bombay, Cochin, Mandapam Camp, Madras, and Vizakhapatnam. All other landings were from beach and boat seines and from gill and trammel nets. No

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<sup>\*</sup> None of the nets used were well-suited to catch five-spot herring so the landings do not give an adequate measure of their abundance.

five-spot herring were in any of the trawl or hook and line catches.<sup>†</sup> The larger catches were taken in the Gulf of Mannar and Palk Bay and near the Godavari Delta. Discussions with biologists of the Central Marine Fisheries Research Institute generally confirmed by brief observations that the larger catches of five-spot herring were made from late January to early April mainly in South India from Trivandrum to Cape Comorin and along the Coromandel Coast.

# LIFE HISTORY AND BIOLOGY

The life history and biology of five-spot herring is imperfectly known. Fragments of information can be obtained from the studies of the anadromous hilsa, usually cited as anomolies to the biology of H. *lisha* and H. *toli* and not recognized as H. *kelee*. The most comprehensive account of the five-spot herring is part of a doctoral dissertation by M. Babu Rao  $\uparrow\uparrow$  and his findings are the basis for this summary of the biology and life history.

Spawning occurs principally in February and March. Mature females containing ova that ranged from 0.75 to 0.80 mm in diameter, were caught in the lower estuary. Males with mature testes appeared in the same landings. Fecundity was estimated from pairs of mature ovaries taken from females that ranged in length from 17.6 to 20.0 cm. The calculated numbers of maturing ova ranged from 15,700 to 31,400 from each pair of ovaries. The locality of spawning is not known; however, small schools of adults were in the lower estuary and spawning may take place there or in the nearby coastal waters. In late March and April the adults move out of the estuary into the ocean. Postlarvae and transformed juveniles, 20 to 40 mm in length, occurred in schools in the lower estuary from April until June when they moved into the ocean. Some juveniles were obtained from the Malabar Coast near Cochin that were 65 to 75 mm in early March, indicating that spawning may occur there as early as November or December.

The rate of growth to maturity is not known. Examination of scales and length-frequency distributions of the catch indicate that sexual maturity is attained by the end of one year when they are about 17 cm long. Few five-spot herring are more than 20 cm long. Smith (1950) stated that the species attains 30 cm off South Africa. There is no other evidence the species attains a greater age than 2 years or a greater length than 25 cm.

Food of the five-spot herring consists of plankton that is filtered while swimming with mouth gaped and opercles flared. They strain small plants and animals from the water with a sieve-like branchial apparatus. This apparatus is composed of gill arches with dermal flaps and long branched and overlapping gill rakers covered with mucus. The fifth gill arch is modified into a pharyngeal organ that presumably accumulates the food into a bolus that is swallowed. The stomach is composed of a muscular cardiac portion much like the gizzard of a fowl and a pyloric sac that empties into a long, coiled intestine. The food consists probably of the smaller, less agile elements of the plankton — mainly diatoms, dinoflagellates, copepods, and the larvae of crustaceans and molluscs. As with other filter feeding animals the food composition varies seasonally, but phytoplankters consistently compose

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<sup>†</sup> None of the nets used were suited to catch five-spot herring so the landings do not give an adequate measure of their abundance.

tt 'Studies on the clupeoid fishes of Godavari Estuary' Thesis submitted for degree of Doctor of Philosophy, Andhra University, Waltair, December 1962.

the bulk of the food. The structure of the alimentary tract suggests that they are principally herbivores.

This brief summary of fecundity, spawning, age, size, and feeding sketches all that is known of the life history and biology of five-spot herring.

## FISHERY POTENTIAL

The resource potential of the five-spot herring in the Indian Ocean is only speculation with our present knowledge. Pelagic clupeoids are sizeable population elements in all oceans. In tropical waters populations of individual species are smaller than in temperate scas, with more species represented in the fauna. As with herring fisherics in other regions, a specialised fishery must be developed before the potential can be realised. Specialisation consists of searching, finding, and catching strategies that are determined by the movements, migrations, and schooling behaviour of the species sought. Because these behavioural characteristics of the five-spot herring are poorly known, the development of a fishery must be exploratory. Methods used in other regions on analogous species, such as menhaden, herring, sardines, and anchovies, should be tried.

# OTHER MARINE CLUPEOIDS OF THE INDIAN OCEAN

Clupeoids are supporting sizeable fisheries in the Indian Ocean. The oil sardine is the largest coastal fishery of India and catches of several species of sardines and anchovies rank prominently in seasonal landings of most countries of the region. F.A.O. statistics for 1968 reported 490,000 metric tons of herringlike fishes from India, Pakistan, Sri Lanka, and West Malaysia. Burma, Indonesia and Thailand reported 1,600,000 tons of unsorted and unidentified fishes of which one-fourth or 400,000 tons may have been clupeoids. Because of inadequate statistics from the entire Indian Ocean region only the clupeoid fisheries of the Indian subcontinent will be discussed. The oil sardine, *Sardinella longiceps*, is the largest single-species fishery of the area. Rainbow sardine (*Dussumieria acuta*), choodai, (which includes several species of *Sardinella*), and anchovies of several genera support small fisheries that are poorly established and fluctuate widely from year to year.

The problems of estimating resource potential for each of these other clupeoid species or groups of species are similar to those problems in the development of the five-spot herring fishery. Identification of species and some knowledge of the life history and biology is required as well as some information on their distribution. The development of a fishery for each species or species group requires some degree of specialisation that includes techniques for finding and catching the fish. To obtain this special information will require exploratory and experimental fishing and a regular program of study during which identity, size, and frequency of occurrence in the landings for each species is recorded.

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