

A Systematic Monograph of the  
Tongue Soles of the Genus  
*Cynoglossus* Hamilton-Buchanan  
(Pisces: Cynoglossidae)

A. G. K. MENON

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## ABSTRACT

Menon, A. G. K. A Systematic Monograph of the Tongue Soles of the Genus *Cynoglossus* Hamilton-Buchanan (Pisces: Cynoglossidae). *Smithsonian Contributions to Zoology*, number 238, 129 pages, 48 figures, 21 plates, 1977.—The genus *Cynoglossus* Hamilton-Buchanan is characterized, and its relationship with other cynoglossid genera is discussed. Forty-nine species including a new species, *C. lachneri*, are recognized.

The origin, distribution, and evolution of the genus are discussed. The genus is of tropical Indo-Pacific and eastern tropical Atlantic in distribution, and the members are mostly marine sandy or muddy shallow-water inhabitants. From the present-day distributional pattern, the genus is considered to have evolved in the Indo-Malayan Archipelago during the Pliocene, and the geological evidences providing explanation for its dispersal to the eastern tropical Atlantic, presumably, during the upper Pliocene have been reviewed.

The genus is composed of an extremely homogeneous assemblage of highly specialized species. Based on a comparative study of the epicranial bony system in different families of flatfishes, it is concluded that in the genus *Cynoglossus*, it is modified to suit a burrowing habit.

The apparently primitive and specialized characters in the genus are also outlined. The possession of a lateral line on the blind side is considered a primitive character, for it serves no purpose to a fish adapted for a burrowing mode of life. Thus, the absence of a lateral line on the blind side, reduction in the number of caudal fin rays, reduced size of scales, contiguous or closely set eyes with narrow interorbital space, or reduced or minute eyes with wide interorbital space, and loss of posterior slitlike nasal opening are considered specialized characters necessary for a burrowing habit. Based on the morphological features and on zoogeography, the 49 species have been divided into six groups and 17 complexes, and their hypothetical evolutionary relationships are traced.

A key for the separation of species is provided; separate keys for the groups and complexes are not provided, however, since they were mainly based on the pattern of distribution and hence arbitrary in nature. Under each species, the complete synonymy, description, coloration in preservation, size diagnosis and affinities, note on synonymy, information on the type and other material examined, and geographical distribution are given. Lectotypes (wherever necessary) have been selected. Lectotype selection has also been made (wherever necessary), even to a nominal species now considered as a junior synonym to avoid any confusion in the future as to its true identity. The species are illustrated in 40 outline drawings and 21 plates. Eight distributional maps are also provided.

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# A Systematic Monograph of the Tongue Soles of the Genus *Cynoglossus* Hamilton-Buchanan (Pisces: Cynoglossidae)

A. G. K. Menon

## Introduction

The present work was begun during 1967–1968 at the Division of Fishes of the National Museum of Natural History, Smithsonian Institution, Washington, D.C., where I was employed for a year as a Senior Postdoctoral Visiting Research Associate and continued for short periods during October–November 1968 at the British Museum, London, and Museum National d'Histoire Naturelle, Paris, and later at the Zoological Survey of India, Calcutta. The opportunities thus afforded for the examination of material were exceptional, and a much larger number of specimens have passed through my hands than I had at first thought possible. The results of my studies are presented here and I hope, if opportunity is given, to pursue in more detail behavioral, ecological, and life history studies of the cynoglossid flatfishes in a subsequent work.

The genus *Cynoglossus* Hamilton-Buchanan is tropical Indo-Pacific and eastern tropical Atlantic in distribution, and its members occur along sandy or muddy shores and estuaries. The species are marine or estuarine shallow-water burrowing forms with a few species (*C. microlepis* (Bleeker), *C. heterolepis* Weber, and *C. kapuasensis* Fowler) enter-

ing fresh-water streams. Of the 49 species included in the genus, one, *Cynoglossus lachneri* Menon, is described here as new.

No comprehensive study of the genus *Cynoglossus* has so far been made, although Norman (1928), Weber and de Beaufort (1929), Punpoka (1964), and Shen (1967, 1969) revised certain Indo-Pacific species and Chabanaud (1949a–d) and Cadenat (1960) revised certain species of the Atlantic. The present work is based on specimens available to earlier workers and on a large number of additional specimens resulting from intensive collecting in recent years, especially in the Indian Ocean during the International Indian Ocean Expedition (1960–1965). It is the first attempt to study the systematics of the genus in the strict sense understood by Myers (1952).

ACKNOWLEDGMENTS.—A large number of individuals and institutions aided me in many ways, especially by the loan of specimens or by making them available for study, by provision of laboratory space or by generously giving information about specimens, notes on specimens in their care, or data from writings unavailable to me, or by helping freely in the translation into English of some of the papers written in French. To each of them I am gratefully indebted, for without their consideration my study could never have been accomplished. To the institutions and their present or former personnel, responsible for the assistance I

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received, I extend my sincere thanks. A list of those individuals and institutions follows, together with the appropriate abbreviation used throughout the text.

AMNH	American Museum of Natural History, New York, D. E. Rosen
AMS	Australian Museum, Sydney, F. H. Talbot, J. R. Paxton
ANSP	Academy of Natural Sciences of Philadelphia, Philadelphia, J. E. Bolhke, J. C. Tyler
BMNH	British Museum (Natural History), London, E. Trewavas, P. H. Greenwood, N. B. Marshall, P. J. P. Whitehead, A. C. Wheeler
CAS	California Academy of Sciences, San Francisco, W. N. Eschmeyer (George Vanderbilt Foundation collection has now been transferred to the Californian Academy of Sciences and bears the abbreviation "GVF" in parentheses after the abbreviation "CAS")
CU	Cornell University, Ithaca, New York, E. C. Raney
HUJ	Hebrew University, Jerusalem, the late H. Steinitz
KU	Kyoto University, Japan
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, M. M. Dick
MNHP	Museum National d'Histoire Naturelle, Paris, M. L. Bauchot
NHV	Naturhistorisches Museum, Vienna, P. Kahsbauer
NMNH	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden, M. Boeseman
RU	Rhodes University, Department of Ichthyology, Grahamstown, South Africa, the late J. L. B. Smith, Mrs. M. M. Smith
SOSC	Smithsonian Oceanographic Sorting Center, Washington, D.C., L. W. Knapp
UMMZ	University of Michigan, Museum of Zoology, Ann Arbor, Michigan, R. R. Miller, R. M. Bailey
USNM	Acronym for former United States National Museum collections in NMNH
UZMK	Universitetets Zoologiske Museum, Copenhagen, J. Nielsen
WAM	Western Australian Museum, Perth, R. McKay
ZMA	Zoologisch Museum, Amsterdam, N. Nijssen
ZMB	Zoologische Museum, Berlin, C. Karrer
ZSI	Zoological Survey of India, Calcutta

To the following from the National Museum of Natural History, Smithsonian Institution, Washington, D.C. I am deeply indebted: Dr. Ernest A. Lachner, Curator of Fishes, Division of Fishes, for initiating this project and for constant guidance and encouragement; Drs. Daniel M. Cohen and Bruce B. Collette of the National Marine Fisheries Service Systematics Laboratory for their considerable help and constant encouragement throughout the period of my work in the Division of Fishes. I am

most grateful to Drs. E. Trewavas and P. H. Greenwood and through them the Trustees of the British Museum (Natural History) for providing me with the outline drawings of the various species of *Cynoglossus* prepared by Mr. Hubert Williams under the supervision of the late Dr. P. Chabanaud and for permitting me to use them in the present work. To Mr. P. J. P. Whitehead I am particularly grateful for his kindness in examining on my behalf some of the types in the British Museum, for attending to my several queries in the course of the preparation of this work, and for carefully and critically going through the manuscript and offering valuable suggestions for the improvement of the work. Dr. Boeseman, Curator of Fishes, Rijks Museum van Natuurlijke Historie, Leiden, searched the literature, as well as the collections in Leiden, and helped me to select the appropriate types for species of *Cynoglossus* described by Bleeker. But for the very kind and generous help that he readily extended to me this work could not have been completed, and it is very gratefully acknowledged here. During the course of my work I have had the benefit of personal discussions with my colleagues in the National Museum of Natural History, especially Drs. R. H. Gibbs, W. R. Taylor, V. Springer, S. Springer, S. H. Weitzman, L. Schultz, W. Aron, L. W. Knapp, and R. Kanazawa. To all of them I am grateful. I have also benefitted from personal discussions with Dr. Carl L. Hubbs on the adaptation of *Cynoglossus* for a burrowing habit.

The staff of the Central Photo Laboratory of the National Museum of Natural History made the photographs. In the X-ray room of the Division of Fishes (NMNH), the radiographs were made by me, with the help of Mr. E. N. Gramblin.

I should like to record my gratitude to the National Research Council (National Academy of Sciences and Engineering) of the United States, Washington, D.C., for awarding me a Smithsonian Senior Postdoctoral Visiting Research Associateship to enable me to work for a year in the Division of Fishes (NMNH). To the Director of the Zoological Survey of India and the Ministry of Education and Youth Services, Government of India, I am thankful for the grant of study leave to enable my visit to the United States.

My wife, Mrs. Rema G. Menon, who came with me to the United States, helped me a great deal by



regularly accompanying me to the laboratory and making counts and measurements.

### Methods

**DEFINITION OF MEASUREMENTS AND COUNTS.**—Measurements were taken on the ocular side of each specimen, using a pair of needlepoint dividers and recording to the nearest one-tenth of a millimeter.

*Standard Length:* Taken from the tip of the snout to the midlateral posterior margin of the hypurals as indicated externally in the specimen.

*Head Length:* Taken from the tip of the snout to the posteriormost point reached by the fleshy margin of the opercle.

*Diameter of Eye:* The vertical diameter taken between the dorsal and ventral rims of the fixed eye.

*Snout Length:* Taken from the tip of the snout to the anterior rim of the fixed eye.

*Interorbital Width:* Taken as the nearest distance between the upper rim of each orbit wherever the eyes are separate.

*Distance between Snout and Corner of Mouth:* Taken in a direct line, being the distance between the tip of the snout and the posterior corner of the cleft of the mouth (measured by keeping the needle of one arm of the divider inside the mouth cleft and the other at the end of the snout).

*Distance between Corner of Mouth and Gill Opening:* Taken in a direct line, being the distance between the inside corner of the cleft of the mouth and the posteriormost point reached by the fleshy margin of the opercle.

The enumeration of dorsal and anal fin rays in *Cynoglossus* is most difficult and tedious, and much of the confusion in the taxonomy of *Cynoglossus* has been caused by erroneous counts made on a limited number of specimens of a particular species. The counts of the dorsal and anal fin rays in this work were taken, therefore, from radiographs and some were from cleared and stained specimens. *Caudal Rays:* All rays in the caudal fin. Since the caudal fin is confluent with both the dorsal and the anal fin some difficulty was experienced in the enumeration of the caudal rays. The caudal rays were therefore counted by placing the fin on the glass stage of a binocular microscope and projecting strong light through the fin. Removing the

mucus and skin by means of a needle, a count was taken and then the fin was turned over and the enumeration checked on the blind side.

*Vertebrae:* In *Cynoglossus* the last six abdominal vertebrae bear short haemapophyses (Figure 1). The caudal vertebrae are, therefore, those beginning from the first interhaemal spine, which forms the posterior boundary of the abdominal cavity. In radiographs the position of the first interhaemal spine can be readily seen.

**RADIOGRAPHY.**—Radiographs were prepared by the use of soft X-rays. In this method the fishes were taped closely to the film holder containing high contrast film and exposed at 22 kV. 125 milliamp-seconds, with the X-ray unit focussed about 20 inches from the object.

**CLEARING AND STAINING.**—A few specimens were cleared and stained for osteological studies and for checking counts made from radiographs. Different methods of clearing and staining specimens have been used (Taylor, 1967). This above method is successful when used on fresh or newly preserved specimens but not on specimens stored in various preservatives for several years (which is most often the case in museum collections). Such specimens may remain opaque because of dark stains in the flesh or they may swell, rupturing the membranes during the clearing process. In order to overcome these difficulties Taylor (1967) evolved a new method, substituting enzyme digestion for alkaline maceration of tissues.

In the improved enzyme method of Taylor, trypsin powder (Fisher Scientific Company's "Purified Trypsin Powder," 1 : 80 MF) is used in sodium borate (borax) buffer solution, which has proved very effective in so far as it supports the most rapid enzyme activity while maintaining a relatively stable and desirable pH over a long period of time. This method has been successfully used in the present work.

### Family CYNOGLOSSIDAE

The Heterosomata to which the Cynoglossidae belong can be divided into seven families: Psettodidae, Citharidae, Scopthalmidae, Bothidae, Pleuronectidae, Soleidae (true soles), and Cynoglossidae (tongue soles or solelike fishes with eyes on the left side). The soles (Soleidae and Cynoglossidae) are distinguished by having a small mouth, the lower

jaw not prominent, the jaws of the blind side strongly curved and toothed, no preopercular margin, the gill membranes fused with free branchiostegal rays, the symmetrical position of the nasal organs, the absence of a postcleithrum in the pectoral arch, and the absence of ribs. In spite of these common characteristics Norman (1934:38) doubted whether the two families are really closely related. Norman cited the example of certain Australian and New-Zealandian genera of the Pleuronectid subfamily Rhombosoleinae (*Ammotretis*, *Colistium*, *Peltorhamphus*) in which some of the species exhibit a strong general resemblance to members of the Soleidae. Especially in *Colistium* the general form of the body, the shape of the head, particularly its preorbital part, the small eyes, the symmetrical nasal organs, the strongly curved jaws of the blind side, the absence of teeth in those of the ocular side, and the extension of the dorsal fin to the end of the snout are all characteristics found in the members of the Soleidae. The development of membranous folds on the blind side of the rays of the marginal fins, the modification of many of the scales on the blind side of the head to form filamentous processes, and the fringed lower lip are some of the other soleid features developed by the Rhombosoleinae (Norman, 1926:259). Chabanaud (1933, 1934b, 1936, 1937) gave much consideration to the probable polyphyletic origin of the Soleoidea from other flatfishes. Kyle (1921:119-121) believed that the flounders and the soles, and even the divisions within each of these groups, have had separate origins from symmetrical fishes.

Although it seems probable that the origin of the unique asymmetry of flatfishes was a single evolutionary event, it must be admitted that the Heterosomata as a whole are held together by little more than the single character that the two eyes are on one side of the head. Many of the features in which the several families agree now appear to represent convergent adaptations (Hubbs, 1945). The work of Parker (1903) on optic nerves of the Heterosomata is, however, of special significance in this connection. In ordinary bony fishes the optic chiasma is dimorphic in character, the right nerve crossing over the left about as often as the left over the right. In the families Soleidae, Cynoglossidae, and Psettodidae, the chiasma is dimorphic, with the nerve of either the left or the right eye the more dorsal in the optic chiasma. In all

other flatfishes, whether dextral or sinistral, the nerve of the migrating eye is dorsal. In the genera of flounders, which are normally dextral (with eyes and color on the right side), the left nerve crosses over the right in all individuals, even in reversed specimens. Similarly in the normally sinistral groups the right nerve is superior even though the individual is variant in having the eyes on the right side. As a result the chiasma is characterized as partly uncrossed in normal individual but doubly crossed in the reversed specimens.

Parker (1903) interpreted the correlation of the type of chiasma with the position of the eye in flounders as adaptive, for when the nerve of the migrating eye is dorsal the chiasma is partly uncrossed rather than doubly crossed as it is when the nerve of the migrating eye is ventral in the chiasma. The chiasma remains dimorphic, however, in both dextral and sinistral soles. This can be explained as due to the relative development of the optic nerves in the two groups. In the flounders, for example, the optic lobes and nerves are larger than in the soles (Evans, 1937:309-310) and are much more conspicuous than the olfactory nerves, occupying a large part of the cavity in which they lie. A complicated arrangement (double crossing) of the nerves may, therefore, involve a mechanical or developmental disadvantage. In soles, on the other hand, the optic nerves are tiny strands lying loose in an extensive space under the large olfactory nerves. In these fishes the olfactory and tactile senses are presumably better developed than the visual. Thus, the double twist of the optic nerves in half the individuals of each species of sole has apparently not been of sufficient selectional significance in the soles, as it has in the flounders, to a fixation of the optic chiasma type in correlation with the usual position of the eye.

The soles, in having several characters in common including the primitive dimorphic type of chiasma, form a natural group, probably split off very early from the other Heterosomata.

The members of the family Cynoglossidae are typically sinistral, with a dimorphic optic chiasma; the jaws are strongly asymmetrical; usually there are two nares on each side of the head, the anterior one tubular, the narial tube of the eyed side always arising in front of the fixed eye; the dorsal and anal fins are confluent with the caudal; the dorsal fin extends onto the head parallel to the

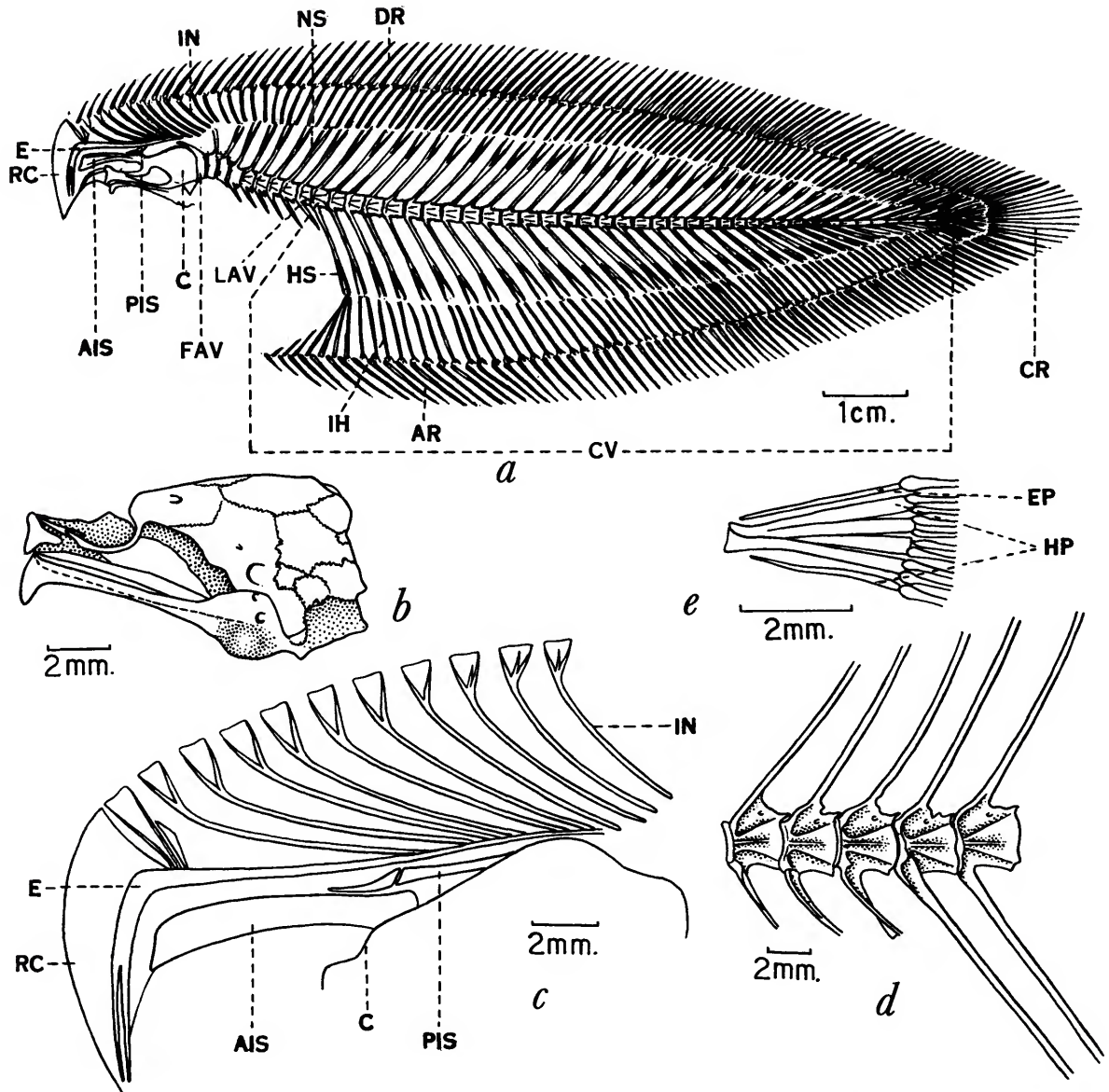


FIGURE 1.—Skeleton of *C. puncticeps*, drawing of a cleared and stained preparation from a 109.0 mm SL specimen (USNM 109799) from the Gulf of Thailand: *a*, entire skeleton; *b*, neurocranium; *c*, epicranium; *d*, last three abdominal and first two caudal vertebrae; *e*, epural and hypural bones supporting the ten caudal rays. (AIS = anterior pseudointerneutral spine, C = cranium, E = erisma, In = interneutral spine, PIS = posterior pseudointerneutral spine, RC = rostral cartilage, AR = anal fin rays, CR = caudal fin rays, DR = dorsal fin rays, EP = epural bone, HP = hypural bone, HS = haemal spine, IH = interhaemal spine, NS = neural spine.)

axis of the cranium, the first dorsal ray never being inserted behind the vertical from the posterior margin of the eye, this ray remaining above the level of the migratory eye even when the dorsal fin is extended to the tip of the snout; the pectoral fins are lacking in the adult; the pelvic of the eyed side is also lacking (except in rare individual cases where it is situated on the eyed side much above the midventral line, as in the case of *Cynoglossus zanzibarensis*, Figure 25); the pelvic fin of the blind side is present with four rays always inserted on the midventral line; the anus and the opening of the oviduct are on the blind side; the urinary papilla is long and situated midventrally in front of and attached to the first anal fin ray; the scales are generally ctenoid; the tactile fringes of the lower side of the head are either short or absent and are replaced by epidermal thickness; and there are no epidermal hairs.

The rostral process of the neurocranium is absent or rudimentary; abdominal vertebrae are usually 9, sometimes 10, or even rarely 12 (*C. robustus*, *C. abbreviatus*, *C. semilaevis*); the number of caudal vertebrae is 33 to 66; the neural arch is complete in all the vertebrae, including the first abdominal vertebra; the haemal arches are complete as far forward as the fourth abdominal vertebra; and an anal interhaemal spine is present, attached to the first caudal haemal spine near its extremity.

The digestive and urinary organs do not extend to the caudal region, only the ovaries and the posturethral portion of the urinary bladder occupy the caudal region, and a swim bladder is absent in the adult.

The family Cynoglossidae though comprising over 100 species is a very homogeneous group, which is evident from the fact that it is comprised

of only three genera: *Symphurus* Rafinesque 1810; *Cynoglossus* Hamilton-Buchanan, 1822; *Paraplagusia* Bleeker, 1886. The genera *Symphurus* and *Cynoglossus* contain most of the species; *Paraplagusia* consists of only four species, *P. bilineatus* (Bloch), *P. blochi* (Bleeker), *P. japonica* (Temminck and Schlegel), and *P. guttata* (Macleay). The three genera are so homogeneous that their subdivision into subgenera would appear only artificial. In spite of its evident homogeneity, the family Cynoglossidae is divisible into two subfamilies, the Symphurinae consisting of the genus *Symphurus* and the Cynoglossinae consisting of the genera *Cynoglossus* and *Paraplagusia*. The two subfamilies are perfectly distinguishable from the point of view of their respective morphology and the geographical distribution.

#### THE RELATIONSHIPS OF THE GENERA

During the course of this revision an examination was also made of the four species of *Paraplagusia*, as well as a dozen species of *Symphurus*. Skeletonized preparations of *C. puncticeps*, *C. browni*, *C. heterolepis*, *C. robustus*, *C. lida*, *Paraplagusia blochi*, and a species of *Symphurus* were studied.

*Paraplagusia* can be distinguished from *Cynoglossus* mainly by its possession of a series of fringes on the lips on the ocular side. In all other features, including the osteology, *Paraplagusia* is very similar to *Cynoglossus*. In the well-developed and more strongly bent erisma and strongly hooked snout, the tip reaching the rear of the lower eye or even beyond, *Paraplagusia* is considered as a form more highly specialized than *Cynoglossus* for a burrowing habit.

#### Key to the Genera of Cynoglossidae

- |  |                     |
|--|---------------------|
| 1. Ventral fins connected with anal, lateral line on ocular side, snout hooked, mouth inferior ..... | 2                   |
| Ventral free from anal, no lateral line on ocular side, snout not hooked, mouth anterior .....       | <i>Symphurus</i>    |
| 2. Lips with fringes, 2 or 3 lateral lines on ocular side .....                                      | <i>Paraplagusia</i> |
| Lips without fringes, 1, 2, or 3 lateral lines on ocular side .....                                  | <i>Cynoglossus</i>  |

#### THE LATERAL-LINE SYSTEM

Except for *Symphurus*, the other members of the family Cynoglossidae have the lateral-line system well developed.

*Head Region:* The head region of all the species of the Cynoglossinae has a complex system of canals. In all the species a supraorbital canal is present, which extends from the snout through the

TABLE 1.—Comparison of subfamilies Symphurinae and Cynoglossinae

Characters	Symphurinae	Cynoglossinae
Snout .....	Not hooked	Hooked
Mouth .....	Terminal	Inferior
Jaws and teeth .....	On ocular side premaxillary smooth, but dentary armed with series of needle-shaped teeth; jaws on blind side toothed, premaxillary and dentary teeth arranged in small number of longitudinal series, forming long narrow band	Jaws on blind side only armed with needle-shaped teeth; on dentary and premaxilla they form wide short band
Scales .....	Ctenoid; head scales of blind side imbricate	Generally ctenoid; head scales on blind side embedded; scales in midlateral line imbricate but with deep median cleft and usually in species with ctenoid scales lateral line scales are provided with cteni on either side of pore of lateral line
Lateral line .....	Absent on both sides	Well developed on ocular side; midlateral line that, except in <i>C. sinusarabici</i> , is accompanied by marginodorsal line and frequently by marginoventral line
Pelvic fin .....	Free from anal fin	Confluent with anal fin
Pectoral fin .....	Rudimentary	Absent
Urinary papilla .....	Short, attached to first anal ray	Long, attached to first anal ray
Neurocranium .....	Vault of cranium absent due to huge fontanelle; otic capsules bulky and hemispherical; a spinous divergence backwardly directed and attached to base of anterior pseudointerneural spine; supraoccipital cartilagenous (Chabanaud, 1940)	Vault of cranium complete; otic capsules not prominent; prefrontal bone without spinous divergence; supraoccipital calcified (Chabanaud, 1940)
Epicranium .....	Anterior pseudointerneural spine slender; erisma short, archlike in shape; rostral cartilage not developed	Anterior pseudointerneural spine robust, quadrangular or swordlike; erisma elongate, falciform directly supporting numerous interneural spines advanced into cranium; rostral cartilage well developed
Vertebrae .....	(9-10) + (38-42) = 57-52  All vertebrae bear diapophyses that are heavy in abdominal region and anterior half of caudal region, but become weaker posteriorly; abdominal haemal spines begin with fourth abdominal vertebra, and are shorter and more strongly oblique than those of caudal series; abdominal haemal spines gradually decrease in length	(9-10 or 11, rarely 12) + (33-66) = 42-76 or 77 or 78  Vertebral diapophyses absent or present only the anterior part of caudal region; abdominal haemal spines begin with fourth abdominal vertebra and are shorter and more strongly oblique than those of caudal series; all abdominal and caudal vertebrae have dorsal spines

TABLE 1.—Comparison of subfamilies Symphurinae and Cynoglossinae—Continued

Characters	Symphurinae	Cynoglossinae
	from ninth to fourth and are also gradually inclined more and more backward; all abdominal and caudal vertebrae have dorsal spines; they are thicker and stronger and less inclined backward toward anterior end; neural spine of first vertebra leans forward so much that it is in contact with posterior face of skull, that of second vertebra distinctly inclined forward but third one only slightly	
Cleithrum .....	Smooth and weakly arched	Subangularly arched; at its base cuticular crest of coracoid segment is hypertrophied into an acute-angled apophysis
Brain .....	Diencephalon not enlarged (Ochiai, 1963:100)	Diencephalon enlarged (Ochiai, 1963:68)
Larval development .....	Symmetrical larval stage known (Kyle, 1913, 1921), with swimbladder on ocular hemisome	Symmetrical larval stage known (Seshappa and Bhimachar, 1955), with swimbladder on ocular hemisome
Ecology .....	Marine but a single species ( <i>S. orientalis</i> (Bleeker) is reported from freshwater at Peiping); majority of species* are eurybathyal (Goode and Bean, 1885, 1886; Alcock, 1889; Gilchrist, 1889; Weber and de Beaufort, 1929, Ginsberg, 1951) and range from 300 m to a maximum 1964 m	Marine but a few species ( <i>C. microlepis</i> , <i>C. heterolepis</i> , <i>C. kapuasensis</i> , <i>C. feldmanni</i> , <i>C. waandersi</i> ) are known to occur in fresh waters; shallow water burrowing forms

\**Symphurus pusillus* (Goode and Bean), 311 m; *S. septemstriatus* (Alcock), 402 m; *S. nebulosus* (Goode and Bean), 414 m; *S. nigrescens* Rafinesque, 420 m; *S. niger* (Goode and Bean), 457 m; *S. marginatus* (Goode and Bean), 587 m; *S. fuscus* Brauer, 638 m; *S. macrophthalmus* Norman, 640 m; *S. ocellatus* Bonde, 640 m; *S. striatus* Gilbert, 730 m; *S. trifasciatus* Alcock, 782 m; *S. regani* Weber and de Beaufort, 794 m; *S. variegatus* (Gilchrist), 823 m; *S. woodmasoni* (Alcock), 896 m; *S. gilesi* (Alcock), 1080 m; *S. australis* Macculloch, 1464 m.

area above the eye and is connected to the mid-lateral line in the posterior part of the head. Above the supraorbital, the cephalodorsal canal commences at the snout, runs posteriorward along the dorsal edge of the head, and is connected to the supraorbital commissure (a dorsal branch of the supraorbital line at the posterior end of the head). These two canals are invariably developed in all the species of Cynoglossinae. From the posterior

end of the supraorbital canal the preopercular canal commences, running ventrally toward the preopercular region. In some forms it turns and runs forward to the corner of the mouth, while in others it turns backward and runs to the edge of the opercular region. From the anterior end of the lower jaw to the operculum stretches the mandibuloopercular canal. At its posterior end it turns upward and is connected to the preopercular canal

in some (*C. bilineatus*), whereas in other groups the mandibuloopercular canal gives off a dorsal branch at the posterior corner of the mouth, thereby connecting it to the preopercular canal (*C. abbreviatus*). In certain other species the mandibuloopercular canal is not connected with the preopercular canal (*C. interruptus*). On the ocular side there is also a small preorbital canal that starts from the tip of the snout and extends obliquely upward in a straight line to before or below the upper eye.

On the blind side of the head the lateral-line system is poorly developed or totally absent. Only small traces of the supraorbital, cephalodorsal, or preopercular canals are found in some forms like the *bilineatus* and the *canariensis* complexes, where the lateral-line system of the abdominocaudal region of the blind side is also developed.<sup>1</sup>

**Abdominocaudal Region:** The Cynoglossinae are the only flatfishes that possess many lateral lines (with the exception of *C. sinusarabici*, in which there is only a midlateral line). All the other members of both *Cynoglossus* and *Paraplagusia* have two or three lateral lines on the ocular side. On the blind side they are generally fewer in number than on the eyed side or are totally absent. In *C. dubius* Day, *C. monodi* Chabanaud, *C. canariensis* Steindachner, *C. senegalensis* Kaup, and *C. borneensis* (Bleeker) there is only one lateral line on the blind side, while in *C. bilineatus* (Lacépède), *C. attenuatus* Gilchrist, *C. lachneri* Menon, and *C. dispar* Day there are two lateral lines on the blind side. In all other members of *Cynoglossus* the lateral-line system is totally absent on the blind side.

Of the lateral lines on the ocular side the most

<sup>1</sup>In the Soleidae the lateral-line system of the blind side of the head region is well developed and various modifications of the scales of the lateral line are found. In *Aseragodes* a row of thin cutaneous flaps is developed on the lateral line, the edges of which are serrated. In *Heteromycteris* and *Soleichthys* the cutaneous structures are hair-shaped and in the latter they are arranged on the lateral line like a brush. In *Synaptura* a well-serrated cutaneous flap occurs, in which the lateral-line canals are embedded (Ochiai, 1966:5). These extra cutaneous structures serve as tactile organs for these nocturnal bottom-feeding fishes in finding their prey. Similar filamentous processes are found on the blind side of the head in certain sole-like pleuronectid genera of the subfamily Rhombosoleinae, which also appear to have nocturnal habits (Norman, 1934:20).

constant is the midlateral line, which extends from the junction of the supraorbital canal with the supraorbital commissures of the lateral-line system of the head region and runs in the midaxis of the body to the base of the caudal fin. In some species, for example *C. bilineatus*, this line branches into three at the base of the caudal fin, the middle running along the axis of the caudal fin, and the other branches running parallel to the middle one and extending onto the caudal fin. The next lateral line of more or less constant occurrence on the ocular side in most of the species is the dorsolateral line, which starts from the junction of the cephalodorsal canal with the supraoccipital commissure of the head region and proceeds posteriorly in a zig-zag manner along the dorsal edge of the abdominocaudal region, extending into the dorsal fin a little distance behind the caudal base. The position of the entrance of this line into the dorsal fin varies in the different species and among individuals of the same species. The third and the least constant lateral line of the ocular side is the ventrolateral line, which starts at the posterior end of the base of the pelvic fin and runs posteriorly in a zig-zag manner along the edge of the anal fin and extends onto the anal fin a short distance before the caudal. The place of entrance of this line onto the anal fin also differs in different species and even among individuals of the same species.

In some of the species of the Cynoglossinae the ventrolateral line is well developed, but the presence or absence of this line should not be depended upon for species differentiation, as this character is highly variable. Norman (1926:300) had already hinted at the unreliability of this character for species or generic differentiation in cynoglossid fishes and observed: "The number of lateral lines on the ocular side may perhaps prove eventually to be of doubtful value as a specific character. Jordan and Starks (1960a:240) have noted that in *Cynoglossus (Areliscus) interruptus* the lower lateral line is broken at irregular intervals and often, especially in smaller examples, it is entirely absent." I have verified this character in a number of species of *Cynoglossus* and also in the case of *Paraplagusia guttata* and find that there is considerable variation in the development of this lateral line among individuals of the same species and even of the same size.

As stated earlier, the midlateral line is the most

constant and well developed and is found in all the species of the Cynoglossinae, while the dorso-lateral, though present in all the species except *C. sinusarabici*, is highly variable as regards its nature and extent. It is, however, fully developed in all the species where the ventrolateral is present.

#### THE SCALES

Along the lateral line in the Cynoglossinae the pored scales usually have the perforating duct simple at its anterior opening, but in *C. senegalensis*, *C. lingua*, and *C. dubius* it is different. In these species the midlateral canal on the ocular side, instead of opening through simple pores on every scale, opens by means of ducts into the adjoining scale above or below. In *C. senegalensis* single ducts alternate with two ducts, whereas in *C. lingua* there are two ducts opening on one side, and in *C. dubius* there are three openings on one side followed by an opening on the opposite side.

The scales are generally ctenoid, the scales of the lateral line having an imbricate arrangement with the lateral-line canal in the middle. In all the species with ctenoid scales the lateral-line scales are provided with spinules above and below the canal.<sup>2</sup> A good deal of variation in the nature of the scales of the two sides, as well as those of the lateral line, occurs among Cynoglossinae. When the scales are ctenoid the spinules are invariably more strongly developed on the ocular than on the blind side. In some species the scales of the ocular side are ctenoid and those of the blind side are cycloid, while in certain others the scales of both sides are cycloid. In some species the scales of the lateral line are cycloid, while all those scales on the ocular side independent of the lateral line are ctenoid (*C. lingua*, *C. senegalensis*, *C. borneensis*, *C. browni*, *C. bilineatus*, *C. lachneri*, *C. dispar*, *C. canariensis*).

Regarding the nature of the scales of *C. cadenati*, Chabanaud (1956) observed that the scales of the upper side are ctenoid (at least in the young), including those of the lateral line (pleurogammiques), and all the pores are simple. On the blind side all the scales are ctenoid (except those of the head, which are cycloid), but the scales toward the fin region are considerably reduced; the marginal spin-

ules are few, lying just above the surface or embedded in the skin. In the case of *C. gilchristi* Regan the scales and pores are as in *C. cadenati*, but the scales in the region of the fins on the blind side are more developed and the marginal spinules are prominent. The rest of the species occurring off the Atlantic coast of Africa, namely, *C. senegalensis* Kaup, *C. guinensis*, *C. canariensis* (= *C. lagoensis*), *C. monodi*, and *C. browni*, form a distinct group characterized by the ctenoid condition (at least in the young) of the upper scales except for the scales on the lateral lines, which are cycloid; by the diverticulated opening of the lateral-line pores; and by the cycloid condition of the scales of the blind side. Thus, in the nature of its scales, *C. cadenati* differs entirely from all the other species of *Cynoglossus* occurring off the Atlantic coast of Africa, and it should undoubtedly be placed in the group containing *C. gilchristi*, which is also characterized by ctenoid scales (at least in the young) on both the blind as well as the eyed side. Chabanaud (1956) further concluded that in the genera *Cynoglossus* and *Paraplagusia* the pleurogammique formula (number of lateral lines on the two sides of the body) should be subordinated to the pholidologique character (nature of scales).

*Modifications of Scale with Age:* Modifications in the nature of the scales occur with age (size) in certain species. For instance, in big specimens of *C. arel*, which have mainly ctenoid scales including those of the lateral line, a number of cycloid scales are found in the lateral line toward the posterior end, especially near the base of the caudal fin. The scales that remain most consistently ctenoid are those of the rows close to the dorsal and the anal fins.

Dealing with modifications of scales among *Cynoglossus*, Chabanaud (1965) divided *Cynoglossus* into two groups according to the nature of scales of the upper side, namely, those with the entire upper side with ctenoid scales and those with the lateral-line scales cycloid and the rest of the scales ctenoid. However, in the case of big specimens of *C. arel*, which are characterized by ctenoid scales on the upper side including those of the lateral line, a number of cycloid scales occur in the lateral line. Modification in the nature of the scales on the upper side is correlated with age, beginning from the posterior end of the fish and at the base of the caudal fin. The most conservative scales are in the

<sup>2</sup>In the Soleidae and Archiridae the scales of the lateral line are much reduced, are enclosed in the skin, and are concealed by the two adjacent series.



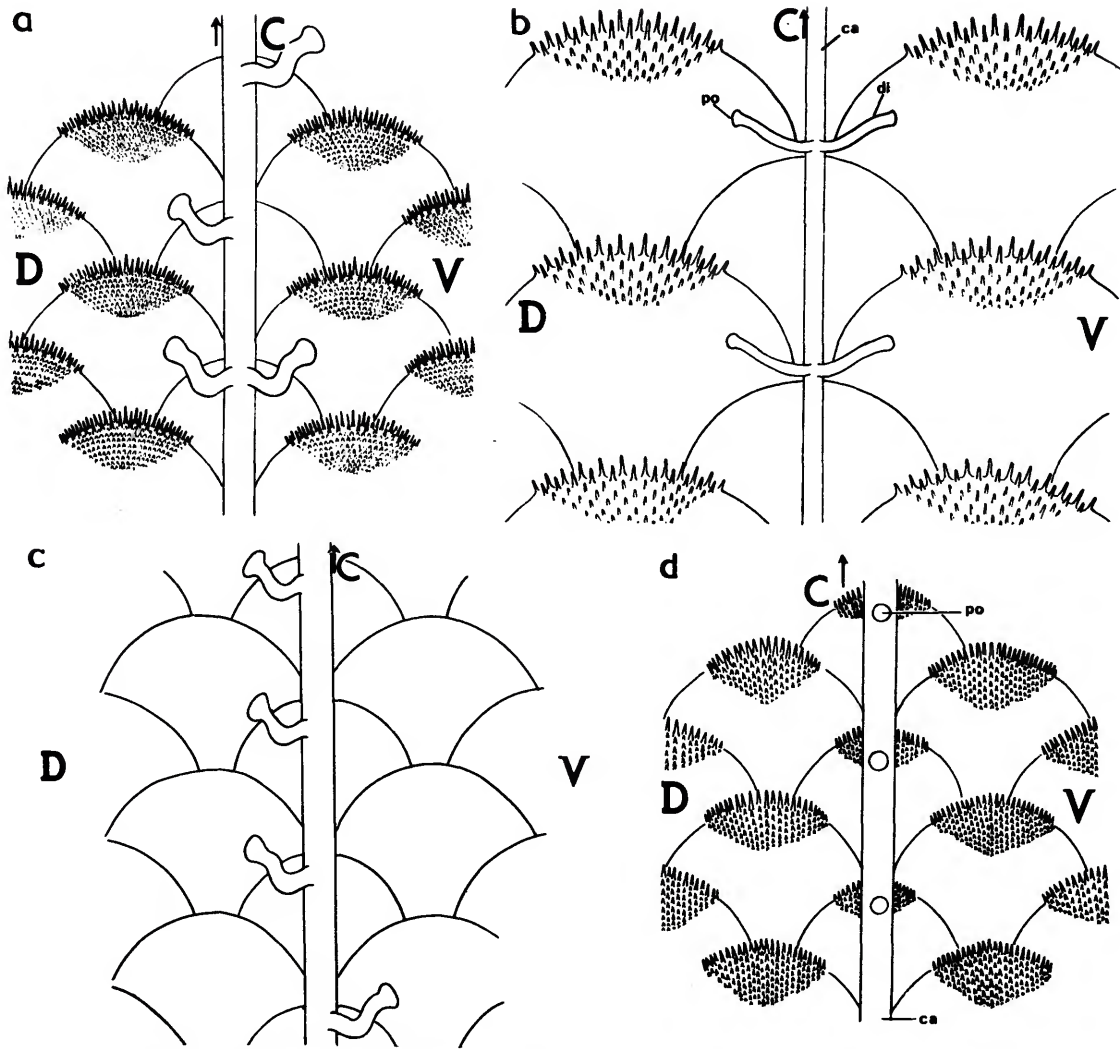


FIGURE 2.—Diagrammatic representation of lateral lines in *Cynoglossus* to show the variations in the perforating ducts in the different species: a, *C. senegalensis* where the scales on the lateral line are cycloid with single duct opening outside, alternately followed by two ducts on either side; b, *C. lingua* where the scales on the lateral line are cycloid with two ducts opening on either side in the adjoining scales; c, *C. dubius* where the scales on the lateral line as well as the adjoining scales are cycloid with three ducts opening on one side followed by a duct opening on the opposite side; d, *Cynoglossus* species where all the scales on the ocular side are ctenoid with a single pore opening on every lateral line scale. (D = dorsal side, V = ventral side, C = caudal side, PO = pore opening, DI = diverticulum, CA = lateral line canal.)

rows closest to the dorsal and anal fins, the rest gradually becoming cycloid with age. It is, therefore, not generally possible to decide to which of the two groups a specimen belongs unless juveniles or immature specimens are examined.

#### THE EPICRANIAL BONY SYSTEM

In the generalized genus *Psettodes*, the first spine of the dorsal fin lies on the nape and well behind the eyes, but in all other flatfishes the fin has ex-

tended forward at least to above the eye and in some even to the extremity of the snout. This forward extension of the dorsal in the Pleuronectoidea is along the ridge of the supraoccipital and hence along the bar formed by the union of the prefrontal and frontal on the blind side above the upper eye, i.e., along the pseudomesial bar instead of along the morphological median line. Above the eye the fin is, therefore, not infrequently bent over a little toward the blind side. In some genera, such as *Pleuronichthys*, one or more rays of the anterior part of the fin are virtually on the blind side of the head.

The anterior extension of the dorsal fin onto the head in flatfishes appears to have been achieved either by (1) the anterior interneural spines themselves moving forward along the upper surface of the cranium from a position in the region of the supraoccipital to one on the frontal of the blind sides as in *Pleuronectes* or (2) as in the case of the Soleoidea, the first few interneural spines being inclined forward, so that the first of these may actually occupy a horizontal position, thus carrying the rays of the dorsal fin to the required place (Norman, 1934:15). The interneural spines, inclined forward onto the cranium, are supported by a hard bony system called the epicranial bony system (Ochiai, 1966:55).

In the case of the Soleoidea those anterior interneural spines that are inclined forward are supported by a special curved spinelike bone lying nearly parallel to the cranium. This rod-shaped bone is considered as the modified first interneural spine and is called the erisma<sup>3</sup> by Norman (1934:15). Its base lies at a point between the ventral side of the anterior end of the first neural spine and the cranium, and its anterior end reaches to the snout. In the Soleidae (except *Heteromycteris* Kaup) and the Symphurinae the erisma is comparatively short and arched, its dorsal side near the anterior end bearing two pterygiophores but no interneural spines. In the specialized *Heteromycteris* the erisma is long and thick, the anterior end being strongly bent ventrally, supporting 15 interneural spines dorsally and two long pterygiophores anteriorly (Ochiai, 1963:13).

In the Cynoglossinae the erisma is quite long and

sickle shaped, supporting 10 interneural spines and two pterygiophores dorsally. The anterior pterygiophore is specially well developed to form an axe-shaped rostral cartilage (Wu, 1932:21) devoid of any fin rays. This rostral cartilage in most of the species is strong and flexible with 12 strong radially arranged muscles on both sides. The erisma in the Cynoglossinae is supported by one or two spinous or sword-shaped bones, the pseudointerneural spines. The anterior pseudointerneural spine is sword shaped in most species, its base fixed lightly on the frontal bone and the broader anterior portion extending forward onto the ventral side of the erisma. In *Symphurus* the anterior pseudointerneural spine<sup>4</sup> is slender and spinous and its base is attached to the supraoccipital bone.

The posterior interneural spine, which is spinous, is present in most members of the Cynoglossinae and the Symphurinae. In the Cynoglossinae it lies between the cranial bones and the anterior pseudointerneural spine, while in the Symphurinae its base is attached to the supraoccipital and it projects forward parallel to the anterointerneural spine.

*The Adaptive Significance of the Erisma:* In *Pleuronectes* a thin membranous bone is developed on the middle axis of the cranium for supporting the interneural spines that have moved onto the head (Ochiai, 1963:56, fig. 14). This structure strengthens the fin rays but prevents further invasion of the dorsal fin through the middle axis to the anterior edge of the eye or snout region. In most species of pleuronectids the dorsal fin, therefore, does not move onto the head portion beyond the eye; if it does, it reaches to the area near the nostril on the blind side. Those fin rays that reach the snout region of the blind side are supported by interneural spines on the prefrontal bone. In the Soleoidea the erisma is separated from the cranium and lies parallel to the middle axis of the head, thereby enabling the dorsal fin to move easily along the dorsal edge of the head as far as the snout without being deflected to the blind side.

In the Soleidae the epicranial bony system is developed primarily to support the dorsal fin rays on the head. In the process of specialization to a bottom living habit and for fast swimming by means of undulating movements, the vertical fins

<sup>3</sup>This bone is called "lame osseuse subuccale" by Wu (1932) and "axonoste libra" or "pseudo-axonoste" by Chabanaud (1934b:284).

<sup>4</sup>This bone is called "axonoste epicranier anterior" by Chabanaud (1940:182).

have extended onto the head. The modification of the pelvic fin, which is attached to the anal fin by a membrane, is also a means of achieving efficient undulating movements of the body. In the case of *Heteromycteris*, the erisma extends anteriorly and is bent ventrally to carry on its dorsal side the interneural spines and the dorsal rays. In addition to carrying those dorsal rays that have extended forward to the head, the erisma has the secondary function of strengthening the snout. In this case, however, there is no rostral cartilage in the anterior portion of the erisma. In the case of *Cynoglossus*, the dorsal fin does not extend far forward and the first pterygiophore does not bear any fin ray but is modified into a rostral cartilage to give support to the snout, thus enabling these fishes to plough the sandy or muddy bottom to secure their food, as well as to hide themselves by burying wholly or partly in the sand. The poorly developed sensory system, or lack of one, on the blind side of the head and body of *Cynoglossus*, in contrast to its development in the Soleidae, points to two distinct types of habit in these two groups of fishes. While members of the Soleidae are mostly feeders on the surface of the bottom by means of their well-developed tactile organs on the blind side of the head, the Cynoglossidae are adapted primarily to ploughing the sand in search of prey and to feeding on organisms living below the surface. In *Symphurus*, although the erisma is not so well developed as in *Cynoglossus* or *Paraplagusia*, it is also strengthened by the two pseudointerneural spines, suggesting a similar habit of burrowing into the bottom for feeding.

#### THE SPECIES GROUPS AND COMPLEXES AND THEIR HYPOTHETICAL EVOLUTIONARY RELATIONSHIPS

Taxonomically the genus *Cynoglossus* has several lines of evolution representing six groups and 17 complexes.

The western periphery of the geographical range of *Cynoglossus*, namely the tropical Atlantic coast of Africa, is occupied by the most unspecialized species closest to the ancestral stock. Toward the Malay Archipelago are the more specialized and rapidly evolving species complexes. The primitive species or their immediate ancestors apparently evolved in this center and were replaced sub-

sequently by the more specialized species, such as those of the *cynoglossus*, the *carpenteri*, and the *heterolepis* groups.

The *canariensis* group, comprising the *canariensis*, the *browni*, the *bilineatus*, and the *attenuatus* complexes, is considered primitive and nearest to the ancestral stock. These species are peripheral in distribution (Figures 4, 5) and are mostly large adult fishes reaching to about 400 mm. They exhibit characters considered primitive in the process of specialization toward a burrowing mode of life. They generally have one or two lateral lines on the blind side, 12 rays in the caudal fin, relatively big eyes separated by a wide interorbital space, two nostrils on the eyed side, large scales, and a rounded snout. The possession of a lateral line on the blind side is considered a primitive character for cynoglossid fishes feeding on organisms living below the surface by digging or burrowing into sand or mud. No useful purpose is likely to be served by having lateral lines on the blind side and, therefore, they are totally absent in the specialized forms. The reduction in the number of caudal fin rays, reduced size of scales, reduced size of eyes, scaly covering of eyes, and loss of posterior slitlike nasal opening, leaving only the anterior tubular nostril, are all specializations for a burrowing mode of life.

The *canariensis* complex is the most primitive complex of species within the *canariensis* group and is characterized by a single lateral line on the blind side. Its members are found at the extreme western extremity of the generic range (Figure 4). The *bilineatus* complex is the next evolved group. It extends to the northern (Japan) and the southern (Australia) periphery (Figure 5) and is characterized by two lateral lines on the blind side.<sup>5</sup> The *attenuatus* complex of species, occupying the east African coast, the Seychelles, and the seas of India and Pakistan (Figure 5), retains the primitive two lateral lines on the blind side but shows a reduction in the number of rays in the caudal fin; otherwise, there are no structural changes from the *bilineatus* complex. *Cynoglossus browni* is placed in a separate

<sup>5</sup>The *bilineatus* complex with two lateral lines on the blind side is considered less primitive than the *canariensis* complex, which has a single lateral line on the blind side purely on a zoogeographical basis. It is probable that the *canariensis* group evolved in west Africa from a form with two lateral lines on the blind side and dropped off one lateral line secondarily in the course of evolution (Carl L. Hubbs, pers. comm.).

complex because of the absence of any lateral line on the blind side. Morphologically, and in its distribution, *C. browni* is closely related to the *canariensis* complex and is probably evolved from a *canariensis*-like ancestor through the loss of the lateral line on the blind side.

The *kopsi* group, with small adult size members attaining about 200 mm, is distinguished by the lack of any lateral line on the blind side, large eyes, either contiguous or separated by a very narrow interorbital space, and a short obtusely pointed snout, with the angle of the mouth situated distinctly nearer to tip of snout than to branchial opening.

The contiguous or subcontiguous nature of the eyes is considered a very useful specialization in fishes with a burrowing habit. In *Cynoglossus* two lines of specialization of the eyes have taken place. In the first case, where the eyes are of large size, they have become contiguous or have come close to one another, generally with the adipose membrane of the eyelid becoming thick and scaly, holding the eyes more or less close together as a compact structure, which gives sufficient protection to them while ploughing or burrowing into the sand. In the other case, which is more commonly met with in the highly specialized species (*heterolepis* group), the eyes have become considerably reduced in size, the interorbital width being the same or even more than the diameter of the eye.

Included in the *kopsi* group are the *kopsi*, *itinus*, *ogilbyi*, *ecaudatus*, and *sealarki* complexes. Of these, the *kopsi* complex is considered the most primitive, i.e., nearest to the *canariensis* group, the body scales being somewhat larger than in the members of any other complex (interlinear scale count: *kopsi* complex 7-12, *ecaudatus* complex 10-12, *ogilbyi* complex 8 or 11-14 and *sealarki* complex 10-17). Reduction in the size of the body scales accompanies specialization. The large imbricate scales on the body are a disadvantage for the burrowing mode of life of a fish. The *itinus*, *ogilbyi*, *ecaudatus*, and *sealarki* complexes comprise closely related species and have evolved into distinct complexes of species mainly through gradual reduction of the size of the body scales from the original *kopsi* stock that had spread to different ecological niches along the coasts of Japan, Australia, and Africa. Today the *kopsi* complex is restricted to an area from the Indo-Australian Archipelago to southern Japan and

westward through India and Pakistan to Cargados Garajos, Seychelles, and the Persian Gulf (Figure 7). The *kopsi* complex is characterized by two nostrils on the ocular side, large body scales, ctenoid on both sides, and 10 rays in the caudal fin.

In the African waters, two major lines of evolution of the early *kopsi* stock seem to have taken place, one along the South African coast leading to the *sealarki* complex of species and the other along the north-east and West coasts of Africa including the Red Sea and the Mediterranean to the *ecaudatus* complex (Figure 7). The *ecaudatus* complex is characterized by two nostrils on the ocular side, comparatively small body scales with 10-12 interlinear rows, ctenoid on both sides, and usually with 8 rays in the caudal fin, while the members of the *sealarki* complex have only the anterior tubular nostril, the posterior slitlike nostril being absent, smaller body scales with 10-17 interlinear rows, ctenoid on the ocular, and partially cycloid on the blind side, and 10 rays in the caudal fin.

The stock that had spread from the Indo-Malayan Archipelago southward to the Australian waters differentiated into the *ogilbyi* complex of species characterized by two nostrils on the ocular side, smaller body scales with 8 or 11-14 interlinear rows, ctenoid on the ocular side, and usually cycloid on the blind side, and 8 rays in the caudal fin. The *itinus* complex seems to have evolved in the Japanese waters through the loss of the posterior slitlike nasal opening, in all the other morphological features *itinus* remaining similar to the *kopsi* complex.

The *arel* group, with relatively large adult size attaining about 400 mm, is a step forward in the evolutionary history of the genus. The members of this group are characterized by fairly large eyes but separated by a narrow interorbital space, much elongated body, and long obtusely pointed snout with the angle of the mouth situated nearer to the branchial opening than to tip of the snout. Its range covers the whole of the Malay Archipelago extending north to Japan and westward to India, Pakistan, and the Persian Gulf (Figure 6). This group has certain similarities to the *canariensis* and *bilineatus* complexes, especially in the large adult size of its members and the nature and position of the eyes and large scales; therefore, it is considered to have evolved as an early offshoot from

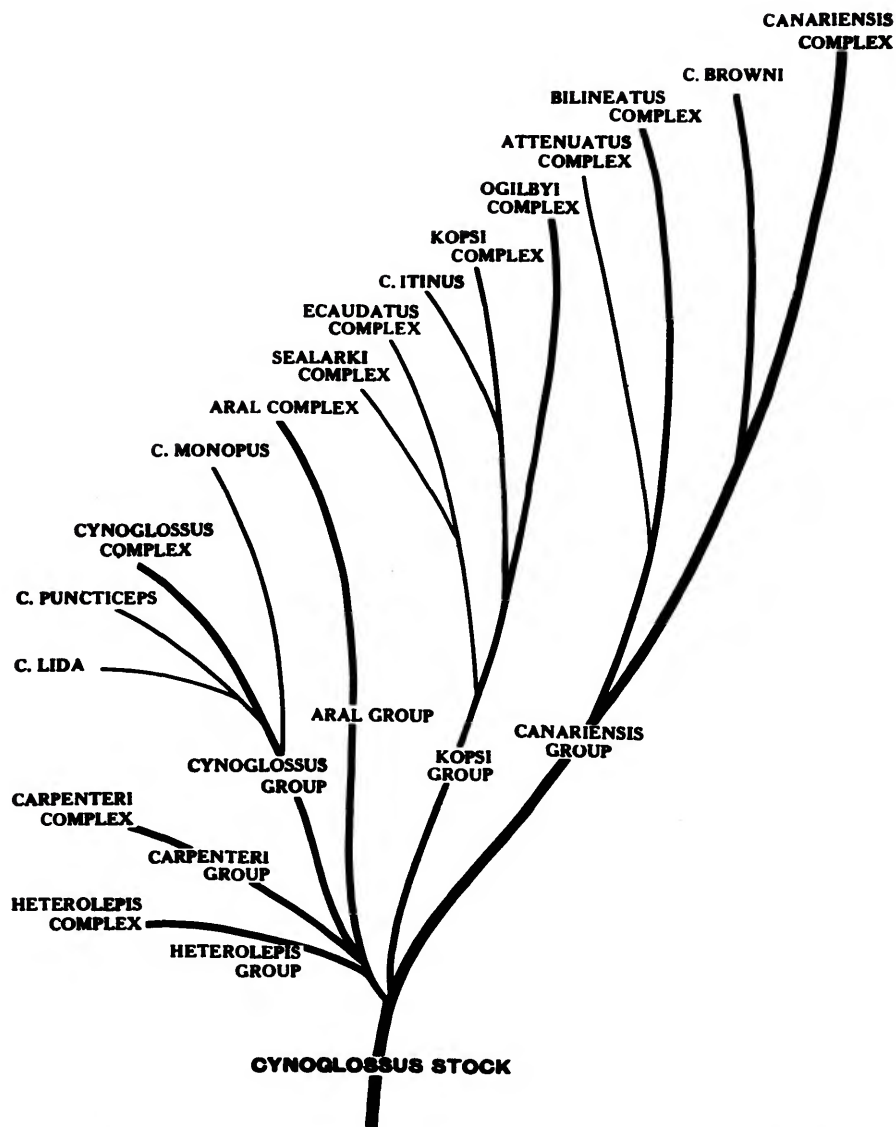


FIGURE 3.—Dendrogram showing the hypothetical evolutionary relationship of the species complexes of *Cynoglossus*.

the main stock, which gave rise to the *canariensis* group.

The *cynoglossus* group, consisting of fishes of small adult size attaining only about 175 mm, is characterized by relatively small eyes (pedunculate in *monopus* complex) separated by a narrow inter-orbital space, a moderately elongated snout, but

with the angle of the mouth situated nearer to the tip of the snout than to the branchial opening (except *lida* complex), and relatively small scales on the body, the interlinear scale rows being 7-21. Its range covers the Malay Archipelago, northwest Australia, the seas of India and Pakistan, and the East Coast of Africa (Figure 8). In evolutionary

relationships, this group is considered closer to the *arel* group, especially in the nature and position of the eyes, the lateral-line system, and the caudal fin ray count, than to the *kopsi* group. Hence it has been considered as a recent offshoot from the stock that gave rise to the *arel* group.

The *carpenteri* group, attaining relatively large adult size (about 300 mm), is most probably derived from an early *cynoglossus*-like ancestor through the elongation of the body, the modified snout with the shifting of the angle of the mouth to a point distinctly nearer to the branchial opening than to the tip of the snout, a reduction in the size of the scales with an increased interlinear scale rows of 15-22, and the addition of a third lower lateral line.

The *heterolepis* group is closely related to the *carpenteri* group, differing mainly in having small or minute eyes with a wide interorbital space. They cluster mostly around the Malay Archipelago (Figure 10) and are most probably evolved as an early offshoot of the stock that gave rise to the *carpenteri* group.

The species complexes have been erected on Zoogeographical basis, and since characters such as the loss of posterior slitlike nares occurred independently in widely separated areas and are mainly adaptive, no separate key for their identification is given. However, a key for the identification of the species has been provided.

#### Genus *Cynoglossus* Hamilton-Buchanan, 1822

- Cynoglossus* Hamilton-Buchanan, 1822:32, 365 [type-species: *Cynoglossus lingua* Hamilton-Buchanan, monotypy.]  
*Cantoria* Kaup, 1858:106 [type-species: *Plagusia potous* (not *potous* of Cuvier) Cantor = *Cantoria penanganensis* Kaup, monotypy.]  
*Arelia* Kaup, 1858: 107 [type-species: *Pleuronectes arel* Schneider = *Arelia schneider* Kaup, tautonymy.]  
*Icania* Kaup, 1858:109 [type-species: *Plagusia cynoglossus* Cantor = *Icania cynoglossus* Kaup, monotypy.]  
*Trulla* Kaup, 1858:109 [type-species: *Trulla cantori* Kaup = *Plagusia trulla* Cantor, tautonymy.]  
*Areliscus* Jordan and Snyder, 1900:380 [type-species: *Cynoglossus joyneri* Günther, monotypy.]  
*Cynoglossoides* Bonde, 1922:23 [type-species: *Cynoglossus attenuatus* Gilchrist, 1905, monotypy.]  
*Cynoglossoides* [not Bonde, 1922] Smith, 1949:165 [type-species: *Cynoglossus ecaudatus* Gilchrist, 1908, original designation; preoccupied by *Cynoglossoides* Bonde 1922.]  
*Dollfusichthys* Chabanaud, 1931:304 [type-species: *Dollfusichthys sinusarabici* Chabanaud, monotypy.]

*Dexiourius* Chabanaud, 1947b:443 [type-species: *Cynoglossus semilaevis* Günther 1873b, monotypy.]

Body lanceolate, eyes on left side, center of migratory eye usually placed in advance of center of fixed eye and usually anterior to its anterior border, pectorals absent; only pelvic fin of blind side present, with four rays, all inserted ventrally in front of anal and connected to it by a membranous extension of its last ray. Dorsal, anal, and caudal are confluent. The abdominocaudal region of the ocular side always bears a mediolateral line that, except in *Cynoglossus sinusarabici*, is accompanied by a marginodorsal line and in some species by a third sensory line, the marginoventral. The dorsolateral line generally runs in a zigzag or interrupted manner posteriorward and enters the dorsal fin, the position of the entrance varying from species to species and even among individuals. The ventrolateral line, when present, originates from the posterior end of the base of the pelvic fin and also runs in a zigzag or interrupted manner along the base of the anal fin, entering the anal fin some distance before the base of the caudal. On the blind side the lateral lines are generally fewer in number than on the ocular side; one or two or often absent. On the ocular side of the head a complex system of lines is present, which in its essentials is invariable.

The scales are generally ctenoid on the ocular side, ctenoid or cycloid on the blind side; the scales on the mediolateral line are imbricate and traversed by the lateral-line canal, the scales having spinules above and below the pores of the lateral line. On the ocular side the anterior nostril is tubular, arising in front of the fixed eye a short distance from the sublachrymal sulcus; the posterior nostril when present is generally a simple opening in the interorbital space when the eyes are separate, or somewhat in front of the middle of the eyes when the eyes are contiguous; on the blind side the anterior nostril is generally tubular, arising above the anterior half of the upper lip, the posterior opening or slit generally lying at a level slightly higher and above the posterior half of the upper lip, the internarial space varying from two-thirds to three-fourths of the distance between the posterior nostril and the corner of the mouth opening. The jaws are strongly asymmetrical; only the jaws of the blind side are armed with teeth; the latter are needle shaped, arranged on the dentary and the premaxil-

lary, forming a wide, short band with a meniscoidal outline. The mouth is rather narrow, the snout hooked and overhanging the mouth opening. The lips are not fringed (cf. *Paraplagusia*). The gill opening is narrow; the gill membranes are united, free from isthmus. The urinary papilla is on the eyed side and wholly joined to the first anal ray. The ovarian duct opens into the posterior half of the anus situated on the blind side.

The length of the neurocranium is less than its height; the cerebral cavity is longer than the rhinophthalmic part of the skull; the vault of the cavity is complete; the sacculi are not prominent.

Vertebral diapophyses are absent. Abdominal vertebrae 9 or 10, rarely 11 or 12, caudal vertebrae 33 to 66. The closure of the abdominal haemal arches is accomplished by a transverse bridge, beyond which the two half-arches are prolonged freely, on each side of the kidney.

The cleithrum is subangularly arched, the cuticular crest of the coracoid segment forming an acutely angled apophysis at its base.

The epicranial bony system is well developed; the erisma is angularly arched and prolonged anteriorly, supporting a strong preoral cartilaginous plate.

Species of *Cynoglossus* were unknown to 18th-century naturalists. The first species of *Cynoglossus* known to science was Schneider's *Pleuronectes arel* from Tranquebar, on the east coast of India. Two years later Lacépède (1802) described a species from China and the East Indies under the name *Achirus bilineatus*.

Hamilton-Buchanan's genus *Cynoglossus* was the seventh in his order Apodes, consisting of "fishes having the dorsal spine of bone and wanting ventral fins." He characterized the genus as comprising fishes "with both eyes on one side of the head and with a flat body, formed for swimming on the side opposite to the eye." Under his genus *Cynoglossus*, Hamilton-Buchanan included only one species, *C. lingua*. In the same work Hamilton-Buchanan described another species, *Achirus cynoglossus*, under his fourth order Thoracini, comprised of fishes having the dorsal spine of bone and ventral fin placed immediately under the pectorals. He recognized, however, the close relationship of this species to *C. lingua*.

In 1949, Chabanaud (1949a-d) published a series of four papers on the Cynoglossidae of the Atlantic

coast of Africa. In the first of these he gave the principal characteristics of the various genera of the Cynoglossidae (1949a:60-64) and described *C. monodi* from Dahomey and Sierra Leone (1949a:65-66), giving a key to all the species, subspecies, and morpha of *Cynoglossus* from that region. Regarding the nature of the scales in *C. monodi* he remarked (1949a:66) that on the upper side all the scales on the lateral line are cycloid; the pores of the sensory canal are more or less distinctly separated; the scales on the body are cycloid for about the three quarters of the body length in the type except for those that are placed near the dorsal fin as well as in the ventral fin; those scales are all ctenoid on the last quarter of the body in the type. The scales on the blind side are cycloid. He observed that by comparison with what exists among the varied species of the Indo-Pacific, it is reasonable to think that in some smaller (younger) individuals all the scales on the upper side of the body (nonpleurogrammiques) are ctenoid, while in larger individuals these scales can become uniformly cycloid. In the second paper in the series, Chabanaud (1949b) redescribed all the species of *Cynoglossus* and in the third and fourth (1949c,d) gave a key and made certain remarks on the various eastern Atlantic species. In the same year (1949e) Chabanaud also described *C. cleopatriides* from the Suez Canal.

In 1950 Chabanaud redescribed *C. cleopatriides* and in 1951 published four important papers. In the first of the series (1951a) he briefly discussed the nature of the lateral line in *C. senegalensis*, *C. lagoensis*, and *C. kopsi*. In the next (1951b) he redescribed *C. brachycephalus* and described a form from the Seychelles similar to *C. brachycephalus*, but with three lateral lines in the abdominocaudal region of the ocular side, which he tentatively considered as a distinct species and provisionally named it *C. seychellensis*. A form of *C. brachycephalus* from the Gulf of Suez, with a single lateral line on the abdominocaudal region of the ocular side (for which he had earlier erected a new genus and species, *Dollfusichthys sinusarabici*), he considered as yet another morphological variety of *C. brachycephalus*. He further observed that the morphological variety of a species is a matter of geographical localization of its representatives. In Indo-Malayan and (in a general way) Indian Ocean species the upper lateral line is unbroken. To the

west of the Indian Peninsula, i.e., in the Persian Gulf and the Red Sea but excluding the Gulf of Suez, the upper lateral line is shortened not only anteriorly, but also from its posterior end to the point that in certain individuals, particularly those that live in the Red Sea, the line in question occupies no more than a minimum extent of the middle part of the abdominocaudal region. Finally, the same lateral line disappears entirely in the 22 specimens examined from the Suez Canal. The Seychelles specimen with three lateral lines could be an exceptional case because not far from its place of capture the individuals found in the Carajos belong to the two lateral-line types.

NOTE ON SYNONYMY.—As indicated by Norman (1926), I find that the number and nature of nostrils and the number of lateral lines on the ocular side are of little value in generic differentiation. *Cantoria* is characterized by two nostrils on the ocular side, both located above the upper lip; *Arelia* by the presence of two nostrils, one tubular on the upper lip before the eyes and the other between the eyes; *Trulla* by the presence of only one nostril in front of the lower eye; and *Icania* with no conspicuous nostril at all. Günther (1862) did not consider any of Kaup's genera distinct and grouped them all under *Cynoglossus*.

As an adaptation to a burrowing habit the tubular narial opening is an advantage. It is, therefore, invariably present in all such species, whereas the posterior slitlike narial opening between the eyes is sometimes absent. The posterior nares are absent in the more highly evolved species like the *capensis* complex of species (in Africa), *C. itinus* (in Japan), and *C. macrophthalmus* (in Australia); they are hidden by a thick fleshy covering as a protection against fine sand particles; they are minute and invisible, unless examined through a lens, in most of the other species.

Jordan and Starks (1906a) restricted the name *Cynoglossus* to species with two lateral lines on ocular side and placed those with three lateral lines in *Areliscus*. Bonde (1922) considered forms with two lateral lines on each side as *Cynoglossoides* and commented (1925) on the utility of splitting the original genus *Cynoglossus* into separate genera and subgenera but observed that "if carried too far it may lead to complications and an undue number of monotypic genera." Further he observed that "the lateral line which is the main character used

in splitting the genera is not always a constant one." Smith (1949), obviously unaware of the generic name *Cynoglossoides* proposed by Bonde, included forms with two lateral lines on ocular side and none on the blind side under his genus *Cynoglossoides*, with *C. ecaudatus* as the type-species. Chabanaud (1931) proposed *Dollfusichthys* for a form characterized by a single lateral line on the ocular side. The lateral lines, as has been pointed out, are highly variable in number and extent, and this cannot be considered as reliable character for generic or even specific differentiation.

Chabanaud (1947c) proposed the genus *Dexiourius* for certain individuals of *C. semilaevis* from China with a vestigial pelvic fin persisting on the eyed side.

#### ZOOGEOGRAPHY AND EVOLUTION

DISTRIBUTION.—The geographical area of *Cynoglossus* comprises the eastern tropical Atlantic, the eastern Mediterranean, the whole of the Indian Ocean, including the Malay area in the east, the Persian Gulf, the Gulf of Oman and the Red Sea, the whole of the East Coast of Africa as far south as the Cape of Good Hope in the west, the west pacific from south China to south Japan, and the whole of the periphery of the Australian continent. The eastern and northern limit of *Cynoglossus* is Tokyo at 35°40'N (*C. interruptus*); the southern limit is the mouth of the Murray River, South Australia, at 34°10'S (*C. broadhursti*). The western limit is marked by the Canary Islands, about 30°N (*C. canariensis*) in the Northern Hemisphere, and Angola, about 10°S (*C. canariensis*) in the Southern Hemisphere.

In spite of the much smaller spread into northern and southern latitudes as compared to that of the Soleidae,<sup>6</sup> the distribution of *Cynoglossus* follows a similar pattern of the Soleidae.

The most important conclusions that can be drawn from an analysis of the distributional data given in Table 2 are:

<sup>6</sup> The eastern limit of the Soleidae is the Galapagos Islands, about 90°E (*Aseraggodes herrei* Sacle), the western limit is the tropical west African coast of Senegal, about 15°W (*Solea senegalensis* Kaup), the northern limit is the North Sea and west coast of Ireland, and the southern limit is the Cape of Good Hope (Alagoa bay, etc.), about 34°S (*Solea bleekeri* Boulenger and *Astroglossus pectoralis* (Kaup), etc.).





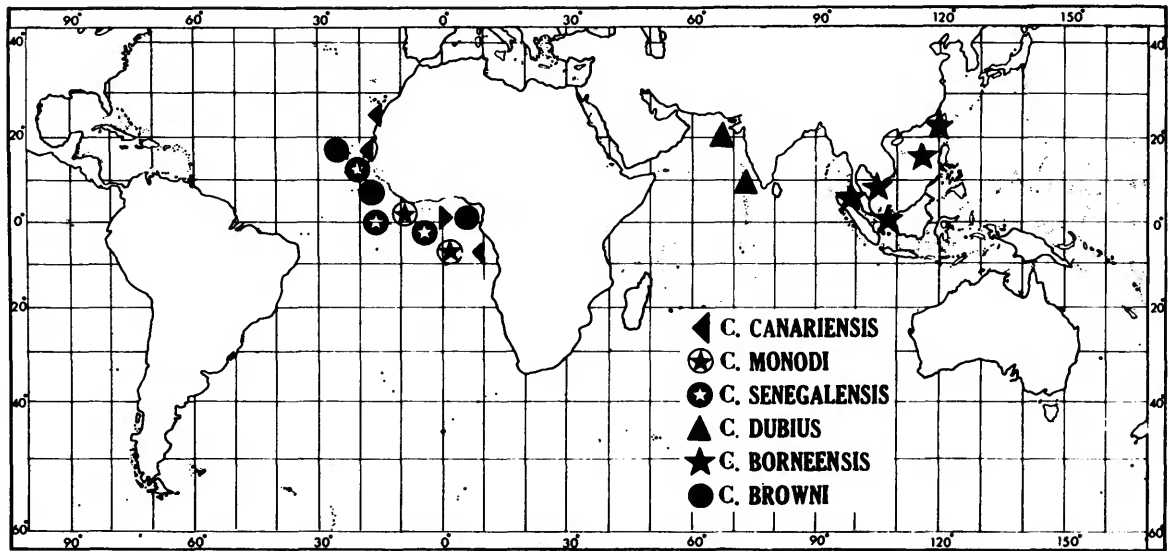


FIGURE 4.—Distribution of *canariensis-browni* complex of species.

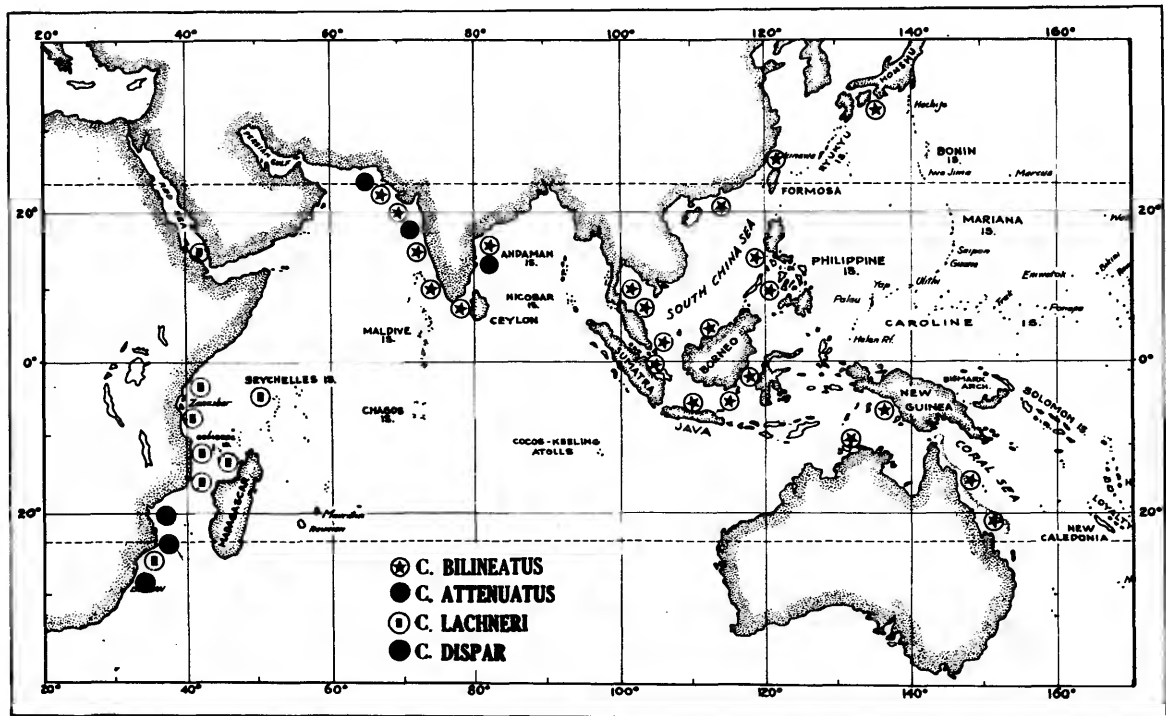


FIGURE 5.—Distribution of *bilineatus-attenuatus* complex of species.

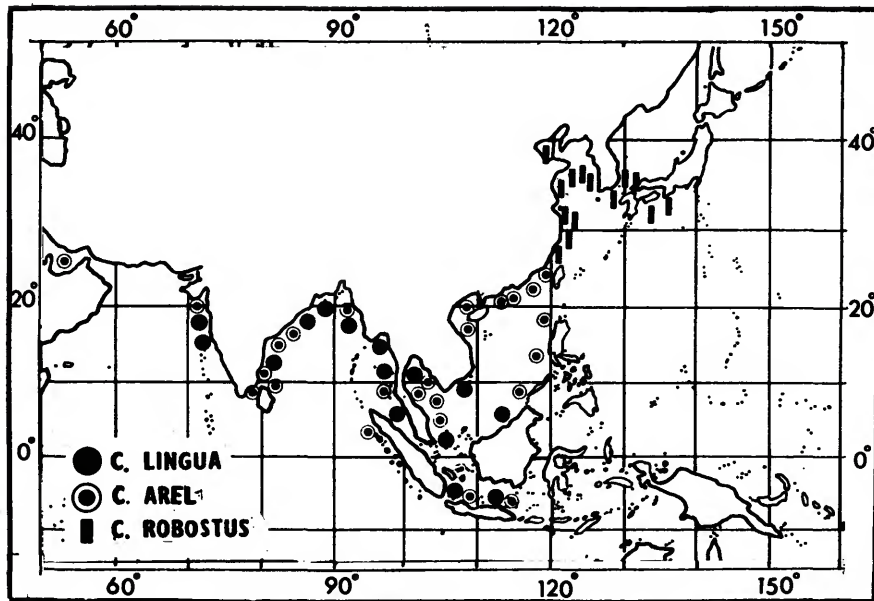


FIGURE 6.—Distribution of *arel* group of species.

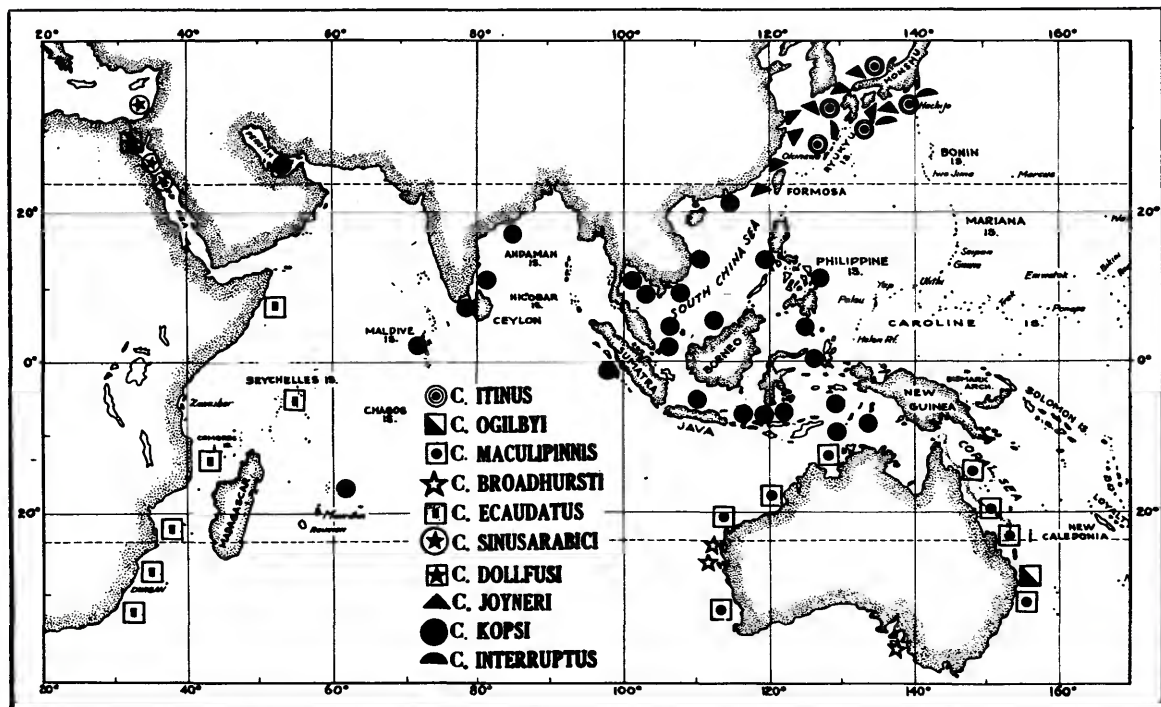


FIGURE 7.—Distribution of *kopsi*, *itinus*, *ogilbyi*, and *ecaudatus* complex of species.

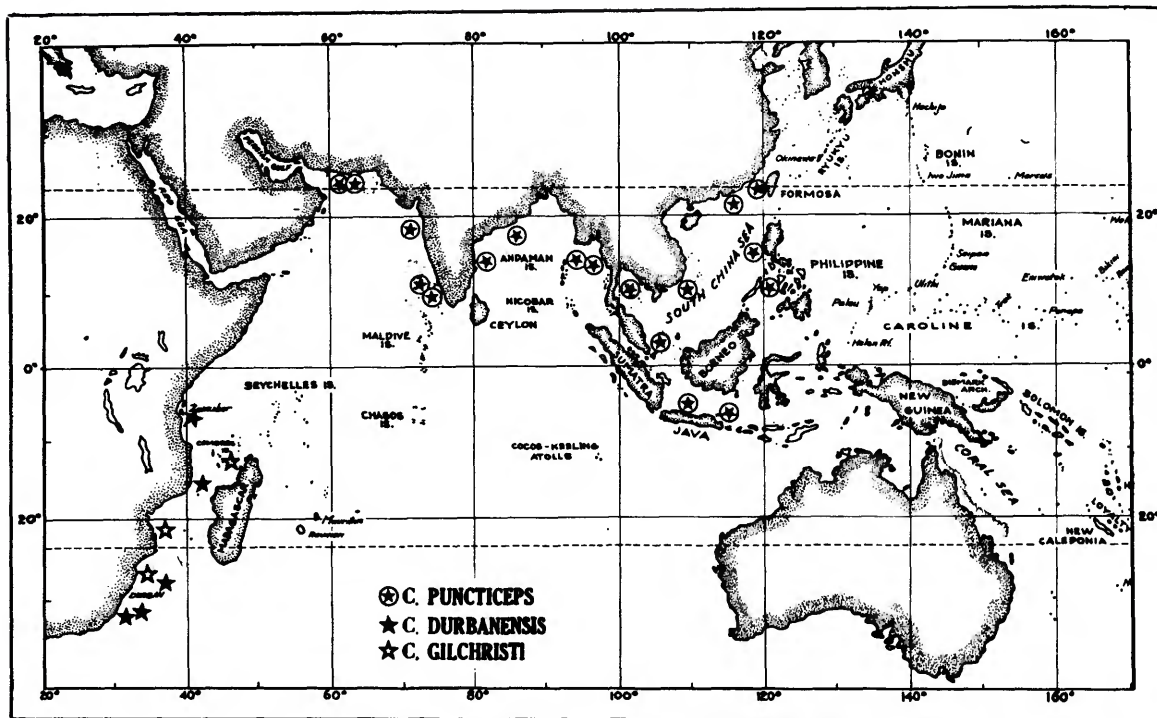


FIGURE 8.—Distribution of *puncticeps* complex of species.

1. There is a decreasing number of species of *Cynoglossus* as one progresses westward from the Indo-Malayan region to the West Coast of Africa through the coasts of India and Pakistan, the East Coast of Africa, and the Red Sea.

2. The most primitive and generalized species are found off the West Coast of Africa.

3. The most specialized forms are found in the Indo-Malayan area.

Thus, the Malayan area, as the world's greatest archipelago containing large areas with a depth of less than 200 (Ekman, 1953), fulfills all the conditions laid down by Matthew (1915) for a center of dispersal of *Cynoglossus*. It has the largest number of species, as well as the most progressive forms, with the generalized species occurring at the periphery of the range of the genus.

In considering the time of evolution of any group of animals of which there is no fossil record, the geological history of the areas it inhabits is essential. At the beginning of the Tertiary, the Tethys Sea covered large areas that today are dry lands, and

from the West Indies to the Pacific Ocean a rich community of tropical animals populated the littoral zone of this area (Ekman, 1953:66). The extinction of the tropical Tethys fauna in the Mediterranean, according to Ekman, was mainly due to the lowering of temperature in the late Tertiary period when the northern elements of the temperate fauna, which emigrated into the Mediterranean, formed the ancestral stock of the Mediterranean fauna of today. However, in the Mediterranean, which is usually defined as a warm-temperate sea, it is the tropical forms that dominate in the present-day fauna. These are mainly related to the fauna of the warmer parts of the Atlantic Ocean. There is, however, a northern boreal element as well in the present-day fauna but these are Pleistocene immigrants (Kosswig, 1955). If it were not for the Tertiary immigrants, the well-adapted species from the north probably would have occupied all the ecological niches in the Mediterranean and thereby would have prevented colonization by the later immigrants from the

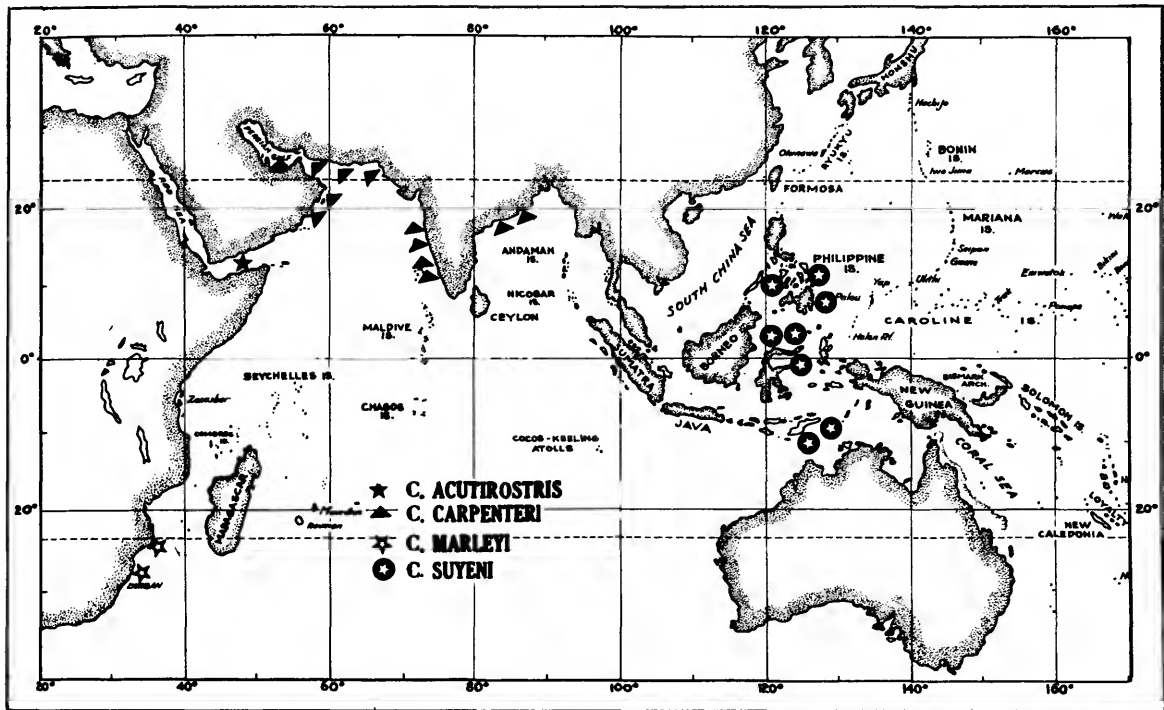


FIGURE 9.—Distribution of *carpenteri* complex of species.

warmer parts of the Atlantic. That there has not been total occupation of all ecological niches in the Mediterranean is evidenced by records of successful immigration of the Indo-Pacific forms into it (Steinitz, 1927, 1929, Ben-Tuvia, 1966). These species coming from the Red Sea, the warmest and saltiest sea (Marshall, 1952a,b), have passed through the Suez Canal with its changing and extreme ecological conditions and have established themselves in the eastern part of the Mediterranean. The great plasticity exhibited by these species does not lend any support to the view that their ancestors died out in the Mediterranean at the end of the Tertiary due to the climatic changes of that epoch; indeed, they had several million years at their disposal for adaptation to the cooling of the climate that occurred then.

The occurrence today of *Symphurus*, the most primitive genus of the Cynoglossidae, in both the east and west Atlantic as well as off both the coasts of America, suggests that it had most probably evolved earlier than the Miocene when communi-

cation existed between the Indo-Pacific and the Atlantic through the Mediterranean and between the American, Atlantic, and the Pacific through Central America.

The present-day distribution of the Soleidae, including the broad soles, the Achiridae, extends throughout the whole of the tropical Indian Ocean, the Pacific, and the Atlantic. Soleid fishes are known from the Eocene beds of Egypt (Woodward, 1910), Java (Vorstman, 1927), and the Gulf Coast (Frizzel and Dante, 1965), but no fossil records of any cynoglossids are so far known. Among the cynoglossids, *Symphurus* has a much wider distribution, coinciding with that of the Soleidae (including the broad soles). From this distributional pattern it is reasonable to conclude that *Symphurus* had evolved much earlier than *Cynoglossus*, probably in the Eocene, and at about the same time as the Soleidae, later spreading westward as far as the Pacific coast of America. *Cynoglossus* (including *Paraplagusia*), the most specialized genus of flatfishes, seems to have a more recent origin, probably not earlier than

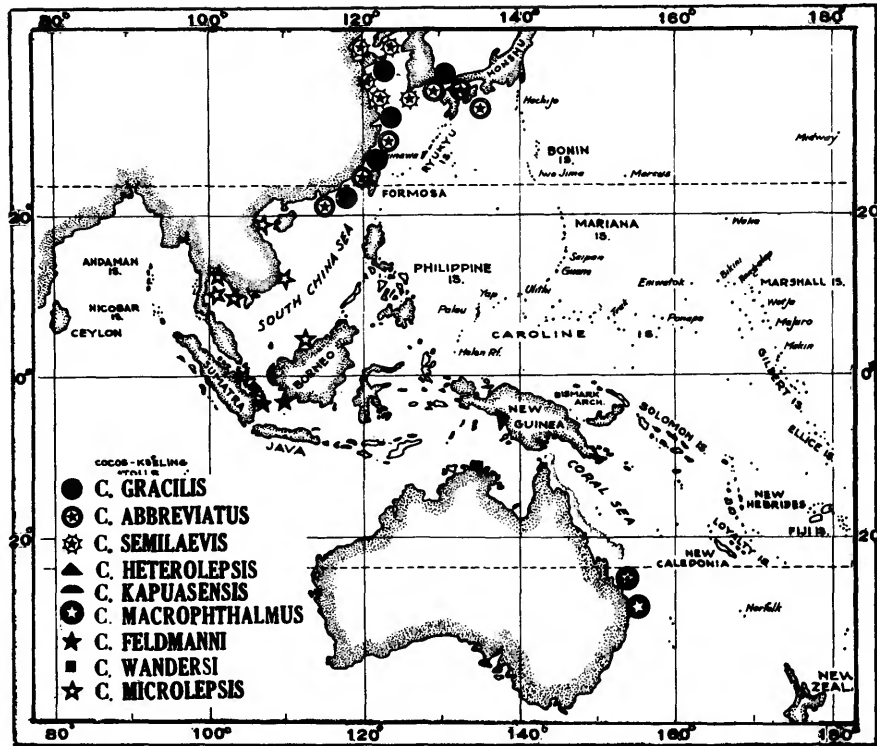


FIGURE 10.—Distribution of *heterolepis* group of species.

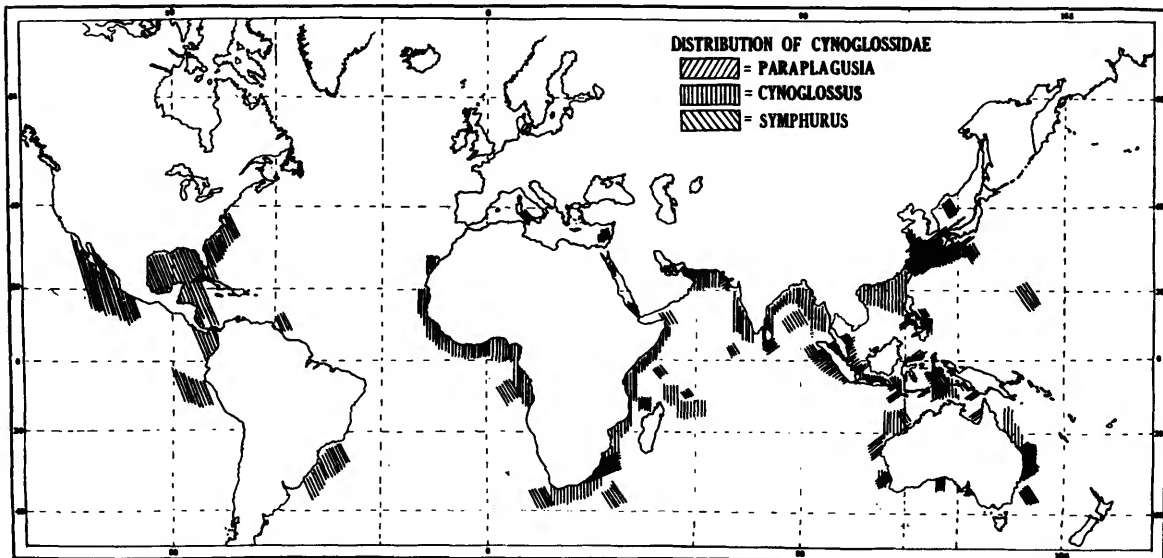


FIGURE 11.—Distribution of Cynoglossidae: *Symphurus*, *Cynoglossus*, and *Paraplagusia*.

Pliocene. The occurrence today of closely related species of *Cynoglossus*—the *canariensis* and the *ecaudatus* groups—off tropical west African coasts on the one hand and in the Indo-Pacific on the other is very significant in this connection (Figures 4, 7).

**GEOLOGICAL HISTORY OF THE RED SEA.**—Geologically the Red Sea is relatively young, the main physical features being completed only during the Pliocene. The Red Sea came into being as a result of faulting of Eocene strata and the filling of this great rift with water from the Tethys Sea to the north of it. During Miocene times this sea extended southward as far as southern Egypt. This no doubt was an extension of the Proto-Mediterranean for its fossils are mainly of Mediterranean affinities (Davies, 1934). The upper Miocene movements caused the elevation of the region and a period of continental conditions prevailed over the gulf of Suez during late upper Miocene and lower Pliocene (Said, 1962). A connection between the Red Sea and the Indian Ocean seems to have been established during the latter half of the middle Pliocene, when a phase of subsidence took place and the Red Sea proper was flooded by the Indian Ocean through a break at the Bab-el-Mandeb Strait (Fox, 1926). Marine Pliocene deposits are noted as far south as latitude 28°30'N, to the south of which there is definite proof of marine invasion by Indo-Pacific marine Pliocene fauna (Said, 1962: 194). To the north of this latitude and caused by the same tectonic movements, considerable sinking of the Gulf of Suez also took place during the middle Pliocene, for the deposits of these periods, especially along the Sinai Gulf coastal strip, are in places more than 1500 m in thickness (Said, 1962). In the north and east the upper Pliocene movements must have been strong enough to produce flooding of the Isthmus of Suez and the free mixing of water from the Mediterranean and the Gulf of Suez, but it is uncertain when the Gulf of Suez became cut off from the Mediterranean (Marshall, 1952a).

This would seem to be the generally accepted geological history of the Red Sea, but Sewell (1948) considered the possibility of the emergence of the shallow sill at the southern end of the Red Sea during the Glacial periods and the reduction of the Red Sea to an inland lake (Marshall, 1952a). It is probable that the Gulf of Suez was also cut off from

the Mediterranean during the glacial periods. An excellent recent account of the geological history of the Red Sea has been given by Botros (1971).

**DISPERSAL DURING THE PLIOCENE TO RECENT.**—The earliest stock of *Cynoglossus*, namely the *canariensis* group, seems to have spread from the Malay area westward through the seas of India and Pakistan to the Arabian coast and thence through the Red Sea to the Mediterranean, presumably during the upper Pliocene. It must then have spread northward through the Chinese Sea to south Japan and through Indonesian waters southward to Australia.

The *kopsi* group (consisting of the *itinus*, *ogilbyi*, *ecaudatus*, and *sealarki* complexes), which is the nearest to the *canariensis* group, also seems to have spread to the Mediterranean along the same route at a later period, but not later than early Pleistocene. Thus, *C. cadenati* is today found off tropical west Africa, while the closely related species *C. dollfusi* and *C. sinusarabici* occur in the Suez Canal, the eastern Mediterranean, and the Red Sea (Figure 7).

The freshwater discharge of the Nile into the Mediterranean must have formed a barrier to the westward spread of many of the Indo-Pacific fishes (Ekman, 1953:88). *Cynoglossus*, however, are bottom-living euryhaline fishes, and the freshwater discharge of the Nile and also the shallow strait that probably existed at the present-day Isthmus of Suez connecting the Red sea and the Mediterranean (Tortonese, 1964:103) would not have formed a barrier for their migration to the Mediterranean and their establishment there.

It is not clear whether the present-day Mediterranean fishes have persisted there throughout the Quaternary period. As stated above, it seems more probable that the Tethys fauna died out as a result of the lowering of temperature or changes in salinity in the Mediterranean during the glacial periods of the Pleistocene. The Isthmus of Suez must have been exposed, leaving probably only brackish water lakes along its course. This separation of the Mediterranean from the Red Sea ended in 1869 when, with the opening of the Suez Canal, fresh opportunities were afforded to the Indo-Pacific fishes to enter into the Mediterranean. The record of *C. sinusarabici* from Israel (Ben-Tuvia, 1966) indicates its recent spread there.

## Key to the Species

1. 12 rays in caudal fin ..... 2  
    Less than 12 rays in caudal fin ..... 8
2. Lateral line on blind side ..... 3  
    No lateral line on blind side (west Africa) ..... *C. browni*
3. 1 lateral line on blind side ..... 4  
    2 lateral lines on blind side (Indo-West Pacific except Africa and Red Sea) ..... *C. bilineatus*
4. Cycloid scales on ocular side ..... 5  
    Ctenoid scales on ocular side ..... 6
5. 17-19 scales between middle and upper lateral lines (west coast of India) ..... *C. dubius*  
    13-14 scales between middle and upper lateral lines (west Africa) ..... *C. monodi*
6. 11-12 scales between middle and upper lateral lines (west Africa) ..... *C. canariensis*  
    More than 12 scales between middle and upper lateral lines ..... 7
7. 16-18 scales between middle and upper lateral lines (west Africa) ..... *C. senegalensis*  
    18-20 scales between middle and upper lateral lines (Borneo and Thailand) ..... *C. borneensis*
8. 10 rays in the caudal fin ..... 9  
    Less than 10 (usually 8) rays in caudal fin ..... 39
9. 2 lateral lines on blind side ..... 10  
    No lateral line on blind side ..... 12
10. 10-11 scales between lateral lines on ocular side (south Africa) ..... *C. attenuatus*  
    More than 11 scales between lateral lines ..... 11
11. 16-18 scales between lateral lines (Mozambique coast and Oman) ..... *C. lachneri*  
    18-20 scales between lateral lines (India and Pakistan) ..... *C. dispar*
12. A single nostril on ocular side ..... 13  
    2 nostrils on ocular side ..... 17
13. Ctenoid scales on blind side ..... 14  
    Cycloid scales on blind side ..... 15
14. 13-15 scales between upper and middle lateral lines (Zanzibar and Kenya) ..... *C. zanzibarensis*  
    17-18 scales between upper and middle lateral line (Queensland) ..... *C. macrophthalmus*
15. 10-11 scales between upper and middle lateral lines (Saya de malha) ..... *C. sealarki*  
    More than 11 scales between lateral lines ..... 16
16. 12 scales between lateral lines (Natal) ..... *C. microphthalmus*  
    15-17 scales between lateral lines (Saldanha Bay, Natal) ..... *C. copensis*
17. Both nostrils situated before eyes, eyes pendunculate (Malay Archipelago, Hong Kong, and Bay of Bengal) ..... *C. monopus*  
    The posterior nostril situated in interorbital space or between anterior part of eyes, eyes nonpendunculate ..... 18
18. Cycloid scales on blind side ..... 19  
    Ctenoid scales on blind side ..... 25
19. 2 lateral lines on ocular side ..... 20  
    3 lateral lines on ocular side ..... 23
20. 11 or more scales between lateral lines ..... 21  
    Less than 11 scales between lateral lines ..... 22
21. Corner of mouth nearer to gill opening than to end of snout; 11-12 scales between lateral lines (Malay Archipelago, Hong Kong, Bay of Bengal) ..... *C. lingua*  
    Corner of mouth nearer to snout than to gill opening; 12-14 scales between lateral lines (Western and South Australia) ..... *C. broadhursti*
22. 10 scales between lateral lines (south China to Japan) ..... *C. robustus*  
    7-9 scales between lateral lines (Malay Archipelago and India) ..... *C. arel*
23. Snout acutely pointed; angle of mouth distinctly nearer gill opening than to end of snout; less than 20 scales between upper and middle lateral lines ..... 24  
    Snout rounded; angle of mouth nearer tip of snout than gill opening; more than 20 (20-25) scales between upper and middle lateral lines (China) ..... *C. semilaevis*
24. Snout about 33 percent of head; 15-19 scales between middle and upper lateral line (coasts of India to Persia) ..... *C. carpenteri*  
    Snout longer, 43 percent of head; 18-20 scales between middle and upper lateral line (Gulf of Aden) ..... *C. acutirostris*
25. Usually two lateral lines on ocular side ..... 26



Usually three lateral lines on ocular side .....	32
26. Angle of mouth distinctly nearer to gill opening than to end of snout (Malay Archipelago and Philippines, India and Africa) .....	<i>C. lida</i>
Angle of mouth nearer to end of snout than to gill opening .....	27
27. Cleft of mouth extending far back posterior margin of fixed eye (India) .....	<i>C. macrostomus</i>
Cleft of mouth extending only middle or about posterior border of fixed eye .....	28
28. Eyes contiguous (Malay Archipelago, Philippines, Taiwan, India, Cargados Garajos, and Persian Gulf) .....	<i>C. kopsi</i>
Eyes not contiguous .....	29
29. 14 of fewer scales between lateral lines .....	30
More than 14 (16-19) scales between lateral lines (Malay Archipelago to Philippines, Taiwan, and India) .....	<i>C. puncticeps</i>
30. Body slender, about 20 percent of SL, 11-12 scales between lateral lines (west Africa) .....	<i>C. cadenati</i>
Body deep, about 26 to 27 percent of SL, 10-14 scales between lateral lines .....	31
31. Snout rounded and short about 27 percent of head, 12 (11-14) scales between lateral lines (east coast of India) .....	<i>C. semifasciatus</i>
Snout somewhat pointed, longer, about 32 percent of head, 13 (12-14) scales between lateral lines (Malay Archipelago, Philippines, and India) .....	<i>C. cynoglossus</i>
32. Eyes contiguous .....	32
Eyes not contiguous .....	34
33. Angle of mouth nearer to gill opening than to tip of snout; 19-22 scales between upper and middle lateral lines (Philippines, Celebes, and Timor) .....	<i>C. suyeni</i>
Angle of mouth nearer to tip of snout than to gill opening; 11-12 scales between upper and middle lateral lines (Japan) .....	<i>C. interruptus</i>
34. Less than 20 scales between upper and middle lateral lines .....	35
More than 20 scales between upper and middle lateral lines .....	38
35. Corner of mouth nearer to tip of snout than to gill opening; 11-12 scales between lateral lines (south China and Japan) .....	<i>C. joyneri</i>
Corner of mouth nearer to gill opening than to tip of snout .....	36
36. Interorbital space narrow, less than half eye diameter; 18-19 scales between upper and middle lateral lines (Durban to Delagoa Bay) .....	<i>C. marleyi</i>
Interorbital space wide, about the same as eye diameter .....	37
37. 15-16 scales between lateral lines (New Guinea and Western Australia) .....	<i>C. heterolepis</i>
17-18 scales between lateral lines (Borneo and Sumatra) .....	<i>C. feldmanni</i>
38. Corner of mouth nearer to tip of snout than to gill opening; interorbital space much less than eye diameter; 24 scales between upper and middle lateral lines (Sumatra and Borneo) .....	<i>C. waandersi</i>
Corner of mouth nearer to gill opening than to tip of snout; interorbital space much wider than eye diameter; 25 scales between upper and middle lateral lines (West Borneo in fresh waters) .....	<i>C. kapuasensis</i>
39. 1 nostril on eyed side (Japan and Hong Kong) .....	<i>C. itinus</i>
2 nostrils on eyed side .....	40
40. Eye contiguous .....	41
Eyes not contiguous .....	43
41. 1 lateral line on ocular side (Red Sea, Suez Canal, and east Mediterranean) .....	<i>C. simusarabici</i>
2 or 3 lateral lines on ocular side .....	42
42. Usually 2 lateral lines on ocular side (east Africa and Seycheles) .....	<i>C. ecaudatus</i>
Usually 3 lateral lines on ocular side (Suez Canal) .....	<i>C. dollfusi</i>
43. Cycloid scales on blind side (south Queensland) .....	<i>C. ogilbyi</i>
Ctenoid scales on blind side .....	44
44. Usually 2 lateral lines on ocular side .....	45
Usually 3 lateral lines on ocular side .....	47
45. 11-12 scales between lateral lines (northwest, north, and east Australia) .....	<i>C. maculipinnis</i>
More than 12 scales between lateral lines .....	46
46. 14-15 scales between lateral lines (Natal to Madagascar) .....	<i>C. gilchristi</i>
18-21 scales between lateral lines (Natal to Zanzibar) .....	<i>C. durbanensis</i>
47. Body deep, more than 20 (24) percent of SL, 18-23 scales between upper and middle lateral lines (south China through Taiwan to south Japan) .....	<i>C. abbreviatus</i>

- Body slender, about 20 percent of SL ..... 48
48. Upper eye distinctly in advance of the lower (Thailand, Cambodia, Borneo, and Sumatra, in fresh waters) ..... *C. microlepis*
- Upper eye not in advance of the lower (south China through Taiwan to Korea) ..... *C. gracilis*

### The *canariensis* group

Four species complexes, namely the *canariensis* complex, the *browni* complex, the *bilineatus* complex, and the *attenuatus* complex, are here included in what may be called the *canariensis* group, *canariensis* being closest to the evolutionary stem of the group and probably of the entire genus. This group (with the exception of *C. browni*) is characterized by one or two lateral lines on the blind side, two or three lateral lines on the ocular side, 12 rays in the caudal fin (except the *attenuatus* complex), large eyes separated by a wide interorbital space, two nostrils on the eyed side, large scales, and rounded snout.

The members of the *canariensis* group are the most morphologically generalized species of the genus, the presence of lateral lines on the blind side being considered a primitive character in *Cynoglossus*. The reduction in the number of caudal fin rays, the small or reduced size of the eyes, the type of scales, and the atrophy or reduction in the number of nostrils are all considered specializations for a burrowing habit.

### The *canariensis* complex

Included in this complex are *C. canariensis*, *C. monodi*, *C. senegalensis*, *C. dubius*, and *C. borneensis*. These are large species characterized by 12 rays in the caudal fin and one lateral line on the blind side. Their center of distribution is in west Africa, the western extremity of the range of the genus; apparently they are a very old group and probably the earliest stock to be given off from the evolutionary center of the genus, namely the Malay Archipelago.

#### 1. *Cynoglossus canariensis* Steindachner

FIGURE 12; PLATE 1

*Cynoglossus canariensis* Steindachner, 1882:13, pl. 2: fig. 2 [type-locality: Bane d'Argain, Canary Is.].—Chabanaud and Monod, 1926:284.—Fowler, 1936:526, fig. 249.—Chabanaud, 1949b:203.—Cadenat, 1960:1383.

*Cynoglossus lagoensis* Regan, 1915:129 [type-locality: Lagos].—Fowler, 1936:526.—Chabanaud, 1949b:207.

**DESCRIPTION.**—Based on 10 specimens 173.0–367.0 mm SL, including the lectotype and paralectotypes of *C. lagoensis*.

Depths of body 21.39–26.45 (M = 24.60) and length of head 20.23–24.19 (M = 21.51) percent of standard length. Diameter of eye 6.29–8.57 (M = 7.13), interorbital width 4.29–8.0 (M = 6.13) percent of length of head. Two nostrils on ocular side, anterior nostril of eyed side tubular, on upper lip in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout pointed, 30.67–34.29 (M = 32.55) percent of length of head, rostral hook short and hardly reaching to vertical through front border of upper eye. Maxillary extending to well beyond fixed eye; angle of mouth extending to beyond vertical from posterior border of fixed eye, nearer to tip of snout than to branchial opening; snout to angle of mouth 46.58–52.86 (M = 49.33), angle of mouth to branchial opening 50.67–57.33 (M = 55.08) percent of length of head.

**Scales:** On eyed side (except on lateral lines) ctenoid in anterior part, cycloid posteriorly; scales on blind side and on lateral lines of eyed side cycloid.

**Lateral-Line System:** 3 lateral lines on ocular side, midlateral line with 76–88 scales. 10–13 (M = 12) scales between upper and middle lateral lines. One lateral line on blind side.

Interlinear scale rows	10	11	12	13
Frequencies	1	0	4	1

**Fins:** Dorsal with 125 and anal with 99 rays, caudal 12 in 3 specimens (radiographs).

**Vertebrae:** 57–59, comprising 9 abdominal and 48–50 caudal elements in 3 specimens (radiographs).

**Coloration:** Upper side uniformly brownish, lower rather whitish in preserved specimens.

**Size:** Largest specimen examined, 546.0 (510 + 36) mm, is from Angola collected by the *Discovery*. BMNH 1935.5.11.228.

**DISTRIBUTION.**—West Africa: Canary Islands, Senegal to Angola.

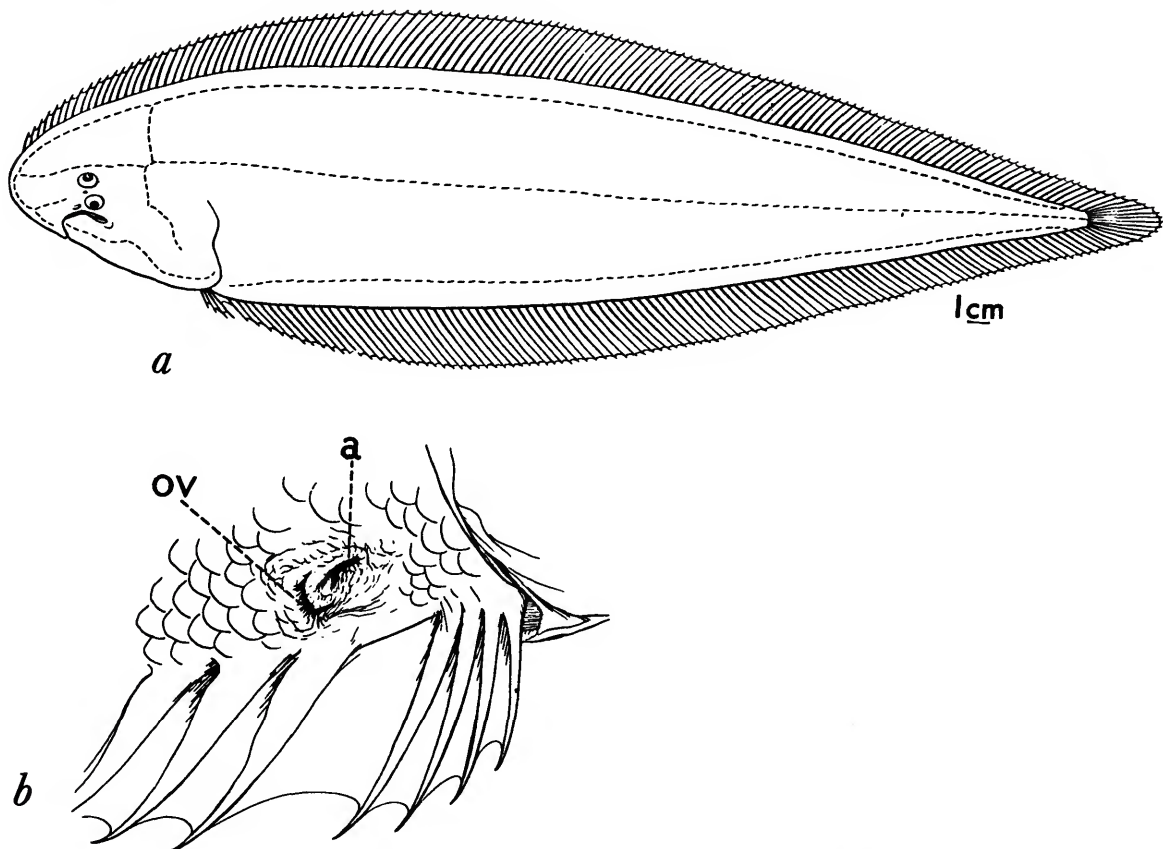


FIGURE 12.—*C. canariensis*: *a*, outline drawing of lateral view of ocular side of a specimen (BMNH 1935.5.11.228) from Angola; *b*, details of anal region on blind side of lectotype (BMNH 1914.11.2.72). (A = anus, OV = ovarian orifice.)

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus canariensis* is closely related to *C. monodi* and *C. senegalensis*. It is, however, distinguishable by its relatively larger scales, the interlinear scale count being 11–13 (12–14 in *C. monodi* and 17–18 in *C. senegalensis*), and the nature of body scales, ctenoid on ocular side, cycloid on blind side (*C. canariensis* and *C. senegalensis*), and mostly cycloid on both sides (*C. monodi*).

**NOTE ON SYNONYMY.**—Steindachner's (1882:13) description of *C. canariensis* was based on a single specimen, 280 mm in TL, from the Canary Islands. His fish had three lateral lines on the ocular side and one on the blind side. Because of the excellence of his description and illustration there has been little confusion in the identity of his species. How-

ever, Regan (1915:129) described *C. lagoensis* on the basis of three specimens, 390–512 mm TL from Lagos and Angola, and related it to "*C. canariensis* Steindachner in which the cleft of the mouth ends below the middle of the eye, the head is smaller, the scales are more numerous." I have examined the lectotype and the paralectotypes of *C. lagoensis* in London and found them referable to *C. canariensis*. Comparison of several specimens from west Africa has shown that the differences noted by Regan are merely intraspecific variation.

**TYPE SPECIMENS.**—Holotype of *C. canariensis*, NHV 47–773, 252 mm SL, 259 mm TL; Canary Islands, Africa (pers. comm., Dr. Paul Kahsbauer).

BMNH 1914.11.2.72, 356 mm SL, lectotype of *C. lagoensis*, designated by Chabanaud (1949b:207),

Lagos, Cadman. Another specimen, BMNH 1914.11.2.71, 365 mm SL, paralectotype of *C. lagoensis*, designated by Chabanaud, Lagos, Cadman, and a further specimen, BMNH 1935.5.11.288, paralectotype of *C. lagoensis*, designated by Chabanaud, Angola, *Discovery*.

**OTHER MATERIAL EXAMINED.**—1 specimen, BMNH 1935.5.11.229, Angola, coll. *Discovery*. 2, BMNH 1962.6.18.135.36, *Atlantide* Sta 86, coll. N. Nielson. 1, BMNH 1962.6.18.137, *Atlantide*, 102.5°34'N, 4°50'E, coll. N. Nielson. 1, ZMA 108.008, W Africa, Cape Bianco, coll. Vermeulen, 1906. 5, USNM 188435, off Lagos, Nigeria, coll. A. Longhurst. 1, CU, Ghana Teshis, Atlantic Drive, coll. Amegah, 26.1.1962. 1, CU, Ghana, Amegah, 14.8.1961.

## 2. *Cynoglossus monodi* Chabanaud

FIGURE 13; PLATE 1

*Cynoglossus monodi* Chabanaud, 1949a:65 [type-locality: Dahomey and Sierra Leone, west Africa].—Cadenat, 1960:1383 [Lagos, Nigeria; Chorkor, Accra, Ghana].

**DESCRIPTION.**—Based on 7 specimens, 281.0–327.0 mm SL, including the holotype of *C. monodi*.

Depth of body 20.00–23.85 ( $M = 21.46$ ) and length of head 19.65–22.0 ( $M = 20.16$ ) percent of standard length. Diameter of eye 6.25–7.08 ( $M = 6.50$ ), interorbital width rather broad, 5.65–8.00 ( $M = 6.88$ ) percent of length of head. Anterior nostril of eyed side tubular, on upper lip in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout narrowly rounded, 38.71–44.25 ( $M = 42.32$ ) percent of length of head, rostral hook rather short, stopping just in front of vertical through front border of fixed eye. Maxil-

lary extending to well beyond fixed eye; angle of mouth extending to right behind vertical from posterior margin of fixed eye, nearer to branchial opening than to tip of snout; snout to angle of mouth 52.42–58.04 (55.46), angle of mouth to branchial opening 38.52–46.77 ( $M = 44.05$ ) percent of length of head.

**Scales:** Cycloid on both sides, except on last quarter of body on upper side, where they are ctenoid.

**Lateral-Line System:** Two lateral lines on ocular side, midlateral line with 85–96 scales, 12–14 scales between middle and upper lateral lines. One lateral line on blind side.

Inter linear scale rows	12	13	14
Frequencies	1	2	3

**Fins:** Dorsal with 125–131 ( $M = 127$ ) rays, anal with 99–105 ( $M = 101$ ) rays, caudal 12 in 3 specimens radiographs).

**Vertebrae:** 57–60 comprising 9 abdominal and 48–51 caudal elements in 3 specimens (radiographs).

**Coloration:** Upper side is light brown and the lower rather whitish in preserved specimens.

**Size:** Largest specimen examined, USNM 193912. 352.0 (327 + 25) mm, is from Nigeria, off Lagos.

**DISTRIBUTION.**—West Africa: Dahomey, Sierra Leone, Nigeria, Accra, Ghana, and Lagos.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus monodi* is closely related to both *C. canariensis* and *C. senegalensis*, but it can be readily distinguished by the cycloid nature of the scales on its ocular side (ctenoid in *C. canariensis* and *C. senegalensis*).

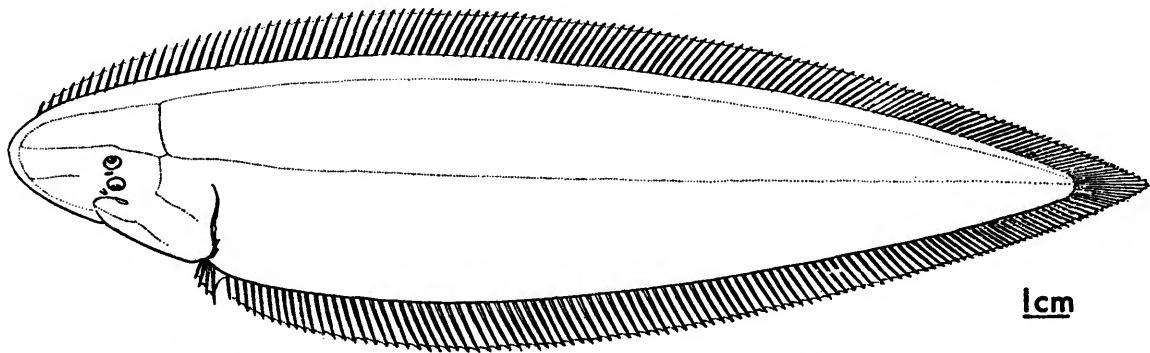


FIGURE 13.—Outline drawing of *C. monodi*, paratype (BMNH 1949.4.30.4) from Great Popo, west Africa.

TYPE SPECIMENS.—Chabanaud (1949a:65) described *C. monodi* on the basis of 3 specimens, 241–349 mm in TL, from Dahomey and Sierra Leone. I have succeeded in locating only 2 specimens, the holotype, MNHP 49–18, 312 mm SL, and one paratype, BMNH 1949.4.30.4, 237 mm SL. The third specimen from Sierra Leone is likely to be in the Paris Museum but is not traceable at the moment.

OTHER MATERIAL EXAMINED.—3 specimens, USNM 188434, Nigeria off Lagos, coll. A. Longhurst, 1962. 2, USNM 193910–12, Liberia, off St. Paul River, 1½–7 fms, coll. G. C. Miller, 29 Dec 1952.

### 3. *Cynoglossus senegalensis* (Kaup)

FIGURE 14; PLATE 2

*Arelia senegalensis* Kaup, 1858:108 [type-locality: west Africa].  
*Plagusia (Arelia) senegalensis*.—Dumeril, 1858:264 [senegal].

*Cynoglossus senegalensis*.—Günther, 1862:502.—Capello, 1872:86, [Bissau, west Africa].—Rochebrune, 1882:116 [Goree, Dakar, Guet N'Dar, Barbarie].—Büttikofer, 1890:480.—Steindachner, 1894:50 [Messurad River mouth, Liberia].—Pellegrin, 1913:153 [Lagune de Porto-Novo, Dahomey]; 1914:78 [Lagune de Porto-Novo, Dahomey].—Fowler, 1936:527, 1261.

*Cynoglossus (Arelia) senegalensis*.—Steindachner, 1870:977 [St. Louis].

*Cynoglossus senegalensis senegalensis* Chabanaud, 1949b:204 [morpha typica, two lateral lines on ocular side, one on blind side]; 1949d:518.

*Cynoglossus senegalensis simulator* Chabanaud, 1949b:205 [Dakar].

*Plagusia bilineata* [not Lacépède].—Duméril, 1858:246 [Isle of Prince, Portuguese West Africa].

*Cynoglossus goreensis* Steindachner, 1882:12, pl. 1: fig. 2 [Goree].—Osorio, 1894:134 [Benguella, Angola]; 1898:199 [Angola].—Pellegrin, 1905:35 [Guet N' Dara, Dakar]; 1913:152 [Konakry, Guinea]; 1914:79 [Guet N' Dar, Dakar; Konakry].—Regan, 1915:129 [Lagos].—Fowler, 1918a:249

[Cape Palmas, Liberia], 268 [Gaboon].—Chabanaud and Monod, 1926:284 [Cape Blanco].—Fowler, 1936:526 [Liberia and Gaboon].—Chabanaud, 1949d:519.

*Cynoglossus guineensis* Osorio, 1909:104, pl. 1: fig. 2 [type-locality: Bolama, Portuguese Guinea].—Chabanaud, 1949b:202 [Dahomey and Togo]; 1949d:519.—Cadenat, 1960:1383 [Lagos, Nigeria, Jui, and region of Freetown, Sierra Leone].

DESCRIPTION.—Based on 11 specimens, 117.5 mm–375.0 mm SL, including the holotype of *C. senegalensis simulator*.

Depth of body 20.38–24.79 (23.13), length of head 18.63–22.13 ( $M = 20.26$ ) percent of standard length. Diameter of eye 6.08–9.68 (8.14), interorbital width 5.98–9.86 ( $M = 7.50$ ) percent of length of head. Two nostrils on ocular side, anterior tubular on upper lip, the tube not extending to fixed eye, the posterior in the anterior half of interorbital space. Snout prominent, broadly rounded, 24.62–39.32 ( $M = 33.84$ ) percent of length of head, rostral hook rather short, extending only to front of anterior nostril. Maxillary extending beyond fixed eye; angle of mouth extending to just beyond vertical from posterior border of fixed eye, slightly nearer to tip of snout than to branchial opening; snout to angle of mouth 47.30–54.29 ( $M = 50.04$ ), angle of mouth to branchial opening 47.14–56.45 (52.07) percent of head.

*Scales*: Ctenoid on ocular side, except those on lateral lines; scales of blind side and of lateral lines on ocular side cycloid.

*Lateral-Line System*: Two or three lateral lines on ocular side, midlateral line with 89–108 scales; 17–18 scales between upper and middle lateral lines. One lateral line on blind side. The midlateral line on ocular side instead of opening through simple pores on every scale opens by means of simple ducts into the adjoining scale, generally with a single

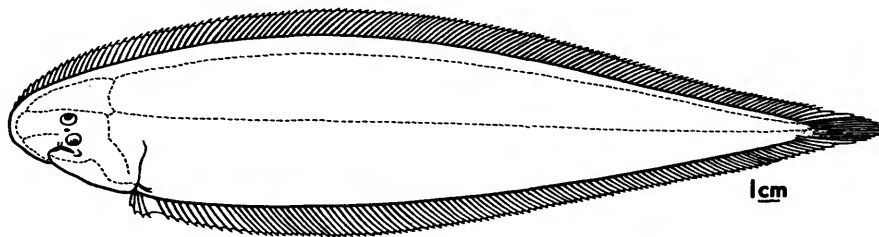


FIGURE 14.—Outline drawing of *C. senegalensis* (BMNH 1896.5.5.51) from Igowe River, Lambarene.

duct on one side followed by two ducts on the other side (Figure 2).

Interlinear scale rows	17	18
Frequencies	6	8

*Fins*: Dorsal with 119–125 ( $M = 121$ ) rays, anal with 93–99 ( $M = 96$ ) rays, caudal 12 in 7 specimens (radiographs).

*Vertebrae*: 56–58 comprising 9 abdominal and 47–49 caudal elements in 7 specimens (radiographs).

*Coloration*: Upper side is dark brown in alcohol and blackish or greenish in formalin, the blind side is white in preserved specimens.

*Size*: The largest specimen examined, 397 (375 + 22) mm, holotype of *Cynoglossus senegalensis simulator* Chabanaud, is from west Africa.

*DISTRIBUTION*.—West Africa: Liberia to Lagos.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus senegalensis* is closely allied to *C. canariensis* and *C. monodi*. These three form a fairly well-defined complex of species, but *C. senegalensis* and *C. canariensis* have ctenoid scales on ocular side (cycloid scales in *C. monodi*). *Cynoglossus senegalensis* is, however, easily distinguished by its smaller body scales, the interlinear scale count being 16–18 cf 10–14 in *C. canariensis*, 12–14 in *C. monodi*.

*NOTE ON SYNONYMY*.—Kaup's (1858:101) description of *Arelia senegalensis* was meager and was based on a single specimen, 555 mm in TL from west Africa. A very salient feature in his description was the presence of two lateral lines on the ocular side. Steindachner had the same species before him when he described *C. goreensis* on the basis of a specimen, 600 mm in TL, from Goree and characterized it by having three lateral lines on the ocular side. Chabanaud (1949b:203) synonymized it with *C. senegalensis* and I concur with him since an additional lateral line is of no significance. Osorio (1909:104) gave the name *C. guineensis* to a specimen from Guinea on the ground that it differed from *C. senegalensis* by its slightly smaller scales and somewhat deeper body. Comparison of numerous specimens from west Africa has convinced me that these differences are only intraspecific variation and I have, therefore, synonymized *C. guineensis* with *C. senegalensis*. It may be pointed out, however, that Osorio's description is defective in that he mentions only 16 scales between the upper and middle lateral lines, whereas in the illustration 18 rows are indicated.

Chabanaud (1949b:205) described *C. senegalensis* morpha *simulator* based on a single specimen, 410 mm in TL from Dakar, and distinguished it from *C. s. senegalensis* morpha *typica* by its possession of an additional lateral line on the ocular side. Since the development of an additional lateral line is not considered of any significance in the differentiation of species in *Cynoglossus*, I have considered the two species conspecific. I have examined the holotype of *C. s. simulator* and found it to be identical to specimens of *C. senegalensis*.

*TYPE SPECIMENS*.—The type specimen of *C. senegalensis* is not available in Berlin (pers. comm., C. Karrer) and is most probably not extant. MHN 49.22, 375 mm SL, holotype of *C. senegalensis simulator*, Nigeria, off Lagos, coll. A. Longhurst. NHV 3-776, 550 mm SL, 590 mm TL, holotype of *C. goreensis*, Goree, Dakar, Senegal (Dr. Paul Käsbauer examined the type on my behalf).

*OTHER MATERIAL EXAMINED*.—3 specimens, USNM 188433, Nigeria, off Lagos, coll. A. Longhurst. 1, USNM 193653, Mesurado R. beach, Liberia, coll. G. C. Miller. 1, USNM 193881, Bushrod Is., Liberia, coll. G. C. Miller. 1, UMMZ 202912, off St. Paul R., Liberia (4½–7 fms). 1, USNM 247424, Nigeria, off Lagos. 2, CU, Volta R., Ghana, coll. Bane and Richards, 23.7.1951. 3, CU, Labadi, Atlantic drainage, Ghana, coll. Amegah, 26.1.62. 3, CU, Teshi, Ghana, coll. Amegah, 26.1.62. 3, BMNH 1862.1.22.22–24, W Africa, coll. A. Murray. 1, BMNH 1891.4.2.14, Lagos, coll. Maloney. 3, BMNH 1896.5.5.51–53, Lambarene, Ogowe R., coll. Kingsley. 1, BMNH 1900.6.28.311, St. Louis, Senegal, coll. Delhez. 3, BMNH 1901.12.28.112.114, Gambia, coll. Budgett. 1, BMNH 1902.11.10.262, Lagama, S Nigeria, coll. Ansoorge. 1, BMNH 1911.6.1.131, Gunja, Angola, coll. Ansoorge. 1, BMNH 1913.7.12.2, Ogowe, coll. Schneider. 1, BMNH 1914.11.2.66, Lagos, coll. Cadman. 1, BMNH 1930.3.24.44, Accra, Gold Coast, coll. Irvine. 1, BMNH 1937.4.9.33, Nigeria, coll. Welman. 1, BMNH 1939.7.12.39, Volta R., Gold Coast, coll. Irvine. 2, BMNH 1948.8.12.1–2, Lagos, Lagoon, coll. Trewavas. 1, BMNH 1949.4.30.3, W Africa, coll. Chabanaud. 1, BMNH 1953.7.10.41, Nigeria, coll. Trewavas.

#### 4. *Cynoglossus dubius* Day

FIGURE 15; PLATE 2

*Cynoglossus dubius* Day, 1873:525 [type-locality: Gwadur]; 1877:435, pl. 95: fig. 2; 1889:456.—Norman, 1928:200.—Saramma, 1963:75 [Kerala coast].—Pradhan, 1964:458 [Bombay coast].

*DESCRIPTION*.—Based on 8 specimens, 257.0–450.0 SL.

Depth of body 27.24–30.86 ( $M = 29.23$ ), length of

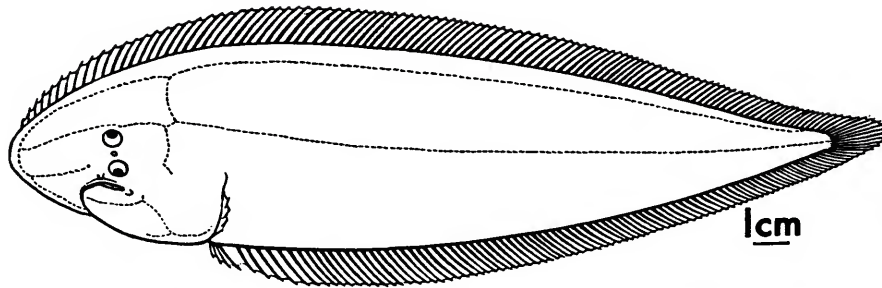


FIGURE 15.—Outline drawing of *C. dubius* (BMNH 1911.12.6.16) from Karachi, Pakistan.

head 23.46–26.07 ( $M = 24.79$ ) percent of standard length. Diameter of eye 5.97–7.61 ( $M = 6.65$ ), interorbital width pronounced, 7.46–9.72 ( $M = 8.42$ ) percent of length of head. Anterior nostril of eyed side tubular, on upper lip in front of fixed eye, the posterior in the anterior half of interorbital space, or in the middle of it. Snout obtusely pointed, 40.30–45.78 ( $M = 42.62$ ) percent of length of head, rostral hook rather short, extending to just beyond mandibular symphysis. Maxillary extending to beyond posterior border of fixed eye; angle of mouth extending below vertical from posterior border of fixed eye, or a little beyond, nearer to branchial opening than to tip of snout; snout to angle of mouth 52.63–54.35 ( $M = 53.74$ ), angle of mouth to branchial opening 45.37–50.53 ( $M = 47.33$ ) percent of length of head.

**Scales:** Cycloid on both sides, except along both dorsal and anal fins toward the posterior side of the ocular side, where the scales are weakly ctenoid.

**Lateral-Line System:** Two lateral lines on eyed side, midlateral line with 98–104 scales, 17–21 scales between two lateral lines. One lateral line on blind side. The midlateral line on ocular side instead of opening through simple pores on every scale opens by means of ducts into the adjoining scale, generally one duct on one side followed by three ducts on the other side (Figure 2).

Interlinear scale rows	17	18	19	20	21
Frequencies	3	3	11	0	1

**Fins:** Dorsal with 111–114 ( $M = 113$ ) rays, anal with 88–91 (90) rays, caudal 12 in 5 specimens (radiographs).

**Vertebrae:** 52–53, comprising 9 abdominal and 43–44 caudal elements in 5 specimens (radiographs).

**Coloration:** Upper side uniformly brown, lower whitish in preserved specimens.

**Size:** The largest specimen examined, 447.0 (450 + 27) mm, is from the Arabian Sea, trawled by *Anton Bruun* (lat. 23°16'N, long. 67°56'E).

**DISTRIBUTION.**—West coast of India.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus dubius* is closely allied to *C. borneensis*. It is distinguishable, however, by having cycloid scales on the ocular side and by the greater number of anal fin rays (88–91 cf. 82–87) and vertebrae (52–53 cf. 48–51).

**NOTE ON SYNONYMY.**—Originally described on the basis of a single specimen by Day, *C. dubius* was well diagnosed and there has been no confusion with regard to its identity.

**TYPE SPECIMEN.**—Day (1873:525) described *C. dubius* from a single specimen, 500 mm in TL, from Gwadur and illustrated the specimen in his *Fishes of India* (pl. 59: fig. 2). Norman (1928:200) described the species from four specimens, 220–460 mm in TL, and stated that it included an example "believed to be the type of the species." Day's type specimen was lost during the Varuna floods in Banaras in 1943, where the collections of the Zoological Survey of India were removed for safety during World War II.

**OTHER MATERIAL EXAMINED.**—1 specimen, ZSI (unregistered), Kumta, Udipi, Mysore State, coll. Umarkutty and B. Sinha, 26.12.66. 1, USNM 139718, backwaters of Travancore, coll. Schultz. 2, SOSC Ref 23, Neendakara, Kerala, lat. ca. 08°56'N, long. ca. 76°30'E, coll. *Anton Bruun*, Oct. 1966. 4, SOSC Ref 23, Arabian Sea, lat. 23°16'N, long. 67°56'E, coll. *Anton Bruun*, 19.11.63. 1, BMNH 1906.10.24.18, Travancore, ex. Trivandrum Museum. 1, BMNH 1911.12.6.16, Kurrachee (Karachi), coll. Townsend. 1, BMNH 1912.7.20.28, Travancore, ex. Trivandrum Museum. 1, BMNH 1938.8.9.13, Calicut, 5 India, coll. Devanesan.

5. *Cynoglossus borneensis* (Bleeker)

FIGURE 16; PLATE 3

*Plagusia borneensis* Bleeker, 1858a:6 [type-locality: Borneo].*Arelia borneensis*.—Bleeker, 1860b:9.*Cynoglossus borneensis*.—Bleeker, 1875:34, pl. 245: fig. 5.—Günther, 1862:498 [Singkawang].—Fowler, 1905:518. [Borneo].—Seale, 1910:288.—Weber and de Beaufort, 1929:205.*Plagusia trulla* Cantor, 1850:1213 [type-locality: Penang Sea, Malay Peninsula].*Cynoglossus trulla*.—Günther, 1862:503.—Duncker, 1904:169.*Trulla cantori* Kaup, 1858:109 [based on Cantor's *P. trulla*].*Cynoglossus sinicus* Wu, 1932:146.

DESCRIPTION.—Based on 4 specimens, 88.0–300.0 mm SL.

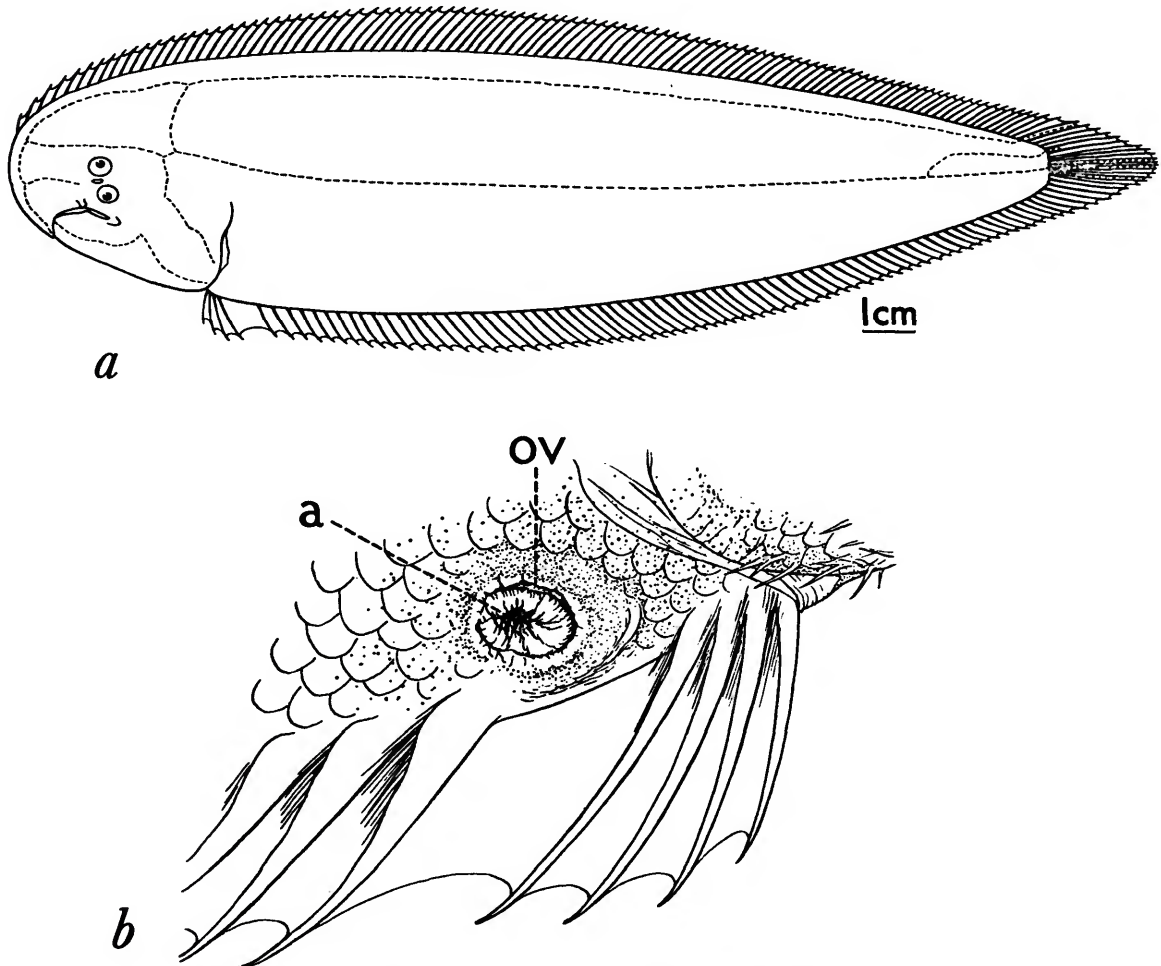
Depth of body 23.04–25.50 ( $M = 24.28$ ), length of head 21.77–25.00 ( $M = 23.30$ ) percent of standard length. Diameter of eye 5.93–9.09 ( $M = 7.80$ ), inter-orbital width 4.35–6.82 ( $M = 6.17$ ) percent of length of head. Anterior nostril of eyed side tubular, on upper lip in front of lower eye, posterior nostril

FIGURE 16.—*C. borneensis*: *a*, outline drawing of lateral view of ocular side of specimen (BMNH 1884.2.26.73) from China; *b*, details of anal region on blind side of specimen (BMNH 1931.4.23.53) from Borneo, female. (A = anus, OV = ovarian orifice.)



simple, in anterior half of interorbital space. Snout rounded, 29.55–37.29 ( $M = 34.36$ ) percent of length of head, rostral hook short, extending hardly to front of anterior nostril. Maxillary extending to beyond fixed eye; angle of mouth extending right up to or just beyond vertical from posterior margin of fixed eye, nearer to tip of snout than to branchial opening; snout to angle of mouth 43.18–50.85 ( $M = 46.86$ ), angle of mouth to branchial opening 51.49–54.55 ( $M = 53.44$ ) percent of length of head.

**Scales:** Ctenoid on ocular side except those on lateral lines, scales on blind side and those on lateral lines of eyed side cycloid.

**Lateral-Line System:** Two lateral lines on eyed side, midlateral line with 94–102 scales, 18–20 scales between the two lateral lines. One lateral line on blind side.

Interlinear scale rows	18	19	20
Frequencies	1	2	1

**Fins:** Dorsal with 108–113 ( $M = 111$ ) rays, anal with 82–87 ( $M = 84$ ) rays, caudal 12 in 8 specimens (radiographs).

**Vertebrae:** 48–51, comprising 9 abdominal and 49–52 caudal elements in 8 specimens (radiographs).

**Coloration:** Upper side with three approximately parallel longitudinal stripes, the middle one on median lateral line and a diffuse dark patch on opercular region, lower side whitish in preserved specimens.

**Size:** Largest specimen examined, 450.0 mm SL, is from China.

**DISTRIBUTION.**—Borneo, Malaya, Gulf of Thailand, and South China Sea.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus borneensis* is closely related to *C. dubius* but can be readily separated by the ctenoid scales on the ocular side (cycloid in *C. dubius*) and the more elongate body (depth of body 23.04–25.50 cf. 27.24–30.86 percent of SL).

**NOTE ON SYNONYMY.**—Bleeker (1858:6) described *P. borneensis* on the basis of a single specimen, 218 mm TL from Sinkawang, Borneo, and characterized it as having two lateral lines on the ocular side and a single one on the blind side. In the *Atlas* (1875:34, pl. 245:fig. 5) he redescribed the species and illustrated it in color. Because of his excellent description and illustration there has not been any confusion in the identity of *C. borneensis*. Cantor (1850:1213) considered a specimen, 300 mm TL, from the sea of Penang, Malay Peninsula, to repre-

sent a new species, *Plagusia trulla*, and characterized it as having only one nostril in front of the lower eye, the depth of the body four and one-half to four and two-thirds in TL, and 12 rays in the caudal fin. Cantor, however, did not mention the number of lateral lines on the body. I have examined the type of *P. trulla* in the British Museum and though the nostrils are not discernible in the stuffed specimen smeared over with varnish, an interlinear scale row of 18 or 19 scales and the 12 rays in the caudal fin are discernible, distinctive enough to refer the specimen to *C. borneensis*. *Cynoglossus sinicus* described from Chinese waters is the same as the present species. Three specimens, one from Hong Kong and the other two from China labeled as *C. sinicus* in the British Museum, agree so well in body depth and scales with *C. borneensis* that I have no reservations in synonymizing them.

**TYPE SPECIMENS.**—Among the Bleeker collection specimens in Leiden is a specimen, 195 mm SL, 212 mm TL, from Sinkawang, Borneo, catalogued as RMNH 6792 (pers. comm., Dr. M. Boeseman); it is evidently the holotype of *C. borneensis*.

There are two stuffed specimens, 212 and 262 mm SL, of *P. trulla* catalogued as BMNH 1860.3.19.431 from Penang, coll. Dr. Cantor.

**OTHER MATERIAL EXAMINED.**—MALAY: 1 specimen, BMNH 1860.3.19.431a, Penang, Malay, coll. Dr. Cantor. 2, BMNH 1933.7.31.28–29, Singapore Mkt., ex. Raffles Museum. BORNEO: 1, Kapuas R., Borneo, coll. Hardenberg. THAILAND: 1, BMNH 1862.11.1.225, Thailand, coll. Jamrach. 1, USNM 103321, Bandon Blight, Gulf of Thailand, coll. H. M. Smith, 29.9.1923. 1, CAS (GVF) 2582, Shakon Prov. ¾ mi off shore, Gulf of Thailand, lat. 13°26'15"N, long. 100°10'E, coll. Naga Expd. 1959–1961. 7, ANSP 87208, Thailand, coll. R. M. de Schauensee, 1936. CHINA: 1, BMNH 1839.3.23.39, Hong Kong, coll. Herklots. 2, BMNH.1884.2.26.73, China.

### The *browni* complex

*Cynoglossus browni* is placed in a separate complex, which is close to the *canariensis* complex of species but differs in the absence of a lateral line on the blind side. Morphologically and in its distribution *C. browni* is related to *C. senegalensis*.

### 6. *Cynoglossus browni* Chabanaud

#### PLATE 3

*Cynoglossus senegalensis* morpha *browni* Chabanaud, 1949b:204 [type-locality: coast of Sierra Leone, West Africa].

*Cynoglossus browni*.—Cadenat, 1960:1382, pl. 2: fig. B; pl. 3: figs. B, C.—Nijssen, 1966:87 [28 miles northwest of Ijmuiden, off the coast of Netherlands].

**DESCRIPTION.**—Based on 12 specimens, 219.5–370.0 mm SL, including the holotype of *C. browni*.

Depth of body 24.22–28.53 ( $M = 25.93$ ), length of head 17.67–20.90 (19.02) percent of standard length. Diameter of eye 3.74–6.60 ( $M = 4.81$ ), interorbital width rather broad 6.25–9.43 ( $M = 7.74$ ) percent of length of head. Anterior nostril of eyed side on upper lip in front of lower eye, posterior nostril in anterior half of interorbital space. Snout narrowly rounded, 26.85–32.08 ( $M = 29.29$ ) percent of length of head, rostral hook short, not reaching to vertical through front border of migratory eye. Maxillary extending well beyond fixed eye; angle of mouth extending to beyond vertical from posterior border of fixed eye and much nearer to tip of snout than to branchial opening; snout to angle of mouth 39.08–50.91 ( $M = 45.57$ ), angle of mouth to branchial opening 54.02–58.39 ( $M = 55.40$ ) percent of length of head.

**Scales:** Ctenoid on ocular side except those on lateral lines, scales on blind side and those on lateral lines of ocular side cycloid.

**Lateral-Line System:** Two lateral lines on ocular side, midlateral line with 84–91 scales, 14–16 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	14	15	16
Frequencies	2	6	9

**Fins:** Dorsal with 119–125 ( $M = 121$ ) rays, anal with 96–99 ( $M = 97$ ) rays, caudal 12 in 15 specimens (radiographs).

**Vertebrae:** 57–59 comprising 9 abdominal and 48–50 caudal elements in 15 specimens (radiographs).

**Coloration:** Upper side more or less dark brown, lower rather whitish in preserved specimens.

**Size:** The largest specimen examined, 402.0 (370 + 32) mm, is from Nigeria, off Lagos.

**DISTRIBUTION.**—West Africa: Senegal to Nigeria and Congo. The record from the Netherlands coast (Nijssen, 1966) is a stray occurrence and the northernmost limit is most likely Senegal.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus browni* shows affinities with *C. senegalensis*, *C. canariensis*, and *C. monodi* but can be readily distinguished by the total absence of a lateral line on the blind side.

**TYPE SPECIMENS.**—Holotype of *C. senegalensis browni*, MNHP 49.23, 219.5 mm SL, from Sierra Leone, west Africa.

**OTHER MATERIAL EXAMINED.**—10 specimens, USNM 188486, off Lagos, Nigeria, coll. A. Longhurst. 6, USNM 188437, off Nigeria, coll. A. Longhurst. 1, USNM 193914, off St. Paul R., Liberia, coll. George C. Miller. 1, ANSP 8690, Cape Palmas, Liberia, coll. Thomas S. Savage.

### The *bilineatus* complex

*Cynoglossus bilineatus*, the only species of the *bilineatus* complex, is characterized by 12 rays in the caudal fin and two lateral lines on the blind side. Its most important difference from the members of the *canariensis* complex of species is an additional lateral line on the blind side. The nature of the scale pattern on the body is very similar to that of the members of the *canariensis* complex, especially in having cycloid lateral-line scales on the ocular side, and in the interlinear scale formula of 13–17 scales. The distribution of *C. bilineatus*, from the evolutionary center of the genus (Malay Archipelago) westward to India and Pakistan, south to New Guinea and Australia, and north to Taiwan and Japan, suggests its probable origin in the Malay Archipelago from an early stock of the *canariensis* group.

### 7. *Cynoglossus bilineatus* (Lacépède)

FIGURE 17; PLATE 4

*Achirus bilineatus* Lacépède, 1802:6 [type-locality: China and the East Indies].

*Cynoglossus bilineatus*.—Ogilby, 1910:39.—Weber, 1913b:443.—Norman, 1926:301 [Queensland]; 1928:198.—Weber and de Beaufort, 1929:194.—Herre, 1933:5 (Sandakan, N. Borneo); 1934:105 [Manila].—Roxas and Martin, 1937:70 [Philadelphia].—Hardenberg, 1941:226 [Merauke, New Guinea].—Suvatti, 1950:326.—Herre, 1953:189 [Philippines].—Munro, 1955:264, pl. 50: fig. 767; 1958:285 [Merauke].—Saramma, 1963:75 [Kerala coast].—Pradhan, 1964:458 [Bombay coast].—Marshall, 1964:468, pl. 64: fig. 454 [east coast of North Queensland].

*Plagusia quadrilineata* Bleeker, 1851a:412; 1852:21.

*Arelia quadrilineata*.—Kaup, 1858:107 [Java, Sumatra].—Oshima, 1927:198 [Tainan, Taihoku].

*Cynoglossus quadrilineatus*.—Günther, 1862:497.—Kner, 1867:295.—Bleeker, 1875:32, pl. 245: fig. 3.—Klunzinger, 1871:573.—Day, 1877 [in part]:435; 1880:409.—Macleay, 1884:53.—Alcock, 1889a:288.—Day, 1889 [in part]:457.—Smith and Pope, 1906:498 [Kochi].—Jenkins, 1910a:30.—Wu, 1932:144.

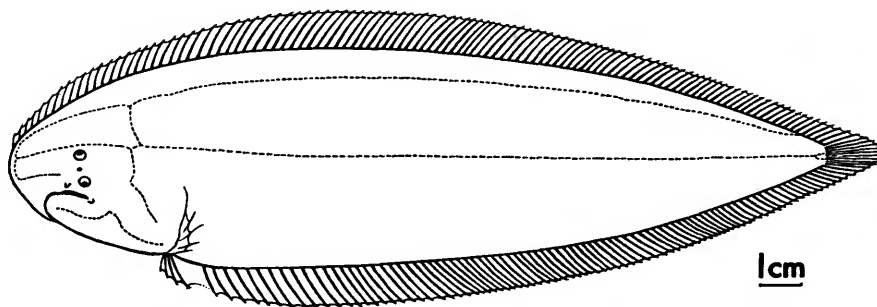


FIGURE 17.—Outline drawing of *C. bilineatus* (BMNH 1931.4.23.52) from Java.

*Cynoglossus lineolatus* Steindachner, 1867:588 [Hong Kong].—Bleeker, 1873:133.—Rutter, 1897:88 [Swatow].—Reeves, 1927:14.—Chu, 1931:95.—Wu, 1932:150.—Fowler, 1934b:218 [Hong Kong, Swatow].

*Cynoglossus quinquelineatus* Day, 1877:432, pl. 98: fig. 1 [type-locality: Madras]; 1889:453.—De Silva, 1956:198.—Norman, 1928:197.

*Cynoglossus sindensis* Day, 1877:434, pl. 90: fig. 6 [type-locality: from Sind through the seas of India].—Jordan and Richardson, 1908:281.—Ogilby, 1910:37 [Croker Island, Northern Territory, Australia].—Norman, 1926:302.—De Silva, 1956:198.

*Arelia diplasios* Jordan and Evermann, 1903:367, fig. 29 [type-locality: Formosa].—Jordan and Richardson, 1909:202, fig. 25 [Formosa].—Oshima, 1927:204.

**DESCRIPTION.**—Based on 24 specimens, 95.0–338.0 mm SL, including the holotype of *Cynoglossus quinquelineatus* Day.

Depth of body 22.22–28.60 ( $M = 25.86$ ), length of head 19.15–24.40 ( $M = 22.21$ ) percent of standard length. Diameter of eye 6.40–11.90 ( $M = 9.04$ ), interorbital width 5.0–10.71 ( $M = 7.86$ ) percent of length of head. Two nostrils on eyed side, anterior one tubular, in front of lower eye. The posterior nostril in anterior half or middle of interorbital space. Snout rounded, 32.61–54.39 ( $M = 37.15$ ), rostral hook short, reaching hardly before vertical through front border of anterior nostril. Maxillary extending beyond fixed eye; angle of mouth extending to below vertical from posterior border of lower eye, slightly nearer to branchial opening than to tip of snout; snout to angle of mouth 46.44–56.90 ( $M = 51.38$ ), angle of mouth to branchial opening 47.92–55.56 ( $M = 49.97$ ) percent of length of head.

**Scales:** Ctenoid on ocular side except those on lateral lines; scales of blind side and those of lateral lines of ocular side cycloid.

**Lateral-Line System:** Two lateral lines on ocular side,<sup>7</sup> 88–96 scales on median lateral line, 13–16 scales between the two lines. Two lateral lines on blind side.

Interlinear scale rows	13	14	15	16
Frequencies	6	17	5	4

**Fins:** Dorsal with 107–113 ( $M = 110$ ) rays; anal with 80–88 ( $M = 86$ ) rays, caudal 12 in 10 specimens (radiographs).

**Vertebrae:** 51–53 comprising 9 abdominal and 42–44 caudal elements in 10 specimens (radiographs).

**Coloration:** Upper side in alcohol brownish with an irregular dark patch on opercular region, lower whitish.

**Size:** Largest specimen examined, 354.0 mm, is from Colombo.

**DISTRIBUTION.**—From Malay Archipelago to the coasts of India and Pakistan and to New Guinea (Croker Island, Northern Territory) and coasts of Queensland and Taiwan and Japan (Kuchi).

**DIAGNOSIS AND AFFINITIES.**—In the number of two lateral lines on both sides of the body, *C. bilineatus* approaches the *attenuatus* complex; it is immediately distinguished from these species by having 12 rays in the caudal fin, whereas the species of the *attenuatus* complex have only 10. The interlinear count of 13–16 in *C. bilineatus* (10–11 in *C. attenuatus*, 16–18 in *C. lachneri*, and 18–20 in *C. dispar*) further distinguishes it from members of the *attenuatus* complex.

<sup>7</sup>Day's *C. quinquelineatus* has an incomplete third lateral line on the eyed side, a variation in the lateral-line system not uncommon in the genus.

NOTE ON SYNONYMY.—Norman (1928:198) included *C. quadrilineatus* Bleeker and *C. sindensis* Day in the synonymy of *C. bilineatus*. Ochiai (1963:76) synonymized *A. diplasios* Jordan and Evermann with *C. bilineatus* and I concur with them. Day (1877:432) described *C. quinquelineatus* on the basis of a single specimen in which an additional lower lateral line on the ocular side is present. Day further noted that his species differed from *C. bilineatus* in having a somewhat smaller eye, a shorter rostral hook, and in the position of the angle of the mouth, which extends hardly to the posterior edge of the eye. I have examined the holotype of *C. quinquelineatus* in Calcutta and found that, except in the additional lower lateral line, it differs from *C. bilineatus* in no other specific character. As has been pointed out earlier, the nature and extent of the lateral lines in *Cynoglossus* are of no significance in specific differentiation, and hence the development of incomplete lateral line on the lower part of the body in *C. quinquelineatus* is of no consequence so I have synonymized it with *C. bilineatus*.

*Cynoglossus lineolatus*, described on the basis of a single specimen, 106 mm in TL, from Swatow, Hong Kong and characterized as having two lateral lines on the blind side, is also referable to *C. bilineatus*.

TYPE SPECIMENS.—The type of *C. bilineatus* is not available in the Paris Museum (pers. comm., Madam Bauchot) and is not extant. Bleeker (1851a:412) described *Plagusia quadrilineatus* on the basis of 18 specimens, 75–300 mm in TL, from Batavia, Sumatra, Muntok, and Bangka. In his *Atlas* (1875:32, pl. 245: fig. 3), Bleeker described and illustrated a specimen of 300 mm in TL. Among the Bleeker collection of specimens in Leiden there are 9 specimens obtained from Batavia, west Sumatra, and Boeling (Bali) and cataloged as RMNH 6789, none of which matches either 75 or 300 mm. Since it is difficult to ascertain which specimen should be considered typical, all the 9 specimens in RMNH are assumed to be syntypes of *P. quadrilineatus* (Dr. M. Boeseman examined all the 9 specimens on my behalf and recommended this solution).

NHV 43.781, 102 mm SL, 111 mm TL, from Hong Kong, holotype of *C. lineolatus*.

Holotype of *C. quinquelineatus*, ZSI 1265, 234 mm SL, 250 mm TL, the figured specimen by Day (1877, pl. 98: fig. 1).

OTHER MATERIAL EXAMINED.—JAPAN: 1 specimen, USNM 59754, Japan, coll. H. M. Smith. 1, USNM 59755, Japan, coll. H. M. Smith. PHILIPPINES: 1, USNM 83396, Philippine Islands, coll. Hongkong Fisheries, 18.11.67. 1, USNM 113179, Limbones Cove, coll. *Albatross*. USNM 137652, Manila Mkt., coll. *Albatross*. 3, USNM (unregistered), Limbones Cove, coll. Hongkong Fisheries Sta, 18.11.67. 1, MCZ 30567, Macasser, Celebes, coll. T. Barbour. 2, ANSP 49038–39, Philippine. 1, NHV 43811, Manila, coll. Schilling, 1828. 1, BMNH 1872.1.18.18, Philippines, coll. Veitch. 7, USNM 137616–137620, Philippines and Borneo, coll. *Albatross*, 1907–1909. BORNEO: 1, BMNH 1895.2.28.63, Sarawak, coll. Brooke. INDONESIA: 3, USNM 72751, Java, coll. Bryant Palmer. 16, USNM 159420, Java, coll. Hubbs and Hardenberg, 6.15–1929. 5, MCZ 30803, Batavia, Java, coll. Bryant Palmer, 1909. 4, ANSP 772.74, Medan, Sumatra, coll. George Vanderbilt Sumatra Expd., 23.5.1939. 1, BMNH 1858.4.29.3, Amboyna, coll. Frank. 1, BMNH 1931.4.23.51, Batavia Mkt., coll. Hardenberg. 1, BMNH 1931.4.23.52, Java, coll. Hardenberg.

THAILAND: 2, ANSP 61829–31, Paknam, coll. R. M. de Schauensee, 21.8.1934. 2, ANSP 61827–28, Bangkok, coll. R. M. de Schauensee, 1734. 1, MCZ (unregistered), Thailand, 7°53'09"N, 98°50'07"E coll. BM Thai-Danish Expd., 15.2.1966. 1, NHV 43810, locality not given, coll. Hein, 1902. 1, CAS (GVF), Gulf of Thailand, lat. 10°26'34"N, long. 9°15'24"E, coll. Thai Fishermen, Naga Expd., 1959–1961. 2, CAS (GVF), Gulf of Thailand, coll. Thai Fishermen, Naga Expd., 24–6.1960. 1, BMNH 1920.7.13.75, Thailand, coll. Prince Chum-pen. SINGAPORE: 1, MCZ 32965, Singapore, coll. F. W. Putnam, 1864. 2, BMNH 1933.7.31.33, 34, Singapore Mkt., ex. Raffles Museum. AUSTRALIA: 1, BMNH 1925.7.22.82, Queensland, coll. *Endeavour*. BURMA: 1, ZSI 3444/1, Elephant point, Arakan coast, coll. Bengal Fisheries.

INDIA: 1, ZSI 12702, Ganjam coast, coll. Marine Survey. 2, ZSI 1145, 1146, Madras, coll. F. Day. 8, ZSI 1231–1234, 12263, Orissa coast, 7–8 fms, coll. Marine Survey. 1, ZSI 26227/1, Puri coast, Orissa, coll. Dr. A. Annandale. 2, ZSI F 2360/2, Marina Beach, Madras, ex. Southern Regional Sta, ZSI; Madras. 2, ZSI (unregistered), Karwar coast, Bombay, coll. Karwar Survey 1967. 1, Maharastra, lat. 18°15'N, long. 72°25'E, coll. F. H. Berry. 1, MCZ 4273, Malabar, coll. F. Day. 1, BMNH 1928.3.20.81, Madras Harbor, ex. Indian Museum. 2, BMNH 1928.3.20.82, 83, Orissa coast, 7–8 fms, ex. Indian Museum. 1, BMNH 1938.8.9.14, Calicut, coll. Devanesan. PAKISTAN: 8, SOSC, W Pakistan, W end of Astola Is., W of Karachi, lat. 25°06'35"N, long. 63°48'65"E, coll. *Anton Bruun* (Woods, Fehlman, Rogers, Stone, and Berry). 1, BMNH 1898.12.24.49, Karachi, coll. Townsend. 3, BMNH 1911.12.6.14, Karachi, coll. Townsend. CEYLON: 1, MCZ 33197, Colombo, coll. Capt. Putnam.

### The *attenuatus* complex

Like *C. bilineatus*, the members of the *attenuatus* complex are large species with two lateral lines on

the blind side but with only 10 rays in the caudal fin. *Cynoglossus attenuatus* and its relatives *C. lachneri* and *C. dispar* have their center of distribution in the central and western sectors of the Indian Ocean and may have descended from the same stock that gave rise to the *bilineatus* complex.

### 8. *Cynoglossus attenuatus* Gilchrist

#### FIGURE 18; PLATE 4

*Cynoglossus attenuatus* Gilchrist, 1905:11, pl. 29 [type-locality: Tugela R. mouth, 4½ miles northwest, South Africa].

*Areliia attenuata*.—Gilchrist and Thompson, 1917:398.—Regan, 1920:221 [Natal].—Barnard, 1925:413 [Natal and Zululand to Delagoa Bay].—Bonde, 1925:292.—Fowler, 1925:187; 1935:405.—Barnard, 1937:41.

*Cynoglossoides attenuatus*.—Bonde, 1922:23.

*Areliia bilineata*.—[not Lacépède], Smith, 1949 [in part]:166, pl. 2: fig. 341.

**DESCRIPTION.**—Based on 3 specimens, 158.0–244.0 mm SL, including the holotype.

Depth of body 21.20–25.59 ( $M = 23.36$ ), length of head 20.89–21.95 ( $M = 21.12$ ) percent of standard length. Diameter of eye 8.57–12.12 ( $M = 9.93$ ), interorbital width 4.55–6.06 ( $M = 5.44$ ) percent of length of head. Anterior nostril on eyed side in front of lower eye, at a level with its lower margin, posterior nostril in anterior half of interorbital space. Snout obtusely pointed 36.36–43.94 ( $M = 40.10$ ) percent of length of head, rostral hook reaching below anterior nostril. Maxillary extending beyond fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye, nearer to branchial opening than to tip of snout; snout to angle of mouth 52.27–57.58 ( $M = 54.08$ ), angle of mouth branchial opening 47.73–50.48 ( $M = 49.04$ ) percent of length of head.

**Scales:** Ctenoid on ocular side, cycloid on blind side; scales on lateral lines of ocular side ctenoid anteriorly and cycloid posteriorly.

**Lateral-Line System:** Two lateral lines on ocular side, median lateral line with 70–76 scales, 10–11 scales between them. Two lateral lines on blind side with 11–12 scales between them.

Interlinear scale rows	10	11
Frequencies	1	1

**Fins:** Dorsal with 114–118 rays; anal with 90–91 rays, caudal 10 in 2 specimens (radiographs).

**Vertebrae:** 54–55, comprising 9 abdominal and 45–46 caudal elements in 2 specimens (radiographs).

**Coloration:** Upper side uniformly brown, lower whitish in preserved specimens.

**Size:** The largest specimen examined, 310 (290 + 10) mm, is from Durban, South Africa.

**DISTRIBUTION.**—South Africa: Natal and Zululand to Delagoa Bay.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus attenuatus*, which is restricted in its distribution to South Africa, is related to *C. lachneri* and *C. dispar*. Phylogenetically, it is most probable that *C. attenuatus* was derived from a population of the early generalized stock of the *bilineatus-attenuatus* complex in South African waters. The attenuated nature of body (mean depth of 23 percent of SL, cf. 25.95 of *C. lachneri* and 29.87 of *C. dispar*) and large scales (10–11) distinguish it from the other species (16–18 in *C. lachneri* and 18–20 in *C. dispar*).

**TYPE SPECIMEN.**—BMNH 1903.12.31.10, holotype of *C. attenuatus*, 210 mm SL, 4½ miles, NW of south head of R. Tugela, Natal, 24 fms, coll. Gilchrist.

**OTHER MATERIAL EXAMINED.**—1 specimen, BMNH

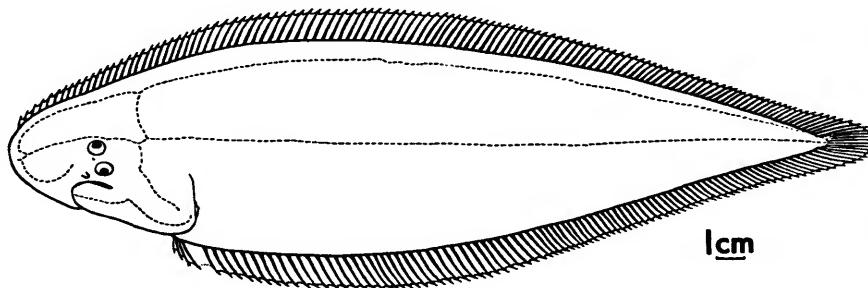


FIGURE 18.—Outline drawing of *C. attenuatus* (BMNH 1919.9.12.51) from Durban.

1919.9.12.51, Durban, coll. Marley. 2, ANSP 88867, Delagoa Bay, South Africa, coll. H. W. Bell Harley, 1923.

### 9. *Cynoglossus lachneri*, new species

#### PLATE 5

**DESCRIPTION.**—Based on 12 specimens (130.0–432.0 mm SL), including the holotype and paratypes.

Depth of body 24.62–27.19 ( $M = 25.95$ ), length of head 17.48–23.14 ( $M = 19.43$ ) percent of standard length. Diameter of eye 7.41–10.89 ( $M = 9.34$ ), interorbital width 6.98–9.76 ( $M = 8.20$ ) percent of length of head. Anterior nostril of the eyed side tubular, on the upper lip, situated almost vertical through the anterior border of upper eye, and some distance in front of lower eye, posterior nostril a simple opening, in anterior half of interorbital space. Two nostrils on blind side, the tubular anterior one on the anterior half of the upper lip, the posterior a little higher and above posterior half of upper lip. Snout rounded, 28.40–34.26 ( $M = 31.47$ ) percent of length of head; rostral hook rather short, scarcely reaching vertical through front border of migratory eye. Maxillary extending beyond hind border of fixed eye; angle of mouth extending below vertical from hind border of fixed eye, nearer to tip of snout than to branchial opening; snout to angle of mouth 45.73–50.00 ( $M = 47.02$ ), angle of mouth to branchial opening 50.00–55.81 ( $M = 52.84$ ) percent of length of head.

**Scales:** Ctenoid on ocular side, except those on lateral lines; scales on blind side and those on lateral lines of ocular side cycloid.

**Lateral-Line System:** Two lateral lines on eyed side, midlateral line with 100–111 scales, 16–18 scales between the two lines. Two lateral lines on blind side.

Interlinear scale rows	16	17	18
Frequencies	3	7	2

**Fins:** Dorsal with 113–121 ( $M = 117$ ), anal with 92–98 ( $M = 96$ ) rays, caudal 10 in 7 specimens (radiographs).

**Vertebrae:** 55–58, comprising 9 abdominal and 46–49 caudal elements in 7 specimens (radiographs).

**Coloration:** Upper side uniformly dark brown, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 461.0 (432 + 29) mm, is from Mombasa, the holotype of *lachneri*.

**DISTRIBUTION.**—Mozambique (Inhaca) coast north-

ward to Red Sea and Gulf of Oman and eastward to Anjouan (Comoro) and Nossi-Be Islands and Seychelles.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus lachneri* has close affinities with *C. attenuatus* and *C. dispar* and in many characters is intermediate between these two species. It is distinguishable, however, by its interlinear scale count (16–18 cf 10–11 in *C. attenuatus*, and 18–20 in *C. dispar*).

**TYPE SPECIMENS.**—USNM 201852, holotype of *C. lachneri*, 432 mm SL, Mombasa, Kenya, coll. Anton Bruun. 16.11.1964. Paratypes: 1 specimen, USNM 203963, paratype of *C. lachneri*, 285 mm SL, Sandy Cove behind reef of Nosi N' Tanga Nossi-Be, Madagascar, lat. 13°22'07"S, long. 48°10'45"E, coll. Anton Bruun. 1, USNM 171046, paratype of *C. lachneri*, 270 mm SL, Madagascar, coll. Dr. J. Millot, Feb 1953. 1, MCZ 11551, paratype of *lachneri*, 234.5 mm SL, Zanzibar, coll. Cooke. 1, NHV 43874, paratype of *C. lachneri*, 130 mm SL, Red Sea, coll. Staind; 1895–1896. 1, RU, paratype of *C. lachneri*, 190 mm SL, Tiwi, Gulf of Oman, coll. Mrs. J. L. B. Smith. 1, RU, paratype of *C. lachneri*, 226 mm SL, Silhoutla Bay, Seychelles, coll. J. L. B. Smith. 3, ZSI F  $\frac{6209}{2}$ , paratype of *C. lachneri*, 176–274 mm SL, Pinda Beach, Mozambique, coll. J. L. B. Smith. 1, ZSI  $\frac{6207}{2}$ , paratype of *C. lachneri*, 326 mm SL, Red Sea, Harkiko Bay, coll. H. Steinitz. 1, ZSI F  $\frac{6208}{2}$ , paratype of *C. lachneri*, 227 mm SL, Inhaca, Mozambique, coll. Mrs. J. L. B. Smith, Aug 1948.

**OTHER MATERIAL EXAMINED.**—2 specimens, BMNH 1869.3.1.30–31, Seychelles, coll. Wright. 1, BMNH 1932.7.29.53, Seychelles, coll. Wood.

### 10. *Cynoglossus dispar* Day

#### FIGURE 19; PLATE 5

*Cynoglossus dispar* Day, 1877:434, pl. 96: fig. 2 [type-locality: Bombay]; 1889:456.—Norman, 1928:199 [Bombay, Madras].—Pradhan, 1964:458 [Bombay coast].

**DESCRIPTION.**—Based on 12 specimens, 167.0–350.0 mm SL, including the lectotype and paralectotypes of *C. dispar*.

Depth of body 24.81–32.58 ( $M = 29.87$ ), length of head 18.83–21.35 ( $M = 20.17$ ) percent of standard length. Diameter of eye 7.81–9.91 ( $M = 8.75$ ), inter-

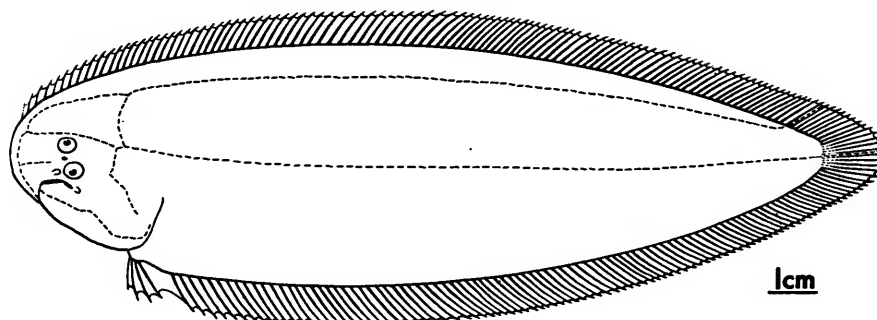


FIGURE 19.—Outline drawing of *C. dispar* (BMNH 1889.2.1.4062) from Madras.

orbital width 4.48–9.01 ( $M = 5.95$ ) percent of length of head. Two nostrils on ocular side, a simple one in anterior half of interorbital space, and a tubular one in front of lower eye. Snout rounded 16.42–31.53 ( $M = 26.60$ ) percent of length of head, rostral hook short and not extending to vertical through the front border of upper eye. Maxillary extending to beyond posterior border of fixed eye; angle of mouth extending to about or almost below vertical from hind border of fixed eye, much nearer to tip of snout than to branchial opening; snout to angle of mouth 38.81–52.25 ( $M = 43.50$ ), angle of mouth to branchial opening 46.85–58.73 ( $M = 56.0$ ) percent of length of head.

*Scales:* Ctenoid on ocular side except those on lateral lines; scales of blind side and those of lateral lines of ocular side cycloid.

*Lateral-Line System:* Two lateral lines on eyed side, 102–119 scales on median lateral line, 18–20 scales between them. Two lateral lines on blind side.

Interlinear scale rows	18	19	20
Frequencies	2	3	3

*Fins:* Dorsal with 109–113 rays, anal with 90–92 rays, caudal 10 in 5 specimens (radiographs).

*Vertebrae:* 53–54, comprising 9 abdominal and 44–45 caudal elements in 5 specimens (radiographs).

*Coloration:* Upper side brownish with somewhat darker irregular blotches, lower whitish in preserved specimens.

*Size:* Largest specimen examined, 389 (350 + 33) mm, is from Karachi, west end of Astola Island, trawled by Anton Bruun.

*DISTRIBUTION.*—India: Madras and Bombay; Pakistan: Astola Island, west of Karachi.

*DIAGNOSIS AND AFFINITIES.*—*Cynoglossus dispar* is closely allied to *C. lachneri* but it can easily be separated by its deeper body (mean depth of body 29.87 percent of SL cf. 25.95 percent of SL) and larger scales (18–20 cf. 10–11 in *C. attenuatus* and 16–18 in *C. lachneri*).

*NOTE ON SYNONYMY:* Originally described by Day from specimens from Bombay and Madras, *C. dispar* was well diagnosed and there has been no confusion with regard to its identity.

*TYPE SPECIMEN:* Day (1877:434) described *C. dispar* from an unstated number of specimens from Bombay and Madras. Norman (1928:199) re-described the species from 4 specimens, 95–350 mm in TL, including examples believed to be the types of the species. Of the register numbers ZSI 1141 and ZSI 1144, which Norman had listed as seen, only the specimen bearing number ZSI 1141 is at present available in the collections of the Zoological Survey of India. The other one was presumably lost in the Varuna floods of Banaras in 1943, where the collections were temporarily shifted during World War II. There are at present six specimens of the syntype series that are traceable; including the one lost, there must have been seven in the series. A specimen, ZSI 2715, 260 mm SL, from Sind collected by F. Day, which formed the basis for Day's figure (pl. 96: fig. 2), is selected here as the lectotype, and the rest of the five specimens ZSI 1141, Bombay, coll. Day, BMNH 1889.2.1.4061, Sind, coll. F. Day, BMNH 1889.2.1.4062, Madras, coll. F. Day, BMNH 1889.2.4063, Bombay, coll. F. Day, NHV 482 Madras, coll. F. Day are selected as paralectotypes.

*OTHER MATERIAL EXAMINED.*—INDIA: 11 specimens, BMNH 1928.3.20.84, Bombay, ex. Indian Museum. 1, BMNH 1933.1.2.6, S. Malabar, coll. Devanesan. PAKISTAN: 5,

SOSC Acc 23, Karachi, west end of Astola Is., lat. 25°06'35"N, long. 63°48'65"E.

### The *kopsi* group

Several related species complexes of *Cynoglossus* may be assembled together in the *kopsi* group, *kopsi* being closest to the evolutionary stem of this group. They are typified by the smaller adult size, large eyes, either contiguous or with a very narrow interorbital space, two nostrils, the posterior one occasionally hidden under scales or absent (*sealarki* and *itinus* complexes), short obtusely pointed snout with the angle of the mouth situated nearer to tip of snout than to branchial opening, one to three lateral lines on ocular side, the dorsolateral and the ventrolateral either absent or incomplete, no lateral line on blind side, 10 or 8 rays in the caudal fin, and large scales. The absence of a lateral line on the blind side, the reduced number of rays in the caudal fin, the contiguous or subcontiguous nature of the eyes, and the absence of the posterior nostril in the *sealarki* and *itinus* complexes are considered as specializations.

Included in this group are the *kopsi*, *itinus*, *ogilbyi*, *ecaudatus*, and *sealarki* species complexes. Their combined range extends to almost the entire distributional limits of the genus.

### The *kopsi* complex

This complex includes the morphologically most generalized species of the group. These species have 7 to 12 interlinear scale rows, both the anterior or posterior nostrils present, and the dorsolateral line extending to varying distances along the dorsal contour (when the ventrolateral line is absent) or with an uninterrupted dorsolateral line (when the ventrolateral is present).

Included in this assemblage are *C. kopsi*, *C. interruptus*, and *C. joyneri*. Its center of distribution covers the whole of the Indo-Australian Archipelago, northward through the Philippines to Taiwan and Japan, and westward through the seas of India and Pakistan to Cargados Garajos, the Seychelles, and the Persian Gulf.

## 11. *Cynoglossus kopsi* (Bleeker)

FIGURE 20; PLATE 6

*Plagusia kopsii* Bleeker, 1851b:494 [type-locality: Rio in

Bintang Island, southeast of Singapore]; 1852:31; 1854a:99.

*Arelia kopsi*.—Bleeker, 1859:184.

*Cynoglossus kopsii*.—Günther, 1862:493 [East Indian Archipelago].—Bleeker, 1875:31. pl. 241; fig. 3.—Weber and de Beaufort, 1929:189.

*Cynoglossus kopsi* morpha *diagramata* Chabanaud [in part], 1951d:273 [type-locality: Arafura Sea].

*Cynoglossus brachycephalus* Bleeker, 1875:38, pl. 244; fig. 6 [type-locality: Sumarta].—Regan, 1908:235 [Maldives and Cargados Carajos].—Weber, 1913b:441.—Norman [in part], 1928:211.—Weber and de Beaufort, 1929:207 [W. Sumatra].—Munro, 1955:265, fig. 772 [Pearl Banks].—De Silva, 1956:199 [Aripu].—Fowler, 1956:188.—Saramma, 1963:78 [Kerala Coast].—Chen and Weng, 1965:93, fig. 64 [Tung-kong].

*Brachycephalus* (*Cynoglossus*) *brachycephalus*.—Chabanaud, 1951b:78.

*Cynoglossus praecisus* Alcock, 1890b:442 [type-locality: off Ganjam coast].

*Cynoglossus brevirostris* [not Day].—Johnstone, 1904:209; Chen and Weng, 1965:92, fig. 63 [Tainan].

*Cynoglossus versicolor* Alcock, 1890b:442 [type-locality: Orissa coast].—Alcock; 1896:330.—Norman, 1928:195.—Punpoka, 1964:74 [Chumpona Province, Thailand].

*Cynoglossus sibogae* Weber, 1913b:442.—Weber and de Beaufort, 1929:200, fig. 54.—Herre, 1934:105 [Banang Sur, La Union Province, Luzon]; 1953:191.—Punpoka, 1964:71 [Goh Korma].

*Cynoglossus interruptus* [not Günther].—Chen and Weng, 1965:90, fig. 61 [Pescadores, Taiwan].

*Cynoglossus melanopterus* [not Bleeker] Shen, 1929:21 [type-locality: Hong Kong].

**DESCRIPTION.**—Based on 43 specimens, 50.0–177.0 mm SL, including the paralectotype of Weber's *C. sibogae*, the holotype of *C. versicolor*, and the holotype of *C. kopsi diagramata*.

Depth of body 22.43–33.87 (M = 26.60), length of head 15.84–24.59 (M = 21.47) percent of standard length. Diameter of eye 11.76–19.05 (M = 14.22) percent of length of head, interorbital space absent. Two nostrils on ocular side, the anterior tubular in front of lower eye, the posterior nostril simple and in front of the interorbital space, sometimes hidden under scales. Snout rounded 24.24–40.62 (M = 28.80) percent of length of head; rostral hook short, extending to front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from anterior half of fixed eye, much nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 35.42–59.38 (M = 41.83), angle of mouth to branchial opening 48.48–68.75 (M = 57.80) percent of length of head.

**Scales:** Ctenoid on both sides, including those of lateral lines.



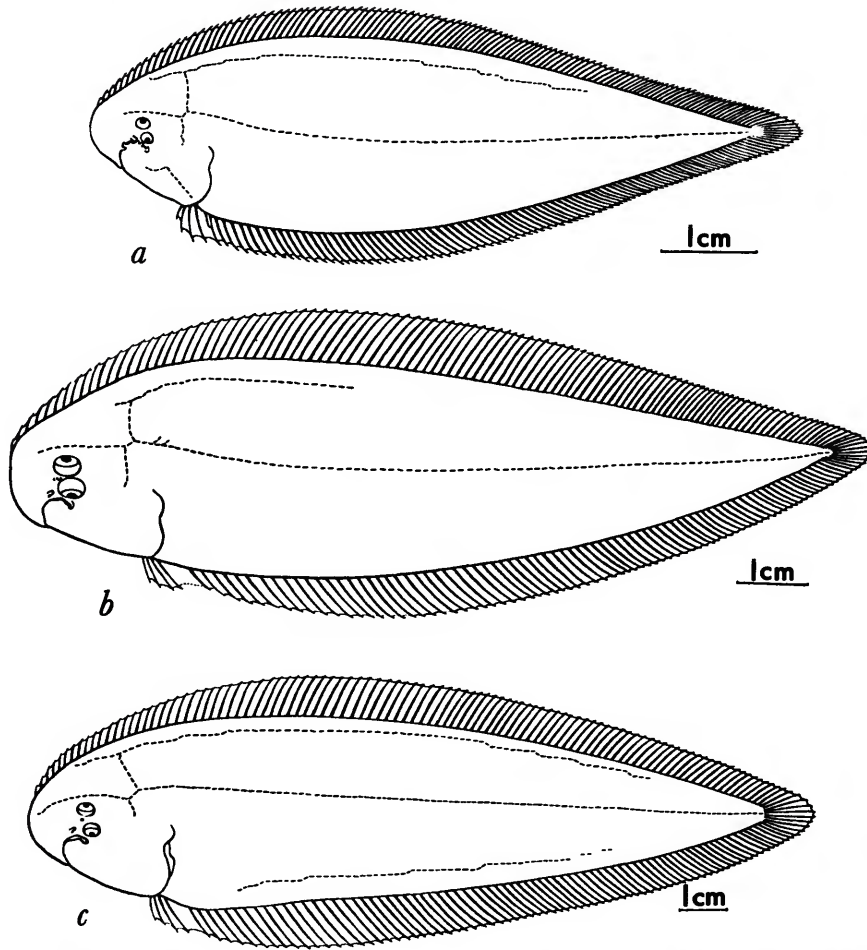


FIGURE 20.—Outline drawing of *C. kopsi* showing variation in number and extent of lateral lines: *a*, specimen 67.5 mm SL (BMNH 1934.9.6.7) from Singlap, Singapore; *b*, specimen 11.32 mm SL (BMNH 1890.2.26.147) from Arafura Sea; *c*, specimen 150.0 mm SL (BMNH 1933.7.31.30) from Singapore.

**Lateral-Line System:** Usually two or three lateral lines on ocular side, dorsolateral line undulating and extending along the dorsal contour of body to varying distances, midlateral line with 57–72 (M = 60) scales, 7–12 (M = 9) scales between the upper and the middle lateral lines. Ventrolateral line sometimes present, extending to varying distance. No lateral line on blind side.

Interlinear scale rows	7	8	9	10	11	12
Frequencies	4	5	14	4	2	3

**Fins:** Dorsal with 103–115 (M = 107) rays, anal

with 80–91 (M = 82) rays, caudal 10 in 30 specimens (radiographs).

**Vertebrae:** 50–55, comprising 9 abdominal and 41–46 caudal elements in 30 specimens (radiographs).

**Coloration:** Upper side brownish, generally with irregular darker spots, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 187 (177 + 10) mm, from China Sea near Hongkong, *Albatross* collection.

**DISTRIBUTION.**—From Indo-Australian Archipel-

ago to Philippines and Taiwan and westward to seas of India and Persian Gulf.

DIAGNOSIS AND AFFINITIES.—*Cynoglossus kopsi* and *C. interruptus* are allopatric species resembling each other in their relatively small size, relatively large contiguous eyes, short and somewhat obtusely pointed snout, two or three interrupted lateral lines on ocular side, and 10 rays in the caudal fin; *C. kopsi* is distinguishable, however, by its larger scales, the interlinear scale count being 7–12,  $M = 9$  cf. 11–12,  $M = 11$  in *C. interruptus* and by usually having two lateral lines, the ventrolateral line occurring only rarely.

NOTE ON SYNONYMY.—Bleeker (1851b:494) described *C. kopsi* from Rio in Bintang, off southeastern Singapore and characterized it as having subcontiguous eyes, three lateral lines on the ocular side, and none on the blind side, without indicating, however, the number of scale rows between the middle and the upper lateral lines. Because of the omission of the key character of interlinear scale row from the original description of *C. kopsi*, there has been considerable confusion in the identity of it. In his *Atlas* (1875, pl. 241: fig. 3) Bleeker, however, gave an excellent illustration and indicated nine rows of interlinear scale rows. In his description of *C. brachycephalus* (1875:38) from Sumatra, Bleeker again delineated this species with subcontiguous eyes and two nostrils but with only two lateral lines on the ocular side. In this case also, Bleeker made no mention of the number of interlinear scale rows present in the species, though in his illustration (1875, pl. 244: fig. 6) nine rows can be distinctly seen. Thus, the presence of an additional lateral line in *C. kopsi* is the only difference distinguishing it from *C. brachycephalus*. An additional lower lateral line as has been stated earlier is of no importance in species differentiation in *Cynoglossus* and I have, therefore, considered these two species as synonymous.

Norman (1928:211) included *C. praecisus* and *C. sibogae* in *C. brachycephalus* and concluded that "this species is very closely related to *C. kopsi* Bleeker, with which it may prove to be identical. There is no trace, however, of a lower lateral line on the ocular side in any of the specimens described above." I have examined the types of *C. praecisus* and *C. sibogae* and I corroborate Norman's tentative conclusion that all three of these species, *C.*

*praecisus*, *C. sibogae*, and *C. brachycephalus*, are synonymous with *C. kopsi*.

Alcock (1890b:442) described *C. versicolor*, based on a single specimen obtained by RIMS Investigator off the Orissa coast, and characterized it as having a single nostril and 12 series of scales between the upper and middle lateral lines. On a reexamination of the type, Norman (1928:195) noted the presence of posterior nostril and traces of an incomplete lower lateral line, characters distinctive of *C. kopsi*. I have examined the holotype of *C. versicolor* and I consider it here as conspecific with *C. kopsi*.

*Cynoglossus melanopterus* Shen described on the basis of eight specimens, 120 to 152 mm in TL, from Talo Harbour, Hongkong is the same as the present species. From the description of the fish as having small subcontiguous eyes, two nostrils, three lateral lines on ocular side, and ctenoid scales on the body, it does not appear to differ a bit from *C. kopsi* and I have, therefore, synonymized them.

TYPE SPECIMENS.—Bleeker's original description of *C. kopsi* was based on two specimens, 125 and 130 mm in TL, and he illustrated the 125-mm specimen in the *Atlas*. In the Bleeker collection of specimens there is only one specimen, though three are recorded in the register and in the card index and two in the auction catalog of 1879 (pers. comm., Dr. M. Boeseman). A specimen 119 mm SL, 125 mm in TL, cataloged as RMNH 7680. Rio (Riau Archipelago), coll. G. F. de Bruyn Kops, 1851, is selected here as the lectotype of *C. kopsi*.

*Cynoglossus brachycephalus* was based on two specimens, 105 and 125 mm in TL, and the illustration drawn from the 125-mm specimen. Chabanaud (1946) selected a specimen, 118 mm SL approximately 124 mm TL, from west Sumatra, RMNH 17877, as lectotype of *C. lectotype* of *C. brachycephalus*; it was taken from a jar of Bleeker's collection from the 1879 auction cataloged as SMNH 6800 containing five specimens. Weber (1913b:442) described *C. sibogae* on the basis of two specimens, 77 and 61 mm, from Molo Strasse (Siboga Sta 51) and Lirung, Insel Saliban (Siboga Sta 133), respectively. The Molo Strasse specimen, 77 mm, which is figured, is selected here as the lectotype and the other specimen the paralectotype. Both the types are in the Zoological Museum, Amsterdam (pers. comm., Dr. N. Nijssen), but I have examined only the paralectotype. Holotype of *C. praecisus* Alcock, ZSI 12843, 111 mm SL, from Ganjam coast, coll.

Marine Survey. Holotype of *C. versicolor*, ZSI 12895, 116 mm SL, from Orissa coast, coll. Marine Survey. Holotype of *C. kopsi diagraphata*, BMNH 1890.2-26.147, 109 mm SL, from Arafura sea, coll. Challenger.

OTHER MATERIAL EXAMINED.—CHINA: 1 specimen, USNM 113181, China Sea near Hongkong, coll. *Albatross*. 1, USNM 137982, China Sea, near Hongkong, coll. *Albatross*. 3, USNM 192859, Ma Kung Mkt., Taiwan, coll. Kuntz and Wells. 2, SOSC Ref 340, off Teluk Kau, Halmahera, lat.  $01^{\circ}08.6'N$ , long.  $128^{\circ}01'E$ , 30–25 fms coll. Tevega Expd. 2, SOSC Ref 340, South China Sea, off Sarawak, lat.  $4^{\circ}44'N$ , long.  $113^{\circ}23'E$ , 100 mm coll. Tevega Expd. 1, BMNH 1855.9.19.1247, China, coll. Belcher. 1, BMNH 1862.6.3.18, China, coll. P. Bleeker. 1, BMNH 1935.4.18.7, South China Sea, coll. Lin.

PHILIPPINES: 11, USNM 112872 Illoilo, coll. Kuntz and Wells. 1, USNM 112873, Illoilo, coll. Kuntz and Wells. 3, USNM 112874, Illoilo, coll. Kuntz and Wells. 1, USNM 113178, Antonis Is., coll. M. Weber, Aug 1899. 1, USNM 137653, Towi, coll. *Albatross*. 1, USNM 137691, Ragay R., Ragay Gulf, coll. *Albatross*. 74, USNM 148586, Illoilo, coll. Keller. SINGAPORE: 1, BMNH 1933.7.31.30, Singapore, ex. Raffles Museum.

INDONESIA: 1, BMNH 1879.5.14.81, Arafura Sea, coll. Challenger. 2, UZMK (unregistered), Java Sea, lat.  $5^{\circ}08'S$ , long.  $106^{\circ}22'E$ , 35 m, coll. Th. Mortensen, 26.7.22. 1, UZMK (unregistered), Java, lat.  $5^{\circ}53'S$ , long.  $05^{\circ}34'E$ , 25 m, coll. Th. Mortensen. 1, UZMK (unregistered), Java Sea, 12 m, coll. Th. Mortensen, 5–8–22. 1, UZMK (unregistered), Java Sea, lat.  $106^{\circ}03'E$ , long.  $5^{\circ}23'S$ , coll. Th. Mortensen, 6.8.22. 1, UZMK (unregistered), Java Sea, lat.  $5^{\circ}57'S$ , long.  $106^{\circ}84'E$ , 22 m, coll. Th. Mortensen, 7.8.1922. 1, UZMK (unregistered), Amboina, ca. 50 fms, coll. Th. Mortensen, 2.11.11. 1, UZMK (unregistered), Amboina, coll. Th. Mortensen, 24.11.22. 1, UZMK (unregistered), Java Sea, lat.  $8^{\circ}26'S$ , long.  $114^{\circ}29'E$ , 70 m, coll. Th. Mortensen, Java-S Africa Expd., 5.4.1929.

THAILAND: 1, CAS (GVF) 2312, Chumphon Prov. Gulf of Thailand, coll. Naga Expd. 1959–1961. 10, CAS (GVF) 2312, Gulf of Thailand, lat.  $12^{\circ}16'45''N$ , long.  $100^{\circ}07'15''E$ ,

coll. Naga Expd., 1959–1961. INDIA: 1, SOSC Ref 381, Pondicherry, Madras State, coll. F. H. Berry, 5.10.66. 4, BMNH 1928.3.20.101–104, Madras coast, 20 fms, ex. Indian Museum. 1, BMNH 1928.3.20.106, Ganjam coast, ex. Indian Museum. 10, ZSI 13021–34 Madras coast, 20 fms, coll. Marine Survey. PERSIAN GULF: 1, ZSI (unregistered), Persian Gulf,  $20^{\circ}20'N$ ,  $48^{\circ}47'E$ , 19.11.190, Marine Survey Sta 352, coll. *Investigator*. 1, UZMK (unregistered), Persian Gulf, ca. 50 fms, 1937–1938. MADAGASCAR: 2, SOSC Ref 170, lat.  $16^{\circ}11'S$ , long.  $43^{\circ}53'E$ , 62 m, coll. *Anton Brunn*, 18.10.64. 1, SOSC Ref 170, lat.  $16^{\circ}03'S$ , long.  $44^{\circ}09'E$ , coll. *Anton Brunn*. MALDIVE ISLANDS: 1, BMNH 1901.12.31, 120, Maldives, coll. Gardiner. ST BRANDON GROUP: 4, BMNH 1908.3.23.149–52, Cargados Garajos, coll. Gardiner. MERGUI ARCHIPELAGO: 1, ZSI (unregistered), Mergui Archipelago  $12^{\circ}35'N$ ,  $38^{\circ}16'E$ , Marine Survey Sta 552, coll. *Investigator*.

## 12. *Cynoglossus interruptus* Günther

### FIGURE 21

*Cynoglossus interruptus* Günther, 1880:70, pl. 30: fig. B [type-locality: Yokohama, Japan].—Steindachner, 1896:220 [Kobe, Hioga, Nagasaki].—Jordan and Snyder, 1900:380 [Tokyo]; 1901:123 [Yokohama].—Smith and Pope, 1906:498.—Wu, 1932:146.—Ochiai, 1959:202; 1963:82, pl. 17: fig. 2.—Chu, 1963:538, fig. 403.—Shen, 1967:212 [Hong Kong].—Ochiai, 1966:84.

*Areliscus interruptus*.—Jordan and Starks, 1906a:240 [Tokyo, Nagasaki, Wakanoura, Matsushima, Onomichi].—Snyder, 1912:441.—Jordan, Tanaka, and Snyder, 1913:336.—Jordan and Thompson, 1914:213.—Hubbs, 1915:494.—Jordan and Hubbs, 1925:302 [Toba, Kobe, Mikawa, Misaki].—Reeves, 1927:14.—Ui, 1929:276.—Schmidt and Lindberg, 1930:1149.—Chu, 1931:95.—Kamohara, 1934:462.—Kuronuma, 1939:83.—Yanai, 1950:22.—Kuroda, 1951:390.—Honma, 1952:225.—Mori, 1952:184.

*Cynoglossus nigropinnatus* Ochiai, 1959:205 [type-locality: Owase, Mimase, Kochi, Japan]; 1963:85, pl. 19.

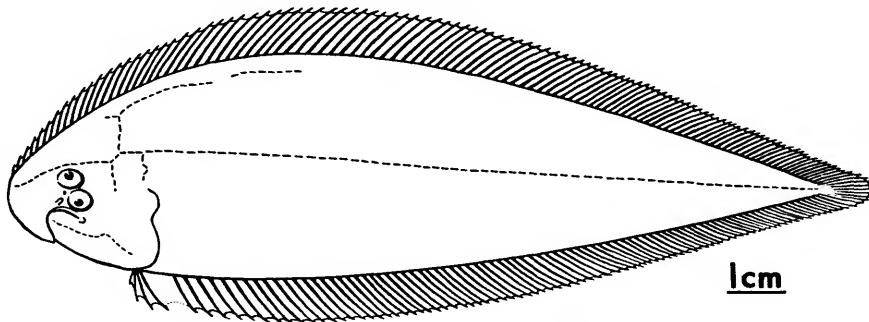


FIGURE 21.—Outline drawing of *C. interruptus*, holotype (BMNH 1879.5.14.92) from Yokohama, Japan.

DESCRIPTION.—Based on 34 specimens, 89.0–158.0 mm SL.

Depth of body 25.47–35.62 ( $M = 28.97$ ), length of head 18.52–24.11 ( $M = 21.25$ ) percent of standard length. Diameter of eye 10.53–21.05 ( $M = 14.18$ ) percent of length of head, interorbital space absent. Two nostrils on ocular side, anterior nostril tubular in front of fixed eye, posterior nostril simple, just above anterior border of lower eye. Snout rounded, 25.0–37.14 ( $M = 31.81$ ) percent of length of head, rostral hook short, extending only to front of anterior nostril. Maxillary extending to just below middle of fixed eye; angle of mouth extending to below vertical from anterior half of lower eye, much nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 33.33–52.63 ( $M = 43.84$ ), angle of mouth to branchial opening 36.36–63.16 ( $M = 56.02$ ) percent of length of head.

*Scales*: Ctenoid on both sides, including those on lateral lines; scales small, moderately serrated with short ctenii on blind side, weakly serrated on ocular side.

*Lateral-Line System*: Two or three lateral lines on ocular side. Dorsolateral line undulated, interrupted at middle of body, becoming obscure or running backward along the dorsal contour entering dorsal fin along 8th to 12th rays counted from the rear; the ventrolateral line absent or present, when present either interrupted at middle of body or running backward and entering anal fin a few rays counted from the rear. The dorsolateral line is usually well developed when the ventrolateral line is present to the fullest extent. Midlateral line with 60–67 ( $M = 63$ ) scales, 11–12 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	11	12
Frequencies	17	14

*Fins*: Dorsal with 103:110 ( $M = 107$ ) rays, anal with 84–86 ( $M = 85$ ) rays, caudal 10 in 5 specimens (radiograph).

*Vertebrae*: 52, comprising 9 abdominal and 43 caudal elements in 5 specimens (radiograph).

*Coloration*: Upper side brownish, with or without dark blotches, blind side yellowish in preserved specimens.

*Size*: Largest specimen examined, 168 (158 + 10) mm, is from Mimase, Kochi, Japan.

DISTRIBUTION.—Japan.

DIAGNOSIS AND AFFINITIES.—*Cynoglossus inter-*

*ruptus*, which is restricted to Japan, can be readily separated from *C. kopsi* by its smaller scales (11–12,  $M = 11$  cf 7–12,  $M = 9$ ) and usually by the occurrence of a ventrolateral line which is absent in the holotype.

NOTE ON SYNONYMY.—Günther (1880:70) described *C. interruptus* on the basis of two specimens, the largest being 150 mm in TL and characterized it as having two lateral lines, upper reaching only two-thirds to caudal, and 12 rows of scales between the middle and the upper. A similar species, *C. nigropinnatus*, was described by Ochiai on the basis of 84 specimens, 80.5–211 mm SL, from Owase, Kochi, and Mimase and was characterized by having three lateral lines on the ocular side, the middle and the upper being separated by 10 rows of scales, and with ctenoid scales on the body. Comparison of numerous specimens of *C. interruptus* has shown beyond doubt that the depth of the body and the presence of an additional lower lateral line noted by Ochiai fall within the normal range of variation of *C. interruptus*. I have, therefore, included *C. nigropinnatus* in the synonymy of *C. interruptus*.

TYPE SPECIMENS.—Holotype of *C. interruptus*, BMNH 1897.5.14.92, 140 mm SL, from Yokohama, Japan, coll. *Challenger*; paratype, BMNH 1890.7.26.146, 140 mm SL, obtained along with the holotype. One paratype of *C. nigropinnatus*, KU 18336, 158 mm SL, two paratypes KU 36619 and KU 26620, 156 and 131 mm SL, Mimase, Japan, coll. Kyoto University.

OTHER MATERIAL EXAMINED.—CHINA: 1 specimen, BMNH 1848.3.16.195, China, coll. Belcher. JAPAN: 2, BMNH 1902.10.31.146–47, Japan, coll. Gordon Smith. 10, BMNH 1923.2.26.650–59, Tokyo, coll. Jordan. 8, BMNH 1923.2.26.660–667, Wahanoura, coll. Jordan. 30, USNM 56360, Nagasaki, col. Bureau Com. Fisheries. 1, USNM 59757, Kagoshima, coll. H. M. Smith. 1, USNM 59756, Kochi, coll. H. M. Smith. 1, USNM 71955, Suruga, coll. *Albatross*. 1, USNM 73868, Yenoshima. 1, USNM 77065, Japan, coll. *Albatross*. 8, USNM 151810 Kobe, coll. D. S. Jordan and Yamamoto, 1922. 5, USNM 152480, Kobe, coll. D. S. Jordan, 1922. 1, NHV 43777, Tokyo, coll. Doderlein.

### 13. *Cynoglossus joyneri* Günther

FIGURE 22; PLATE 6

*Cynoglossus joyneri* Günther, 1878:486 [type-locality: Tokei, Japan]; 1880:70 pl. 30; fig. A [Tokyo].—Otaki, 1897:25.—Wu, 1932:154; 1933:61 [Chefoo].—Wu and Wang, 1933:304 [China].—Chabanaud, 1951d:269.—Tchang, 1955:301, fig.

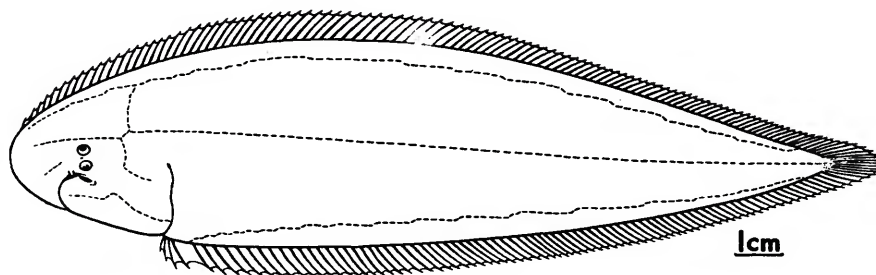


FIGURE 22.—Outline drawing of *C. joyneri* (BMNH 1924.12.15.87) from Amoy, China.

186.—Ochiai, 1959:208; 1963:88, pl. 18.—Chu, 1963:542, fig. 408.—Shen, 1967:211 [Kowloon].  
*Areliscus joyneri*.—Jordan and Snyder, 1900:380 [Tokyo].—Jordan and Starks, 1906a:241 [Tokyo].—Smith and Pope, 1906:498 [Kochi].—Snyder, 1912:441 [Kagoshima].—Jordan, Tanaka and Snyder, 1915:336 [listed].—Jordan and Hubbs, 1925:302.—Kuroda, 1931:122.—Kamohara, 1938:62 [Tosa].—Kuronuma, 1939:83.—Yanai, 1950:22.—Kuroda, 1951:390.—Kamohara, 1952:85.—Honma, 1952:225.—Chen and Weng, 1965:100, fig. 70 [Tung Kong].  
*Cynoglossus (Areliscus) lighti* Norman, 1925:270 [type-locality: Amoy and Wenchow].  
*Cynoglossus lighti*.—Chu, 1931:95.—Wu, 1932:155 [Tang-Tchou and Amoy].—Chabanaud, 1951a:270.—Wang, 1933:63, fig. 30.  
*Trulla lighti*.—Fowler, 1934b:216.—Chen, 1951:123.  
*Areliscus tenuis* Oshima, 1927:201 [type-locality: Tainan].  
*Cynoglossus tshusanensis* Chabanaud, 1951d:270 [type-locality: Tshusan Archipelago, China].

**DESCRIPTION.**—Based on 10 specimens, 193.0–199.0 mm SL.

Depth of body 20.28–43.64 ( $M = 25.88$ ), length of head 18.86–40.00 ( $M = 23.75$ ) percent of standard length. Diameter of eye 7.14–10.14 ( $M = 8.80$ ), interorbital space 4.76–7.95 ( $M = 4.46$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular in front of lower eye, posterior nostril simple in anterior half of interorbital space. Snout obtusely pointed, 32.73–42.03 ( $M = 36.54$ ) percent of length of head, rostral hook rather short and extending to front of anterior nostril. Maxillary extending well beyond posterior border of fixed eye; angle of mouth extending to almost below vertical from posterior half of fixed eye or even beyond, being more or less midway between tip of snout and branchial opening; tip of snout to angle of mouth 47.62–60.32 ( $M = 51.34$ ), angle of mouth to branchial opening 47.06–63.49 ( $M = 52.26$ ) percent of length of head.

**Scales:** Ctenoid on ocular side, including those of lateral lines; on the blind side scales are cycloid on head, weakly ctenoid on body.

**Lateral-Line System:** Usually three lateral lines on eyed side, the dorsolateral line undulates and runs backward along dorsal contour of body, usually entering dorsal fin along 7th ray counted from the rear, midlateral line with 66–72 ( $M = 70$ ) scales, 11–12 ( $M = 12$ ) scales between middle and upper lateral line, ventrolateral line usually present, entering anal fin along 5th to 7th ray counted from the rear. No lateral line on blind side.

Interlineal scale rows	11	12
Frequencies	1	8

**Fins:** Dorsal with 105–112 ( $M = 109$ ) rays, anal with 81–85 ( $M = 83$ ) rays, caudal 10 in 7 specimens (radiographs).

**Vertebrae:** 50–53 ( $M = 51$ ) comprising 9 abdominal and 41–44 caudal elements in 7 specimens (radiograph).

**Coloration:** Upper side brownish, blind side yellowish white in preserved specimens.

**Size:** Largest specimen examined, 231.5 mm SL, is from Japan (BMNH 1878.4.5.94).

**DISTRIBUTION.**—From South China Sea through Taiwan, Tung-hai, Yellow Sea, Po-hai to Korea and Japan.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus joyneri* is closely related to *C. interruptus*; it is, however, distinguished by its longer obtusely pointed snout (36.54 percent cf. 31.81 percent of head length) and the situation of the angle of mouth, which is somewhat midway between the tip of snout and branchial opening, whereas it lies very much nearer to the tip of snout than to branchial opening in the case of *C. interruptus*.

NOTE ON SYNONYMY.—Günther (1878:486) described *C. joyneri* on the basis of two specimens, 236 and 249 mm in TL, from Tokei, Japan and characterized it as having three lateral lines, the upper and the middle being separated by 13 scale rows. Norman (1925:270) described a similar species *C. lighti* on the basis of four specimens, 107 to 160 mm in TL, from Amoy and Wenchow and differentiated it from *C. joyneri* by its slender body and shorter head. Comparison of a number of specimens from Japan has clearly indicated that the differences noted by Norman are not significant to retain *C. lighti* as a distinct species from *C. joyneri*. Oshima (1927:201) and Chabanaud (1951d:270) described *C. tenuis* and *C. tshusanensis* from Tainan and Tshusan Archipelago, China, respectively. Oshima's description was based on a single specimen, 170 mm in TL, and he characterized it as having three lateral lines, the upper and the middle being separated by 12 rows of scales, and considered it "closely related to *Areliscus joyneri* differing from it in having a lower body and ctenoid scales on both sides." *Cynoglossus joyneri* too has ctenoid scales on both sides except scales of the head of the blind side, which are cycloid. Ochiai (1963:90) synonymized *C. tenuis* with *C. lighti*, which is a junior synonym of *C. joyneri*. *Cynoglossus tshusanensis* was described on the basis of three specimens, 81.5 to 97 mm in TL, characterized as with two nostrils, contiguous eyes, and three lateral lines on ocular side, the middle and the upper being separated by 11–12 scales. I have examined the types of *C. tshusanensis* in London and compared them with the types of *C. joyneri*; the differences noted between them were found only to be attributable to intraspecific variability and hence they are synonymized here.

TYPE SPECIMENS.—1 specimen, BMNH 1878.4.15.94, 231.5 mm SL, lectotype of *C. joyneri*, designated by Chabanaud (1951d:269), Jokee, Japan, coll. Joyner. 1, BMNH 1878.4.15.95, 229 mm SL, paralectotype of *C. joyneri*, designated by Chabanaud, obtained along with the lectotype. 1, BMNH 1924.12.15.87, 131 mm SL, lectotype of *C. lighti*, Amoy, China, coll. Light. 2, BMNH 1924.12.15.88–89, 131, and 169 mm SL, paralectotypes of *C. lighti*, collected along with the lectotype. 1, BMNH 1924.12.15.90, 117 mm SL, paralectotype of *C. lighti*, Wenchow, China, coll. Light. 1, BMNH 1892.12.12.32, 88 mm SL, holotype of *C. tshusanensis*,

Chusan Is., China, coll. Walker. 2, BMNH 1892.12.12.33–34, 74 and 77 mm in SL, paratype of *C. tshusanensis*, collected along with the holotype.

OTHER MATERIAL EXAMINED.—JAPAN: 3 specimens, USNM 6122, E coast of Japan, coll. Blake. 1, USNM 59763, Kochi, Japan, coll. H. M. Smith. 1, USNM 151796, Shizuoka, Japan, coll. D. S. Jordan, 1922. 2, KU 12545 and 12559, Yamaguchi, Japan. 2, KU 26965 and 26972, Omuta, Fukuoka Pref., Japan.

### The *itinus* complex

*Cynoglossus itinus*, the only species of the *itinus* complex, has its center of distribution in Japan and is related to the *kopsi* complex, both having descended from a common ancestral stock. The principal character distinguishing this species is the absence of the posterior nostril.

### 14. *Cynoglossus itinus* (Snyder)

#### PLATE 7

*Trulla itina* Snyder, 1909:609 [type-locality: Naha, Okinawa, Japan].—Jordan, Tanaka, and Snyder, 1915:337.—Kamohara, 1952:58.—Kuroda, 1954:66.

*Cynoglossus itinus*.—Ochiai, 1959:200; 1963:79, pl. 17: fig. 1. *Cynoglossus punctatus* Shen, 1969:21, figs. 9–19 [type-locality: Hong Kong].

DESCRIPTION.—Based on 8 specimens, 99.5–131.0 mm SL.

Depth of body 25.40–28.64 ( $M = 27.07$ ), length of head 19.44–21.61 ( $M = 20.56$ ) percent of standard length. Diameter of eye 10.87–15.38 ( $M = 13.22$ ), interorbital space 2.08–7.14 ( $M = 4.35$ ) percent of length of head. Anterior nostril on ocular side tubular, in front of lower eye, posterior nostril absent. Snout rounded, 25.0–30.43 ( $M = 27.24$ ) percent of length of head, rostral hook short, not extending to vertical through the front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, much nearer to tip of snout than to branchial opening, tip of snout to angle of mouth 36.54–45.24 ( $M = 40.55$ ) angle of mouth to branchial opening 55.77–69.05 ( $M = 61.34$ ) percent of length of head.

Scales: Ctenoid on ocular side including those on lateral lines; on blind side, cycloid on head and weakly ctenoid on body.

**Lateral-Line System.**—Three lateral lines on ocular side, dorsolateral line slightly undulated, runs backward along the dorsal contour of body, entering dorsal fin usually along 20th dorsal ray counted from the rear, midlateral line with 71–78 ( $M = 74$ ) scales, 12–14 ( $M = 13$ ) scales between them; ventrolateral line present. No lateral line on blind side.

Interlinear scale rows	12	13	14
Frequencies	4	3	1

**Fins:** Dorsal with 102–103 ( $M = 102$ ) rays, anal with 83–86 ( $M = 84$ ) rays, caudal 8 in 3 specimens (radiographs).

**Vertebrae:** 50–52, comprising abdominal and 41–43 caudal elements in 3 specimens (radiographs).

**Coloration:** Upper side light brown with blackish blotches, blind side yellowish in preserved specimens.

**Size:** Largest specimen examined, 141 (131+10) mm, is from Miya Aichi, Japan, KU 16057.

**DISTRIBUTION.**—Japan and Hong Kong.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus itinus* has close affinity with *C. interruptus* and *C. joyneri*. It is distinguished, however, by the lack of the posterior nostril and a reduction in the number of caudal fin rays.

**NOTE ON SYNONYMY.**—Snyder (1909:609) described *C. itinus* on the basis of a single specimen, 115 mm in TL, from Naha, Okinawa, Japan and characterized it as having a single nostril and three lateral lines on ocular side, the upper and the middle being separated by 12 or 13 scale rows. Recently, Shen (1969:21) described *C. punctatus* from seven specimens, 110 to 136.5 mm SL, from Tolo Harbor, Hong Kong. In having three lateral lines, contiguous eyes, only one nostril, and the ctenoid nature of the scales, *C. punctatus* exhibits the same features as the present species.

**TYPE SPECIMEN.**—Holotype of *C. itinus*, USNM 62957, 105 mm SL, Okinawa, Japan, coll. *Albatross*.

**OTHER MATERIAL EXAMINED.**—JAPAN: 1 specimen, USNM 71610, Satsuma, coll. Bureau of Com. Fisheries. 2, USNM 72022, Satsuma, coll. Bureau of Com. Fisheries. 2, USNM 72023, Tanegashima, coll. *Albatross*. 1, KU 15351, Owase, coll. Dr. T. Iwai, 15.1.1950. 1, KU 16057, Miya Aichi. 1, MCZ 31166, Japan, coll. E. L. Morse.

### The *ogilbyi* complex

The center of distribution of the *ogilbyi* complex is in Australia. Like the *itinus* complex, it is also

closely related to the *kopsi* complex by the nature of the eyes situated close together, with a very narrow interorbital space, and the variable nature of the lateral-line system. Both *C. itinus* and *C. ogilbyi* complexes have evolved (the former in Japanese waters and the latter in the Australian waters) from a common ancestral stock that spread northward and southward from the generic evolutionary center. The most outstanding characteristics of the members are: contiguous or closely situated eyes with a narrow interorbital space, two or three (*C. maculipinnis*) lateral lines, the dorsolateral line extending full extent or interrupted, and large scales, the interlinear scale count being 8 or 11 to 14 and usually eight rays in caudal fin and cycloid scales on the blind side. Included in this complex are *C. ogilbyi*, *C. maculipinnis*, and *C. broadhursti*.

### 15. *Cynoglossus ogilbyi* Norman

*Cynoglossus ogilbyi* Norman, 1926:304, fig. 14 [type-locality: southern Queensland].

**DESCRIPTION.**—Based on the holotype of *C. ogilbyi*, 179.7 mm SL.

Depth of body 27.88, length of head 18.92 percent of standard length. Diameter of eye 12.65, interorbital space narrow, 2.06 percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, just in front of interorbital space. Snout rounded, 26.47 percent of length of head, rostral hook short, extending to just in front of anterior nostril. Maxillary extending beyond posterior border of fixed eye; angle of mouth extending to below vertical from posterior half of fixed eye, much nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 40.0, angle of mouth to branchial opening 58.53 percent of length of head.

**Scales:** Ctenoid on ocular side, cycloid on blind side.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line incomplete, extending along the dorsal contour of the body and extending the dorsal fin at 31st dorsal ray, counted from the rear, midlateral line with 66 scales and 8 scales between the middle and upper lateral lines. No lateral line on blind side.

**Fins:** Dorsal with 115 rays, anal with 95 rays, caudal 8 in 1 specimen (radiograph).

*Vertebrae*: 56, comprising 9 abdominal and 47 caudal elements in 1 specimen (radiograph).

*Size*: Only specimen examined, 186 (179 + 7) mm, is the holotype.

*DISTRIBUTION*.—Southern Queensland.

*DIAGNOSIS AND AFFINITIES*.—The nearest relative of *C. ogilbyi* is *C. maculipinnis*; it differs from *C. maculipinnis* in having larger scales (interlinear scale row count 8 cf. 10–13,  $M = 11$ ) and cycloid scales on the blind side.

*TYPE SPECIMENS*.—Holotype of *C. ogilbyi*, AMS-E 2796, 179.7 mm SL, southern Queensland.

## 16. *Cynoglossus maculipinnis* Rendahl

### PLATE 7

*Cynoglossus maculipinnis* Rendahl, 1921:17 [type-locality: northwest Australia].—Norman, 1926:302.

*Cynoglossus maccullochi* Norman, 1926:302, fig. 13 [type-locality: 7–10 miles northwest of Hummocky Is., east coast of Queensland].

*DESCRIPTION*.—Based on 11 specimens, 42.5–139.0 mm SL.

Depth of body 23.89–29.31 ( $M = 26.58$ ), length of head 19.0–24.04 ( $M = 21.42$ ) percent of standard length. Diameter of eye 11.90–20.00 (15.79), very narrow, 1.59–5.26 ( $M = 2.97$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril in anterior part of the interorbital space, or immediately in front of the eyes. Snout rounded, 28.00–35.00 ( $M = 31.16$ ) percent of length of head; rostral hook short, ending in front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 41.46–50.00 ( $M = 44.75$ ), angle of mouth to branchial opening 50.00–60.00 ( $M = 56.33$ ) percent of length of head.

*Scales*: Moderate in size, ctenoid on both sides.

*Lateral-Line System*: Usually two lateral lines on ocular side, occasionally three or rarely one; dorso-lateral line extends to the full extent, very rarely ending at two-thirds of body; <sup>s</sup> midlateral line with 64–76 ( $M = 70$ ) scales, 10–13 ( $M = 12$ ) scales

\*In one of the specimens examined from Lindeman Island, the dorso-lateral line is absent, but the midlateral line is present.

between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	10	11	12	13
Frequencies	1	2	6	1

*Fins*: Dorsal with 102–114 ( $M = 107$ ) rays, anal with 79–89 ( $M = 82$ ) rays, caudal 8 (10) in 7 specimens (radiographs).

*Vertebrae*: 48–53, comprising 9 abdominal and 39–44 caudal elements in 7 specimens (radiographs).

*Coloration*: Upper side brownish, with darker patches forming six or seven irregular bands; two black dots on caudal fin; lower whitish or yellowish in preserved specimens.

*Size*: Largest specimen examined, 150 (139 + 11) mm, is obtained off Lindeman Island, AMS IA 6810.

*DISTRIBUTION*.—Australia: Western, Northern Territory, and Queensland; recorded up to a depth of 72 fms.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus maculipinnis* is closely allied to *C. ogilbyi* and *C. broadhursti*. The three species, forming a species-complex, seem to have evolved in Australia from a common ancestral stock. The differences between *C. maculipinnis* and *C. ogilbyi* have been outlined under *C. ogilbyi*; from *C. broadhursti* it differs in having ctenoid scales on both sides of body (*C. broadhursti*, like *C. ogilbyi*, has cycloid scales on blind side).

*NOTE ON SYNONYMY*.—Rendahl (1921:17) described *C. maculipinnis* based on a single specimen, from northwestern Australia, and characterized it with two lateral lines on the ocular side separated by 13 rows of scales, ctenoid scales on both sides of the body, two nostrils, the upper eye situated forward by a third of the eye diameter and the interorbital space less than the diameter of eyes.

Norman (1926:302) described *C. maccullochi* on the basis of a single specimen, 190 mm in TL, from Hummocky Island on the east coast of Queensland collected by *Endeavour*, and related it to *C. maculipinnis*; *C. maccullochi*, however, had larger eyes and three lateral lines on ocular side. In the British Museum there is a specimen, BMNH 1925.7.22.84, 107.5 mm SL, collected by *Endeavour* from the Moreton Bay on the east coast of Queensland that has only two lateral lines, the upper and the middle lines being separated by 13 rows of scales. In another specimen from Lindeman Island (QMI 15454), 110.5 mm SL, only one lateral line,



the midlateral line, is present while four other specimens, QMI 15454, exhibit two lateral lines. Comparison of a number of specimens has revealed that the larger eye and an additional lower lateral line noted by Norman are attributable to intraspecific variation in the species, and *C. maculipinnis*, having priority over *C. maccullochi*, is used here as the valid name for the species.

**TYPE SPECIMEN.**—Holotype of *C. maccullochi*, AMS 2693, Hummocky Island, east coast of Queensland, coll. *Endeavour*, examined by Dr. John R. Paxton on my behalf.

**OTHER MATERIAL EXAMINED.**—1 specimen, AMS 1B 3306, Repulse Bay, Queensland, 1954. 1, AMS 1A 6810, off Shaw and Lindeman Is. 1, WAM P 11729 Exmouth Gulf, W Australia, coll. R. McKay. 1, WAM P 11733, Exmouth Gulf. 1, WAM P 11799, Careening Bay, Garden Island, W Australia, coll. M. Graham, 20.1.63. 5, QM 1.15452-56, Lindeman Is. 1, MCZ 38506, Moreton Bay, S Queensland, coll. E. J. Coulter; 6.6.52. 1, USNM 174029, Port Bradshaw, Australia, N T, coll. R. R. Miller, 25.7.48. 1, BMNH 1925.7.22.84, Moreton Bay, S Queensland, coll. *Endeavour*. 1, BMNH 1933.8.14.24, NW Australia, coll. Gray. 2, BMNH 1933.8.12.56-57, NE of Low Island, Great Barrier Reef, coll. G. B. R. Expd.

## 17. *Cynoglossus broadhursti* Waite

FIGURE 23; PLATE 8

*Cynoglossus broadhursti* Waite, 1905:73, pl. 8; fig. 2 [type-locality: off Carnarvon to the northward of Houtman's Abrolhos].—Norman, 1926:302 [mouth of Murray R.].

**DESCRIPTION.**—Based on 4 specimens, 183.0–229.0 mm SL.

Depth of body 26.78–29.26 ( $M = 27.94$ ), length of head 17.72–20.74 ( $M = 19.00$ ) percent of standard length. Diameter of eye 10.47–11.84 ( $M = 11.15$ ), interorbital space 7.37–10.29 ( $M = 8.43$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in the anterior half of the interorbital space. Snout rounded, 26.47–34.21 ( $M = 30.36$ ) percent of length of head, rostral hook short, extending to front of the anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 40.00–47.37 ( $M = 43.48$ ), angle of mouth to branchial opening 52.63–55.81 ( $M = 54.53$ ) percent of length of head.

**Scales:** Ctenoid on ocular side except those of lateral lines; scales of the blind side and those of lateral lines on ocular side cycloid.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line running backward along the dorsal contour of body and entering dorsal fin along the 6th to 14th ray, counted from the rear, midlateral line with 72–77 scales, 12–14 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	12	13	14
Frequencies	2	1	1

**Fins:** Dorsal with 105–110 ( $M = 107$ ) rays, anal with 83–87 ( $M = 85$ ) rays, caudal 10 in 5 specimens (radiographs).

**Vertebrae:** 51–54 comprising 9 abdominal and 42–45 caudal elements in 5 specimens (radiograph).

**Coloration:** Upper side uniformly brownish, lower whitish or yellowish in preserved specimens.

**DISTRIBUTION.**—Western and southern Australia.

**Size:** The largest specimen examined, 245 (229 + 16) mm, is from the mouth of the Murray River.

**DIAGNOSIS AND AFFINITIES:** *Cynoglossus broadhursti* is readily distinguished from its close relatives, *C. maculipinnis* and *C. ogilbyi*, by a greater interlinear scale count (12–14,  $M = 12$  cf. 8 in *C. ogilbyi* and 10–13,  $M = 11$  in *C. maculipinnis*).

**TYPE SPECIMEN.**—Holotype of *C. broadhursti*, a specimen trawled off Carnarvon to the northward of Houtman's Abrolhos, in Australian Museum, Sydney (not examined).

**OTHER MATERIAL EXAMINED.**—2 specimens, AMS 1.10360 and 1.10359, mouth of Murray River, S Australia. 2, WAM P 14739 and P 14741, Shark Bay, W. Australia, coll. W. and W. Poob Bros., 18.9.65. 1, BMNH 1925.7.22.83, W Australia, coll. *Endeavour*.

## The *ecaudatus* complex

*Cynoglossus ecaudatus* and its relatives *C. sinu-sarabici*, *C. dollfusi*, and *C. cadenati* have their center of distribution in the western sector of the Indian Ocean, including the Red Sea and Gulf of Suez, the eastern coast of the Mediterranean Sea and the Senegal–Ghana coast. This complex is related to the *kopsi* complex and is most probably descended from a common ancestral stock.

The principal characters distinguishing this complex are the large contiguous eyes with a narrow

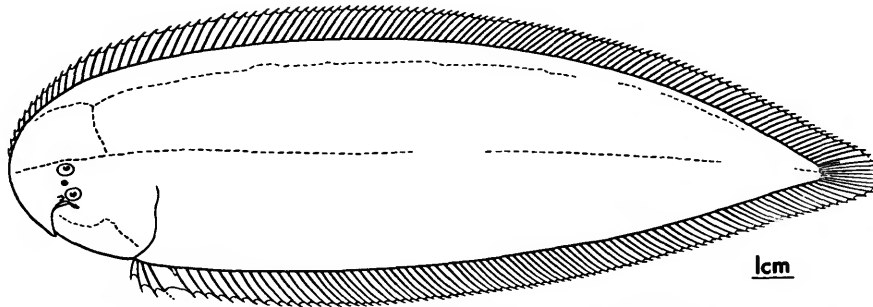


FIGURE 23.—Outline drawing of *C. broadhursti* (BMNH 1925.7.22.83) from Western Australia.

interorbital space, one or two lateral lines, and the ctenoid scales on both sides of the body.

### 18. *Cynoglossus ecaudatus* Gilchrist

FIGURE 24; PLATE 8

*Cynoglossus ecaudatus* Gilchrist, 1908:162, pl. 46 [type-locality: off Tugela River].—Gilchrist and Thompson, 1917:398.—Thompson, 1918:128.—Regan, 1920:222 [Natal]—Bonde, 1922:25.

*Areliscus ecaudatus*.—Barnard, 1925:415 [Natal and Zululand coast].

*Cynoglossoides ecaudatus*.—Smith, 1949:165, pl. 10.

*Cynoglossus kopsii* [not Bleeker].—Regan, 1908:235 [Seychelles].

*Areliscus natalensis* Bonde, 1922:23, pl. 4; fig. 2 [type-locality: Natal Seas, South Africa].

*Cynoglossus hunteri* Bonde, 1925:293 [type-locality: Delagoa Bay].—Barnard, 1925:413 [Delagoa Bay]; 1937:41.

*Cynoglossus lingua* [not Ham Buch.].—Smith, 1949:166 [Delagoa Bay].

*Cynoglossus brachycephalus* [*Cynoglossus seychellensis* Chabanaud (in Schedule)], 1951b:78 [type-locality: Seychelles].

*Cynoglossus kopsi diagramata* Chabanaud [in part], 1951d:273 [type-locality: Seychelles].

**DESCRIPTION.**—Based on 4 specimens, 101.5–150.0 mm SL, including the holotype of *C. natalensis* Bonde.

Depth of body 25.36–28.02 ( $M = 27.00$ ), length of head 19.70–21.74 ( $M = 20.32$ ) percent of standard length. Diameter of eye 12.50–13.33 ( $M = 13.05$ ) percent of length of head, interorbital space absent. Two nostrils on ocular side, anterior nostril tubular in front of lower eye, posterior nostril simple, immediately in front of the eyes. Snout obtusely rounded, 22.50–33.33 ( $M = 26.31$ ) percent of length of head; rostral hook short, ending in front of an-

terior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, much nearer to tip of snout than to branchial opening, tip of snout to angle of mouth 34.78–45.00 ( $M = 39.95$ ), angle of mouth to branchial opening 54.35–65.00 ( $M = 58.59$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those on lateral lines.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line ending at a point between middle and two-thirds of the length of the body, midlateral line with 64–66 scales, 10–12 scales between middle and upper lateral line. No lateral line on blind side.

Interlinear scale rows	10	12
Frequencies	2	2

**Fins:** Dorsal with 108–110 rays, anal with 86–87, caudal 8 in 2 specimens (radiographs).

**Vertebrae:** 52–53, comprising abdominal and 43–44 caudal elements, in two examples in 2 specimens (radiographs).

**Coloration:** Upper side brown, with more or less distinct dark crossbands, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 166 mm, is from Somali coast.

**DISTRIBUTION.**—All along East Coast of Africa and Seychelles; recorded from 26–000 fms.

**DIAGNOSIS AND AFFINITIES.**—Superficially and in several morphometric and meristic characters *C. ecaudatus* is more closely allied to *C. cadenati* of the Senegal-Ghana species than to *C. sinusarabici* or *C. dollfusi*. From *C. cadenati* it can, however, be distinguished by the fewer number of rays in the

caudal fin (8 cf. 10). It is quite conceivable that these two species have descended from a common ancestral stock that spread to west Africa through the Mediterranean during comparatively recent times when marine connections between the Red Sea and the Mediterranean existed.

NOTE ON SYNONYMY.—Gilchrist (1908:162) described *C. ecaudatus* (spelled *acaudatus*) on the basis of a single specimen, about 100 mm SL obtained off Tugela River, and characterized it as having contiguous eyes, ctenoid scales on both sides, and two lateral lines on ocular side separated by 10 rows of scales. I have examined the holotype of *C. ecaudatus* in Cape Town and found traces of the lower lateral line along the abdominal region. *Cynoglossus natalensis*, described on the basis of a single specimen, 125 mm in TL from Natal and characterized as having contiguous eyes, ctenoid scales, and three lateral lines, the lower one being faintly represented just behind the operculum only for an inch, is the same species as *C. ecaudatus*. I have examined the holotype of *C. natalensis* in London and found it identical with *C. ecaudatus*.

Bonde (1925:293) described *C. hunteri* on the basis of a single specimen, 75 mm in TL, from Delagoa Bay and related it to *C. lingua*. The type is not traceable in the South African Museum, but from the description it does not appear to differ in any significant way from *C. ecaudatus*. I have, therefore, synonymized it with *C. ecaudatus*.

TYPE SPECIMENS.—Holotype of *C. ecaudatus* in South African Museum, off Tugela River. Holotype of *C. natalensis*, BMNH 1922.3.27.18, 116 mm SL, Natal, 29 fms, coll. S.S. Pickle.

OTHER MATERIAL EXAMINED.—1 specimen, BMNH 1908.3.23.148 (one of the paratypes of *kopsi diagramata*

Chabanaud), Amirantes, Seychelles, coll. Gardiner. 1, BMNH 1969.5.14.401, Seychelles, coll. Wright. 1, BMNH 1904.11.4.5, S Africa, coll. J. D. F. Gilchrist, 2, SOSC Ref 145, Somali coast, 76–80 fms, 17.2.64.

## 19. *Cynoglossus cadenati* Chabanaud

### PLATE 9

*Cynoglossus cadenati* Chabanaud, 1947a:441 [type-locality: off Senegal coast, west Africa]; 1949b:205.—Cadenat, 1960:1383 [Accra and Sierra Leone].

*Cynoglossus cadenati cadenati*.—Chabanaud, 1949b:206 [type-locality: Senegal].

*Cynoglossus cadenati honoris* Chabanaud, 1949b:206 [type-locality: coasts of Sierra Leone].

*Holotype*: A specimen of 145.0 mm SL, off Senegal coast, west Africa, MNHP 49–20.

*DESCRIPTION*.—Based on 4 specimens, 104–159 mm SL, including the holotype and the paratype of *C. cadenati* and also the holotype of *C. cadenati honoris* Chabanaud.

Depth of body 18.99–23.00 ( $M = 20.71$ ), length of head 18.60–21.15 ( $M = 19.67$ ) percent of standard length. Diameter of eye 13.33–16.67 ( $M = 14.34$ ), interorbital space 2.38–9.09 ( $M = 5.99$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular in front of lower eye, posterior nostril simple, in the anterior half of the interorbital space. Snout rounded, 28.81–31.00 ( $M = 28.51$ ) percent of length of head, rostral hook short, extending to front of anterior nostril. Maxillary extending to below posterior border of fixed eye; angle of mouth extending to below vertical from posterior half of fixed eye; angle of mouth reaching below posterior half of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to

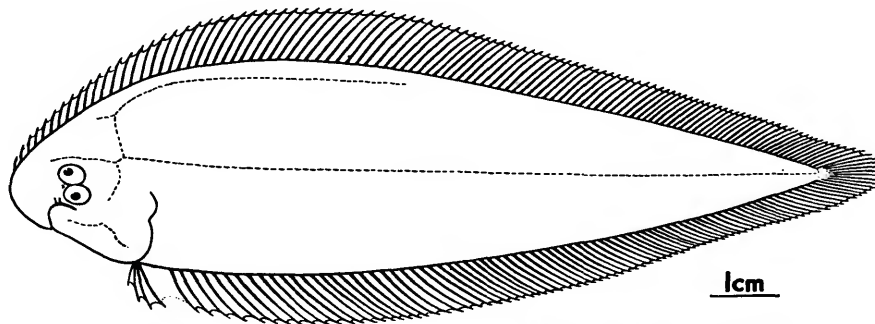


FIGURE 24.—Outline drawing of *C. ecaudatus* (BMNH 1922.3.27.18) from Natal.

angle of mouth 40.48–45.83 ( $M = 43.31$ ), angle of mouth to branchial opening 52.08–57.14 ( $M = 54.68$ ) percent of length of head.

*Scales*: Ctenoid on both sides, including those of lateral lines.

*Lateral-Line System*: Two lateral lines on ocular side, midlateral line with 68–72 ( $M = 70$ ) scales and 11–12 scales between them. No lateral line on blind side.

Interlinear scale rows	11	12
Frequencies	2	2

*Fins*: Dorsal with 109–115 ( $M = 112$ ) rays, anal with 87–88 ( $M = 87$ ) rays, caudal (9) 10 in 3 specimens (radiographs).

*Vertebrae*: 52–53, comprising abdominal and 43–44 caudal elements in 3 specimens (radiographs).

*Coloration*: Upper side uniformly brown, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 173 mm, is from Liberia, off St. Paul River.

*DISTRIBUTION*.—West Africa (Senegal to Ghana), recorded from a depth of 6–12 fms.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus cadenati* is closely related to both *C. ecaudatus* and *C. dollfusi*. In the number of midlateral scale rows, anal and dorsal fin ray counts, and the vertebral number these three species are very closely allied. *Cynoglossus cadenati*, however, differs from both species in higher caudal fin ray count of 10, whereas in the other species there are only 8.

The close affinity of these three species is of considerable zoogeographical significance. It is conceivable that they evolved from a common ancestral stock in comparatively recent times when a probable connection between the Red Sea and the Mediterranean existed, which zoogeographically must not be earlier than early Pleistocene.

*NOTE ON SYNONYMY*.—Chabanaud (1947a:441) described *C. cadenati* on the basis of three specimens, 106–159 mm in TL, from Senegal and Sierra Leone, west Africa and characterized it as having two lateral lines on ocular side separated by 11–12 scale rows and related it to *C. canariensis*. *Cynoglossus cadenati honoris* was rightly included in the synonymy of *C. cadenati* by Chabanaud (1955a:450).

*TYPE SPECIMENS*.—MNHP 49.20, 145 mm SL, holotype of *C. cadenati*, Senegal, W Africa, coll. M. J. Cadenat, 1947. 1, MNHP B 2547, 104 mm SL, paratypes of *C. cadenati*, collected along with

the holotype. MNHP 49.21, 106.5 mm SL, holotype of *C. cadenati honoris*, Sierra Leone, J. Cadenat, 1947.

## 20. *Cynoglossus dollfusi* (Chabanaud)

*Paraplagusia dollfusi* Chabanaud, 1931:303 [type-locality: Suez Canal].

*Cynoglossus dollfusi*.—Gruvel and Chabanaud, 1937:8 [Suez Canal].

*Trulla dollfusi*.—Fowler, 1956:183.

*Cynoglossus lingua* [not Hamilton-Buchanan].—Gruvel and Chabanaud, 1937:10 [Suez Canal].

*Cynoglossus cleopatrides* Chabanaud, 1949e:146 [type-locality: Suez Canal].

*DESCRIPTION*.—Based on the holotype of *C. cleopatrides* Chabanaud, 129.0 mm SL.

Depth of body 18.99, length of head 18.60 percent of standard length. Diameter of eye 16.67, interorbital space 8.33 percent of length of head. Two nostrils on ocular side, anterior nostril in front of lower eye, posterior nostril in the anterior half of the interorbital space. Snout rounded, 27.08 percent of length of head, rostral hook rather short, ending in front of the perpendicular of the anterior border of fixed eye. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, nearer to tip of snout than to branchial opening, tip of snout to angle of mouth 45.83, angle of mouth to branchial opening 52.08 percent of length of head.

*Scales*: Moderate size, ctenoid on ocular side, including those on lateral lines, weakly ctenoid on blind side.

*Lateral-Line System*: Two lateral lines on ocular side, midlateral line with 70 scales, 11 scales between middle and upper lateral lines. No lateral line on blind side.

*Fins*: Dorsal with 115 rays, anal with 85 rays, caudal 8 (radiograph).

*Vertebrae*: 53, comprising 9 abdominal and 44 caudal elements (radiograph).

*Coloration*: Upper side brownish, lower whitish or yellowish in preserved specimens.

*Size*: The only specimen examined is the holotype of *C. cleopatrides*.

*DISTRIBUTION*.—Suez Canal.

*DIAGNOSIS AND AFFINITIES*.—The nearest relative of *C. dollfusi* is *C. cadenati*; it differs from *C. cadenati* in having a lesser number of rays in the caudal fin.

NOTE ON SYNONYMY.—Chabanaud described *C. dollfusi* from the Suez Canal, basing his description on a single specimen, 33.0 mm in TL, and characterized it as having three lateral lines in the ocular side, 11 series of scales between the middle and upper lateral lines, and with ctenoid scales on both the sides. The type of *C. dollfusi* is not available in Paris but Gruvel and Chabanaud (1937:35, figs. 9–12) redescribed the species based on the same specimen and illustrated it. I examined the holotype of *C. cleopatrides* Chabanaud and found it to conform well in all respects, including the number of scales between the upper and middle lateral lines, with the description of *C. dollfusi* except for the absence of any trace of the ventral lateral line on the ocular side. As had been pointed out, there is considerable variation in the development of the lower lateral line among individuals of the same species of *Cynoglossus* (even of the same size), and the presence or absence of this line should not be depended upon for species differentiation. Chabanaud's description of *C. cleopatrides* is, however, inaccurate in so far as the nature of scales on the blind side of the body is concerned—the scales on the blind side of the holotype are ctenoid and not cycloid as mentioned in the description. I have, therefore, no hesitation in synonymizing *C. cleopatrides* with *C. dollfusi*.

TYPE SPECIMENS.—MNHP 49.24, 129 mm SL, holotype of *C. cleopatrides*, Suez Canal, coll. Prof. R. P. Dollfus, 1928.

## 21. *Cynoglossus sinusarabici* (Chabanaud)

FIGURE 25; PLATE 9

*Dollfusichthys sinusarabici* Chabanaud, 1931:304 [type-

locality: Suez Canal]; 1934a:158.—Gruvel and Chabanaud, 1937:6, figs. 5–8.—Ben-Tuvia, 1953:13; 1963:115; 1966:267. *Cynoglossus sinusarabici*.—Chabanaud, 1939:30; 1954:465; 1955b:166. *Cynoglossus brachycephalus* [not Bleeker].—Chabanaud, 1951b:78 [with one lateral line].

DESCRIPTION.—Based on 2 specimens, 83.0 and 99.0 mm SL, the lectotype and paralectotype of *C. sinusarabici*.

Depth of body 23.23–25.30 ( $M = 24.26$ ), length of head 19.70–20.48 ( $M = 20.09$ ) percent of standard length. Diameter of eye 15.38–17.65 ( $M = 16.52$ ) percent of head, interorbital space absent. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in front of eyes. Snout rounded, 26.47–30.77 ( $M = 28.62$ ) percent of length of head, rostral hook short, ends in front of anterior nostril. Maxillary extending below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, much nearer to tip of snout than to branchial opening, tip of snout to angle of mouth 43.59–47.06 ( $M = 45.32$ ), angle of mouth to branchial opening 58.82–61.54 ( $M = 60.18$ ), percent of length of head.

*Scales*: Ctenoid on both sides.

*Lateral-Line System*: Only midlateral line present on ocular side with 54–60 scales, 11 scales from base of dorsal to midlateral line at middle of body. No lateral line on blind side.

*Fins*: Dorsal with 99–101 rays, anal with 78–79 rays, caudal 8 in 2 specimens (radiograph).

*Vertebrae*: 48–50 comprising 9 abdominal and 39–41 caudal elements in 2 specimens (radiograph).

*Coloration*: Upper side uniform brown, lower whitish in preserved specimens.

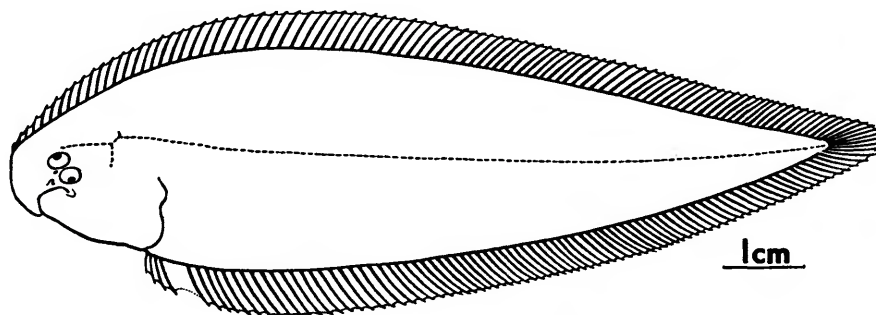


FIGURE 25.—Outline drawing of *C. sinusarabici* (BMNH 1938.107.11) from Great Bitter Lake, Suez Canal.

*Size:* Largest specimen examined, 107 mm (99 mm SL) is the lectotype of *C. sinusarabici*.

*DISTRIBUTION.*—Red Sea, Suez Canal, and eastern Mediterranean (Israel); recorded from a depth of not more than 75 fms.

*DIAGNOSIS AND AFFINITIES.*—In *C. sinusarabici* only the midlateral line is present, which readily distinguishes it from the other members of the *ecaudatus* complex.

*TYPE SPECIMENS.*—Chabanaud (1931:304) described *C. sinusarabici* on the basis of 24 specimens, the maximum length being 134 mm, from the Gulf of Suez. 1 specimen, MNHP 1967-600a, 99.0 mm SL, which is selected here as the lectotype, agrees well with the original description of the species. Fourteen other paralectotypes, MNHP 1967-600b, are available in the Paris Museum. The whereabouts of the rest of the 9 original specimens are not known to me.

#### The *sealarki* complex

*Cynoglossus sealarki*, *C. microphthalmus*, *C. zanzibarensis*, and *C. capensis* form the *sealarki* complex, the characteristics of which are the absence of the posterior nostril, comparatively smaller eyes with a very narrow interorbital space, three lateral lines on ocular side, and relatively small scales on the body, the interlinear scale count being 10-11 or 14-15 or 17. Their distribution is now the central and western parts of the Indian Ocean. They seem to have descended from the same ancestral stock from which the *kopsi* complex of species evolved.

## 22. *Cynoglossus sealarki* Regan

FIGURE 26; PLATE 10

*Cynoglossus sealarki* Regan, 1908:235, pl. 26: fig. 1 [type-locality: Saya-de-Malha Bank].—Norman, 1928:195.

*DESCRIPTION.*—Based on 4 specimens, 164-182 mm SL, including the lectotype and the paralectotypes of *C. sealarki*.

Depth of body 23.08-24.39 ( $M = 23.50$ ), length of head 18.45-21.67 ( $M = 19.99$ ) percent of standard length. Diameter of eye 9.38-12.82 ( $M = 11.08$ ) percent of length of head, interorbital space 2.56-3.23 ( $M = 2.90$ ) percent. Anterior nostril of eyed side tubular, in front of lower eye, posterior nostril absent. Snout rounded, 30.77-35.48 ( $M = 32.87$ ) percent of head, rostral hook very short, extending to front of anterior nostril. Maxillary extending to below middle of fixed eye; angle of mouth extending to below vertical from anterior half of fixed eye, and nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 30.77-45.16 ( $M = 37.92$ ), angle of mouth to branchial opening 42.31-61.29 percent of length of head.

*Scales:* Ctenoid on ocular side including those of lateral lines; scales on blind side cycloid anteriorly and ctenoid posteriorly.

*Lateral-Line System:* Three lateral lines on ocular side, midlateral line with 64-66 scales, 10-11 scales between middle and upper lateral line in 3 specimens. No lateral line on blind side.

Interlinear scale rows	10	11
Frequencies	1	2

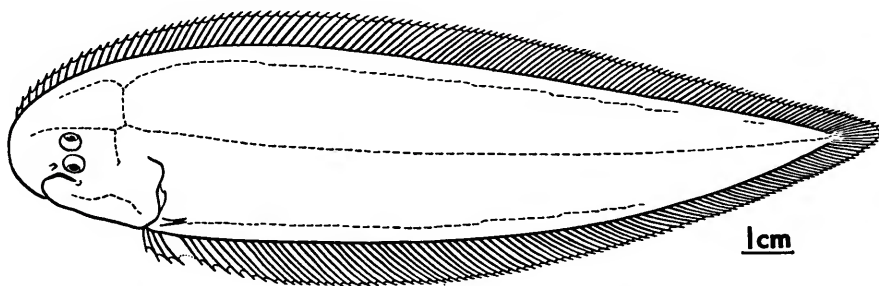


FIGURE 26.—Outline drawing of *C. sealarki*, paralectotype (BMNH 1908.3.23.154) from Saya-de-malha.

*Fins*: Dorsal with 112–116 ( $M = 114$ ) rays, anal with 92–96 rays, caudal 10 in 2 specimens (radiograph).

*Vertebrae*: 57 comprising 9 abdominal and 48 caudal elements in 2 specimens (radiographs).

*Coloration*: Upper side uniform brown, lower whitish in preserved specimens.

*Size*: Largest specimen examined the lectotype of *C. sealarki*, is 190 mm.

*DISTRIBUTION*.—Saya-de-Malha Bank; recorded from a depth of over 123 fms.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus sealarki* is closely allied to *C. microphthalmus*. It can, however, be distinguished by its larger scales, the interlinear scale count being 10–11, whereas *C. microphthalmus* has 14 scale rows between its middle and upper lateral lines.

*NOTE ON SYNONYMY*.—Regan (1908:235) described *C. sealarki* based on four specimens, 172 to 190 mm in TL, from Sayade Malha, over 123 fms. There has been no question of the identity of the species.

*TYPE SPECIMENS*.—From the syntype series a specimen, BMNH 1908.3.23.153, 182 mm SL, from Saya-de-Malha Bank, coll. Gardiner, is selected here as the lectotype of *C. sealarki*, and 3 specimens, BMNH 1908.3.23.154–156, 164–180 mm SL, collected along with the lectotype are paralectotypes.

### 23. *Cynoglossus microphthalmus* (Bonde)

FIGURE 27

*Areliscus microphthalmus* Bonde, 1922:24, pl. 4: fig. 3 [type-locality: Natal Seas]; 1925:292 [Delagoa Bay].  
*Trulla microphthalmus*.—Barnard, 1925:416.

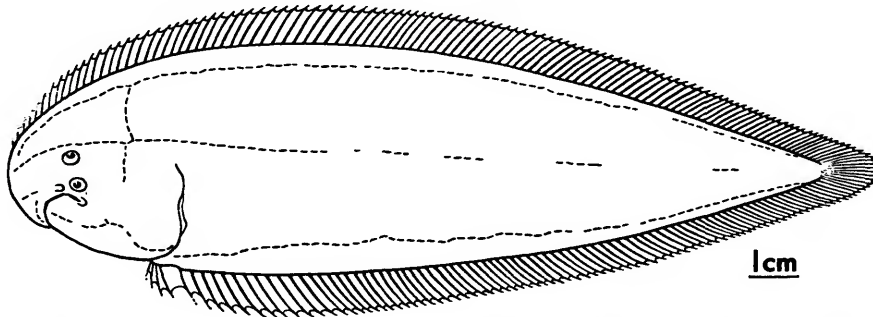


FIGURE 27.—Outline drawing of *C. microphthalmus*, holotype (BMNH 1922.3.27.17) from Natal.

*DESCRIPTION*.—Based on the holotype of *C. microphthalmus*, 164.0 mm SL.

Depth of body 29.27, length of head 21.34 percent of standard length. Diameter of eye 11.43, interorbital space 5.71 percent of length of head. Anterior nostril on ocular side tubular, in front of lower eye, posterior nostril absent. Snout rounded, 30.00 percent of length of head, rostral hook rather short, extending to front of anterior nostril. Maxillary extending to below posterior border of fixed eye; angle of mouth extending to below vertical from posterior half of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 44.29, angle of mouth to branchial opening 58.57 percent of length of head.

*Scales*: Ctenoid on ocular side, including those of lateral lines; scales on blind side cycloid anteriorly and weakly ctenoid posteriorly.

*Lateral-Line System*: Three lateral lines on ocular side, midlateral line with 79 scales, 14 scales between middle and upper lateral lines, ventrolateral line slightly undulated. No lateral line on blind side.

*Fins*: Dorsal with 108 rays, anal with 86 rays, caudal 10.

*Vertebrae*: (Not counted).

*Coloration*: Upper side light brown, lower whitish in preserved specimens.

*Size*: The only specimen examined, 174.5 mm, is the holotype of *C. microphthalmus*.

*DISTRIBUTION*.—Natal, South Africa; recorded from a depth of 29 fms.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus microphthalmus* is closely allied to *C. sealarki*, but it can be easily distinguished by its wider interorbital space (5.71 percent of length of head cf. 2.90 percent).

TYPE SPECIMENS.—Holotype of *C. microphthalmus*, BMNH 1922.3.27.27, 164 mm SL, Natal, coll. Gilchrist.

24. *Cynoglossus zanzibarensis* Norman

FIGURE 28; PLATE 10

*Cynoglossus (Trulla) zanzibarensis* Norman, 1939:105, fig. 36 [type-locality: Zanzibar, 183–293 m].—Nielsen, 1961:226 [off Durban, 430–595 m]; 1964:132 [off Durban, 230 m].

DESCRIPTION.—Based on 15 specimens, 49.0–172.0 mm SL, including the lectotype and paralectotype of *C. zanzibarensis*.

Depth of body 21.78–28.19 ( $M = 25.60$ ), length of head 20.72–24.10 ( $M = 21.98$ ) percent of standard length. Diameter of eye 8.82–13.33 ( $M = 11.28$ ), interorbital space absent or narrow, 0.31–4.76 ( $M = 2.75$ ) percent of length of head. Anterior nostril on ocular side tubular, in front of lower eye, posterior nostril absent. Snout rounded, 27.27–35.0 ( $M = 32.55$ ) percent of length of head; rostral hook very

short, extending to front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending to below vertical from middle of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 37.33–47.06 ( $M = 41.93$ ), angle of mouth to branchial opening 53.85–64.71 ( $M = 58.15$ ) percent of length of head.

*Scales*: Ctenoid on both sides, those of head on blind side rather weakly ctenoid.

*Lateral-Line System*: Three lateral lines on ocular side, midlateral line with 72–76 scales, 13–15 scales between them. No lateral line on blind side.

Interlinear scale rows	13	14	15
Frequencies	2	4	4

*Fins*: Dorsal with 116–121 ( $M = 119$ ) rays, anal with 94–99 ( $M = 96$ ) rays, caudal 10 in 6 specimens (radiographs).

*Vertebrae*: 51–58, comprising 9 abdominal and 42–49 caudal elements in 6 specimens (radiographs).

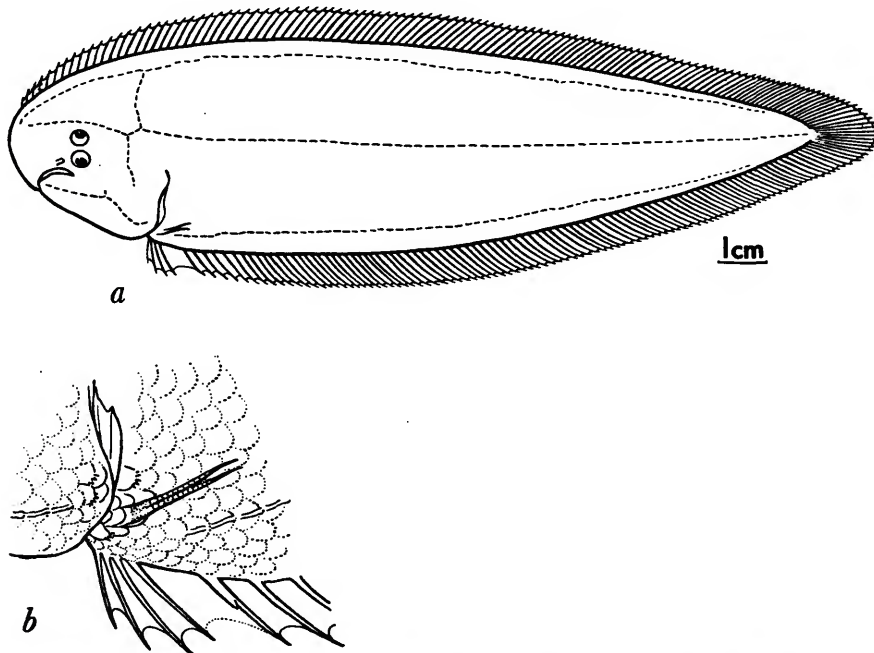


FIGURE 28.—*C. zanzibarensis*, paralectotype, (BMNH 1939.5.24.1810) from Zanzibar area: *a*, outline drawing of lateral view; *b*, details of pelvic fin; pelvic fin of eyed side persists as rudimentary structure.



*Coloration*: Upper side brownish, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 185 mm, is from the Arabian Sea, lat. 21°23'N, long. 69°46'E.

*DISTRIBUTION*.—Durban through Zanzibar to Kenya.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus zanzibarensis* is closely related to *C. capensis*, especially in the position of the eyes, which are close together leaving a very narrow or no interorbital space. From *C. capensis* it is readily differentiated by the ctenoid scales on both sides of its body.

*NOTE ON SYNONYMY*.—Originally described on the basis of five specimens, 130–177 mm in TL, collected off Zanzibar by John Murray Expedition. *Cynoglossus zanzibarensis* is well diagnosed and there has been no confusion with regard to its identity.

*TYPE SPECIMENS*.—A specimen, BMNH 1939.5.24.1813, 149 mm SL, from Zanzibar, which is an excellent example of the species, is selected here as the lectotype of *C. zanzibarensis* and four specimens, BMNH 1939.5.24.1810–12 and 14, 120–169 mm SL are paralectotypes.

*OTHER MATERIAL EXAMINED*.—3 specimens, SOSC Ref 170, Kenya coast, lat. 02°56'S, long. 40°28'E, coll. Anton Bruun. 1, SOSC Ref 23, Kenya coast, lat 20°50'S, long. 40°31'E, coll. Anton Bruun. 2, SOSC Ref 170, Mozambique coast, lat. 25°12'S, long. 34°04'E, coll. Anton Bruun. 5, SOSC Ref 170, Mozambique coast, coll. Anton Bruun.

## 25. *Cynoglossus capensis* (Kaup)

### PLATE 11

*Trulla capensis* Kaup, 1858:109 [type-locality: Cape of Good Hope].—Thompson, 1918:128.—Bonde, 1925:292 [Delagoa Bay].—Barnard, 1925:416.—Smith, 1949:166, pl. 2: fig. 342.

*Plagusia capensis*.—Castelnau, 1861:71.

*Cynoglossus capensis*.—Günther, 1862:503.—Boulenger, 1902:

4.—Nielsen, 1964:133 [Cape Barracouda, Agulhas Bank]

*Areliscus capensis*.—Bonde, 1922:24.

*DESCRIPTION*.—Based on 6 specimens, 87.0–293.0 mm SL.

Depth of body 23.56–43.70 ( $M = 29.21$ ), length of head 18.09–34.03 ( $M = 21.68$ ) percent of standard length. Diameter of eye 10.71–12.90 ( $M = 11.54$ ), interorbital space absent or very narrow, 1.79–1.89 ( $M = 11.84$ ) percent of length of head. Anterior nostril on ocular side, in front of lower eye, posterior nostril absent. Snout rounded, 28.40–35.85 ( $M = 32.14$ ) percent of length of head, rostral hook very

short, ends well in front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth reaching below vertical from middle of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 37.14 46.77 ( $M = 43.20$ ), angle of mouth to branchial opening 56.79–62.50 ( $M = 59.65$ ) percent of length of head.

*Scales*: Ctenoid on ocular side; scales of blind side cycloid anteriorly, weakly ctenoid posteriorly.

*Lateral-Line System*: Three lateral lines on ocular side, midlateral line with 98–104 scales, 15–17 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	15	16	17
Frequencies	1	-	2

*Fins*: Dorsal with 108–110 ( $M = 109$ ) rays, anal with 85–86 ( $M = 85$ ) rays, caudal 10 in 3 specimens (radiographs).

*Vertebrae*: 50–52 comprising 9 abdominal and 41–43 caudal elements, in 3 specimens (radiographs).

*Coloration*: Upper uniformly brown, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 314 (293 + 21) mm, is from False Bay, South Africa.

*DISTRIBUTION*.—South Africa (from Saldanha Bay to Natal) recorded from a depth of 10–60 fms.

*DIAGNOSIS AND AFFINITIES*.—Superficially and in many morphometric characters *C. capensis* resembles *C. zanzibarensis*. It is distinguished, however, by its deeper body, the cycloid nature of the scales of the anterior part of the blind side, and 15 to 17 scale rows between its middle and upper lateral lines.

*TYPE SPECIMENS*.—Kaup's (1858:108) brief description of *C. capensis* from the Cape of Good Hope was based on a single specimen without indication of its size. Kaup apparently did not retain the specimen on which his description was based and I have found no evidence that it is extant.

*OTHER MATERIAL EXAMINED*.—1 specimen, BMNH 1897.10.18.1, False Bay, coll. Gilchrist. 1, BMNH 1891.9.3.2, Algoa Bay, coll. Leslie. 1, BMNH 1904.11.4.4, Cape Point, coll. Gilchrist. 1, BMNH 1922.3.27.22, Natal, Gilchrist. 2, MCZ 11184, Cape of Good Hope, coll. Sayard.

### The *arel* group

This group is more highly specialized for a

burrowing habit than the previous groups and is typified by relatively larger adult size, more elongate body, total absence of any lateral-line system on blind side, 10 rays in caudal fin, two lateral lines on ocular side, relatively small eyes separated by a narrow interorbital space, two nostrils on ocular side, somewhat obtusely pointed long snout with angle of mouth situated nearer to branchial opening than to tip of snout, and large scales, ctenoid on ocular side and cycloid on blind side. The obtusely pointed snout with the consequent placing of the angle of mouth nearer to branchial openings, more elongate body, and smaller eyes are further specializations toward a burrowing mode of life.

Included in this group is the *arel* complex consisting of *C. arel*, *C. robustus*, and *C. lingua*; *C. arel* with an interlinear scale formula of seven to nine scales being closest to the evolutionary stem of this group. Their combined range covers the whole of the Malay Archipelago extending north to Japan and west to India, Pakistan, and the Persian Gulf. This group, which has certain similarities with the *canariensis* and *bilineatus* complexes, appears to have evolved in the main generic evolutionary center as an early offshoot from the stock that gave rise to the *canariensis* group.

### The *arel* complex

*Cynoglossus arel*, *C. robustus*, and *C. lingua* form the *arel* complex, which is the only complex within the *arel* group. The characteristics of the complex are, therefore, the same as given above for the group.

## 26. *Cynoglossus arel* (Schneider)

FIGURE 29; PLATE 11

- Pleuronectes arel* Schneider, 1801:159 [type-locality: Tranquebar, east coast of Madras].
- Cynoglossus arel*.—Norman, 1928:201.—De Silva, 1956:199 [Palk Bay, Ceylon].—Saramma, 1963:76 [Kerala coast].
- Cynoglossus melampetala* Richardson, 1846:281 [China].—Whitehead, 1969:218, pl. 29a.
- Cynoglossus melampetalus*.—Günther, 1862:496.—Bleeker, 1873:131 [Canton].—Günther, 1880:55 [Hong Kong].—Sauvage, 1881:107 [Swatow].—Wu, 1932:148.—Fowler, 1934b:221.—Chu, 1963:540, fig. 406.—Shen, 1967:216.
- Plagusia grandisquamis* Cantor, 1850:1214 [type-locality: seas of Penang].
- Trulla grandisquamis*.—Kaup, 1858:109.

- Cynoglossus grandisquamis*.—Günther, 1862:503.—Duncker, 1904:169.—Weber and de Beaufort, 1929:208.
- Plagusia potous* [not *potous* Cuvier].—Cantor, 1850:1217 [type-locality: seas of Malay Peninsula and islands].
- Plagusia macrolepidota* Bleeker, 1851a:415 [type-locality: Batavia]; 1852:25.
- Arelia macrolepidota*.—Bleeker, 1859:184.
- Cynoglossus macrolepidotus*.—Günther, 1862:496.—Bleeker, 1875:34, pl. 242; fig. 2.—Day, 1877:434, pl. 96; fig. 3; 1889:455.—Alcock, 1889:288.—Rutter, 1897:89.—Seale, 1910:288.—Jenkins, 1910a:30.—Norman, 1928:202, fig. 18.—Weber and de Beaufort, 1929:205.—Herre, 1933:5 [Sandakan].—Fowler, 1934b:219; 1937:87.—Okada and Matsubara, 1938:437 [Formosa, Java, Banka].—Herre, 1941:392 [Andaman Is.].—Suvatti, 1950:327.—Herre, 1953:190.—Munro, 1955:265, pl. 51; fig. 770.—Fowler, 1956:186, fig. 101.—De Silva, 1956:197.—Scott, 1959:43.—Kuronuma, 1961:32.—Saramma, 1963:76.—Punpoka, 1964:64.—Pradhan, 1964:458.—Chen and Weng, 1965:95, fig. 66.—Shen, 1967:215.
- Plagusia cantoris* Bleeker, 1853a:153 ["Hindustan and Archipelagus, Indicum" based on 2 stuffed specimens of Cantor's *P. potus* from Singapore].—Günther, 1862:502.—Bleeker, 1875:33.
- Plagusia oligolepis* Bleeker, 1854b:445.
- Arelia olegolepis*.—Bleeker, 1859:185.
- Cynoglossus oligolepis*.—Günther, 1862:496.—Bleeker, 1875:34, pl. 242; fig. 3.—Steindachner, 1867:587 [Ning-Pou].—Bleeker, 1873:134 [Ning Pou].—Day, 1877:433, pl. 95; fig. 4; 1889:455.—Alcock, 1887:280.—Johnstone, 1904:209.—Weber, 1913b:441.
- Cantoria pinangenensis* Kaup, 1858:106 [based on *Plagusia cantoris* Bleeker].
- Arelia kaupii* Bleeker, 1860a:73.
- Cynoglossus kaupii*.—Günther, 1862:497.—Bleeker, 1875:32, pl. 244; fig. 4.—Weber and de Beaufort, 1929:196.
- Cynoglossus elongatus* Günther, 1862:501 [type-locality: East Indian seas].—Bleeker, 1875:34.

DESCRIPTION.—Based on 26 specimens, 150.0–330.0 mm SL, including the holotype of *C. macrolepidotus* and *C. oligolepis*.

Depth of body 19.94–25.81 ( $M = 22.73$ ), length of head 19.69–28.39 ( $M = 23.99$ ) percent of standard length. Diameter of eye 6.61–10.85 ( $M = 8.48$ ), interorbital width 1.75–5.21 ( $M = 3.43$ ) percent of length of head. Two nostrils on eyed side, the anterior one tubular in front of lower eye, posterior simple in the anterior half of the interorbital space. Snout obtusely pointed, 20.66–41.89 ( $M = 35.87$ ) percent of length of head, rostral hook short, extending to front of the anterior nostril. Maxillary extending to beyond the fixed eye; angle of mouth extending to below vertical from hind border of fixed eye or little beyond, more or less midway between tip of snout and branchial opening; tip of snout to angle of mouth 46.25–55.10 ( $M = 50.71$ ), angle of mouth

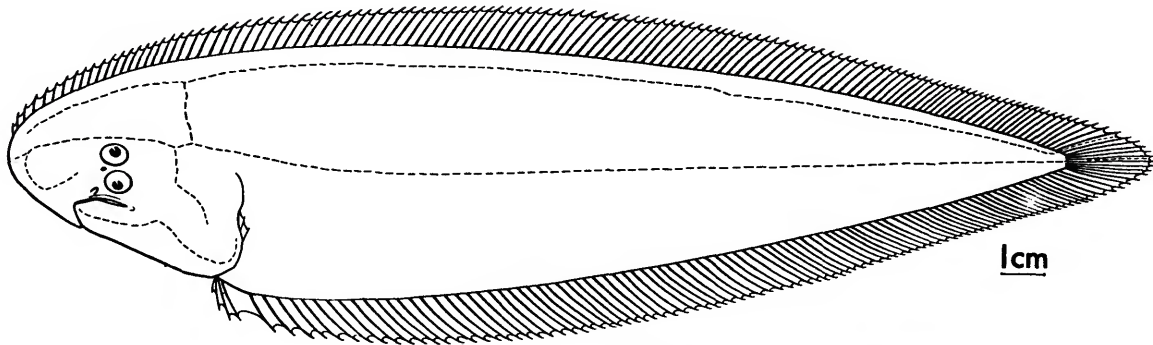


FIGURE 29.—Outline drawing of *C. arel* (BMNH 1848.3.16.193) from Chinese seas.

to branchial opening 46.49–53.49 ( $M=49.33$ ) percent of length of head.

**Scales:** Ctenoid on ocular side, including scales on lateral line, those on head rather weakly serrated; scales on blind side cycloid.

**Lateral-Line System:** Two lateral lines on eyed side, median lateral line with 56–70 scales, 7–9 scales between them. No lateral line on blind side.

Interlinear scale rows	7	8	9
Frequencies	20	43	10

**Fins:** Dorsal with 116–130 ( $M=125$ ) rays, anal with 85–98 ( $M=95$ ) rays, caudal 10 in 42 specimens (radiographs).

**Vertebrae:** 50–57 comprising 9 abdominal and 41–48 caudal elements in 42 specimens (radiographs).

**Coloration:** Upper side more or less uniformly brownish, lower whitish in preserved material.

**Size:** Largest specimen examined, 365.0 mm SL, from Madras, India.

**DISTRIBUTION.**—From Malay Archipelago, through seas of India to Persian Gulf and through South China Sea to Philippines and Taiwan; recorded from a depth of 5–45 fms.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus arel* is closely related to both *C. lingua* and *C. robustus*. It is distinguished by the lower number of interlinear and midlateral scales, anal and dorsal rays, and vertebrae than the other two species. *Cynoglossus arel* appears to be less specialized than *C. robustus* for a burrowing mode of life in that it has a shorter snout (mean length 35.87 percent of length of head cf. 39.36 percent) and larger

eyes (mean diameter of eye 8.48 percent of length of head cf. 7.84 percent).

**NOTE ON SYNONYMY.**—Schneider's (1801:159) description of *P. arel* is not quite adequate to distinguish it from most other species of *Cynoglossus*. He described *C. arel* on the basis of four dried specimens from Tranquebar on the east coast of Madras, India, neither giving any illustration of the species nor mentioning the size of his specimens. In the original description, the number of scale rows between the upper and middle lateral lines was not indicated, which in fact had created the confusion in the identity of the species. Richardson (1846:281) described *C. melampetala* from China, based on John Reeve's collections of Chinese drawings; Cantor (1850:1214) described *Plagusia grandisquamis* on the basis of a specimen from Penang; Bleeker (1851a:415) described *P. macrolepidota* from Batavia, and Bleeker (1860a:73) described *Arelia kaupii* from Sumatra. Bleeker in his *Atlas* (1875:34, pl. 242: fig. 2) redescribed *C. macrolepidotus* and illustrated it. His description and illustration were so good that subsequent workers identified this common and widely distributed Indo-West Pacific species with *C. macrolepidotus*, not suspecting that the earlier name *arel* was its senior synonym. Bleeker (1853a:153), based on two stuffed specimens of Cantor's *Plagusia potous*, 217 and 322 mm SL, from Singapore, described another species *P. cantoris*, which he differentiated from all other known species on the basis of both nostrils being placed above the upper lip in front of the lower eye. I have examined the types of *P. cantoris*; even though varnished over, the position of the nostrils cannot be

detected. Likewise, Cantor's *P. grandisquamis*, which is differentiated by only one nostril in front of the lower eye, the absence of the narial openings between the eyes, and two lateral lines on ocular side separated by six scale rows, is also represented in the British Museum by a stuffed specimen. I have examined it and though the presence of the nostrils in the varnished skin is not discernible, an inter-linear count of seven scales can be determined, a distinctive characteristic feature of *C. arel*.

While describing *P. oligolepis* and *A. kaupii*, Bleeker did not compare them with any other species. From his description it would appear that he considered *P. oligolepis* different from *C. macrolepidotus* on the basis of a narrower interorbital space, the situation of the angle of the mouth being somewhat nearer to the gill opening than to the tip of mouth, and a slightly greater depth of the body. *Cynoglossus kaupii*, described on the basis of a single specimen, was differentiated both in its original description and in Bleeker's *Atlas* from all other species by two lateral lines on both sides. Günther (1862) considered *C. macrolepidotus*, *C. oligolepis*, and *C. kaupii* as distinct species, but about *C. kaupii* he remarked that "*Pleuronectes arel* Bl. Schn. p. 159, or *Arelia schneider* Kaup, l.c., appears to be closely related to this species." He described another species, *C. elongatus*, based on a specimen of Cantor's *Plagusia potous* from Penang, and characterized it as a somewhat elongated fish with the depth of the body being "six times and two-thirds in the total length." I have not been able to locate Cantor's stuffed specimen that formed the basis for Günther's *C. elongatus*, but from the description, "two lateral lines on the left side, separated by about eight longitudinal series of scales at their point of greatest distance," the identity of the species is unmistakable and is readily referable to *C. arel*.

Sixty-one years after the original description of *C. arel*, Norman (1928:201) examined the type of *C. arel* from the Berlin Museum and resurrected the species. He further synonymized *C. oligolepis* with *C. arel* but somehow retained *C. macrolepidotus* as a separate species, differentiating it from *C. arel* by its somewhat deeper body. I have examined a large number of specimens of various sizes including specimens from Madras, the type-locality of *C. arel*, and compared them with the specimens labeled as *C. macrolepidotus* in the British Mu-

seum, including a specimen from Bleeker's collection (BMNH 1862.6.3.8), and I have come to the definite conclusion that the differences noted by Norman in the proportional measurements are attributable to intraspecific variation and that they are conspecific. *Cynoglossus kaupii*, from the original description as well as from Bleeker's excellent illustration, appears to exhibit no significant difference from *C. arel*; eight or nine scales between the lateral lines on the left side fairly well confirm the identity of the species. *Plagusia melampetalus* Richardson (1846) is synonymized with *C. arel*, because from the characterization of the species in the original description, especially the indication that the two lateral lines on the left side are separated by seven series of scales, the identity of the species is unmistakable.

TYPE SPECIMENS.—Holotype of *P. arel*, ZMB 2431, 207 mm SL, 221 mm TL, Tranquebar, east coast of Madras. (Dr. C. Karrer kindly examined the type in the Zoological Museum, Berlin and gave the necessary details).

Bleeker's description of *P. macrolepidota* was based on 7 specimens, 155–240 mm in TL, from Batavia. In his *Atlas* (1875:34, pl. 242: fig. 2) he redescribed and illustrated the species based on 17 specimens, 155–240 mm in TL, and illustrated a specimen of 240 mm in TL. Among the Bleeker collection in Leiden there are 6 specimens, cataloged as RMNH 6785 (pers. comm., Dr. M. Boeseman). The specimen, 218 mm SL (239 mm TL), that formed the basis for Bleeker's illustration and has already been indicated as such by a label in the bottle by Chabanaud in 1946 is selected here as the lectotype. RMNH 6785 is now restricted to the lectotype and the rest of the 5 specimens, 134–190 mm SL (146–206 mm TL), are paralectotypes and have been recataloged as RMNH 26209 (Dr. M. Boeseman examined the types on my behalf and selected the paralectotypes).

Bleeker's description of *P. oligolepis* was based on one specimen, 365 mm in TL, from Batavia. Among the specimens in the Bleeker collection in Leiden, there are two specimens cataloged as RMNH 6786 (pers. comm., Dr. M. Boeseman). A specimen measuring 338 mm SL (365 mm TL) is considered to be the holotype of *P. oligolepis* and is retained as RMNH 6786, the other specimen, 272 mm SL (293 mm TL), having been removed.

Bleeker's description of *A. kaupii* was based on

one specimen, 255 mm in TL, from Benkulen, Sumatra. Among the Bleeker collection in Leiden there is a specimen, 232 mm SL (248 mm TL), coll. J. A. W. Van Ophuysen, 1858, cataloged as RMNH 6783 (pers. comm., Dr. M. Boeseman) and it is the holotype of *A. kaupii*.

OTHER MATERIAL EXAMINED.—CHINA: 1 specimen, BMNH 1848.3.16.198, China Sea, coll. Vice Admiral E. Belcher. 2, BMNH 1879.5.14.79–80, Hong Kong, coll. Challenger. 1, BMNH 1924.12.15.82, Santuas, China, coll. Light. 4, BMNH 1924.12.15.83–86, Amoy, coll. Light. 1, BMNH 1955.5.18.6, S China, coll. Lin. 1, USNM 6511, China, coll. Stempson. 3, USNM 36895, Hong Kong, coll. W. Stempson. 1, USNM 56430, China, coll. Jouy. 1, USNM 137951, Hong Kong Mkt., coll. Albatross. 3, USNM (unregistered), Hong Kong, Fisheries Research Sta, Hong Kong. 1, MCZ 33194, Hong Kong. 1, ANSP 76713, Tai Po, China, coll. G. C. Herklots. 1, ANSP 77399, Hong Kong, China, coll. G. C. Herklots.

INDONESIA: 1, BMNH 1862.5.3.2, Batavia, coll. P. Bleeker. 1, BMNH 1931.4.23.48, Batavia Mkt., coll. Hardenberg. 1, BMNH 191.4.23.49, Cheriban, Java, coll. Hardenberg. 1, BMNH 191.4.23.50, Kelampis, Madura, coll. Hardenberg. 1, USNM 72749, Java, coll. B. Palmer. 4, UMMZ 154921 (OR.274495), Batavia, coll. Hubbs and Hardenberg. 1, MCZ OR.274867, Java, Surabaya, coll. Hubbs and Palmer. 1, MCZ OR.274867, Batavia. 1, NHV OR.276012, Padang, coll. Dr. K. Paul. 1, UZMK OR.275455, lat. 5°56'S, long. 106°34'E, coll. Th. Mortensen. 2, UZMK (unregistered) Lampong Bay, coll. Th. Mortensen. 1, UZMK (unregistered), lat. 6°22'S, long. 105°44'E, coll. Th. Mortensen, 26.7.22. 1, UZMK (unregistered), Bantam Bay (Sta 105), coll. Th. Mortensen, 5.8.22.

THAILAND: 2, UZMK (unregistered), Gulf of Thailand, lat. 6°57'N, long. 99°23'E, and lat. 7°00'N, long. 99°21'E, 30–26 m, coll. BM-Thai-Danish Expd., 10.2.66. 5, UZMK (unregistered), Gulf of Thailand, Jan–Feb 1966. 1, UZMK (unregistered), Gulf of Thailand. 4, ANSP 76816, Thailand, coll. R. M. Schauensee. 1, ANSP 87212, Bangkok, coll. R. M. Schauensee. 3, CAS (GVF), lat. 11°59'24"N, long. 102°11'06"E, coll. Naga Expd. 1, CAS (GVF), lat. 13°90'N, long. 100°45'E, coll. Naga Expd. 1, CAS (GVF), lat. 10°26'13.5"N, long. 99°15'27"E, coll. Naga Expd., 18–5–60. 2, GAS (GVF), lat. 12°39'25"N, long. 100°15'45"E, coll. Naga Expd., 13–12–60. 1, GAS (GVF), Gulf of Thailand, lat. 11°49'N, long. 94°49'E, coll. Thai fishermen, 2.1.1960. 4, CAS (GVF), Gulf of Thailand, coll. Naga Expd., 22.4.1960. 11, CAS (GVF), lat. 13°05'50"N, long. 100°26'10"E, coll. Naga Expd., 13.12.1960. 1, CAS (GVF), lat. 13°05'50"N, long. 100°26'10"E, coll. Naga Expd., 13.12.1960. 2, CAS (GVF), lat. 11°40'N, long. 100°39'E and lat. 11°51'N, long. 100°39'E, coll. Thai fishermen, 10.1.1961.

SINGAPORE: 8, MCZ 332208, Singapore, coll. Dr. G. Mead. 1, NHV OR.276012, Singapore, coll. Dr. K. Paul. 1, BMNH 19337.21.27, Singapore, ex. Raffles Mus.

BURMA: 1, BMNH 1928.3.20.96, Gulf of Martaban, ex. Indian Museum. 1, ZSI  $\frac{F 1170}{1}$ , Gulf of Martaban, coll. Marine Survey. 1, ZSI  $\frac{F 253}{2}$ , Mergui Mkt.

INDIA: 1, BMNH 1888.11.6.45, E coast of Madras, coll.

Thurston. 1, BMNH 1867.5.30.12, Madras, coll. F. Day. 1, BMNH 1869–5–30.12, Madras, coll. F. Day. 2, BMNH 1889.2.1.4058, 59, Madras, coll. F. Day. 1, BMNH 1928.3.20.92–91, Orissa coast ex. Indian Museum. 2, BMNH 1928.3.20.93–94, R. Hooghly, ex. Indian Museum. 1, BMNH 1928.3.20.95, Andamans, ex. Indian Museum. 1, BMNH 1928.3.20.97, R. Hooghly, ex. Indian Museum. 1, BMNH 1928.3.20.98, R. Hooghly, ex. Indian Museum. 1, ZSI 1143 (original of Day's pl. 96: fig. 3), Madras, coll. F. Day. 1, ZSI 1190, Madras, coll. F. Day. 1, ZSI 1458 (original of Day's pl. 95: fig. 4), Madras, coll. F. Day. 1, ZSI 2716 (original of Day's pl. 90: fig. 5), Madras, coll. F. Day. 1, ZSI 11588, Sandheads, R. Hooghly, coll. R. M. Daley. 4, ZSI 12111–4, Orissa coast, coll. Marine Survey. 2, ZSI 12215, Orissa coast, 5 mi S of False Pt., 7 fms, coll. Marine Survey. 1, ZSI 12126, Orissa coast, coll. Marine Survey. 1, ZSI  $\frac{F 8760}{1}$ , Orissa coast, coll. Bengal Fisheries Golden Crown.

2 ZSI  $\frac{F 1232}{1}$ , Keechankuppan, 3 mi S of Nagapatnam, coll.

A. G. K. Menon, 8.2.57. 1, ZSI  $\frac{F 2826}{1}$ , Puri coast, coll. N.

Annandale. 1, ZSI  $\frac{F 3445}{1}$ , locality unknown, coll. Bengal

Fisheries Golden Crown. 3, ZSI  $\frac{F 3572}{1}$ , locality not known,

coll. Bengal Fisheries Golden Crown. 3, ZSI  $\frac{F 3648}{1}$ , locality

not known, coll. Bengal Fisheries Golden Crown. 1, ZSI  $\frac{F 1297}{2}$ , Veerampatnam, 3 mi S of Pondicherry, coll. A. G. K.

Menon, 22.12.56. 1, ZSI  $\frac{F 1208}{2}$ , Sonakuppam Village, Cud-

dalore, coll. A. G. K. Menon, Jan 57. 1, ZSI  $\frac{F 1210}{2}$ , Pondi-

cherry Mkt., coll. A. G. K. Menon, 25.12.1956. 1, ZSI  $\frac{F 1229}{2}$ ,

Tranquebar coast, Tanjore Dt., Madras, coll. A. G. K. Menon,

29.1.57. 1, ZSI  $\frac{F 1772}{2}$ , Alibagh, Colaba Dt., Maharashtra

29.1.57. 1, ZSI  $\frac{F 1772}{2}$ , Alibagh, Colaba Dt., Maharashtra

State, coll. K. K. Tiwari, 24.11.55. 33, SOSC Acc. 4, lat.

14°52'N, long. 96°39'E, Sta 39a, coll. Anton Bruun, 31.3.63.

127, SOSC Acc. 4, lat. 15°04'N, long. 95°51'E, Sta 41, coll.

Anton Bruun 31.3.63. 1, SOSC Acc. 4, lat. 15°20'N, long.

96°24'E, coll. Anton Bruun, 31.3.63. 6, SOSC Acc. 4, lat.

15°08'N, long. 94°54'E, Sta 42, coll. Anton Bruun, 1.4.63. 3,

SOSC Acc. 4, lat. 21°52'N, long. 91°36'E, Sta 44, coll. Anton

Bruun, 4.4.63. 5, SOSC Acc. 4, lat. 19°50'N, long. 92°55'E,

coll. Anton Bruun, 5.4.63. 4, SOSC Acc. 4, lat. 19°41'N,

long. 93°08'E, coll. Anton Bruun, 5.4.63. 1, SOSC Acc. 23,

lat. 20°22'N, long. 11°47'E, coll. Anton Bruun, 15.11.63. 129,

SOSC Acc. 23, lat. 20°20'N, long. 70°50'E, 98 fms, coll.

Anton Bruun, 15.11.63. 1, SOSC Acc. 23, lat. 21°23'N, long.

69°46'E, Sta 211A, coll. Anton Bruun, 16.11.63. 1, SOSC Acc.

23, lat. 22°03'N, long. 68°19'E, coll. Anton Bruun, 18.11.63.

8, SOSC Acc. 23, lat. 22°21'N, long. 68°42'E, Sta 217A, 14

fms, coll. Anton Bruun, 18.11.63. 5, SOSC Acc. 23, lat.

lat. 14°52'N, long. 96°39'E, coll. *Anton Bruun*, 31.11.63. 1, SOSC Acc. 4, lat. 14°52'N, long. 96°24'E, Sta 39A., coll. *Anton Bruun*, 31.11.63. 1, SOSC Acc. 23, lat. 21°28'N, long. 59°28'E, coll. *Anton Bruun*, 4.12.63. 2, SOSC Acc. 23, Royapuram Beach, Madras, lat. 13°07'N, long. 80°20'E, coll. *Anton Bruun*, 13.9.66. 1, SOSC Acc. 23, Ennor fish landing, Madras, lat. 13°13'N, long. 80°25'E, coll. *Anton Bruun*, 14.9.66. 5, SOSC. Ref 334, Porto Novo, Madras, lat. 11°30'N, long. 79°50'E, 12 fms, coll. *Anton Bruun*, 21.9.66. 2, SOSC, Porto Novo, Madras, lat. 11°32'N, long. 79°53'E, coll. *Anton Bruun*. 1, SOSC, Pondicherry, lat. 11°55'N, long. 79°53'E, coll. *Anton Bruun*. 1, specimen, SOSC, Veerampatnam, Pondicherry, lat. 11°52'N, long. 39°54'E, coll. *Anton Bruun*. 1, SOSC Acc. 23, Palk Strait, Madras, lat. 09°20'N, long. 79°10'E, coll. *Anton Bruun*, 29.9.66. 2, SOSC Acc. 23, Mandapam Camp, Tamil Nadu, lat. 09°25'N, long. 79°10'E, coll. *Anton Bruun*, 29.9.66. 3, SOSC Ref. 334, lat. 08°39'N, long. 78°15'E, coll. *Anton Bruun*, 1.10.66. 1, SOSC, Porto Novo, Madras, coll. *Anton Bruun*, 2.10.66. 1, SOSC Ref. 381, Porto Novo, Madras, coll. *Anton Bruun*, 9.10.66. 1, SOSC, Madras, coll. T. H. Berry. 4, UZMK (unregistered), Ceylon and Calcutta, lat. 20°51'N, long. 87°58'E, coll. Th. Mortensen, 26.7.51. 2, UZMK (unregistered), Ceylon and Calcutta, lat. 20°51'N, long. 87°58'E, coll. Galathea Expd., 26.4.65. 3, UZMK (unregistered), Bombay, lat. 18°48'N, long. 72°37'E, 20-30 m, coll. Galathea Expd., 12.5.64. 1, ANSP 77146, Bombay, coll. F. F. Hallberg. 1, ANSP 77546, Bombay, coll. F. F. Hallberg. 1, ANSP 77520, Bombay, coll. F. Hallberg. 1, ANSP 88356, Bombay, coll. H. W. Fowler.

PAKISTAN: 1, BMNH 1882.2.1.4060, Sind, coll. F. Day.

PERSIAN GULF: 10, BMNH 1911.2.23.58-67, Persian Gulf, coll. Tounsend. 2, BMNH 1928.3.20.89-90, N end of Persian Guf, ex. Indian Museum.

## 27. *Cynoglossus robustus* Günther

FIGURE 30; PLATE 12

*Cynoglossus robustus* Günther, 1873a:243 [type-locality: Shanghai].—Steindachner, 1896:219 [Japan].—Jordan and Snyder, 1901:123.—Jordan and Starks, 1906a:239 [Japan, China].—Fowler and Bean, 1922:68 [Tokyo]. Jordan and Hubbs, 1925:302 [Kobe].—Fowler, 1930:616 [Hong Kong].—

Wu, 1931:169 [Chi-Pou].—Chu, 1931:95 [Shanghai, Hong Kong].—Wu, 1932:147 [Tehou-San].—Wu and Wang, 1933:304 [Amoy].—Fowler, 1934b:221 [China].—Okada and Matsubara, 1938:437 [Chinese sea].—Mori, 1952:183 [Quelpar Is.].—Kamohara, 1952:86 [Tosa].—Matsubara, 1955:1285 [S Japan, S China Sea].—Tchang, 1955:297, fig. 183.—Chen, 1956:106 [Kaohsiung].—Ochiai, 1959:213.—Chu, 1963:539, fig. 405.—Chen and Weng, 1965:96, fig. 67 [Kulung].—Shen, 1967:213, figs. 130-133 [Kowloon].

*Cynoglossus brunneus* Regan, 1905a:26 [Inland Sea of Japan].—Jordan and Starks, 1906a:239 [Inland Sea of Japan].—Jordan, Tanaka and Snyder, 1913:336 [listed].

*Cynoglossus inusita* Jordan, Tanaka, and Snyder, 1913:335 [type-locality: Tokyo, Nagasaki].—Hubbs, 1915:494 [Kobe].

DESCRIPTION.—Based on 16 specimens, 100.0-388.0 mm SL, including the holotype of *C. robustus*.

Depth of body 21.03-29.25 ( $M = 25.09$ ), length of head 20.16-24.46 ( $M = 22.46$ ) percent of standard length. Diameter of eye 6.52-9.88 ( $M = 7.84$ ), interorbital width 3.70-7.64 ( $M = 5.37$ ) percent of length of head. Anterior nostril tubular, in front of lower eye, posterior nostril simple, in the anterior half of the interorbital space. Snout obtusely pointed 33.58-44.83 ( $M = 39.36$ ) percent of length of head, rostral hook short, extending only to front of anterior nostril. Maxillary extending to beyond fixed eye; angle of mouth extending to just vertical from below posterior border of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 48.91-56.32 ( $M = 53.64$ ) angle of mouth to branchial opening 45.00-57.94 ( $M = 47.99$ ) percent of length of head.

Scales: Ctenoid on ocular side with the lateral-line scales cycloid anteriorly, ctenoid posteriorly; scales on blind side cycloid.

Lateral-Line System: Two lateral lines on eyed side, midlateral line with 70-82 scales, 10 scales between. No lateral line on blind side.

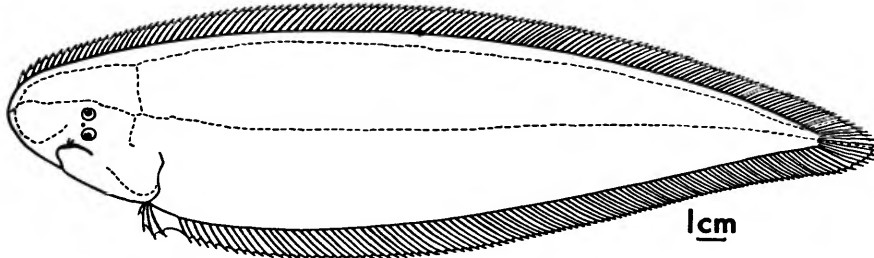


FIGURE 30.—Outline drawing of *C. robustus*, holotype (BMNH 1873.7.30.61) from Shanghai, China.

Interlinear scale rows	10
Frequencies	8

*Fins*: Dorsal with 125–134 ( $M = 129$ ) rays, anal with 90–104 ( $M = 100$ ) rays, caudal 10 in 8 specimens (radiographs).

*Vertebrae*: 56–61 comprising 10 (rarely 9) abdominal and 47–51 caudal elements in 8 specimens (radiographs).

*Coloration*: Upper side light brown, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 413 mm, is from Onomichi, Japan.

**DISTRIBUTION**.—From South China Sea through Taiwan, Tung-hai, Yellow Sea, Po-hai to Korea and Japan.

**DIAGNOSIS AND AFFINITIES**.—*Cynoglossus robustus* is closely allied to *C. arel*. It differs from *C. arel* in having a more elongate body, longer snout, and smaller eyes with a wider interorbital space (3.70–7.94,  $M = 5.37$  percent of length of head cf. 1.75–5.21,  $M = 3.43$  percent). The number of interlinear scale rows further distinguishes the two species, *C. robustus* having an invariable number of 10, while *C. arel* has a count of 7–9 ( $M = 7$ ).

**NOTE ON SYNONYMY**.—Günther's (1873a:243) *C. robustus* was described on the basis of a specimen, 212.5 mm in TL, from Shanghai and characterized as having two lateral lines on ocular side, separated by 10 longitudinal series of scales, and one lateral line on blind side. From the Inland Sea of Japan, Regan (1905a:26) described *C. brunneus* based on a single specimen, 200 mm in TL. The salient feature in which this fish is differentiated from *C. robustus* is its slightly larger scales, with only 9 interlinear scale rows. I have examined the holotype of *C. brunneus* and found it to possess 10 scale rows between the middle and the upper lateral lines; therefore there can be no doubt that they are identical. Jordan and Starks (1906a:239) recorded *C. robustus* both from Japanese and Chinese waters but doubted the conspecificity of the Chinese *C. robustus* with that of the Japanese. Jordan, Tanaka, and Snyder (1913), however, gave a new name, *C. inusita*, to the Japanese specimens procured by Jordan and Starks. Hubbs (1915:494) concurred with Jordan and collaborators in keeping the Japanese form distinct and further pointed out that the Japanese specimens differed from the type specimens of *C. robustus* in having fewer rays (122–127) and scales (74) on the midlateral line,

whereas the type specimens have 130 rays in the dorsal and 83 scales along the midlateral line. The differences in the fin rays and scale count noted by Hubbs in the Japanese specimens in comparison with the type specimens of *C. robustus* is not, however, substantiated by the more numerous specimens now available.

**TYPE SPECIMENS**.—Holotype of *C. robustus*, BMNH 1873.7.30.61, 296.5 mm SL, from Shanghai, China, coll. Swinhoe. Holotype of *C. brunneus*, BMNH 1905.6.6.248, 186 mm SL, from Inland Sea of Japan, coll. Gordon Smith.

**OTHER MATERIAL EXAMINED**.—CHINA: 1 specimen, BMNH 1862.11.1.271, Shanghai, coll. Jamrach. 1, BMNH 1925.5.26.17, Yenting, China, ex. Sci. Soc., China. 1, BMNH 1031.12.1.268, Chusen Is., China, coll. S. L. Hora (Indian Museum). 1, USNM 27016, China, coll. Jordan. 3, USNM 159452, Yellow Sea, China, coll. C. L. Hubbs, 1929. 1, KU 20726, E China Sea, ex. Kyoto University. 1, MCZ 11329, Hong Kong, coll. Capt. Putnam. TAIWAN: 1, USNM 7660, Taiwan, coll. F. Beker. 1, USNM 177429, Taipei Mkt., Taiwan, coll. D. K. Lawless. KOREA: 1, UMMZ 159452, Korea, near Fusan, coll. C. L. Hubbs, 1929. 4, UMMZ 159450, Korea, coll. C. L. Hubbs, 1929. JAPAN: 1, BMNH 1923:2.26.649, Tokyo, Japan, coll. Jordan. 1, USNM 37886, Tomo, Japan. 1, USNM 39966, Japan, coll. Hitchcock. 2, USNM 56386, Japan, coll. Jordan and Snyder. 2, USNM 56349, Onomichi, Japan, coll. Jordan and Snyder. 1, USNM 75933, Japan. 1, USNM 77145, Kobe, Japan, coll. *Albatross*, 1906. 1, USNM 159449, Osaka Mkt. Japan, coll. C. L. Hubbs, 7.10.1929. 1, USNM 159453, Kobe Mkt. Japan, coll. C. L. Hubbs, 1929. 2, USNM 159690, Mikawa Bay, Japan, coll. M. Tshikawa, 1922. 1, KU 12612, Kofu, Japan, coll. Kyoto University, Jan 1950.

## 28. *Cynoglossus lingua* Hamilton-Buchanan

FIGURE 31; PLATE 12

"Jerree Potoo."—Russell, 1803:57, pl. 73.

*Cynoglossus lingua* Hamilton-Buchanan, 1822:32, 365 [type-locality: Gangetic estuaries].—Vinciguerra, 1889:190.—Günther, 1862:501.—Day, 1877:433, pl. 96: fig. 1; 1889:454, fig. 163.—Norman, 1928:200, fig. 16.—Weber and de Beaufort, 1929:203.—Smith, 1933:83.—Suvatti, 1936:97; 1950:327.—Munro, 1955:264.—Fowler, 1956:186.—Scott, 1959:42.—Kuronuma, 1961:32.—Pradhan, 1964:458 [Bombay coast].—Punpoka, 1964:62, fig. 20.

*Plagusia lingua*.—Cantor, 1850:1215.—Jerdon, 1853:148.

*Arelia lingua*.—Kaup, 1858:107.

*Pleuronectes potous* Cuvier, 1836:307.

*Plagusia potous*.—Bleeker, 1852:23.—Jerdon, 1853:148.

*Arelia potous*.—Bleeker, 1859:185.

*Cynoglossus potous*.—Bleeker, 1875:33, pl. 241: fig. 4.

*Plagusia macrorhynchus* Bleeker, 1851a:413 [type-locality: Tjilankahan]; 1852:22.

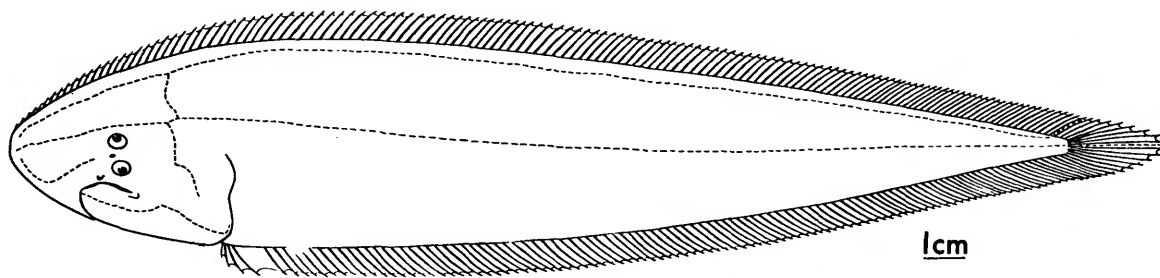


FIGURE 31.—Outline drawing of *C. lingua* (BMNH 1933.7.31.25) from Singapore.

*Arelia macrorhynchos*.—Kner, 1867:295.—Bleeker, 1875:3, pl. 242: fig. 2.—Weber and de Beaufort, 1929:208.

*Cynoglossus acinaces* Jenkins, 1910b:130 [type-locality: Khulna, E. Bengal].

**DESCRIPTION.**—Based on 18 specimens, 214.0–345.0 mm SL.

Depth of body 17.24–21.71 ( $M = 18.94$ ), length of head 21.17–25.75 ( $M = 22.95$ ) percent of standard length. Diameter of eye 5.26–8.51 ( $M = 6.51$ ), interorbital width 1.75–6.40 ( $M = 3.28$ ) percent in length of head. Anterior nostril of eyed side tubular, in front of lower eye, on upper lip, posterior nostril simple, in anterior half of interorbital space. Snout pointed, 37.04–45.00 ( $M = 41.21$ ) percent of length of head, rostral hook rather short, extending just below the anterior nostril. Maxillary extending well beyond fixed eye; angle of mouth extending to just beyond vertical from posterior border of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 50.00–58.33 ( $M = 53.81$ ), angle of mouth to branchial opening 40.47–49.09 ( $M = 45.57$ ) percent of length of head.

**Scales:** Ctenoid on ocular side with cycloid scales on head and on the lateral lines; cycloid on blind side.

**Lateral-Line System:** Two lateral lines on ocular side, midlateral line with 90–101 scales, 11–12 scales between them. No lateral line on blind side. The midlateral line on the ocular side, instead of opening through simple pores on every scale, opens by means of ducts, one on either side into the adjoining scale (Figure 2).

Interlinear scale rows	11	12
Frequencies	5	16

**Fins:** Dorsal with 126–138 ( $M = 132$ ) rays, anal

with 97–114 ( $M = 101$ ) rays, caudal 10 in 17 specimens (radiographs).

**Vertebrae:** 57–66, comprising 9 abdominal and 48–57 caudal elements in 17 specimens (radiographs).

**Coloration:** Upper side uniformly brown with or without darker patches, lower lighter in preserved specimens.

**Size:** Largest specimen examined, 378 (355 + 23) mm, is from Indonesia.

**DISTRIBUTION.**—From Malay Archipelago including Thailand and Vietnam to seas and estuaries of India and Pakistan.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus lingua* is closely related to the other two species of the *arel* complex, but it is immediately distinguished from them by the marked elongation of the body, a longer snout, much smaller eyes, and smaller body scales having an interlinear scale count of 11–13 ( $M = 12$ ).

**NOTE ON SYNONYMY.**—Hamilton-Buchanan (1822: 32) described *C. lingua* from the Gangetic estuaries, based on his unpublished original drawings now preserved in the Asiatic Society of Bengal and reproduced by Hora (1929, pl. 15: figs. 1, 2). Norman (1928:200) included in the synonymy *Pleuronectes potous* Cuvier, *Plagusia macrorhynchos* Bleeker, *C. elongatus* Günther, and *C. acinaces* Jenkins. I concur with Norman in including all these species as synonyms of *C. lingua* except *C. elongatus*, which I have synonymized with *C. arel*.

Bleeker (1851a:413) described *P. macrorhynchos* on the basis of a figure of the fish from Tjilankakan, Bantam. There is no specimen of the fish in Leiden (pers. comm., Dr. M. Boeseman). Cuvier's description of *P. potous* was based on Russel's "Jerree



Potoo" and not on any specimen. Jenkins (1910b: 130) described *C. acinaces* on the basis of five specimens, 59–148 mm SL, from Morrelganj, Kulna district, Bangladesh and related it to *C. elongatus* and *C. lingua* but differentiated them in the much higher number of rays in the dorsal and anal fins and in the greater slenderness of the body. The differences noted by Jenkins fall within the normal range of variation of *C. lingua*.

TYPE SPECIMENS.—Günther (1862:501) considered a stuffed specimen from the Ganges in the British Museum, presented by G. R. Whitehouse, as probably the type of *C. lingua*. Günther (1861: IV), referring to the Whitehouse collections, was very cautious saying that he "believed [it] to contain many typical specimens of Hamilton-Buchanan's work." Hora (1929) examined this question and concluded that there was absolutely no evidence to show that the Whitehouse collections contained Hamilton-Buchanan's specimens. Hamilton-Buchanan never kept any zoological collections and for his descriptions in the "Gangetic Fishes" he relied entirely on his drawings and field notes. I have not been able to locate the stuffed specimen referred to by Günther.

A specimen ZSI F 4149/1, 148 mm SL, the largest of the syntypes, from Sunderbans of Kulna district, Bangladesh, is selected here as the lectotype of *C. acinaces*. The other four specimens, 59–114 mm SL, are paralectotypes.

OTHER MATERIAL EXAMINED.—CHINA: 1 specimen, BMNH 1862.11.1.271, Shanapai, coll. Jamrack. INDONESIA: 2, USNM 72748, Batavia, Java, coll. O. Brayant, 4.2.1909. 1, ZMA 108005, Indonesia, coll. P. Bleeker, 1806. 1, ZMA 108006, Indonesia, coll. Gier Expd., 1908. 2, MCZ 30812, Batavia, coll. Brayant and Palmix. BORNEO: 2, USNM 137410 and 13411, Luzon and Borneo, coll. *Albatross*. THAILAND: 3, USNM 103320, Thailand, coll. H. M. Smith, 23.6.1933. 2, USNM 119682, Thailand, coll. H. M. Smith, 23.6.1933. 5, ANSP 76788, Thailand, coll. R. M. Schauensee, 1936. 1, ANSP 76813, Thailand, coll. R. M. Schauensee, 1936. 3, ANSP 87318, Thailand, coll. R. M. Schauensee, 1936. 2, ANSP 274537, Bangkok, coll. R. M. Schauensee. 6, ANSP 89447, Bangkok, coll. R. M. Schauensee and H. W. Fowler, 1936. 5, CAS (GVF), Gulf of Thailand, coll. local fishermen, 7.9.1957. 3, CAS (GVF) 2582, lat. 13°26'N, long. 100°10'E, coll. Naga Expd., 17.5.61. 1, MCZ 11338, Thailand, coll. C. L. Salmin, 1871. 1, UMMZ 181230, Gulf of Thailand, coll. John Bardach. 1, BMNH 1934.12.18.78, Gulf of Siam, coll. Siamese Museum. BURMA: 3, MCZ 11134, Rangoon, coll. Theobals. 1, BMNH 1870.6.14.7, Moulmein, coll. F. Day. 1, ZSI  $\frac{F 1511}{1}$ , off Akyab, 34 fms, coll. Marine Survey. SINGAPORE: 1, MCZ 11513, Singapore, coll. Capt.

Putnam. 3, BMNH 1933.7.31.24–26, Singapore Mkt., coll. Raffles Museum. VIETNAM: 1, TNSP 76858, Saigon, coll. Hugo Rutherford, Dec 1934. MALAYA: 4, MCZ 274867, Penang, coll. Capt. Putnam. 1, BMNH 1938.8.10.1, Penang, coll. Fish Inst. 1, BSI 9055, Penang, coll. F. Stoliczka. INDIA: 1, BMNH 1855.12.26.601, Ganges, coll. Zool. Soc. 1, BMNH 1872.4.17.37, N. E. Bengal, coll. Jordan. 2, BMNH 1889.2.1.4051, 4055, Calcutta, coll. F. Day. 1, BMNH 1889.2.1.4054, Calcutta, coll. F. Day. 1, BMNH 1889.2.1.4056, Orissa, coll. F. Day. 1, BMNH 1889.2.1.4057, Madras, coll. F. Day. 2, BMNH 1928.3.20.85–86, locality not given, ex. Indian Museum. 1, ZSI 1461, Calcutta, coll. F. Day. 1, ZSI  $\frac{F 1618}{2}$ , Mouth of Arasalar R., Karaikal, coll. A. G. K. Menon, 10.3.58. 1, ZSI  $\frac{F 1650}{2}$ , Sunderbans, coll. A. Rahim. 1, ZSI  $\frac{F 1651}{2}$ , Sullermukai R., 24-Parganas, coll. J. T. Jenkins. 16, ZSI  $\frac{F 1791}{2}$ , Karar, N Kanara Dt., Maharashtra, coll. K. K. Tiwari, 20.2.56. 6, ZSI  $\frac{F 1649}{2}$ , Sunderhans, coll. S. W. Kemp. 1, ZSI  $\frac{F 2013}{2}$ , Pulta Water Works, Barrackpore, coll. Pulta Survey. 1, ZSI  $\frac{F 3040}{1}$ , 24-Parganas, coll. Bengal Fisheries. 1, ZSI  $\frac{F 5849}{1}$ , 24-Parganas, coll. J. T. Jenkins. 1, ZSI  $\frac{F 5987}{1}$ , Nabaspur, coll. J. T. Jenkins. 1, specimen, ZSI (unregistered), Morrison Bay, coll. Chilka Survey. 1, ZSI 1208, Calcutta.

### The *cynoglossus* group

This is a group of specialized species of *Cynoglossus* characterized by relatively small eyes (pedunculate in *monopus*) separated by a small interorbital space, a moderately elongate snout with the angle of mouth situated nearer tip of snout than to branchial opening (except *lida*), two lateral lines on ocular side, and relatively small crenoid scales on both sides of the body. No lateral line on blind side.

Included in this group are the *cynoglossus*, *monopus*, *puncticeps*, and *lida* complexes. Their combined range covers the whole of the Malay Archipelago, the seas of India and Pakistan, and the East Coast of Africa. This group appears to be related to the *arel* complex and may have evolved from a recent offshoot of the *arel* stock.

### The *cynoglossus* complex

*Cynoglossus cynoglossus*, *C. semifasciatus*, and *C. macrostomus* form the *cynoglossus* complex. The characteristics of this complex are the small eyes

separated by a small interorbital space, obtusely pointed snout with the angle of the mouth nearer to the tip of snout than to the branchial opening, two lateral lines on ocular side, and relatively small scales on body, the interlinear scale count being 12 to 16. This complex ranges through the Malay Archipelago and the seas of India and Pakistan.

### 29. *Cynoglossus cynoglossus* (Hamilton-Buchanan)

FIGURE 32; PLATE 13

- Achirus cynoglossus* Hamilton-Buchanan, 1822:132, 373 [type-locality: Ganges mouth].  
*Plagusia cynoglossus*.—Cantor, 1850:1211.  
*Icania cynoglossa*.—Kaup, 1858:109.  
*Cynoglossus cynoglossus*.—Norman, 1928:208 [Bengal].—Weber and de Beaufort, 1929:199.—Punpoka, 1964:60.  
*Plagusia oxyrhynchus* Bleeker, 1851a:416 [type-locality: Batavia]; 1852:26.  
*Arelia oxyrhynchus*.—Bleeker, 1859:185.  
*Cynoglossus oxyrhynchus*.—Günther, 1862:499.—Bleeker, 1875:36, pl. 245: fig. 1.—Weber and de Beaufort, 1929:201.  
*Plagusia sumatrana* Bleeker, 1853c:529 [type-locality: Benkulen, Sumatra].  
*Arelia sumatrensis*.—Bleeker, 1859:185.  
*Cynoglossus sumatrensis*.—Günther, 1862:497.—Bleeker, 1875:35, pl. 243: fig. 1.—Jordan and Richardson, 1908:281 [Ticao Island].—Fowler, 1918b:65 [Philippines].  
*Cynoglossus sumatranus*.—Norman, 1928:209.—Weber and de Beaufort, 1929:202.—Fowler, 1938:88.—Herre, 1953:191.—Punpoka, 1964:72.  
*Plagusia bengalensis* Bleeker, 1853a:152 [type-locality: Hooghly, Calcutta].  
*Cynoglossus bengalensis*.—Günther, 1862:499 [Ganges].—Day, 1877:435, pl. 97: fig. 4 [Hooghly, Calcutta].  
*Cynoglossus hamiltonii* Günther, 1862:504 [Ganges: Pinang].—Duncker, 1904:169.  
*Cynoglossus buchanani* Day, 1869:522 [India].

*Cynoglossus deltae* Jenkins, 1910b:130 [type-locality: Khulna, E Bengal].—Norman, 1928:212.

*Cynoglossus semifasciatus* [not Day].—Suvatti, 1936:98; 1950:328.—Punpoka, 1964:70.

**DESCRIPTION.**—Based on 45 specimens, 62.0–147.0 mm SL, including the lectotype and paralectotype of *C. deltae*.

Depth of body 22.03–34.21 ( $M = 27.11$ ), length of head 18.94–28.95 ( $M = 22.54$ ) percent of standard length. Diameter of eye 3.03–13.04 ( $M = 8.44$ ), interorbital space 1.89–9.68 ( $M = 3.56$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, either in front of interorbital space or in anterior half of it. Snout obtusely pointed, 21.43–45.45 ( $M = 32.87$ ) percent of length of head, rostral hook rather short, extending to front of anterior nostril or reaches just short of perpendicular through anterior border of fixed eye. Maxillary extending to below posterior border of fixed eye or just behind it; angle of mouth extending below vertical from posterior half of fixed eye, nearer to tip of snout than to branchial opening, tip of snout to angle of mouth 39.22–53.49 ( $M = 45.64$ ), angle of mouth to branchial opening 47.37–60.71 ( $M = 51.97$ ) percent of length of head.

**Scales:** Ctenoid on both sides.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line usually undulating and stopping at a very short distance from caudal base, midlateral line with 70–90 ( $M = 82$ ) scales, 12–14 ( $M = 13$ ) scales between them. No lateral line on blind side.

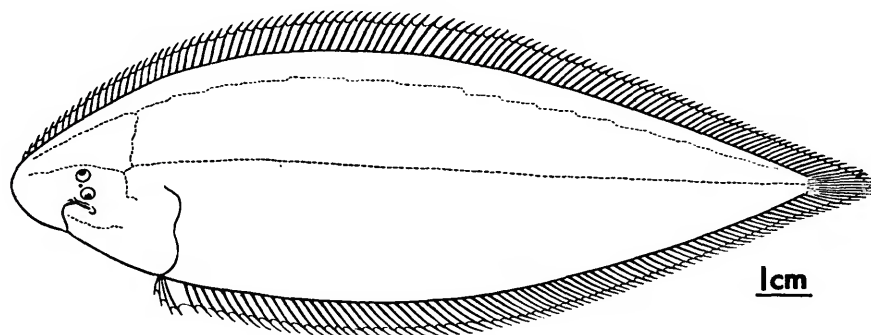


FIGURE 32.—Outline drawing of *C. cynoglossus* (BMNH 1858.8.15.55) from Ganges, coll. G. K. Waterhouse.

Interlinear scale rows	12	13	14
Frequencies	6	8	26

*Fins*: Dorsal with 95–102 (M=100) rays, anal with 72–78 (M=75) rays, caudal 10 in 42 specimens (radiographs).

*Vertebrae*: 44–48, comprising 9 abdominal and 35–39 caudal elements in 42 specimens (radiographs).

*Coloration*: Upper side uniformly brownish with or without darker spots, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 160 (147+13) mm, is from the Ganges.

**DISTRIBUTION**.—From Malay Archipelago to Philippines, and westward to Burma, Bangladesh, and India (W Bengal). In seas and estuaries as far as the tidal reaches.

**DIAGNOSIS AND AFFINITIES**.—The nearest relative of *C. cynoglossus* is *C. semifasciatus*. The species, however, differs in several respects, especially in the obtusely pointed and longer snout (mean length 32.87 percent of length of head cf. 27.40 percent), wider interorbital space (mean width 3.56 percent of head cf. 2.16 percent), and the greater number of interlinear scale rows (12–14, M = 13 cf. 11–14, M = 12).

**NOTE ON SYNONYMY**.—Hamilton-Buchanan (1822: 132) described *C. cynoglossus* from the Ganges on the basis of his original drawing of the fish now in the Asiatic Society of Bengal and reproduced by Hora (1929, pl. 19: figs. 2, 3). Norman (1928:208) synonymized *Plagusia bengalensis* Bleeker with *C. cynoglossus* and Bleeker's *P. oxyrhynchos* and *P. sumatrana* are here included under *C. cynoglossus*. Bleeker (1851a:416) characterized *P. oxyrhynchos* by its two lateral lines on the left side separated by 13 longitudinal series of scales, a single lateral line on the blind side, two nostrils, and subcontiguous eyes; and *P. sumatrana* (Bleeker, 1853c:529) with two lateral lines on the left side, one on the right, two nostrils, and a wider interorbital space. He did not, however, indicate the interlinear scale rows in *P. sumatrana*. I have examined a specimen of *P. sumatrana* (BMNH 1862.6.3.9) and another of *P. oxyrhynchos* (BMNH 1862.6.3.17) from the Bleeker collection in the British Museum and compared them with the specimens of *C. cynoglossus* from the Ganges, and I have no hesitation in synonymizing them. In the specimens examined, the lateral line on the blind side, stated to be present on Bleeker's

*P. oxyrhynchos* and *P. sumatrana*, is absent and in all other respects they conform well with *C. cynoglossus*.

Jenkin's (1910b:130) *C. deltae* was described on the basis of two specimens from Morrelganj, Kulna, Bangladesh, and he characterized it by two lateral lines on the ocular side separated by 10–12 series of scales. In the interlinear count, as well as in all other meristic and proportional measurements, the types of *C. deltae* agree so well with *C. cynoglossus* that they are undoubtedly conspecific.

Günther's (1862:504) *C. hamiltonii*, described on the basis of a dried skin from Cantor's collection from Penang in the British Museum, and characterized with two lateral lines on the left separated by 13 series of scales is synonymized here with *C. cynoglossus*. Günther has not noted any conspicuous nostril in his specimen. I have not been able to trace the type (skin) mentioned in Günther's catalog to ascertain whether the nostril is present or not. From the other details of the description, however, I have come to a definite conclusion that *C. hamiltonii* is nothing other than *C. cynoglossus*.

**TYPE SPECIMENS**.—As stated earlier, Hamilton-Buchanan never kept any zoological collections and for his descriptions he entirely relied on his drawings and field notes. *Cynoglossus cynoglossus* was not figured in his book on the fishes of the Ganges (1822) either. Hora (1929:pl. 19: figs. 2 and 3), however, reproduced Hamilton-Buchanan's manuscript drawing of *C. cynoglossus*, a specimen measuring about 106 mm long.

Bleeker's description of *P. oxyrhynchos* was based on five specimens, 100–120 mm in TL from Batavia. Bleeker in his *Atlas* (6:36, pl. 245: fig. 1) redescribed the species on eight specimens, 100–120 mm in TL from Batavia, Borneo, and Amboina and illustrated it.

In the Bleeker collection in Leiden there are six specimens, 88–111 mm SL, 97–123 TL, of *P. oxyrhynchos* cataloged as RMNH 6793. Chabanaud in 1946 indicated a specimen, 92 mm SL, 101 mm TL, as the lectotype. The largest specimen estimated here as measuring 123 mm TL may have been the "120" specimens that Chabanaud seems to have rejected because of damage. The 92 mm SL specimen is recognized as the lectotype and retained as RMNH 6793, the remaining five specimens including the "120" example having been removed to RMNH 26210. Of these five, two, 58–90 mm S.L.,

97–99 mm TL, are too small to be considered as paralectotypes; the other three specimens, 93–111 mm SL, 103–123 mm TL, are recognized as paralectotypes. (Dr. M. Boeseman examined the type material on my behalf.)

Bleeker (1853c:526) described *P. sumatrana* based on a single specimen 121 mm long from Benculen, Sumatra. In the Bleeker collection in Leiden there is a specimen cataloged as RMNH 6787, which unfortunately is mutilated with the head mostly missing, but otherwise agrees with Bleeker's figure of a 121 mm example. Strangely Bleeker, in the *Atlas* (6:36), refers to only a single specimen though he lists three localities. According to Dr. Boeseman, at the 1879 auction there was only a single specimen in the Bleeker collection and since it agrees with Bleeker's figure in size, it must be the holotype.

Bleeker's description of *P. bengalensis* was based on two specimens, 120 mm TL and 139 mm TL, from Hooghly River near Calcutta. According to Dr. Boeseman, in the Bleeker collection in Leiden there are two examples, 106 mm SL, 120 mm TL and 126 mm SL, 139 mm TL, both syntypes, cataloged as RMNH 6794. The largest specimen is selected here as the lectotype, and is retained as RMNH 6794; the other specimen recataloged as RMNH 26211 is the paralectotype.

A specimen, 64.0 mm SL, ZSI F 4150/2 from the Sunderbans of Morelganj, Khulna district, Bangladesh, collected by Bengal Fisheries, is selected as the lectotype of *C. deltai* and a specimen, BMNH 1928.3.20.133, 62.5 mm SL, taken along with the lectotype as the paralectotype.

**OTHER MATERIAL EXAMINED.**—PHILIPPINES: 1 specimen, ANSP 49038, Philippines, coll. R. M. de Schauensee. 1, NHV 43826, Philippines, coll. Naga Expd. INDONESIA: 1, BMNH 1862.6.3.9, Sumatra, coll. P. Bleeker. 1, BMNH 1862.6.3.17, locality not given, coll. P. Bleeker. 1, BMNH 1931.4.23.46, Batavia Mkt., coll. Hardenberg. 1, ZMA 108.007, Indonesia, coll. Kleiweg de Zwaan. 1, AMNH 18414, Java, coll. Zeeviss. 1, USNM 87943, Sumatra, coll. H. C. Kollers. THAILAND: 2, ANSP 59918, Thailand, coll. R. M. de Schauensee. 3, ANSP 61843–51, Thailand, coll. R. M. de Schauensee. 1, ANSP 87278, Thailand, coll. R. M. de Schauensee. 4, ANSP 87840, Thailand, coll. R. M. de Schauensee. 31, ANSP 89461, Thailand, coll. R. M. de Schauensee. 6, CAS (GVF), Gulf of Thailand, coll. Naga Expd. 1, CAS (GVF), Thailand, coll. Naga Expd. 1, NHV 43766, Thailand, coll. Naga Expd. MALAYA: 2, MCZ 30343, Penang coll. E. P. Ward. BURMA: 1, BMNH 1928.3.20.112, Mergui, coll. Indian Museum. 2, ANSP 77027, Burma, coll. Halberg. 4, MCZ 33199, Burma. INDIA: 1,

BMNH 1852.9.13.235A, Hooghly R., coll. Zool. Society. 1, BMNH 1855.9.19.12.32, Ganges, coll. Hasler. 1, BMNH 1855.12.26.602, R. Ganges, coll. Zool. Soc. 1, BMNH 1862.6.3.9, Sumatra, coll. P. Bleeker. 1, BMNH 1862.6.3.17, locality not given, coll. P. Bleeker. 2, BMNH 1889.2.1.4065–66, Calcutta, coll. F. Day. 1, BMNH 1928.3.20.133, Sunderbans, ex. Indian Museum. 2, BMNH 1928.3.20.108 and 112, Calcutta, ex. Indian Museum. 3, BMNH 1928.3.20.109–111, Hooghly R., ex. Indian Museum. 1, BMNH 1934.11.21.8c, Hooghly R., ex. Zoological Survey of India. 2, BMNH 1954.5.20.21, Hooghly R., ex. Zoological Survey of India. 1, ZSI 461, Calcutta, coll. J. Anderson. 1, ZSI 1499, Calcutta, coll. F. Day. 1, ZSI 2689, Calcutta, coll. F. Day. 2, ZSI 752/2, Hooghly R., coll. Hooghly Survey. 2, ZSI (unregistered), Tolly's Nallah, coll. Nirod. 1, ZSI F 2014/2, Barrackpore, coll. Pulta Survey. 2, ZSI F 3434/1, Orissa coast, coll. C. A. Paiva. 6, ZSI F 5042/2, Sunderbans, Gangetic delta, coll. S. W. Kemp. 1, ZSI 6865/2, Sunderbans, Gangetic delta, coll. S. W. Kemp.

### 30. *Cynoglossus semifasciatus* Day

FIGURE 33; PLATE 13

*Cynoglossus semifasciatus* Day, 1877:436, pl. 97: fig. 5 [type-locality: 'Sea at Madras']; 1889:458.—Alcock, 1889:289.—Jenkins, 1910a:30.—Norman, 1928:207.  
*Cynoglossus brevisrostris* Day, 1877:437, pl. 97: fig. 6 [type-locality: Madras]; 1889:459.—Norman, 1928:212.  
*Cynoglossus bengalensis* [not Bleeker].—Johnstone, 1904:209.  
*Cynoglossus cynoglossus* [not Hamilton-Buchanan].—Munro, 1955:266, pl. 50 [Ceylon].—De Silva, 1956:197 [Ceylon].

**DESCRIPTION.**—Based on 41 specimens, 75.5–136.0 mm SL, including the holotype of *C. semifasciatus* and *C. brevisrostris*.

Depth of body 24.53–31.58 ( $M = 27.88$ ), length of head 19.81–29.41 ( $M = 22.76$ ) percent of standard length. Diameter of eye 5.36–12.96 ( $M = 8.29$ ), interorbital space narrow, 1.79–2.50 ( $M = 2.21$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in the anterior half of interorbital space. Snout rounded or obtusely pointed, 21.43–32.50 ( $M = 27.40$ ) percent of length of head, rostral hook rather short, extending to front of anterior nostril. Maxillary extending well beyond posterior border of fixed eye; angle of mouth extending a little beyond vertical from fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 33.33–47.62 ( $M = 41.66$ ), angle of mouth to branchial opening 47.62–60.73 ( $M = 54.64$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those of lateral lines.

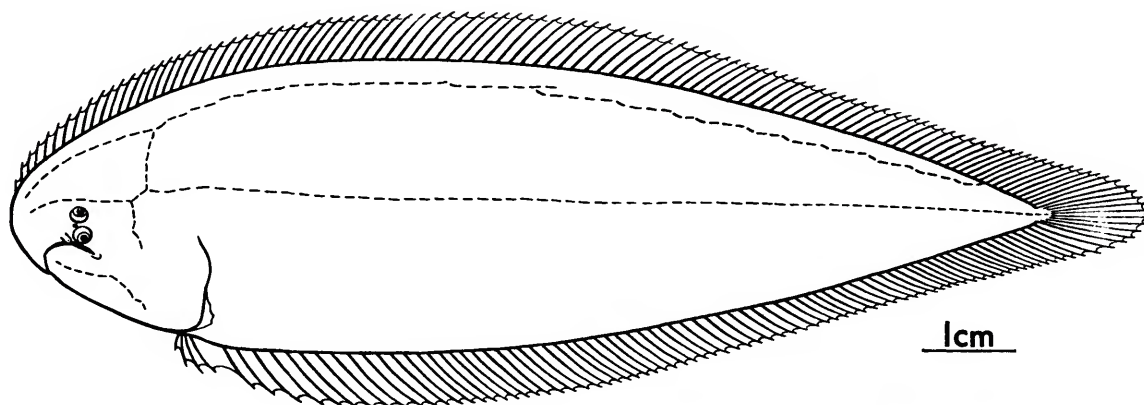


FIGURE 33.—Outline drawing of *C. semifasciatus* (BMNH 1928.2.6.1) from Tanur, Malabar coast.

**Lateral-Line System.**—Two lateral lines on ocular side, the dorsolateral line entering the dorsal fin at a short distance from the caudal base, the midlateral line with 70–78 ( $M = 75$ ) scales, 11–14 ( $M = 12$ ) scales between them in 31 examples. No lateral line on blind side.

Interlinear scale rows	11	12	13	14
Frequencies	2	16	11	2

**Fins:** Dorsal with 99–107 ( $M = 102$ ) rays, anal with 75–83 ( $M = 79$ ), caudal 10 in 23 specimens (radiographs).

**Vertebrae:** 47–50 comprising 9 abdominal and 38–41 caudal elements in 23 specimens (radiographs).

**Coloration:** Upper side light brownish with a number of irregular vertical dark bands, lower whitish in preserved specimens.

**Size:** The largest specimen examined from Portonovo, Madras, trawled by *Anton Bruun* is 138 (123 + 15) mm long.

**DISTRIBUTION:** East coast of India and Ceylon, recorded from a depth of 7–10 fms.

**DIAGNOSIS AND AFFINITIES.**—In many morphometric characters *C. semifasciatus* resembles *C. macrostomus*. It is distinguishable, however, by its deeper body (mean depth 27.88 percent of SL cf. 25.89 percent), lesser number of interlinear scales (11–14,  $M = 12$  cf. 14–16,  $M = 15$ ), and midlateral scales (70–78,  $M = 75$  cf. 80–92,  $M = 83$ ).

**NOTE ON SYNONYMY.**—Day (1877:436) described *C. semifasciatus* on the basis of a single specimen from Madras coast and characterized it as having

two lateral lines on ocular side separated at their highest distance by 12 or 13 rows of scales. Norman (1928), in his revision of flatfishes of India, noted that in *C. semifasciatus* the lateral lines on the ocular side are separated by 13–14 series of scales and not 12 or 13 as Day observed. The name *C. semifasciatus*, however, had been wrongly assigned to the commercial species of the Malabar coast, namely, *C. macrostomus*, having wider range of 15–16 scales between the lateral lines (Menon 1971). This was mainly brought about by Norman's (1928: 207) placing *C. semifasciatus* in the group, showing a range of 12 or 15 scales between the lateral lines in his key to the species of *Cynoglossus*; thereby, workers using Norman's key, having assumed a wider range for *C. semifasciatus*, confused the Malabar sole for this species. *Cynoglossus semifasciatus* can be readily distinguished by its lower number of interlinear scales, 11–14 ( $M = 12$ ) cf. 14–16 ( $M = 15$ ).

Day (1877:437) described another species from Madras coast, *C. breviostris*, based on a single specimen and characterized it as having a lesser number of 10 scale rows between the lateral lines on ocular side. I have examined the holotype of *C. breviostris* and found it to have 11 interlinear scales, which falls within the range of variation of this character for *C. semifasciatus*. I have, therefore, included *C. breviostris* in the synonymy of *C. semifasciatus*.

**TYPE SPECIMENS.**—Holotype of *C. semifasciatus*, ZSI 2490, 102 mm SL, Madras coast, coll. F. Day.

Holotype of *C. brevirostris*, ZSI 2690, 110 mm SL, Madras coast, coll. F. Day.

OTHER MATERIAL EXAMINED.—INDIA: 2 specimens, ZSI 2359/2, 2360/2, Marina Beach, Madras, coll. ZSI, Southern Regional Sta. 1, ZSI F 3437/1, Puri, Orissa coast, coll. Golden Crown. 2, ZSI 12680/2, Gopalpur, Orissa, coll. Investigator. 2, ZSI (unregistered), Madras, coll. A. Daniel. 28, ZSI (unregistered), Waltair coast, coll. K. V. Sekharan. 2, BMNH 1889.2.1.4066–67, Calcutta, coll. F. Day. 1, BMNH 1928.3.20.107, Ganjam coast, coll. Investigator. 1, SOSC, Ref. 334, Thirumulli, Madras, lat. 11°13'N, long. 79°53'E, coll. Anton Bruun, 23.9.1966. 3, SOSC Ref 334, Madras, lat. 11°35'N, long. 79°5'E, coll. Anton Bruun. 1, SOSC Ref 334, Vellar Estuary Madras, lat. 11°30'N, long. 79°50'E, coll. Anton Bruun. 4, SOSC Ref 334, Porto Novo, Madras, coll. Anton Bruun.

### 31. *Cynoglossus macrostomus* Norman

FIGURE 34; PLATE 14

- Cynoglossus hamiltonii* [not Günther].—Day, 1877:436, pl. 95: fig. 3 ["Hooghly at Calcutta"]; 1889:458.  
*Cynoglossus macrostomus* Norman, 1928:204 [type-locality: Hooghly Estuary, near Calcutta].  
*Cynoglossus luctuosus* Chabanaud, 1947e:813 [type-locality: Madras].  
*Cynoglossus semifasciatus* [not Day].—Seshappa and Bhimachar, 1955:183.—Saramma, 1963:77 [Kerala coast].  
*Cynoglossus cynoglossus* [not Hamilton-Buchanan].—Saramma, 1963:77 [Kerala coast].

DESCRIPTION.—Based on 40 specimens, 90–138 mm SL, including the holotypes and paratypes of *C. macrostomus* and *C. luctuosus*.

Depth of body 23.11–28.11 ( $M = 25.89$ ), length of head 23.97–30.83 ( $M = 26.39$ ) percent of standard length. Eye diameter 5.56–10.34 ( $M = 7.59$ ), interorbital space sometimes absent, 1.39–4.17 ( $M = 2.94$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in the anterior half of interorbital space. Snout obtusely pointed, 20.59–30.0 ( $M = 25.80$ ) percent of length of head, rostral hook short, extending to front of anterior nostril. Maxillary extending to well beyond posterior margin of fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye or just beyond it, nearer to tip of snout to branchial opening, tip of snout to angle of mouth 35.29–47.50 ( $M = 40.49$ ), angle of mouth to branchial opening 43.55–62.07 ( $M = 57.48$ ) percent of length of head.

Scales: Ctenoid on both sides.

Lateral-Line System: Two lateral lines on ocular

side, dorsolateral line curving onto dorsal fin at a short distance from caudal base, midlateral line with 80–92 ( $M = 83$ ) scales; 14–16 ( $M = 15$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	14	15	16
Frequencies	13	17	10

Fins: Dorsal with 100–106 ( $M = 103$ ) rays, anal with 78–84 ( $M = 80$ ), caudal 10 in 23 specimens (radiographs).

Vertebrae: 48–51 comprising 9 abdominal and 38–42 caudal elements in 23 specimens (radiographs).

Coloration: Upper side light brownish with dark brown mottling on it, giving the appearance of several irregular transverse bands, lower whitish in preserved specimens.

Size: Largest specimen examined, 154 (138 + 18), is from Cochin.

DISTRIBUTION.—Seas and estuaries of India; recorded from a depth of 8–12 fms.

DIAGNOSIS AND AFFINITIES.—*Cynoglossus macrostomus* closely resembles *C. semifasciatus*, particularly with regard to the extension of the maxillary beyond the posterior border of the fixed eye, the relatively larger eyes, and the vertebral and fin-ray counts. *Cynoglossus macrostomus* is, however, easily distinguishable by the large number of interlinear scale rows (14–16,  $M = 15$  cf. 11–14,  $M = 12$ ) and the midlateral scale rows (80–92,  $M = 83$  cf. 70–78,  $M = 75$ ), the more elongate body (depth 23.11–28.33,  $M = 25.89$  percent of SL cf. 24.53–31.58,  $M = 27.88$  percent), longer head (23.97–30.83,  $M = 26.89$  percent of SL cf. 19.81–29.41,  $M = 22.76$ ), and the coloration, especially the distinctive blackish nature of the fins.

NOTE ON SYNONYMY.—Norman (1928:204) considered *C. hamiltonii* described by Day (1877:436) as distinct from *C. hamiltonii* Günther (1862:504) and described it as *C. macrostomus*, basing his description on two specimens from "Calcutta and Orissa." He characterized the new species as having two lateral lines on ocular side, divided by 15 or 16 rows of scales. This species, which forms an important commercial fishery on the west coast of India and popularly known as the "Malabar sole," has all along been confused with *C. semifasciatus* (Menon, 1971). *Cynoglossus macrostomus* can, however, be readily distinguished from *C. semifasciatus* by its larger number of interlinear scales, 14–16

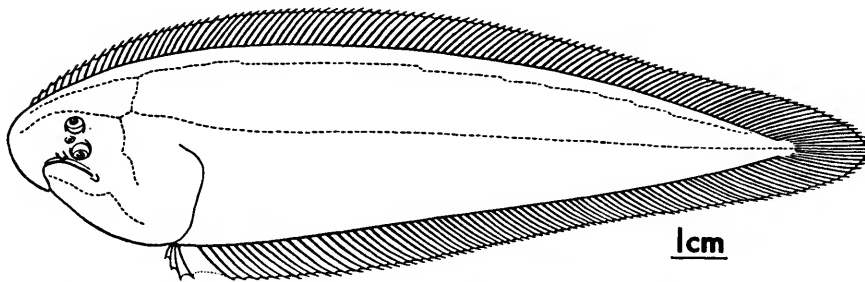


FIGURE 34.—Outline drawing of *C. macrostomus* (BMNH 1932.2.6.1) from Tanur, Malabar coast.

( $M = 15$ ) cf. 11–14 ( $M = 12$ ). Another species confused with the Malabar sole is *C. luctuosus* Chabaud (1947c:813) described on the basis of nine specimens from Tanur on the Malabar coast and characterized with 14–15 rows of scales between the lateral lines on the ocular side. I have examined the type of this species in London and found the species to be identical with *C. macrostomus*. I have, therefore, synonymized them.

**TYPE SPECIMENS.**—Holotype of *C. macrostomus*, ZSI 1460, 121 mm SL, Hooghly estuary near Calcutta, coll. F. Day; paratype, BMNH 1889.2.1.4074, 122.5 mm SL, Orissa, India, coll. F. Day. Holotype of *C. luctuosus*, BMNH 1932.2.6.8, 133 mm SL, Tanur, coll. D. W. Devanaseen; 8 paratypes, BMNH 1932.2.6.1–7 and 9, 106–138 mm SL, Tanur obtained along with holotype.

**OTHER MATERIAL EXAMINED.**—INDIA: 1 specimen, BMNH 1928.3.20.132, Portugese India, coll. S. W. Kemp. 2, ZSI 143, Mormugao Bay, Goa, coll. S. W. Kemp. 4, ZSI 173–6, Mormugao Bay, Goa, coll. S. W. Kemp. 1, SOSC Ref 334, Neendakara, Kerala, lat.  $08^{\circ}55'N$ , long.  $76^{\circ}30'E$ , coll. Anton Bruun. 6.10.1966. 1, SOSC Ref 334, Ernakulam, Kerala, lat.  $10^{\circ}0'N$ , long.  $76^{\circ}12'E$ , coll. Anton Bruun. 1, SOSC Ref 334, Kerala, lat.  $09^{\circ}21'N$ , long.  $76^{\circ}17'E$ , coll. Anton Bruun. 22, SOSC Ref 334, Neendakara, Kerala, lat.  $08^{\circ}56'N$ , long.  $76^{\circ}30'E$ , coll. Anton Bruun. 17, SOSC Ref 334, Cochin, Kerala, lat.  $10^{\circ}00'N$ , long.  $76^{\circ}08'E$ , coll. Anton Bruun. 1, ANSP 74855, Calicut, coll. Madras Fisheries Department.

#### The *monopus* complex

*Cynoglossus monopus*, the only species of the *monopus* complex, is typified by its small pedunculate eyes placed close together before the eyes. Its range extends from the Malay Archipelago to seas of India toward the west, and northward along the South China Sea to Hong Kong.

#### 32. *Cynoglossus monopus* (Bleeker)

FIGURE 35; PLATE 14

*Plagusia monopus* Bleeker, 1849:11 [type-locality: Bali].

*Cynoglossus monopus*.—Bleeker, 1875:38, pl. 245: fig. 4.—Alcock, 1896:330.—Norman, 1928:204.—Weber and de Beaufort, 1929:197.—Chu, 1931:94.—Smith, 1933:84.—Fowler, 1934b:219.—Suvatti, 1936:94; 1950:326.—Kuronuma, 1961:32.—Punpoka, 1964:66 [Sumat Prakarn Province, Thailand].

*Plagusia melanopterus* Bleeker, 1851a:415; 1852:25.

*Arelia melanopterus*.—Bleeker, 1859:184.

*Cynoglossus melanopterus*.—Günther, 1862:502.—Alcock, 1889:289.—Seale, 1914:78 [Hong Kong].—Chu, 1931:94.

*Arelia ceratophrys* Kaup, 1858:108.

**DESCRIPTION.**—Based on 11 specimens, 94.0–153.0 mm SL.

Depth of body 21.90–26.12 ( $M = 23.58$ ), length of head 19.46–21.57 ( $M = 20.37$ ) percent of standard length. Eyes small, close together and pedunculate; diameter of eye 4.0–6.78 ( $M = 5.80$ ) percent of length of head, interorbital space almost absent. Two nostrils on ocular side, close together in front of the anterior border of fixed eye, anterior nostril tubular, posterior simple. Snout obtusely pointed, 26.32–37.29 ( $M = 31.82$ ) percent of head, rostral hook rather short, ending just in front of anterior nostril. Maxillary extending to below posterior border of fixed eye or just behind it; angle of mouth extending to below vertical from posterior half of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 39.39–47.62 ( $M = 44.06$ ), angle of mouth to branchial opening 53.06–64.41 ( $M = 57.76$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those on lateral lines.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line undulated, entering dorsal

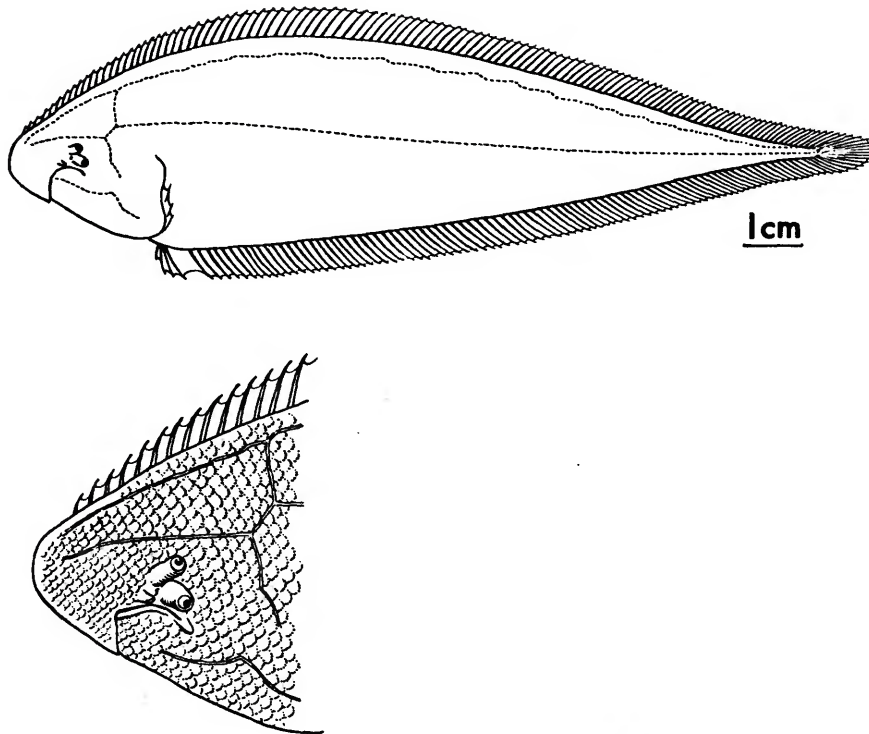


FIGURE 35.—Outline drawings of *C. monopus* (BMNH 1862.6.3.13) from Bleeker's collection.

fin along 3rd to 5th ray, counted from the rear, midlateral line with 108–125 ( $M = 117$ ) scales, 16–20 ( $M = 17$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	16	17	18	19	20
Frequencies	5	2	1	2	1

**Fins:** Dorsal with 115–120 ( $M = 117$ ) rays, anal with 92–96 ( $M = 94$ ), caudal 10 in 6 specimens (radiographs).

**Vertebrae:** 53–56, comprising 9 abdominal and 44–47 caudal elements in 6 specimens (radiographs).

**Coloration:** Upper side light brownish, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 188.5 mm in SL, is from Bangkok.

**DISTRIBUTION:** From Malay Archipelago to Hong Kong and to northern part of Bay of Bengal; recorded from a depth of 7–10 fms.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus monopus* occupies a rather isolated position with regard to the position of the nostrils, which are placed close

together in front of the anterior border of the fixed eye, and the small pedunculate eyes. The most closely related species is *C. macrostomus*. In the obtusely pointed snout, the elongate nature of the body, and especially in the blackish coloration of the posterior portion of the fins in fresh specimens, these species resemble each other to a certain extent. There is no doubt that *C. monopus* evolved from a *macrostomus*-like ancestor.

**NOTE ON SYNONYMY.**—Norman (1928:204) included *P. melanopterus* Bleeker and *A. ceratophrys* Kaup in the synonymy of *C. monopus* (Bleeker) and I concur with him.

**TYPE SPECIMENS.**—Bleeker (1849:11) described *P. monopus* from Batavia and Boleling, Bali and another species *P. melanopterus* Bleeker (1851a:415) from Batavia and Boleling, Bali, actually as a replacement name for *P. monopus* and obviously based on the same types, but possibly including a few additional specimens for *P. melanopterus* collected after the publication of *P. monopus* but



earlier than that of *C. melanopterus*. Unfortunately, Bleeker did not mention the number of specimens on which the description of *P. monopus* was based but only the maximum size of the specimens, namely 180 mm, was indicated. This maximum size mentioned for *P. monopus* is obviously erroneous as in the subsequent description of *P. melanopterus* consisting of the same material. The maximum size mentioned is 170 mm, Bleeker's (1850a:415) description of *P. melanopterus* being based on 11 specimens, 95 to 170 mm in TL.

According to Dr. M. Boeseman, the specimens cataloged as RMNH 6799 (1879 auction) originally contained 11 specimens, including the types of both *P. melanopterus* and *P. monopus*, but there is no specimen of 170 mm in length in it, and there may or may not be a syntype of *P. monopus* in the original material. According to him, however, it seems reasonable to assume that actually the maximum size must have been only 160 mm, as the jar originally included 11 examples, 83–147 (92.5–159) mm.

Chabanaud in 1946 removed two of the smaller, 83–100 (92.5–100) mm, specimens to *C. oxyrhynchus* and a specimen of 130 (141) mm was selected as the lectotype of *C. melanopterus* and indicated as such in the label.

Since *C. melanopterus* was described as a replacement name for *C. monopus*, it is appropriate to consider the 141 mm specimen as the lectotype of *P. monopus*. It is accordingly selected here, retaining RMNH 6799. The remaining 8 specimens are paralectotypes of both *C. melanopterus* and *C. monopus* are recataloged as RMNH 26212.

OTHER SPECIMENS EXAMINED.—INDONESIA: 1 specimen, BMNH 1862.6.3.13, loc. not given, coll. P. Bleeker. 2, BMNH 1931.4.23.43–44, Java, coll. Hardenberg. 1, BMNH 1931.4.23–45, Bay of Batavia, coll. Hardenberg. 3, AMNH 17014, Sumatra, coll. Zeeviss, 1941. 6, AMNH 19815, Sumatra, coll. Zeeviss, 1941. 1, ZMC. (unregistered), St. Helena, coll. Th. Mortensen, 1930. PHILIPPINES: 1, AMNH 19645, Celebes, coll. Zeeviss, 1941. THAILAND: 1, USNM 88374, Thailand, coll. H. M. Smith. 9, CAS (GVF), Samut Prakan Province, Gulf of Thailand, coll. Thai Fisheries. 1, ANSP 59919, Bangkok, coll. R. M. de Schaunsee. SINGAPORE: 1, MCZ 33209, Singapore. CEYLON: 2, BMNH 1933.12.27.1–2, Ceylon, coll. Harvard. INDIA: 3, BMNH 1890.12.4.14–16, Ganjam coast, ex. Indian Museum. 2, BMNH 1928.3.20.99–100, Orissa coast, ex. Indian Museum. 2, SOSC, Porto Novo, Madras, lat. 11°35'N, long. 79°50'E, coll. Anton Bruun, 1966. 1, SOSC, Bombay, Maharashtra, lat. 18°50'N, long. 72°35'E, coll. Anton Bruun. 1, SOSC, Porto Novo, Madras, lat. 11°30'N, long. 79°50'E,

coll. Anton Bruun. 6, ZSI 124.20–25, Orissa coast, 7 fms, coll. Investigator. 1, ZSI 12617, Ganjam coast, coll. Investigator.

### The *puncticeps* complex

The *puncticeps* complex has its center of distribution in the Indo-Australian Archipelago including northwest Australia, Philippines, the seas of India and Pakistan, and farther westward to the East Coast of Africa. This complex is closely related to the *cynoglossus* complex and both may have descended from a common ancestral stock.

The principal character that distinguishes this complex is the smaller size of its body scales, the interlinear scale rows being 14 to 19.

Included in this complex are *C. puncticeps*, *C. durbanensis*, and *C. gilchristi*.

### 33. *Cynoglossus puncticeps* (Richardson)

#### FIGURE 36; PLATE 15

- Plagusia puncticeps* Richardson, 1846:280 [type-locality: China].—Whitehead, 1969:218, pl. 29c.
- Cynoglossus puncticeps*.—Günther, 1862:500.—Bleeker, 1875: 37, pl. 245: 15, fig. 7.—Day, 1877:437, pl. 97: fig. 1; 1889:459.—Alcock, 1889:289.—Jordan and Seale, 1907:46.—Jenkins, 1910:30.—Norman, 1928:205.—Weber and de Beaufort, 1929:198.—Chu, 1931:94.—Herre, 1932:433.—Wu, 1932:151 [Amoy, Pehai, Canton, Hong Kong, and Hainan].—Smith, 1933:84.—Fowler, 1934b:220, fig. 34.—Suvatti, 1950:328.—Herre, 1953:190.—Munro, 1955:265, pl. 51: fig. 771.—Fowler, 1956:137.—De Silva, 1956:198 [Panadura].—Munro, 1958:285 [Kau Kau].—Kuronuma, 1961:32.—Punpoka, 1964:69 [Thailand].—Pradhan, 1964: 458.—Chen and Weng, 1965:91, fig. 62 [Tainan and Tungkong].—Shen, 1967:214, figs. 138–141 [Lamma Island].
- Plagusia nigrolaberculata* Richardson, 1846:280 [coasts of China, Canton].—Kaup, 1858:110.—Whitehead, 1969:218, pl. 29b.
- Cynoglossus nigrolaberculatus*.—Bleeker, 1873:131 [reference].
- Plagusia aurolimbata* Richardson, 1846:280 [coasts of China].—Kaup, 1858:110.—Whitehead, 1969:218, pl. 28b.
- Cynoglossus aurolineatus*.—Bleeker, 1873:130.
- Plagusia javanica* Bleeker, 1851a:414 [type-locality: Batavia]; 1852:24.
- Arelia javanica*.—Bleeker, 1859:184.
- Plagusia brachyrhynchus* Bleeker, 1851a:414 [type-locality: Batavia]; 1852:24.
- Arelia brachyrhynchus*.—Bleeker, 1859:184.
- Cynoglossus brachyrhynchus*.—Günther, 1862:499.—Bleeker, 1875:37, pl. 243: fig. 4.—Day, 1877:435, pl. 96: fig. 4; 1839:457.—Johnstone, 1904:206.—Weber, 1913b:443.
- Cynoglossus brevis* Günther, 1862:500 [type-locality:

Ganges].—Day, 1877:437, pl. 97: fig. 2.—Alcock, 1889:289.—  
 Hora, 1923b:760.—Norman, 1928:206.  
*Cynoglossus lida* [not Bleeker].—Jenkins, 1910a:31.  
*Cynoglossus lida* var. *punctatus*.—Jenkins, 1910a:30.  
*Cynoglossus puncticeps immaculata* Pellegrin and Chevey,  
 1940:154 [Vietnam].

DESCRIPTION: Based on 87 specimens, 35.0–166.0 mm SL, including the paralectotype of *C. brevis*.

Depth of body 12.05–45.16 ( $M = 28.43$ ), length of head 11.45–30.65 ( $M = 22.22$ ) percent of stand-

ard length. Diameter of eye 6.25–16.13 ( $M = 10.71$ ), interorbital space rather narrow, 0.36–6.67 ( $M = 3.03$ ) percent of length of head. Two nostrils on ocular side, anterior nostrils tubular, in front of lower eye, posterior nostril simple, immediately in front of interorbital space. Snout rounded or obtusely pointed, 24.39–41.18 ( $M = 32.67$ ) percent of length of head, rostral hook short, usually ends in front of anterior nostril, rarely reaching below anterior border of fixed eye. Maxillary extending to

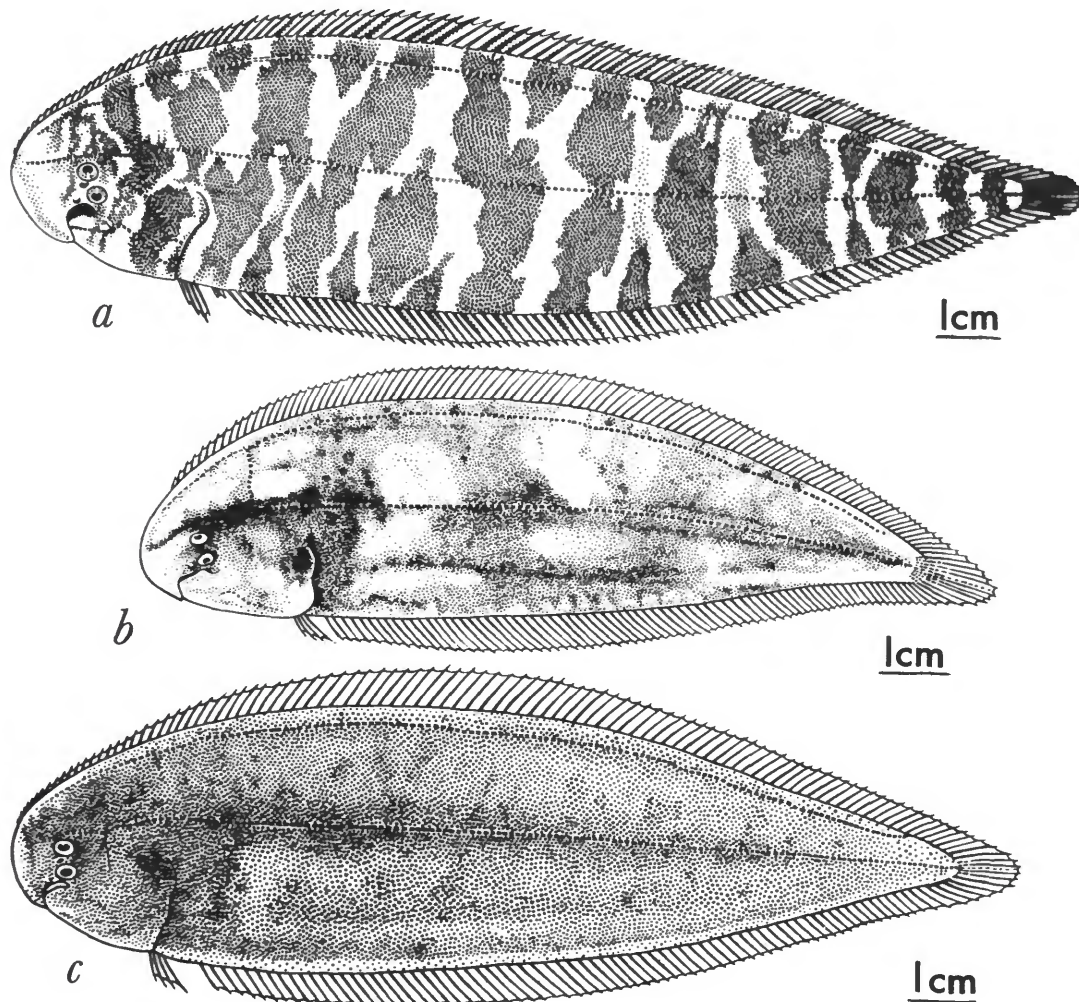


FIGURE 36.—Lateral view of ocular side of three specimens of *C. puncticeps* showing variation in pigment pattern: a, specimen 143.5 mm SL (ZSIF 5358/2) from Alleppey, Kerala; b, c, specimens 110.6 and 135.3 mm SL from Cochin coll. R. R. C. Edwards, Aberdeen.

below middle or posterior half of fixed eye; angle of mouth extending to below vertical from anterior half or middle of fixed eye, usually nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 34.21–51.43 ( $M = 44.16$ ), angle of mouth to branchial opening 41.67–72.73 ( $M = 55.62$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those of lateral lines.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line slightly undulating, running backward and entering dorsal fin along 5th–6th ray, counted from the rear, midlateral line with 78–99 ( $M = 87$ ) scales, 14–19 ( $M = 16$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	14	15	16	17	18	19
Frequencies	4	6	22	23	16	9

**Fins:** Dorsal with 90–100 ( $M = 96$ ) rays, anal with 72–78 ( $M = 75$ ) rays, caudal 10 in 57 specimens (radiographs).

**Vertebrae:** 44–49, comprising 9 abdominal and 35–40 caudal elements in 57 specimens (radiographs).

**Coloration:** Upper side brownish with dark blotches all over the body, appearing as somewhat irregular crossbands that disappear with age, lower whitish. Some of the rays of the vertical fins marked with dark brown.

**Size:** Largest specimen examined, 175 (161 + 14) mm, is from Sind, Pakistan.

**DISTRIBUTION.**—From northwest Australia, Malay Archipelago to Philippines, through South China Sea to Taiwan, and westward to seas of India; recorded from a depth of 7–75 fms and known from brackish waters as well.

**DIAGNOSIS AND AFFINITIES.**—The color pattern with large irregular blotches on the head and body, which are often united to form irregular crossbands, and some of the rays of the vertical fins with dark brown predominating are characteristic. Considerable variation from this pattern occurs, however, probably with changes in the nature of the substratum or intensity of light penetration. *Cynoglossus puncticeps*, which is replaced by *C. durbanensis* and *C. gilchristi* along the East Coast of Africa, is distinguished by 10 caudal fin rays whereas in the other species the number is only 8.

**NOTE ON SYNONYMY.**—Norman (1928:205) included *P. javanica* Bleeker and *P. brachyrhynchus*

Bleeker in the synonymy of *C. puncticeps* and I concur with him. The additional names included here are *P. nigrolaberculata* Richardson, *P. auro-imbata* Richardson, *C. brevis* Günther, and *C. p. immaculata* Pellegrin and Chevey.

Richardson's descriptions of *P. puncticeps*, *P. auroimbata*, and *P. nigrolaberculata* were all based on Reeves Chinese fish drawings (see Whitehead, 1969). Fowler (1934b) synonymized the latter two species with *C. puncticeps*. I have examined Reeve's original drawings of these species in the British Museum and found no significant difference between them.

Günther (1862:500) described *C. brevis* on the basis of a single specimen, 108 mm in TL, from the Ganges and characterized it with two lateral lines on left side separated by 17 scale rows. I have examined the holotype of *C. brevis* in the British Museum and I am convinced that differences in the proportional measurements such as the longer head length and longer snout in the type are attributable to intraspecific variations and that the two species are essentially the same in all respects including the color pattern, though considerable variation in pigmentation with age and change in the substratum is exhibited by the fish.

Pellegrin and Chevey described *C. p. immaculata* on the basis of a specimen from Bac Lieu, Cochin China. I have examined the holotype of *C. p. immaculata* in Paris and found it to exhibit no significant difference with *C. puncticeps*; *C. p. immaculata* is, therefore, synonymized here with *C. puncticeps*.

**TYPE SPECIMENS.**—Bleeker's description of *P. javanica* was based on 17 specimens, 100–155 mm in TL. In the Bleeker collection in Leiden, cataloged as RMNH 6797, there are 20 specimens as *C. puncticeps*, obviously the specimens of *P. javanica* having been added to *C. puncticeps* after its synonymy. Out of the 20 specimens, 17 specimens, 90–109 (100–120) mm, are types and 3 specimens, 83–84 (91–92) mm, are nontypes. None of these agree with Bleeker's upper size limit of 155 mm, which may well be erroneous. Dr. Boeseman examined the material on my behalf and selected a specimen of 90 mm SL, 100 mm TL, as the lectotype of *P. javanica*. It was retained as RMNH 6797 and the remaining 16 specimens were removed as paralectotypes of *P. javanicus* and recataloged as RMNH 26206.

Bleeker's (1851a:414) description of *P. brachyrhynchus* was based on two specimens, 118 and 122 mm in TL, from Batavia. In the Bleeker collection specimens in Leiden cataloged as RMNH 6796, there are nine specimens one of which, 114 mm SL, 123 mm in TL, from Batavia, is selected as the lectotype of *P. brachyrhynchus*. The lectotype is retained as RMNH 6796 and the paralectotypes of 52–145 (56–? caudal mutilated) mm have been recataloged as RMNH 26207.

Holotype of *C. brevis*, BMNH 1855.12.26.602, 80 mm SL, from Ganges, ex. Zool. Society.

Holotype of *Cynoglossus puncticeps immaculata* Pellegrin and Chevey, MNHP 40.39, from Bac Lieu, Cochin China.

OTHER MATERIAL EXAMINED.—CHINA: 2 specimens, BMNH 1848.3.16 194a,b, China. 2, BMNH 1850.3.19.916 a,b, China. 1, BMNH 1851.12.27.215, China. 1, BMNH 1851.12.27.344, China. 1, BMNH 1924.12.15.67, Hainan Is., coll. Light. 4, BMNH 1924.12.15.68–71, Amoy, coll. Light. 10, BMNH 1924.12.15.72–81, Santuao, coll. Light. 9, BMNH 1924.12.15.80 a–h, Santuao, coll. Light. 1, BMNH 1930.7.28.16, Zingkow, coll. Chen. 2, BMNH 1930.7.28.14–15, Haikon, coll. Chen. 1, BMNH 1936.10.7.57, Foochow, coll. Chen. 4, USNM 6937, 6958, China. 1, UMMZ 70359, China, coll. Bead and Steeve.

PHILIPPINES: 1, BMNH 1872.10.18.133, Manila, coll. Meyer. 1, BMNH 1879.5.14.82, Philippines, coll. Challenger. 1, USNM 83075, Philippines. 1, USNM 1068026, Philippines, coll. H. C. Keller. 16, USNM 112871, 78–81, Philippines, coll. H. C. Keller. 1, USNM 113179, Philippines, coll. H. C. Keller. 18, USNM 137695–137703, Philippines, coll. H. C. Keller. 18, USNM 137695–137703, Philippines, coll. Albatross. 1, ANSP 635524, Philippines, coll. J. Clemense. 8, ANSP 82548, Philippines, coll. J. Clemense. 1, ANSP 82547, Philippines, coll. J. Clemense.

SINGAPORE: 1, BMNH 1933.12.27.6, Singapore, ex. Indian Museum. 2, BMNH 1933.7.31–32, Singapore, ex. Raffles Museum. 2, BMNH 1934.9.6.5–6, Singapore Mkt., ex. Raffles Museum. 10, BMNH 1934.11.21.9–18, Singlap, ex. Raffles Museum. 3, MCZ 11510, Singapore.

THAILAND: 1, USNM 109799, Gulf of Thailand, coll. H. M. Smith. 4, ANSP 61837, Paknam. 5, ANSP 61843–55, Paknam, coll. R. de Schanenam. 1, ANSP 61842, Paknam, coll. R. de Schanenam. 2, ANSP 61852–53, Bangkok, coll. R. de Schanenam. 1, ANSP 61841, Bangkok, coll. R. de Schanenam. 2, ANSP 61852–53, Bangkok, coll. R. de Schanenam. 1, ANSP 61841, Bangkok, coll. R. de Schanenam. 1, ANSP 61854, Bangkok, coll. R. de Schanenam. 2, ANSP 87437, Bangkok, coll. R. de Schanenam. 1, CAS (GVF), Gulf of Thailand, coll. Naga Expd.

BORNEO: 1, BMNH 1894.1.19.1932, Bruntal (Sarawak), coll. Brooke.

INDONESIA: 1, BMNH 1931.4.21.47, Java, coll. Hardenberg. 1, BMNH 1931.4.23.46, Batavia Mkt., coll. Hardenberg. 1, ZMA 108.002, Indonesia, coll. Tydeman. 5,

UMMZ (unregistered), Java. 2, AMNH 18414, Java. 1, NHV 43806, Java, coll. E. Novara. BURMA: 1, ZSI 1462, Moulmein, coll. F. Day.

INDIA: 1, BMNH 1852.9.13.235 B, Ganges, ex. Zool. Soc. 1, BMNH 1855.9.19.47, locality unknown, coll. Haslar. 1, BMNH 1862.6.3.15, locality unknown, coll. P. Bleeker. 1, BMNH 1862.6.3.20, locality unknown, coll. P. Bleeker. 1, BMNH 1889.2.1.4069, Bombay, coll. F. Day. 1, BMNH 1889.2.1.4072, Andamans, coll. F. Day. 1, BMNH 1889.2.1.4075, Calcutta, coll. F. Day. 1, BMNH 1928.3.20.113, Trivandrum, ex. Indian Museum. 1, BMNH 1928.3.20.114, Trivandrum, Travancore, ex. Indian Museum. 4, BMNH 1928.3.20.115–118, Ganjam coast, ex. Indian Museum. 2, BMNH 1928.3.20.119–120, Ganjam coast, 7–14 fms, ex. Indian Museum. 2, BMNH 1928.3.20.121–122, Chilka Lake, ex. Indian Museum. 1, BMNH 1928.3.20.123, Chilka Lake, ex. Indian Museum. 5, BMNH 1928.3.20.124–128, Chilka Lake, ex. Indian Museum. 2, BMNH 1928.3.20.129–30, Orissa coast, 7 fms, ex. Indian Museum. 1, BMNH 1928.3.20.131, Ganjam coast, 8–9 fms, ex. Indian Museum. 1, BMNH 1933.1.2–7, Calicut, Malabar, coll. Devanesan. 2, BMNH 1938.8.9.11.12, Calicut, coll. Devanesan. 1, ZSI 139, Travancore, coll. F. Day. 2, ZSI 161 and 282, Goa, coll. S. W. Kemp. 1, ZSI 463, Calcutta bazar, ex. Asiatic Society. 1, ZSI 1147, Calicut, coll. F. Day. 1, ZSI 1148, Bombay, coll. F. Day. 1, ZSI 1459, Calcutta, coll. F. Day. 1, ZSI 2691, Calcutta, coll. F. Day. 1, ZSI 2693, Madras, coll. F. Day. 2, ZSI 12167, Orissa coast, coll. Marine Survey. 2, ZSI 12235 and 12673, Ganjam coast, Orissa, coll. Marine Survey. 8, ZSI 12658–63 to 70, Ganjam coast, coll. Marine Survey. 1, ZSI 12674, Ganjam coast, 4–14 fms, coll. Marine Survey. 2, ZSI  $\frac{F 4188}{1}$ , Trivandrum, ex. Trivandrum Museum. 2, ZSI  $\frac{F 8579}{1}$ , Calcutta bazar, ex. Asiatic Society. 1, ZSI  $\frac{F 8580}{1}$ , Calcutta bazar, ex. Asiatic Society. 1, ZSI  $\frac{F 922}{2}$ , 5 mi SE of Geokale, Patashmpur, Chilka Lake, Orissa, coll. K. S. Misra. 6, ZSI  $\frac{F 962}{2}$ , S of Cherryakuda Is., 4 mi NE of Ramba, Chilka Lake, Orissa, coll. K. S. Misra. 5, ZSI  $\frac{F 1655}{2}$ , North Ernakulam Back Waters, coll. F. H. Gravely. 10, ZSI (unregistered), Kerala, coll. A. G. K. Menon. 9, ZSI (unregistered), Barkul, Chilka Lake, coll. Chilka Survey, 1.3.1914. 1, ZSI (unregistered), Barkul, Chilka, coll. Chilka Survey, 5.3.1914. 2, ZSI (unregistered), S of Kalidai, Chilka Lake, coll. Chilka Survey, 5.3.1914. 1, ZSI (unregistered), Kalidai, Chilka Lake, coll. Chilka Survey, 21.2.1914. 14, ZSI (unregistered), Channel off Barhampore, Chilka Lake, coll. Chilka Survey, 2.9.1914. 1, ZSI (unregistered), Gopkuda Bay, Chilka Lake, coll. Chilka Survey, 14.2.1914. 5, ZSI (unregistered), Channel of Satpara, coll. Chilka Survey. 1, ZSI (unregistered), Kalupara Ghat, Chilka Lake, coll. Chilka Survey. 1, ZSI (unregistered), Patashmpur, Chilka Lake, coll. Chilka Survey, 12.3.1914. 1, ZSI (unregistered), Long Is., near Manipatna, Chilka Lake, coll. Chilka Survey. 1, ZSI (unregistered), Cheriya Is. to Barkuda Is. across mouth of Rambha Bay, coll. Chilka Survey, 1914. 1, ZSI (unregistered), Barkuda Is., Chilka Lake, coll. Chilka Survey, 17.2.1914. 1, ZSI (unregistered), Cheriya Is. Bay, Chilka Lake, coll. Chilka

Survey. 1, ZSI (unregistered), channel between Satpara and Barikuda, Chilka Lake, coll. Chilka Survey. 4, ZSI (unregistered), W of Satpara, Chilka Lake, coll. Chilka Survey. 2, ZSI (unregistered), Cochin, coll. Edward. 4, ZSI (unregistered), Cochin, coll. Dr. A. Daniel, 22.9.1960. 2, ZSI (unregistered), Cochin, coll. Dr. Quasim. 1, ZSI (unregistered), Aleppy, Kerala, coll. Chakrapany. 1, ZSI (unregistered), Travancore, coll. Dr. E. G. Silas. 1, ZSI (unregistered), Karwar, coll. K. K. Tiwari. 1, SOSC, Madras, coll. Anton Bruun. 1, ANSP 74855, Calcutta. 1, NHV 43770, Calcutta, coll. F. Day.

PAKISTAN: 1, BMNH 1889.2.1.4068, Sind, coll. F. Day. 2, BMNH 1911.12.6.17.18, Karachi, coll. Townsend. 1, NHV 43772, Sind, coll. F. Day.

### 34. *Cynoglossus durbanensis* Regan

FIGURE 37; PLATE 15

*Cynoglossus durbanensis* Regan, 1921a:2 [type-locality: Durban, South Africa].—Bonde, 1922:25.—Barnard, 1925:412.—Smith, 1949:165.

**DESCRIPTION.**—Based on 7 specimens, 88.5–182.0 mm SL, including the lectotype and paralectotype of *C. durbanensis*.

Depth of body, 25.82–30.88 ( $M = 28.31$ ), length of head 17.43–20.90 ( $M = 18.95$ ) percent of standard length. Diameter of eye 8.20–10.87 ( $M = 9.78$ ), interorbital space 6.38–10.81 ( $M = 8.67$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in front of interorbital space. Snout obtusely rounded, 23.40–33.96 ( $M = 30.20$ ) percent of length of head, rostral hook short, ends in front of anterior nostril. Maxillary extending to below posterior half of fixed eye; angle of mouth extending below vertical from middle or posterior half of fixed

eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 40.43–49.06 ( $M = 43.70$ ), angle of mouth to branchial opening 55.32–63.04 ( $M = 58.11$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those of lateral lines.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line usually entering dorsal fin along 3rd–5th ray counted from the rear, midlateral line with 90–106 ( $M = 99$ ) scales, 18–21 ( $M = 20$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	18	19	20	21
Frequencies	1	1	4	1

**Fins:** Dorsal with 98–105 ( $M = 102$ ) rays, anal with 78–84 ( $M = 81$ ) rays, caudal 8(9) in 5 specimens (radiographs).

**Vertebrae:** 48–50, comprising 9 abdominal and 39–41 caudal elements in 5 specimens (radiographs).

**Coloration:** Light brownish with darker irregular blotches and dots in preserved material.

**Size:** Largest specimen examined (lectotype) is 184 (170 + 14) mm from Durban.

**DISTRIBUTION.**—Africa (Natal to Zanzibar).

**DIAGNOSIS AND AFFINITIES.**—The nearest relative of *C. durbanensis* is *C. gilchristi*. The features that distinguish this species are: the deeper body (mean depth 28.31 percent of SL cf. 27.16 percent), smaller eyes (mean diameter 9.78 percent of head cf. 11.56 percent), wider interorbital space (mean width 8.67 percent of head cf. 6.22 percent), and smaller body scales, the interlinear scale rows being 18–21,  $M = 19$ , whereas in *C. gilchristi* there are only 14–15,  $M = 14$ .

**TYPE SPECIMENS.**—BMNH 1920.7.23.37, 170 mm

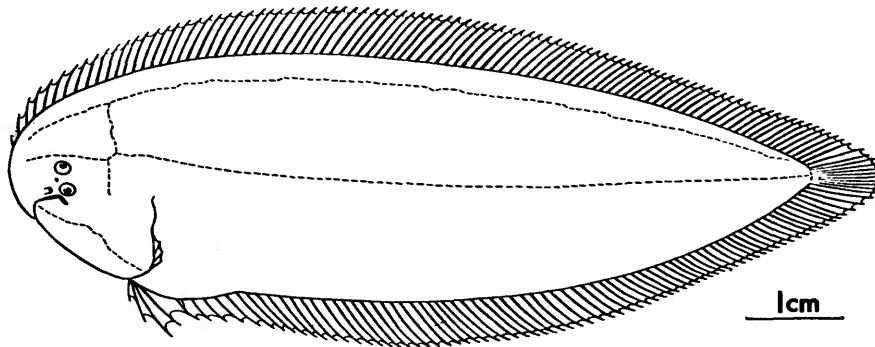


FIGURE 37.—Outline drawing of *C. durbanensis* (BMNH 1922.5.5.20) from Lumbo.

SL, from Durban, coll. H. W. B. Marley, an excellent example of the species, is selected here as the lectotype of *C. durbanensis* and BMNH 1920.7.23.38, 152 mm SL, collected along with the lectotype as the paralectotype.

**OTHER MATERIAL EXAMINED.**—1 specimen, BMNH 1920.12.6.30, Durban, ex. Transvaal Museum. 1, BMNH 1922.5.5.20, Lumbo, E Africa, coll. Laveridge. 1, ANSP 63890, Durban, coll. H. W. Bell Marley, 1935. 1, ANSP 87113, Natal coast, coll. H. W. Bell Marley, 1935. 3, MCZ 11519, Zanzibar, coll. Cooke.

### 35. *Cynoglossus gilchristi* Regan

FIGURE 38; PLATE 16

*Cynoglossus brachycephalus* [not Bleeker].—Gilchrist, 1905:12, pl. 30.—Bonde, 1922:25.—Gilchrist and Thompson, 1917:399.

*Cynoglossus gilchristi* Regan, 1920:222 [type-locality: Natal, off mouth of Umhlanga River].—Barnard, 1925:412.—Bonde, 1925:294.

*Cynoglossoides gilchristi*.—Smith, 1949:165, fig. 337.

**DESCRIPTION.**—Based on 4 specimens, 44.0–133.0 mm SL, including the holotype of *C. gilchristi*.

Depth of body 24.81–28.73 ( $M = 27.16$ ), length of head 18.0–23.86 ( $M = 21.58$ ) percent of standard length. Diameter of eye 8.0–18.18 ( $M = 11.56$ ), interorbital space 4.55–7.89 ( $M = 6.22$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in front of the interorbital space. Snout rounded, 26.0–31.82 ( $M = 28.84$ ) percent of length of head, rostral hook rather short, ends below anterior nostril or just in front of it. Maxillary extending to below middle or posterior half of fixed eye; angle of mouth extending to below vertical

from anterior half or middle of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 44.0–47.62 ( $M = 46.11$ ), angle of mouth to branchial opening 54.55–57.89 ( $M = 56.40$ ) percent of length of head.

**Scales:** Ctenoid on both sides, including those of lateral lines.

**Lateral-Line System:** Two lateral lines on ocular side, dorsolateral line more or less undulated, generally stopping at four-fifths of length of the body and becoming obscure; midlateral line with 74–80 ( $M = 77$ ) scales, 14–15 ( $M = 15$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	14	15
Frequencies	1	3

**Fins:** Dorsal with 104–110 ( $M = 106$ ) rays, anal with 82–86 ( $M = 84$ ) rays, caudal 8 in 3 specimens (radiographs).

**Vertebrae:** 50 comprising of 9 abdominal, 49 caudal elements in 3 specimens (radiographs).

**Coloration:** Upper side light brown with irregular darker blotches, lower whitish in preserved specimens.

**Size:** Largest specimen examined (holotype), 141 (133 + 8) mm, is from Natal.

**DISTRIBUTION.**—From Natal and Delagoa Bay to Nossi Be, Madagascar; recorded from depths of 4–30 fms.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus gilchristi* is closely related to *C. durbanensis*; the differences distinguishing it from *C. durbanensis* are outlined under *C. durbanensis*.

**TYPE SPECIMENS.**—Holotype of *C. gilchristi*, BMNH 1903.9.29.2, 133 mm SL, Umhlanga R., Natal, S Africa, coll. Gilchrist.

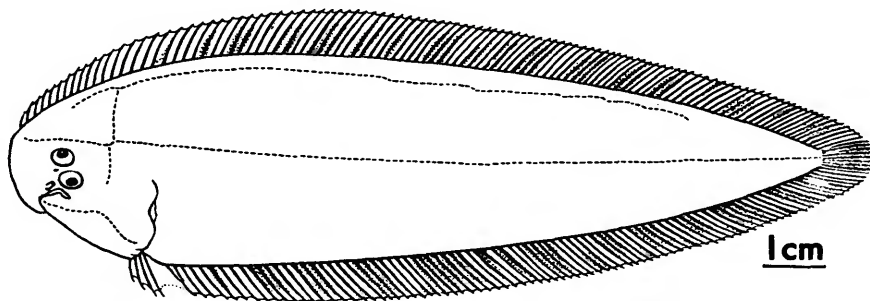


FIGURE 38.—Outline drawing of *C. gilchristi*, holotype (BMNH 1903.9.29.2) from Natal.

OTHER MATERIAL EXAMINED.—3 specimens, SOSC Ref 134, Nossi Be, Madagascar, lat. 13°20'50"S, long. 48°19'50"E, coll. *Te-vega* Expd.

### The *lida* complex

*Cynoglossus lida*, the only species forming the *lida* complex, is characterized by a broadly round prominent snout, the angle of the mouth being distinctly nearer to the branchial opening than to the tip of the snout and the rostral hook extending to as far below the middle of the fixed eye. In all other features it appears to be closely related to the *puncticeps* complex and may have evolved from a common ancestral stock.

### 36. *Cynoglossus lida* (Bleeker)

FIGURE 39; PLATE 16

*Plagusia lida* Bleeker, 1851a:415 [type-locality: Batavia]; 1852:23.

*Arelia lida*.—Bleeker, 1859:184.

*Cynoglossus lida*.—Günther, 1862:498.—Bleeker, 1875:36, pl. 243: fig. 2.—Day, 1877:436, pl. 97: fig. 3; 1889:458.—Alcock, 1889:288.—Vinciguerra, 1889:188.—Jenkins, 1910a: 30.—Regan, 1920:221, fig. 5 [Durban].—Bónde, 1922:25.—Barnard, 1925:411 [Natal coast].—Fowler, 1925:187 [Natal].—Norman, 1928:210.—Weber and de Beaufort, 1929:203.—Smith, 1933:83.—Fowler, 1935:405 [Natal and Zululand].—Smith, 1949:166.—Herre, 1953:190.—Munro, 1955:206.—Silva, 1956:199.—Fowler, 1956:187, fig. 102.—Punpoka, 1964:61.—Chen and Weng, 1965:94 [Taiwan].

*Plagusia polytaenia* Bleeker, 1853c:529 [type-locality: Priaman].

*Arelia polytaenia*.—Bleeker, 1859:185.

*Cynoglossus polytaenia*.—Bleeker, 1875:36, pl. 244: fig. 1.—Weber and de Beaufort, 1929:201.

*Cynoglossus intermedius* Alcock, 1889:288.

*Cynoglossus os* Fowler, 1904:556 [type-locality: Padang, Sumatra].

DESCRIPTION.—Based on 23 specimens, 45.0–200.0 mm SL, including the holotype of *C. intermedius*.

Depth of body 21.92–27.55 ( $M = 23.78$ ), length of head 21.15–25.56 ( $M = 23.30$ ) percent of standard length. Diameter of eye 3.70–8.89 ( $M = 6.32$ ), interorbital space 3.19–7.41 ( $M = 3.93$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout rounded, 30.43–43.33 ( $M = 37.99$ ) percent of length of head, rostral hook rather long, extending to as far as below middle of fixed eye. Maxillary extending to below posterior border of fixed eye, or just behind it; angle of mouth extending to below vertical from posterior half of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 44.44–57.45 ( $M = 53.03$ ), angle of mouth to branchial opening 41.57–55.56 ( $M = 46.55$ ) percent of length of head.

Scales: Ctenoid on both sides.

Lateral-Line System: Two lateral lines on ocular side, midlateral line with 72–90 ( $M = 80$ ) scales, 12–15 ( $M = 13$ ) scales between middle and upper lateral line. No lateral line on blind side.

Interlinear scale rows	12	13	14	15
Frequencies	16	37	20	2

Fins: Dorsal with 99–108 ( $M = 105$ ) rays, anal with 77–85 ( $M = 81$ ) rays, caudal 10 in 57 specimens (radiographs).

Vertebrae: 47–52, comprising 9 abdominal and 38–43 caudal elements in 57 specimens (radiographs).

Coloration: Upper side light brownish, lower whitish in preserved specimens.

Size: Largest specimen examined is 213.0 (200 + 13) mm, trawled by *Anton Bruun*.

DISTRIBUTION.—From Malay-Archipelago and

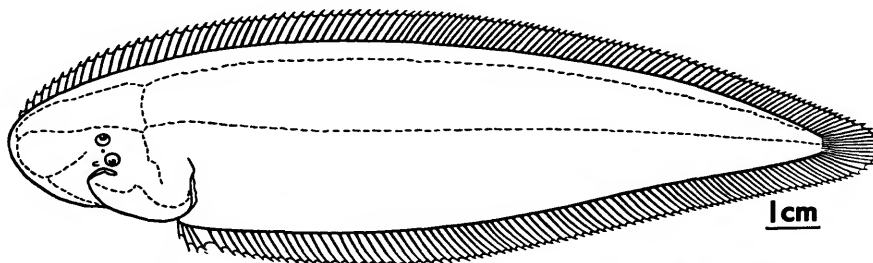


FIGURE 39.—Outline drawing of *C. lida* (BMNH 1919.9.12.50) from Durban.

Philippines through seas of India and Pakistan to East Coast of Africa; recorded from a depth of 13–15 fms.

**DIAGNOSIS AND AFFINITIES.**—Superficially *C. lida* resembles *C. puncticeps* in many morphometric characters. It is distinguishable, however, by the lack of dark irregular blotches on the body and the dark brown marking of some of the rays of the vertical fins and by the shape of its broadly rounded snout (mean length 37.99 cf. 32.67 percent of head). It is also characterized by the rictus of the mouth being much nearer to the gill opening than to the end of snout (mean distance from rictus of mouth to gill opening 46.55 percent of head cf. 55.62 percent of head).

**NOTE ON SYNONYMY.**—Bleeker's description of *P. lida* was on the basis of five specimens, 100–145 mm in TL, from Batavia. He characterized it as having two lateral lines on the left side separated by 13 series of scales and having the angle of the mouth nearer to the gill opening than to the end of the snout. Norman (1928:210) synonymized *C. intermedius* Alcock with *C. lida*. I have examined the holotype of *C. intermedius* in the *Zoological Survey of India* and find that the differences noted by Alcock in the type of *C. intermedius*, such as the more numerous, weakly ctenoid scales and the longer head, are attributable to intraspecific variation and that they are conspecific. Günther (1862:498) considered *P. polytaenia* Bleeker (1853e:529) conspecific with *P. lida* though Weber and de Beaufort (1929:201) retained it as a separate species from *C. lida*. I examined a specimen, BMNH 1862.6.3.14, of *P. polytaenia* from the Bleeker collection in London and found it to conform well with Bleeker's description and figure of *P. lida*. Fowler (1904:556) described *C. os* based on a single specimen from Pedang. I have not been able to locate the type in Philadelphia (pers. comm., Dr. James C. Tyler), but from the description it is found to exhibit no significant difference from *P. lida*.

**TYPE SPECIMENS.**—Among Bleeker's material in Leiden is one obviously composite lot (RMNH 6791) of 6 specimens, including the 5 syntypes of *P. lida* (pers. comm., Dr. M. Boeseman). Since Bleeker in his *Atlas* (1875:6, pl. 243: fig. 2) gave the illustration of a specimen measuring 145 mm in TL, obviously the largest specimens in the syntype series, a specimen 134 mm SL, approximately 145 mm in TL, in the lot RMNH 6791, is selected as

lectotype of *P. lida* and retained in RMNH 6791. The other five examples, 91–126 (100–136) mm, recataloged as RMNH 26208, include 4 paralectotypes of *P. lida*.

Bleeker described *P. polytaenia* on the basis of a single specimen, 107 mm in TL, from Priaman, Sumatra. Among the Bleeker collection in Leiden is a specimen 100 mm in SL, 107 mm in TL, indicated as holotype, RMNH 6790, presumably by Chabanaud (pers. comm., Dr. Boeseman).

Holotype of *C. intermedius*, ZSI 12246, 192.5 mm SL, Orissa coast, coll. Marine Survey.

**OTHER MATERIAL EXAMINED.**—PHILIPPINES: 1 specimen, BMNH 1872.4.6.96, Celebes, coll. Meyer. 12, USNM (unregistered), Philippines, coll. *Albatross*, 1907–09. 5, USNM 137955–59, Philippines, coll. *Albatross*. 9, USNM (unregistered), Philippines, coll. *Albatross*. INDONESIA: 1, BMNH 1862.6.3.14, locality not given, coll. P. Bleeker. 1, BMNH 1862.6.3.16, locality not given, coll. P. Bleeker. 1, ZMA OR-276101, Indonesia. BURMA: 1, BMNH 1889.2.1.4064, Sitoung, coll. F. Day. 1, ZSI 2688, Burma, coll. F. Day. INDIA: 1, BMNH 1928.3.20.129–30, Orissa coast, ex. Indian Museum. 1, BMNH 1928.3.20.31, Ganjam coast, ex. Indian Museum. 2, ZSI 12259–60, Orissa coast, coll. Marine Survey. 2, ZSI 12684–85, Orissa coast, coll. Marine Survey. 2, ZSI F  $\frac{1228}{2}$ , and F  $\frac{1560}{2}$ , Tranquebar, E coast, India, coll.

A. G. K. Menon. 1, ZSI F  $\frac{1246}{2}$ , Kilingimedu, Karaikkal, coll. A. G. K. Menon. 1, ZSI F  $\frac{1225}{2}$ , Sonakuppam, Cuddalore, coll. A. G. K. Menon. 28, SOSC Ref 170, Madras, coll. *Anton Bruun*. AFRICA: 1, BMNH 1919.9.12.50, Durban, coll. Marley. 13, SOSC Ref 170, Mozambique coast, lat. 19°09'S, long. 36°30'E, coll. *Anton Bruun*. 8, SOSC Ref 170, NW coast of Madagascar, coll. *Anton Bruun*. 1, SOSC Ref 170, Mozambique coast, coll. *Anton Bruun*. 2, ANSP 64104–05, Mozambique, coll. *Albatross*. 1, ANSP 84664, Natal, coll. H. W. Bell Marley. 1, ANSP 86319, Natal, coll. H. W. Bell Marley. 2, MCA 34108, Mozambique, coll. T. Barbous. 1, RU 275565, Inhaca., coll. J. L. B. Smith.

### The *carpenteri* group

This group is basically a natural assemblage of specialized, lately evolved species of *cynoglossus*. The principal characters distinguishing this group are three lateral lines on the ocular side, none on the blind side, two nostrils on ocular side, snout long and pointed, with the angle of mouth situated nearer to branchial opening than to tip of snout, small eyes usually with a narrow interorbital space (absent in *C. suyeni*), small scales, the interlinear scale count being 15–22. The species of this group are distributed on one hand in the Philippines



through Celebes to the Timor Sea and on the other in the seas of India and Pakistan to the East Coast of Africa. This group is most probably derived from a *cynoglossus*-like ancestor through elongation of the body (especially the snout), reduction in the size of the body scales, and addition of a ventrolateral line on the ocular side.

#### The *carpenteri* complex

*Cynoglossus carpenteri*, *C. acutirostris*, *C. marleyi*, and *C. suyeni* form the *carpenteri* complex, which is the only complex under the *carpenteri* group. The characteristics of the complex are, therefore, the same as given above for the group.

#### 37. *Cynoglossus carpenteri* Alcock

FIGURE 40; PLATE 17

*Cynoglossus carpenteri* Alcock, 1889:287, pl. 18: fig. 1 [type-locality: Orissa coast]; 1890a:217; 1896:330; 1898, pl. 22: fig. 5; 1899:133.—Boulenger, 1901:263.—Regan, 1905b:329.—Norman, 1928:196.—Saramma, 1963:75 [Kerala coast].

**DESCRIPTION.**—Based on 21 specimens, 60.0–181.0 mm SL, including lectotype and paralectotype of *C. carpenteri*.

Depth of body 23.81–29.5 ( $M = 26.66$ ), length of head 27.61–33.87 ( $M = 29.85$ ) percent of standard length. Diameter of eye 6.33–10.53 ( $M = 8.56$ ), interorbital space 2.08–6.56 ( $M = 3.74$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in front of interorbital space. Snout

obtusely pointed, 30.85–36.84 ( $M = 33.32$ ) percent of head; rostral hook rather short, extends up to a point from anterior nostril to anterior border of fixed eye. Maxillary extending to well beyond fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye or little beyond it, either slightly nearer to branchial opening than to tip of snout or midway between these two; tip of snout to angle of mouth 39.02–56.10 ( $M = 50.76$ ), angle of mouth to branchial opening 47.37–54.55 ( $M = 48.78$ ) percent of length of head.

**Scales:** Cycloid on ocular side with ctenoid scales posteriorly, cycloid on blind side.

**Lateral-Line System:** Three lateral lines on ocular side, both dorsolateral and ventrolateral lines usually entering dorsal and anal fins respectively at a very short distance from caudal base, midlateral line with 75–96 scales, 15–19 ( $M = 16$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	15	16	17	18	19
Frequencies	10	14	4	1	1

**Fins:** Dorsal with 101–110 ( $M = 107$ ) rays, anal with 80–89 ( $M = 84$ ) rays, caudal 10 in 12 specimens (radiographs).

**Vertebrae:** 51–55 comprising 9 abdominal and 42–46 caudal elements in 12 specimens (radiographs).

**Coloration:** Upper side uniformly brownish, opercular region rather blackish, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 230 (212 + 18) mm, is from the Indian Ocean trawled by *Anton Bruun*.

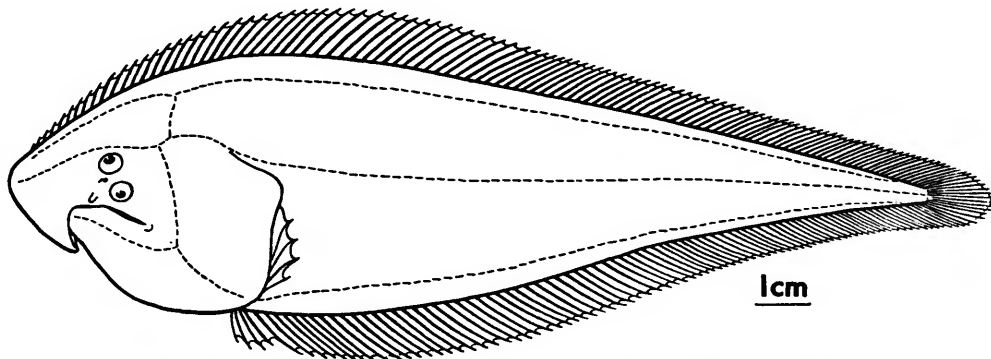


FIGURE 40.—Outline drawing of *C. carpenteri* (BMNH 1928.3.20.75) from Bay of Bengal.

**DISTRIBUTION.**—Seas of India to Persian Gulf; trawled from a depth of 68–230 fms.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus carpenteri*, *C. acutirostris*, *C. marleyi*, and *C. suyeni* are four allopatric species that resemble each other in the small, and closely placed eyes, wide mouth cleft extending below or beyond the posterior border of fixed eye, and long pointed snout, all specifications for living on a sandy or muddy bottom and plowing or burrowing into the substratum for feeding. *Cynoglossus carpenteri* is closely related to *C. acutirostris* but can be separated from it by its shorter snout (33.2 percent cf. 43.46 percent of head) and somewhat larger scales (15–19 cf. 18–20 interlinear rows).

**TYPE SPECIMENS.**—A specimen, ZSI 12434, 148 mm SL, from Orissa coast, coll. Marine Survey, is here selected as the lectotype of *C. carpenteri* and a specimen, ZSI 12433, 141.5 mm SL, collected along with the lectotype as the paralectotype.

**OTHER MATERIAL EXAMINED.**—INDIA: 6 specimens, ZSI 12727, Bay of Bengal, 98–102 fms, coll. Marine Survey. 6, ZSI 12728, Bay of Bengal, 98–102 fms, coll. Marine Survey. 6, ZSI 13589–94, Bay of Bengal, coll. Marine Survey. 9, ZSI F 647/1–656/1, off Calicut coast, 100 fms, coll. Marine Survey. 6, ZSI F 1275/1–1280/1, Arabian Sea, 156–200 fms, coll. Marine Survey. 3, BMNH 1890.7.31.10–12, Ganjam coast, lat. 18°30'N, long. 84°36'E, coll. Marine Survey. 3, BMNH 1890.11.28.27–29, Ganjam coast, lat. 18°30'N, long. 84°46'E, coll. Marine Survey. 1, BMNH 1928.3.20.74, Arabian Sea, 156–200 fms, ex. Indian Museum. 3, BMNH 1928.3.20.75–77, Bay of Bengal, 28–102 fms, ex. Indian Museum. 3, BMNH 1928.3.20.78–80, off Calicut coast, 100 fms, coll. Marine Survey. 53, SOSC Ref 23, Arabian Sea, lat. 24°13'N, long. 65°52'E, 93 fms, coll. *Anton Bruun*. 1, SOSC Ref 23, Arabian Sea, lat. 24°10'N, long. 65°54'E, 126 fms, coll. *Anton Bruun*. 19, SOSC Ref 23, Arabian Sea, lat. 23°13'N, long. 66°40'E, 100 fms, coll. *Anton Bruun*. 18, SOSC Ref 23, Arabian Sea, lat. 24°55'N, long. 61°10'E, 100 fms, coll. *Anton Bruun*. 116, SOSC Ref 23, Arabian Sea, lat. 24°13'N, long. 65°52'E, coll. *Anton Bruun*. 2, USNM 44418, Bay of Bengal, coll. RIMS Investigator. OMAN: 4, ZSI F 1160/1–63/1, Gulf of Oman, 230 fms, coll. Marine Survey. 3, BMNH 1901.1.30–32, Sea of Oman, 24°59'N, 60°58'E, 100 fms, coll. Townsend. 2, BMNH 1901.1.81.14–15, Gulf of Oman, 25°35'N, 57°47'E, 170 fms, coll. Townsend. 1, BMNH 1939.5.24.1799, Gulf of Oman, 196 fms, coll. *John Murray* Expd. PERSIA: 3, BMNH 1903.7.8.24–26, Persian Gulf, 15 fms, coll. Townsend.

### 38. *Cynoglossus acutirostris* Norman

FIGURE 41; PLATE 17

*Cynoglossus (Areliscus) acutirostris* Norman, 1939:104, fig. 35 [type-locality: Gulf of Aden].

**DESCRIPTION.**—Based on 11 specimens, 182.0–238.0 mm SL, including lectotype and paralectotypes of *C. acutirostris*.

Depth of body 26.29–30.53 ( $M = 28.40$ ), length of head 23.11–27.47 ( $M = 26.04$ ) percent of standard length. Diameter of eye 6.14–9.71 ( $M = 7.95$ ), interorbital space rather narrow, 0.91–3.88 ( $M = 1.92$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular in front of fixed eye, posterior nostril simple, immediately in front of interorbital space. Snout acutely pointed, 37.74–48.54 ( $M = 43.46$ ) percent of head; rostral hook rather long, reaches below anterior border of fixed eye. Maxillary extending beyond fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye or just beyond, much nearer to branchial opening than to tip of snout, tip of snout to angle of mouth 52.83–65.05 ( $M = 58.40$ ), angle of mouth to branchial opening 35.79–45.28 ( $M = 39.90$ ) percent of length of head.

**Scales:** Cycloid on ocular side with ctenoid scales posteriorly; cycloid on blind side.

**Lateral-Line System:** Three lateral lines on ocular side, both dorsolateral and ventrolateral lines slightly undulating and entering dorsal and anal fins, respectively, at a very short distance from caudal base; midlateral line with 84–92 ( $M = 87$ ) scales, 18–20 ( $M = 19$ ) scales between them. No lateral line on blind side.

Interlinear scale rows	18	19	20
Frequencies	5	4	2

**Fins:** Dorsal with 110 rays, anal with 94 rays, caudal 10 in 1 specimen (radiograph).

**Vertebrae:** 58, comprising 9 abdominal and 49 caudal elements in 1 specimen (radiograph).

**Coloration:** Upper side uniformly brownish, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 254 (238 + 16) mm, is one of the type specimens from Gulf of Aden.

**DISTRIBUTION.**—Gulf of Aden; trawled from a depth of about 120 fms.

**DIAGNOSIS AND AFFINITIES.**—The acutely pointed long snout is unique among the species of the genus *Cynoglossus* and serves as a ready diagnostic character. In most other characters *C. acutirostris* is very similar to *C. carpenteri*.

**TYPE SPECIMENS.**—A specimen, BMNH 1939.5.24.1800, 238 mm SL, from Gulf of Aden, coll.

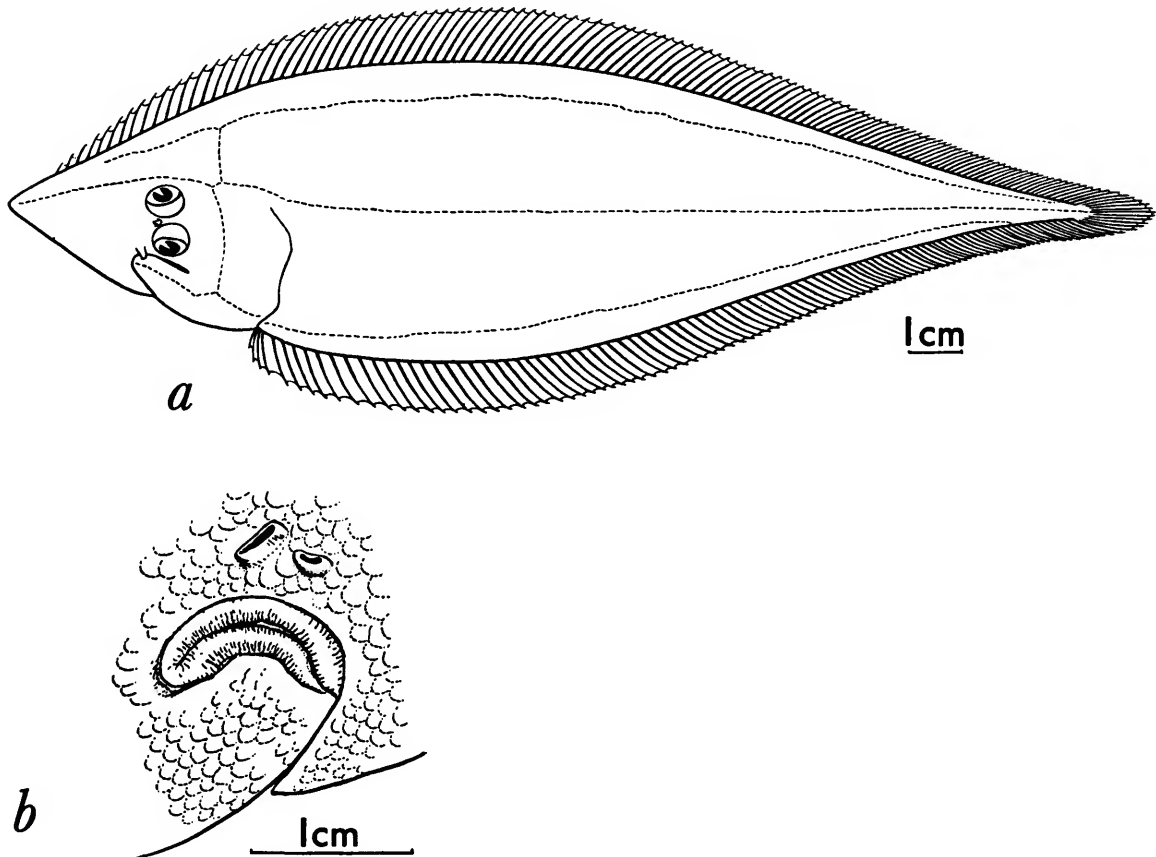


FIGURE 41.—*C. acutirostris*, lectotype (BMNH 1939.5.24.800): *a*, outline drawing of lateral view of ocular side; *b*, details of head of blind side.

*John Murray* Expd. is here selected as the lectotype of *C. acutirostris* and 9 specimens, BMNH 1939.5.24.1801–1809, 182–238 mm SL, collected along with the lectotype and a specimen, USNM 109493, 190 mm SL, also collected along with the lectotype are the paralectotypes.

### 39. *Cynoglossus marleyi* Regan

FIGURE 42; PLATE 18

*Cynoglossus (Trulla) marleyi* Regan, 1921b:418 [type-locality: off Umvoti River, Natal].  
*Areliscus marleyi*.—Bonde, 1922:25.—Barnard, 1925:414.—Fowler, 1925:187.—Bonde, 1925:292.—Fowler, 1935:361.—Barnard, 1937:41.—Smith, 1949:166.

**DESCRIPTION.**—Based on 2 specimens, 162.0–316.0 mm SL, including the holotype of *C. marleyi*.

Depth of body 21.60–25.63 ( $M = 23.62$ ), length of head 18.0–20.68 ( $M = 19.34$ ) percent of standard length. Diameter of eye 7.0–8.96 ( $M = 7.98$ ), interorbital space 2.63–4.48 ( $M = 3.56$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout pointed, 38.81–45.61 ( $M = 42.41$ ) percent of length of head; rostral hook rather long, reaches below fixed eye. Maxillary extending to below posterior border of fixed eye, or a little beyond it, angle of mouth extending to below vertical from posterior border of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 52.24–59.65 ( $M = 55.95$ ), angle of mouth to branchial opening 40.30–47.37 ( $M = 43.34$ ) percent of length of head.

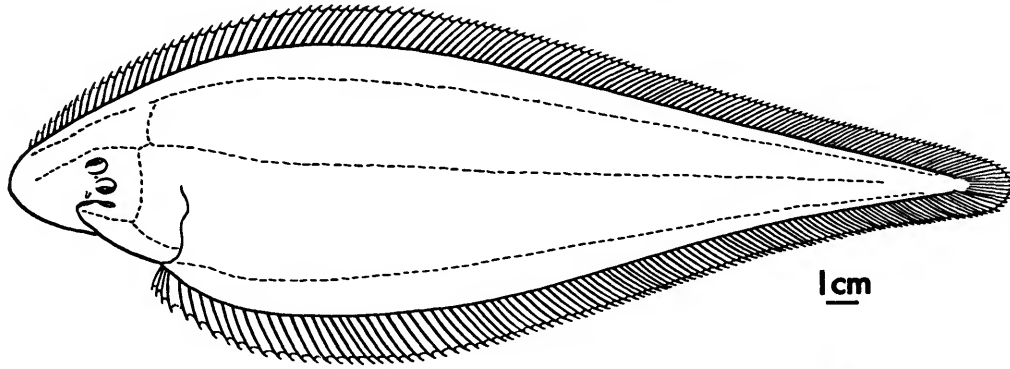


FIGURE 42.—Outline drawing of *C. marleyi*, holotype (BMNH 1921.3.1.21) from Natal.

**Scales:** Ctenoid on both sides.

**Lateral-Line System:** Three lateral lines on ocular side, midlateral line with 112–113 scales, 18–19 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	18	19
Frequencies	1	2

**Fins:** Dorsal with 126 rays, anal with 105 rays, caudal 10 in 1 specimen (radiograph).

**Vertebrae:** 62, comprising 9 abdominal and 53 caudal elements in 1 specimen (radiograph).

**Coloration:** Upper side uniform brown, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 336 (316 + 20) mm, is the holotype from Natal.

**DISTRIBUTION.**—Durban to Delagoa Bay; recorded from depths of 30–150 fms.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus marleyi*, which is restricted in its distribution to South Africa, is related to *C. carpenteri* and is undoubtedly evolved from a *carpenteri*-like ancestor. The ctenoid scales on the ocular side and the more elongate snout (mean length 42.21 percent of head cf. 33–32 percent) distinguish it from *C. carpenteri*.

**TYPE SPECIMENS.**—Holotype of *C. marleyi*, BMNH 1921.3.1.21, 316 mm SL, from Natal, 130 fms, coll. Marley.

**OTHER MATERIAL EXAMINED.**—1 specimen, 160 mm SL, from off Natal coast, lat. 29°27'S, long. 31°31'E, coll. Anton Bruun, 25.9.64.

#### 40. *Cynoglossus suyeni* Fowler

PLATE 18

*Cynoglossus xiphoideus* [not Günther].—Weber, 1913b:441.—Weber and de Beaufort, 1929:193 [Timor Sea].

*Cynoglossus suyeni* Fowler, 1934a:347, fig. 101 [type-locality: Mindora Is., Philippines].

*Cynoglossus beauforti* Chabanaud, 1951c:3, figs. 2, 3 [type-locality: Timor Sea].

**DESCRIPTION.**—Based on 20 specimens, 110.0–257.0 mm SL, including the holotypes of *C. suyeni* and *C. beauforti*.

Depth of body 19.29–25.25 ( $M = 22.59$ ), length of head 19.39–23.23 ( $M = 21.13$ ) percent of standard length. Diameter of eye 6.67–12.28 ( $M = 9.10$ ) percent of length of head, interorbital space mostly absent, or very narrow. Two nostrils on ocular side, anterior nostril tubular in front of lower eye, posterior nostril simple, in anterior part of interorbital space. Snout rather pointed, 38.46–46.34 ( $M = 42.97$ ) percent of length of head; rostral hook long, reaches below anterior border of fixed eye. Maxillary extending well beyond fixed eye; angle of mouth extending just behind vertical from posterior border of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 53.33–60.98 ( $M = 57.61$ ), angle of mouth to branchial opening 39.02–48.31 ( $M = 44.05$ ) percent of length of head.

**Scales:** Ctenoid on both sides.

**Lateral-Line System:** Three lateral lines on ocular side; midlateral line with 102–126 ( $M = 114$ ) scales, 19–22 ( $M = 20$ ) scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	19	20	21	22
Frequencies	4	9	3	1

*Fins*: Dorsal with 115–126 ( $M = 110$ ) rays, anal with 92–105 ( $M = 91$ ) rays, caudal 10 in 9 specimens (radiographs).

*Vertebrae*: 57–61, comprising 9 abdominal and 48–52 caudal elements in 9 specimens (radiographs).

*Coloration*: Upper side uniformly brownish, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 275 (257 + 18) mm, is from Philippine-Celebes area, trawled by *Albatross*.

*DISTRIBUTION*.—From Philippines through Celebes to the Timor Sea; trawled from a depth of 173 fms.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus suyeni*, which is restricted to the deeper waters off Mindanao Island southward through the Celebes Sea to the Timor Sea, is closely related to *C. carpenteri* and has undoubtedly evolved from a *carpenteri*-like ancestor. It can be readily separated from *C. carpenteri* by the nature and position of its eyes, which are scaly and contiguous. The ctenoid scales on the ocular side and the longer snout (mean length 42.97 percent of head cf. 33.2 percent) further distinguish it from *C. carpenteri*. The scaly covered contiguous eyes are considered a further specialization for a burrowing mode of life.

*NOTE ON SYNONYMY*.—*Cynoglossus beauforti* Chabanaud (1951c) was described based on a specimen obtained from the Timor Sea by the Siboga Expedition and included under *C. xiphoides* by Max Weber (1931:441). Weber and de Beaufort (1929:193) in giving the description of *C. xiphoides* (not Gunther) observed:

We made the above description after the specimen of the Siboga Expedition from the Timor sea, mentioned by one of us *l.c.*, who stated already that there are some differences between Gunther's type specimen and this one. In the type the eyes are separated by more than one eye diameter and the upper one is considerably in advance of the lower; also the height is less, 4.2/3 times in length with caudal and the head is shorter, 5½ times in length with caudal. Therefore we are not sure that our specimen really is the same as *C. xiphoides* and thought it therefore better to give a description of this specimen only.

I have examined the holotype of *C. beauforti* and compared it with the holotype and 13 other specimens of *C. suyeni* in the National Museum of Natural History, Smithsonian Institution, Wash-

ington, D.C. I have no hesitation regarding the inclusion of it in the synonymy of *C. suyeni*.

*TYPE SPECIMENS*.—Holotype of *C. suyeni*, USNM 93086, 142 mm SL, from Mindanao Island, Philippines, coll. *Albatross*. Holotype of *C. beauforti*, ZMA 108.001, 210 mm SL from Timor Sea, lat. 10°27'09"S, long. 123°28'7"E, coll. M. Weber, Siboga Expd.

*OTHER MATERIAL EXAMINED*.—13 specimens, USNM 137941–50, from Philippines to Celebes, coll. *Albatross*.

### The *heterolepis* group

Two related species complexes of *cynoglossus* can be assembled in what may be called the *heterolepis* group, *heterolepis* being closest to the evolutionary stem of the group. They are characterized by a much elongated, pointed snout (except *C. semilaevis* and *C. macrophthalmus*) with the angle of mouth situated nearer to branchial opening than to tip of snout, much smaller body scales, the interlinear scale count being 15–25, very small eyes with the interorbital space measuring about equal to the diameter of the eye or even wider than one eye diameter (*C. heterolepis*, *C. gracilis*, *C. semilaevis*, *C. microlepis*), and usually two nostrils on ocular side and three lateral lines. No lateral line on blind side.

The *heterolepis* group has its center of distribution in the Malay Archipelago and extends through the South China Sea and Taiwan to Korea and Japan; it is regarded as a very lately evolved group of specialized species split off from the *carpenteri* complex.

### The *heterolepis* complex

*Cynoglossus heterolepis*, *C. feldmanni*, *C. wandersi*, *C. kapuasensis*, *C. semilaevis*, *C. abbreviatus*, *C. gracilis*, and *C. microlepis* form the *heterolepis* complex. The characteristics of this complex are almost the same as given for the group and it differs from the *macrophthalmus* complex by having both nostrils present.

#### 41. *Cynoglossus heterolepis* Weber

FIGURE 43; PLATE 19

*Cynoglossus heterolepis* Weber, 1910:237 [type-locality:

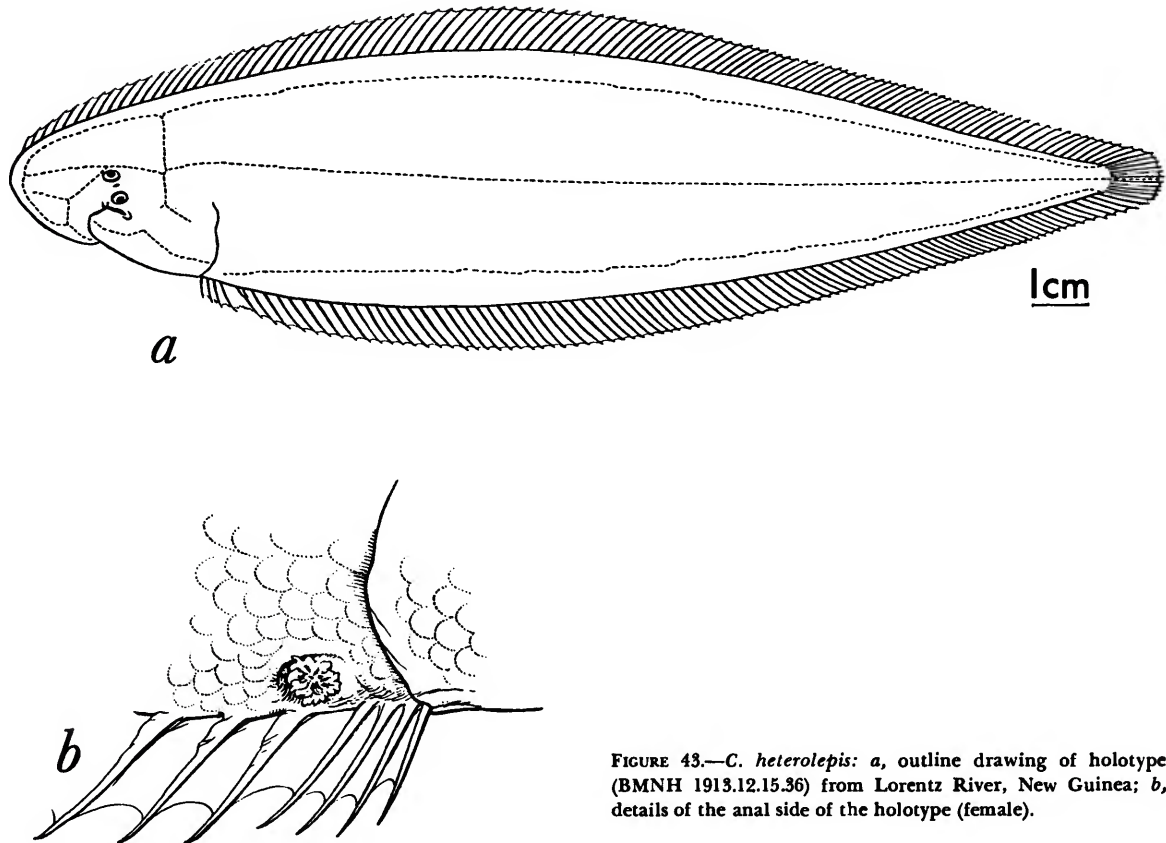


FIGURE 43.—*C. heterolepis*: a, outline drawing of holotype (BMNH 1913.12.15.36) from Lorentz River, New Guinea; b, details of the anal side of the holotype (female).

Lorentz R.]; 1913a:590 [Lorentz R., Bivak Is.].—Weber and de Beaufort, 1929:186, figs. 52, 53 (Lorentz R.).—Hardenberg, 1941:227 (Petpembeowe).—Munro, 1958:285.

**DESCRIPTION.**—Based on 4 specimens, 65–194 mm SL, including the holotype of *C. heterolepis*.

Depth of body 16.44–23.45 ( $M = 18.89$ ), length of head 19.07–25.09 ( $M = 23.28$ ) percent of standard length. Diameter of eye 3.23–5.97 ( $M = 5.08$ ), interorbital space 3.23–5.71 ( $M = 4.37$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in the middle of interorbital space. Snout obtusely pointed, 41.94–45.71 ( $M = 43.92$ ) percent of length of head; rostral hook rather short, ends just in front of anterior nostril. Maxillary extending to a little behind fixed eye; angle of mouth extending below vertical from posterior border of fixed eye, nearer to branchial opening

than to tip of snout; tip of snout to angle of mouth 43.24–57.14 ( $M = 51.06$ ), angle of mouth to branchial opening 41.79–43.24 ( $M = 42.46$ ) percent of length of head.

**Scales:** Ctenoid on both sides, those on blind side rather weakly serrated.

**Lateral-Line System:** Three lateral lines on ocular side, midlateral line with 100–120 scales, 15–16 scales between middle and upper lateral line. No lateral line on blind side.

Interlinear scale rows	15	16
Frequencies	2	2

**Fins:** Dorsal with 113–116 ( $M = 115$ ) rays, anal with 86–89 ( $M = 88$ ) rays, caudal 10 in 4 specimens (radiographs).

**Vertebrae:** 51–52, comprising 9 abdominal and 41–43 caudal elements in 4 specimens (radiographs).

**Coloration:** Upper side uniformly brownish with or without darker spots, lower whitish in preserved specimens.

**Size:** The largest specimen examined, 203 (194 + 9) mm, is the holotype from the Lorentz River, New Guinea.

**DISTRIBUTION.**—New Guinea (Lorentz River) and Australia (Northern Territory).

**DIAGNOSIS AND AFFINITIES.**—Though geographically widely separated, *C. heterolepis* is closely related to *C. feldmanni*, found in the rivers of Borneo, Sumatra, and Cambodia. It differs from *C. feldmanni* chiefly in its slender body (mean depth 18.89 percent of SL, cf. 27.11 percent) and relatively large scales, the interlinear scale rows being 15–16 versus 17–18 in *C. feldmanni*.

**TYPE SPECIMENS.**—Holotype of *C. heterolepis*, BMNH 1913.12.15.36, 194 mm SL, Lorentz River, New Guinea, coll. M. Weber.

**OTHER MATERIAL EXAMINED.**—1 specimen, BMNH 1937.3.17.1, Upper Fly R., Papua, ex. American Museum. 4, USNM 174028, Australia, N.T., coll. R. R. Miller, Arnhem Land Expt.

**42. *Cynoglossus feldmanni* (Bleeker)**

FIGURE 44

*Plagusia feldmanni* Bleeker, 1853b:455 [type-locality: Borneo].  
*Arelia feldmanni*.—Bleeker, 1859:184.  
*Cynoglossus feldmanni*.—Bleeker, 1875:31, pl. 243: fig. 5, 184.  
*Cynoglossus (Areliscus) hardenbergi* Norman, 1931.—422 [type-locality: Palembang, Sumatra].  
*Cynoglossus abentoni* Stauch, 1966.—126 [type-locality: Baklau and Prek-Tasom, Cambodia].

**DESCRIPTION.**—Based on 2 specimens, 148.5 and 207.0 mm SL, including the holotype of *C. hardenbergi*.

Depth of body 26.94–27.29 (M = 27.11), length of head 21.55–22.46 (M = 22) percent of standard length. Diameter of eye 5.38–7.81 (M = 6.59), interorbital space 4.30–4.69 (M = 4.54) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout obtusely pointed, 39.78–40.62 percent of length of head, rostral hook of moderate size, reaches just below anterior border of fixed eye. Maxillary extending to below posterior half or posterior border of fixed eye; angle of mouth extending to below vertical from posterior half of fixed eye, slightly nearer branchial opening than tip of snout; tip of snout to angle of mouth 49.46–51.46 (M = 50.46), angle of mouth to branchial opening 46.88–49.46 (M = 48.17) percent of length of head.

**Scales:** Ctenoid on both sides except those on the head region of the blind side, where the scales are either cycloid or very feebly ctenoid.

**Lateral-Line System:** Three lateral lines on ocular side, midlateral line with 81–84 scales, 17–18 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	17	18
Frequencies	1	1

**Fins:** Dorsal with 98 rays, anal with 77 rays, caudal 10 in 1 specimen (radiograph).

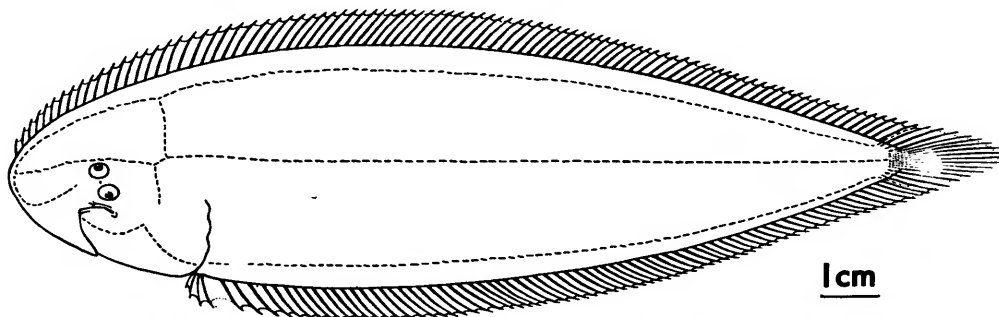


FIGURE 44.—Outline drawing of *C. feldmanni*, holotype (BMNH 1862.6.3.10) from Borneo.

*Vertebrae*: 50, comprising 9 abdominal and 41 caudal elements in 1 specimen (radiograph).

*Coloration*: Upper side brownish with irregular darker spots, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 231.5 (207 + 24.5) mm, is the type of *C. hardenbergi* from Sumatra.

*DISTRIBUTION*.—Borneo, Sumatra, and Cambodia. In rivers.

*DIAGNOSIS AND AFFINITIES*.—*Cynoglossus feldmanni* resembles both *C. heterolepis* and *C. waandersi*. The differences between this species and *C. heterolepis* have been previously outlined. It is distinguishable from *C. waandersi* by a lower interlinear scale count (17–18 cf. 24) and by the position of the rectus of the mouth, which is nearer to the branchial opening than to the tip of the snout (rectus of the mouth in *C. waandersi* is much nearer to the snout than to branchial opening).

*NOTE ON SYNONYMY*.—Bleeker (1853b:455) described *P. feldmanni* on the basis of a single specimen, 160 mm in TL from Pengaron, and characterized it as having three lateral lines on left side, the upper and lower separated from the middle by 17 or 18 series of scales, and by the angle of the mouth being nearer to gill opening than to extremity of snout. Norman (1931:422) described a similar species *C. (Areliscus) hardenbergi* on the basis of a single specimen, 233 mm in TL, from Palembang, Sumatra and related it to *C. feldmanni*, but differentiated it by its larger scales and longer and more pointed rostral hook. He characterized the fish as having three lateral lines on ocular side, the upper and the middle separated by 16 or 17 series of scales. I have examined the holotype of *C. (Areliscus) hardenbergi* in the British Museum and found it to conform well with the description and figure of *C. feldmanni*, the differences noted by Norman being considered here as attributable to intra-specific variation in the species.

Stauch (1966:126) described *C. abentoni* on the basis of two specimens, 66 and 129 mm in TL, from Ba-Klaut and Prek-Tasom, Cambodia, and characterized it as having three lateral lines on ocular side, the upper and the middle being separated by 16 series of scales. Stauch, while describing the fish, compared it with *C. waandersi* (Bleeker). *Cynoglossus waandersi*, however, has smaller scales, the interorbital scale rows being 24, whereas in the interlinear scale character and other proportional

and meristic characters *C. abentoni* is identical with *C. feldmanni*. I have examined the holotype and the paratype of *C. abentoni* in Paris and found them identical with *C. feldmanni*.

*TYPE SPECIMENS*.—Among the Bleeker collection in Leiden is a specimen, 145 mm SL, 162 mm TL, cataloged as RMNH 6782 from Pengaron, Borneo, coll. A. Feldmann, 1852 (pers. comm. Dr. M. Boeseman) that appears to be the holotype of *C. feldmanni*. Holotype of *C. hardenbergi*, BMNH 1931.4.23, 207 mm SL, Sumatra, coll. Hardenberg. Holotype of *C. abentoni*, MNH P 65-466, 120 mm SL, Ba Klaut, Patit Lac, coll. Aubenton, paratype, MNH P 65-465, 61 mm SL, Prek Tasom, coll. Aubenton.

*OTHER MATERIAL EXAMINED*.—SUMATRA: 1 specimen, ZMA 108.004, Ojambi. BORNEO: 1, BMNH 1862.6.3.10, Borneo, coll. Bleeker.

### 43. *Cynoglossus waandersi* (Bleeker)

#### PLATE 19

*Plagusia waandersii* Bleeker, 1854a:98 [type-locality: confluence of rivers Lamatang and Enim at Palembang, eastern Sumatra].

*Arelia waandersii*.—Bleeker, 1859:185.

*Cynoglossus waandersi*.—Bleeker, 1875:31, pl. 241: fig. 2.—Weber and de Beaufort, 1929:189.

*DESCRIPTION*.—Based on a single specimen, 73.0 mm SL.

Depth of body 27.40 percent of standard length, length of head 24.66 percent. Diameter of eye 11.11, interorbital space 5.56 percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, immediately in front of interorbital space. Snout obtusely pointed, 41.67 percent of length of head; rostral hook, rather short, ends in front of anterior border of fixed eye. Maxillary extending to below posterior half of fixed eye; angle of mouth extending below vertical from middle of fixed eye, nearer to tip of snout than branchial opening; tip of snout to angle of mouth 47.22, angle of mouth to branchial opening 55.56 percent of length of head.

*Scales*: Ctenoid on both sides.

*Lateral-Line System*: Three lateral lines on ocular side, midlateral line with 80 scales, 24 scales between middle and upper lateral lines. No lateral line on blind side.



*Fins:* Dorsal with 89 rays, anal with 67 rays, caudal 10 in 1 specimen (radiograph).

*Vertebrae:* 42, comprising 9 abdominal and 33 caudal elements (radiograph).

*Coloration:* Upper side yellowish brown, with darker patches, lower whitish in preserved specimens.

*Size:* The only specimen examined, 83 (73 + 10) mm, is from Sumatra (reported up to 300 mm by Weber and de Beaufort).

**DISTRIBUTION.**—Sumatra and Borneo, in rivers.

**DIAGNOSIS AND AFFINITIES.**—This species is more closely allied to *C. kapuasensis* than to *C. feldmanni* in having the more enlarged body and smaller scales. It can, however, be separated from *C. kapuasensis* by having the rictus of the mouth nearer to the tip of the snout than to the branchial opening and by its reduced eyes (diameter 11.11 percent in length of head cf. 7.41 percent).

From all the other members of the *heterolepis* group, however, *C. waandersi* is distinct in its fewer vertebrae (Figure 53, Graph 4).

**TYPE SPECIMENS.**—Bleeker's (1854a:98) description of *P. waandersi* was based on a single specimen, 145 mm in TL, from the confluence of the Lamatang and Enim rivers at Palembang, Sumatra. In his *Atlas* (1875–1876:31, pl. 241: fig. 2), he described and illustrated a specimen measuring 145 mm in TL. Among the Bleeker collection in Leiden is a specimen, 129 mm SL, 145 mm in TL from the confluence of Lamatang and Enim rivers, Prov. Palembang, Sumatra, coll. P. S. van Bloemen Waanders, 1854, cataloged as RMNH 6781 (pers. comm. Dr. M. Boeseman). It is here considered to be the holotype of *C. waandersi*.

**OTHER MATERIAL EXAMINED.**—1 specimen, USNM 171680, Moesi R., Moea, Sumatra, coll. A. Thieremann, 1929.

#### 44. *Cynoglossus kapuasensis* Fowler

*Cynoglossus kapuasensis* Fowler, 1905:519 [type-locality: Kapuas R., W Borneo].

*Cynoglossus kapuasensis*.—Seale, 1910:288 [misprint for *C. kapuasensis*].

**DESCRIPTION.**—Based on a single specimen, the holotype, 285.0 mm SL.

Depth of body 23.16, length of head 18.95 percent of standard length. Eyes small, diameter of eye 7.41, interorbital space is equal to one eye diam-

eter, 7.41 percent in length of head. Two nostrils on ocular side, anterior nostril tubular, just in front of vertical through front border of lower eye, posterior nostril simple, in posterior half of interorbital space. Snout rather obtusely pointed, 45.37 percent of head; rostral hook rather long, reaches below fixed eye. Maxillary extending to below posterior border of fixed eye; angle of mouth extending to below vertical from posterior half of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 61.11, angle of mouth branchial opening 50.0 percent of head.

*Scales:* Ctenoid on both sides, scales on anterior third of body smaller than those on rest of body.

*Lateral-Line System:* Three lateral lines on ocular side, dorsolateral line running backward and entering dorsal fin along 5th ray, counted from the rear, midlateral line with 126 scales, 25 scales between middle and upper lateral lines; ventrolateral line runs backward and enters anal fin along 5th ray, counted from the rear. No lateral line on blind side.

*Fins:* Dorsal with 109 rays, anal with 85 rays, caudal 10 in 1 specimen (radiograph).

*Vertebrae:* 50, comprising 9 abdominal and 41 caudal elements, in 1 specimen (radiograph).

*Coloration:* Upper side rather dark brown with darker mottlings and blotches, lower rather brownish white in preserved specimens.

*Size:* The only specimen examined is 285.0 mm in SL.

**DISTRIBUTION.**—Western Borneo (Kapuas River).

**DIAGNOSIS AND AFFINITIES.**—This species is closely related to *C. feldmanni* and *C. waandersi*. It is distinguished from *C. feldmanni* by larger eyes (diameter 7.41 percent of head cf. 6.59 percent), wider interorbital space (7.41 percent of head cf. 4.54 percent), and smaller scales, the interlinear scale rows being much larger (25 cf. 17–18). From *C. waandersi* it is separated by having the rictus of the mouth situated nearer to the branchial opening than to the tip of snout, by smaller eyes (diameter of eye 7.41 percent of head cf. 11.11 percent), and wider interorbital space (7.41 percent of head cf. 5.56 percent of head).

**TYPE SPECIMEN.**—Holotype of *C. kapuasensis*, ANSP 72348, 285 mm SL, Kapuas R., W Borneo, coll. Harrison and Hiller, 1898.

45. *Cynoglossus semilaevis* Günther

FIGURE 45; PLATE 20

*Cynoglossus semilaevis* Günther, 1873:379 [type-locality: Chefoo, China]; 1898:261 [Nin-Tchouang].—Mori, 1927:183.—Chu, 1931:95.—Wu, 1932:152 [Tsing-Wang-Tao, Tsing-Tao, Tchefoo, Tcha-Pou, Wen Chou, and Amoy].

*Areliscus semilaevis*.—Jordan and Starks, 1906a:242.

*Trulla semilaevis*.—Fowler, 1934b:212.

*Arelia rhomaleus* Jordan and Starks, 1906b:526, fig. 5 [Port Arthur, Manchuria].

*Areliscus rhomaleus*.—Jordan and Metz, 1913:63.—Reeves, 1927:14 [Swatow].—Sowerby, 1930:183.—Chu, 1931:95.

*Cynoglossus roulei* Wu, 1932:153 [type-locality: Amoy, China].

**DESCRIPTION.**—Based on 8 specimens, 134.0–530.0 mm SL, including the holotype of *C. semilacvis* and syntypes of *C. roulei*.

Depth of body 24.63–30.19 ( $M = 27.09$ ), length of head 20.89–26.79 ( $M = 23.93$ ) percent of stand-

ard length. Upper eye not in advance of fixed eye, diameter of eye 3.52–8.11 ( $M = 5.77$ ), interorbital space rather broad, 5.88–9.28 ( $M = 8.09$ ) percent of the length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower edge of lower eye, posterior nostril simple, in the anterior half of interorbital space. Snout rather rounded, 34.26–37.10 ( $M = 36.02$ ) percent of head, rostral hook short, extending to front of anterior nostril. Maxillary extending to behind fixed eye; angle of mouth extending below vertical from posterior half of fixed eye, nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 44.33–50.0 ( $M = 46.69$ ), angle of mouth to branchial opening 50.0–56.45 ( $M = 54.35$ ) percent of length of head.

**Scales:** Ctenoid on ocular side, cycloid on blind side.

**Lateral-Line System:** Three lateral lines on ocular

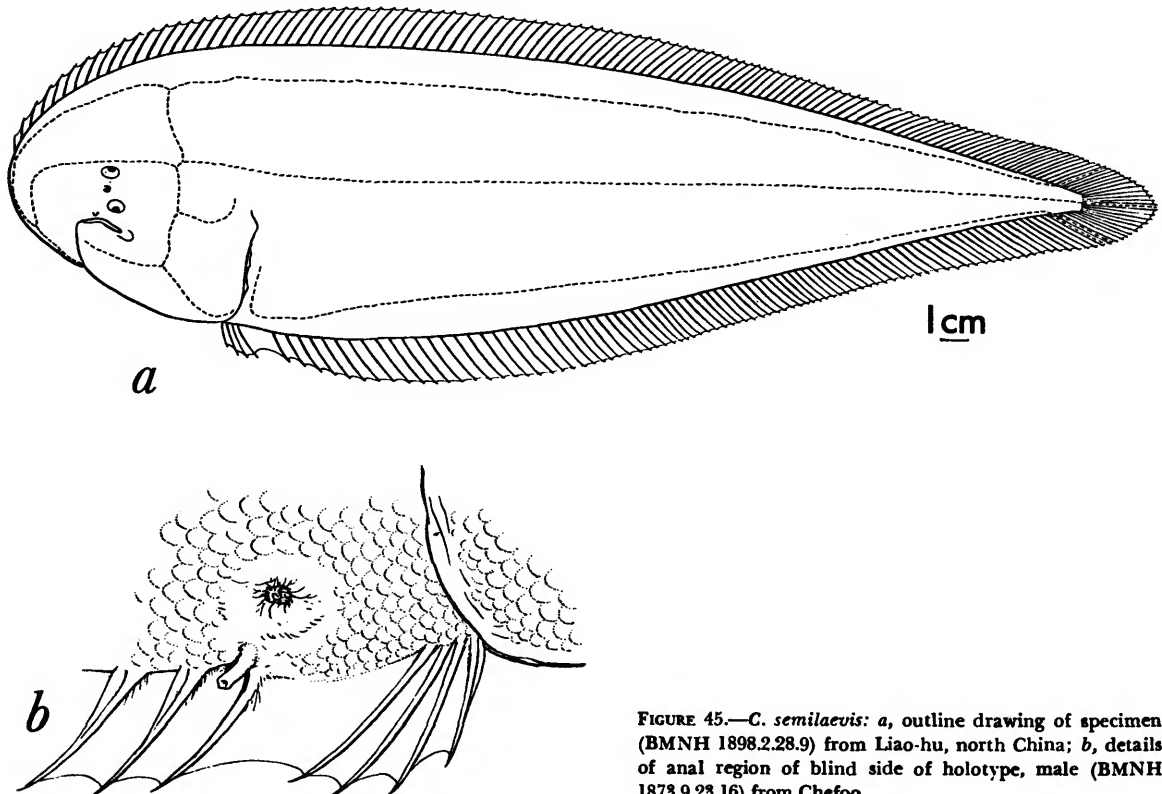


FIGURE 45.—*C. semilaevis*: a, outline drawing of specimen (BMNH 1898.2.28.9) from Liao-hu, north China; b, details of anal region of blind side of holotype, male (BMNH 1873.9.23.16) from Chefoo.

side, midlateral line with 110–138 ( $M = 120$ ) scales, 20–25 ( $M = 23$ ) scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	20	21	23	24	25
Frequencies	1	1	3	2	1

*Fins*: Dorsal with 124 rays, anal with 96 rays, caudal 10 in 1 specimen (radiograph).

*Vertebrae*: 55, comprising 11 abdominal and 44 caudal elements in 1 specimen (radiograph).

*Coloration*: Upper side uniformly brown, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 566 (530 + 36) mm, is from Shanghai.

*DISTRIBUTION*.—China.

*DIAGNOSIS AND AFFINITIES*.—This species is closely related to *C. abbreviatus* but is readily separated from it by the number of caudal fin rays (10), short rounded snout (mean length 36.0 percent of head cf. 37.52 percent), smaller eyes (mean diameter 5.77 percent of head cf. 7.57 percent), wider interorbital space (8.09 percent of head cf. 6.80 percent), and cycloid scales on the blind side of the body.

In the rounded short snout, 10 rays in the caudal fin, and the position of the rictus of the mouth, which is nearer to the snout than to the gill opening, *C. semilaevis* is considered a more generalized species and could represent the ancestral condition from which the more specialized species like *C. abbreviatus*, *C. gracilis*, and *C. microlepis* evolved.

*NOTE ON SYNONYMY*.—Günther (1873b:379) described *C. semilaevis* on the basis of a single specimen, 455 mm in TL, from Chefoo, China and characterized it as having a deeper body, three lateral lines on the ocular side, the middle and the upper separated by 21 rows of scales, the scales between lateral lines smooth, between outer and vertical fins ctenoid, and cycloid on the blind side.

*Areliia rhomaleus* was described by Jordan and Starks (1906b:526) on the basis of one specimen from Port Arthur, 380 mm in TL, and characterized by having three lateral lines, the middle and the upper being separated by 24 scale rows, ctenoid scales on ocular side and cycloid on the blind side. Jordan and Starks considered this species to be closely related to *C. abbreviatus* but preferred to retain it separately because of its increased number of interlinear scale rows. From *trigrammus* (= *abbreviatus*) they differentiated this species by its longer dorsal fin, larger eyes, and narrower inter-

orbital space. Fowler (1934b:213), however, confused this species with *C. abbreviatus*. Another species *C. roulei* with almost identical characters as *C. rhomaleus* was described by Wu (1932:153) from China. I have examined a type specimen of all three species and found them to be so similar in all respects that there is no question but that they are synonymous.

*TYPE SPECIMENS*.—BMNH 1873.9.23.16, 440.5 mm SL, holotype of *C. semilaevis*, Chefoo, coll. Surinoh. USNM 55635, 363 mm SL, holotype of *A. rhomaleus*, Port Arthur, coll. J. F. Abbott. 2 specimens, 223 and 260 mm SL, BMNH 1860.7.28.48 and BMNH 1924.12.15.64, types (? syntypes) of *C. roulei*, Amoy, China, coll. Stevens (1860.7.28.48) and Light (1924.12.15.64).

*OTHER MATERIAL EXAMINED*.—2 specimens, BMNH 1895.5.15–16, Shanghai, coll. Stylan. 1, BMNH 1896.2.28.9, Liao-ho, N China, coll. Dr. W. Morrison. 1, BMNH 1930.7.28.13, Chekiang, China, coll. J. Chen. 3, BMNH 1939.1.17.56, Hong Kong. 1, (skeleton) MCZ 11323, Hong Kong. 3, USNM 56395, Port Arthur, China, coll. J. F. Abbott. 1, USNM 137988, Kowloon, China, coll. *Albatross*.

#### 46. *Cynoglossus abbreviatus* (Gray)

FIGURE 46; PLATE 20

- Plagusia abbreviata* Gray, 1835, pl. 94: fig. 3 [type-locality: China].—Richardson, 1846:280 [coasts of China, Canton].
- Cynoglossus abbreviatus* Günther, 1862:494 [Amoy]; 1873a:244 [Shanghai].—Bleeker, 1873:136.—Peters, 1880:923 [Ningpo].—Seale, 1914:78 [Hong Kong].—Fowler and Bean, 1920:321 [Soochow].—Evermann and Shaw, 1927:113 [Hangchow, Nanking, Ningpo].—Tchang, 1929:37, fig. 43 [Yangtze R.].—Fowler, 1930:615 [Hong Kong].—Wu, 1932:157 [Tchou-San, Tchefoo, Tsingtao].—Ochiai, 1963:95, pl. 21.—Chu, 1963:544, fig. 441.—Shen, 1967:208 [Kowloon].
- Areliciscus abbreviatus*.—Jordan and Metz, 1913:62 [Fusan].—Reeves, 1927:14 [Shanghai, Ningpo, Swatow].—Wu, 1929:71, fig. 57 [Amoy].—Chu, 1931:96.—Herre and Myers, 1931:252 [Canton].—Matsubara, 1955:1286.
- Trulla abbreviata*.—Fowler, 1934b:213, fig. 29 [China, Hong Kong, Canton, Amoy, Soochow, Ningpo, Hongchow, Nanking, Shanghai, Yangtze R.].
- Cynoglossus trigrammus* Günther, 1862:494, [type-locality: Chinese seas].—Bleeker, 1865b:56 [Amoy]; 1873:131.—Martens, 1876:399 [Shanghai].—Sauvage, 1881:107 [Swatow].—Rutter, 1897:89 [compiled].—Wu, 1932:160 [Swatow].—Wu and Wang, 1933:303 [Amoy].—Ochiai, 1959:211; 1963:92, pl. 20.—Chu, 1963:542, fig. 409.—Shen, 1967:210 [Kowloon].
- Areliciscus trigrammus*.—Reeves, 1927:14.—Oshima, 1927:202 [Taihoku].—Chu, 1931:95.—Herre, 1932:433 [Canton].—Matsubara, 1955:1286.
- Trulla trigrammus*.—Fowler, 1934b:214.

*Areliscus purpureomaculatus* Regan, 1905a:26 [type-locality: Inland Sea of Japan].—Jordan and Starks, 1906a:242.—Jordan, Tanaka, and Snyder, 1913:336.—Jordan and Hubbs, 1925:303.—Wu, 1932:156 [Tsing-Tao, Chefoo].—Kamohara, 1952:86 [Tosa].—Mori, 1952:184 [Pusan].  
*Cynoglossus xiphoideus* [not Günther].—Wu, 1932:158.  
*Areliscus gracilis* [not Günther].—Chen and Weng, 1965:99 [Tungkong].

**DESCRIPTION.**—Based on 19 specimens, 96.0–285.0 mm SL, including the types of *C. trigrammus* and the holotype of *C. purpureomaculatus*.

Depth of body 22.58–27.78 ( $M = 24.98$ ), length of head 18.16–22.22 ( $M = 20.22$ ) percent of standard length. Diameter of eye 5.56–9.52 ( $M = 7.57$ ), interorbital space 4.35–9.47 ( $M = 6.80$ ) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in front of lower eye, posterior nostril simple, in anterior half of interorbital space. Snout obtusely pointed, 35.24–40.71 ( $M = 37.52$ ) percent of length of head, rostral hook short, ends in front of anterior nostril. Maxillary extending to below posterior half or rarely to posterior border of fixed eye; angle of mouth extending below vertical from middle or posterior half of fixed eye, slightly nearer to tip of snout than to branchial opening; tip of snout to angle of mouth 46.23–50.0 ( $M = 47.89$ ), angle of mouth to branchial opening 47.62–55.79 ( $M = 52.44$ ) percent of head.

**Scales:** Rather small, ctenoid on both sides, those on blind side weakly serrated.

**Lateral-Line System:** Three lateral lines on ocular side, dorsolateral line running backward and entering dorsal fin posteriorly, midlateral line with 118–136 ( $M = 125$ ) scales, 18–23 ( $M = 21$ ) scales between middle and upper lateral line, ventrolateral line runs backward and enters anal fin posteriorly. No lateral line on blind side.

Interlinear scale rows	18	19	20	21	22	23
Frequencies	3	1	4	6	4	1

**Fins:** Dorsal with 128–135 ( $M = 130$ ) rays, anal with 100–108 ( $M = 104$ ) rays, caudal 8 (9) in 12 specimens (radiographs).

**Vertebrae:** 60–64, comprising 10–11 abdominal and 46–53 caudal elements in 12 specimens (radiographs).

**Coloration:** Upper side brownish with or without dark blotches, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 295.0 mm SL, is from Hong Kong.

**DISTRIBUTION.**—South China Sea (Amoy, Canton, Kowloon, Hong Kong, and Shanton) through Taiwan, Shanghai, Tunghai, and Po-hai to Korea and Japan.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus abbreviatus* is closely related to *C. gracilis*; it is distinguished by its deeper body (mean depth of body 24.98 percent of SL, cf. 20.78 percent) and larger eyes (mean diameter 7.57 percent of head cf. 40.25 percent).

**NOTE ON SYNONYMY.**—Gray's naming of *P. abbreviatus* was based on Hardwicke's collection of illustrations. The illustration that is the iconotype of the species was issued in 1834 as part of one group among several that were later combined in two volumes without text (Gray, 1834). Günther (1862:496) gave the description of the species and characterized it as having three lateral lines, the middle and the upper separated by 19 series of scales, the height of the body being contained three and three-fourths in the total length, and the length of head four times and two-thirds. This description agrees well with Gray's illustration of the species. Günther mentioned the type of the species "adult:

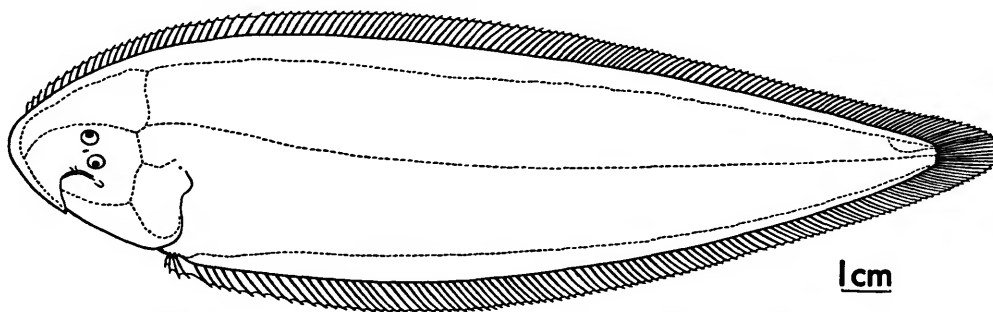


FIGURE 46.—Outline drawing of *C. abbreviatus* (BMNH 1924.12.15.62) from Amoy.

stuffed. China. Presented by J. R. Reeves Esq." I have examined two stuffed specimens, 220 and 315 mm SL, of *C. abbreviatus* from Reeves' collections, which in most probability formed the basis for Hardwicke's illustration of the species.

*Cynoglossus trigrammus*, described on the basis of two specimens, 182.5 and 275 mm SL, from China is a synonym of *P. abbreviatus*. The differences noted, such as 21 series of scales separating the middle and upper lateral line, the height of the body four times and two-thirds and the length of the head five times and one-third are all attributable to intraspecific variation. Most subsequent workers, however, treated *C. trigrammus* as a species distinct from *C. abbreviatus* (Fowler, 1934b:214), their differentiation of the two species being mainly based on the depth of the body in TL. They considered forms with depth of three and three-fourths to four as *C. abbreviatus*, and those above four to four and one-half as *C. trigrammus*. Fowler further considered *T. abbreviata* as a species with ctenoid scales on the ocular side and cycloid on the blind (Fowler, 1934b:214) and *T. trigrammus* with ctenoid on both sides. I have examined the types of *C. trigrammus* and compared them with a number of specimens labeled as *C. abbreviatus* from China in the British Museum and found them to be similar in proportional and meristic characters. The nature of the body scales as has been pointed out earlier cannot be depended upon for species differentiation, as the ctenoid scales tend to become weaker in their ctenoid nature as the fish grows. In bigger specimens the scales on the blind side appear more or less cycloid, especially on the anterior half of the body. Obviously, Fowler's (1934b) inclusion of *Arelia rhomaleus* in the synonymy of *C. abbreviatus* was based on the cycloid nature of scales of the blind side of the fish, and *A. rhomaleus* is here placed under *C. semilaevis*. Ochiai (1963) synonymized *C. purpureomaculatus* Regan with *trigrammus*. *Cynoglossus purpureomaculatus* was described from Japan on the basis of a single specimen, 202 mm SL, which I have examined and found to agree well with *C. abbreviatus*. Regan did not compare his species with any other but indicated an interlinear scale row of 19, which falls within the range of variation of this character in *C. abbreviatus*.

**TYPE SPECIMENS.**—Of the two specimens from China on which Günther based his description of *C. trigrammus*, a specimen, BMNH 1856.9.19.1215,

182.5 mm SL, from the Hassler collection is selected here as the lectotype of *C. trigrammus* and the other specimen, BMNH 1851.12.27.169, 155 mm SL, as the paralectotype. BMNH 1905.6.6.248, 202 mm SL, holotype of *C. purpureomaculatus*, Japan, coll. Gordon Smith.

**OTHER MATERIAL EXAMINED.**—1 specimen, BMNH 1863.2.23.28, Amoy, China, coll. R. Surinohoc. 1, BMNH 1873.7.30, 60, Shanghai, coll. R. Surinohoc. 4, BMNH 1924.12.15.58–61, Foochow, China. 1, BMNH 1924.12.15.62, Amoy, coll. Light. 1, BMNH 1924.12.15.63, Amoy, China, coll. Light. 2, BMNH 1924.12.15.65, Foochow, China, coll. Light. 2, BMNH 1930.7.28.10.11, Pailow, Canton, coll. J. Chen. 1, BMNH 1931.6.23.7, Pearl R., Canton, coll. Hoffman. 2, BMNH 1939.1.17.57–58, Hong Kong, coll. Herklot. 1, BMNH 1939.1.12.59, Hong Kong, coll. Harklots. 1, BMNH 1939.3.23, 100, Hong Kong, coll. Harklots. 2, stuffed, China, coll. Reeves. 2, USNM 37762, Korea, coll. J. B. Bernadou. 1, USNM 84006, China, coll. N. Gist Gee. 1, USNM 86028, China, coll. Sowerby. 2, USNM 87050, China, coll. Sowerby. USNM 87051, China, coll. Sowerby. 3, USNM 130447, China, coll. Sowerby. USNM 130482, China, coll. Sowerby. 1, USNM (without reg. no.), Pearl River mouth, Hong Kong, coll. Hong Kong Fisheries Dept. 1, ANSP 52908, Hong Kong coll. F. H. Fowler. 2, MCZ 11155–11156, China. 1, UMMZ 167447, China, coll. J. J. Tu.

#### 47. *Cynoglossus gracilis* Günther

FIGURE 47; PLATE 21

*Cynoglossus gracilis* Günther, 1873a:244 [type-locality: Shanghai]; 1898:261 [New Chwang].—Mori, 1927:184.—Wu, 1932:160 [Yangtze R.].—Fowler, 1934b:214.—Tchang, 1955:304, fig. 189.—Chu, 1963:543, fig. 410.—Shen, 1967:209 [Kowloon].

*Areliscus gracilis*.—Reeves, 1927:14 [Chefoo].—Chu, 1931:96.—Matsubara, 1955:1286.

*Trulla gracilis*.—Fowler, 1934b:214.

*Cynoglossus microps* Steindachner, 1898:510 [type-locality: Hong Kong].—Wu, 1932:158.

*Areliscus hollandi* Jordan and Metz, 1913:62, pl. 9: fig. 3 [type-locality: Fusan, Korea].

*Cynoglossus pellegrini* Wu, 1932:159 [type-locality: Hainan].

*Areliscus trigrammus* [not Günther].—Chen and Weng, 1965:98, fig. 68 [Quemoy].

**DESCRIPTION.**—Based on 14 specimens (84–228 mm SL), including holotype and paratypes of *C. gracilis*.

Depth of body 19.08–23.20 (M = 20.78), length of head 16.92–23.18 (M = 20.42) percent of standard length. Upper eye not in advance of lower, diameter of eye 4.21–7.84 (M = 5.86), interorbital space 5.00–8.16 (M = 6.27) percent of length of head. Two nostrils on ocular side, anterior nostril tubular, in

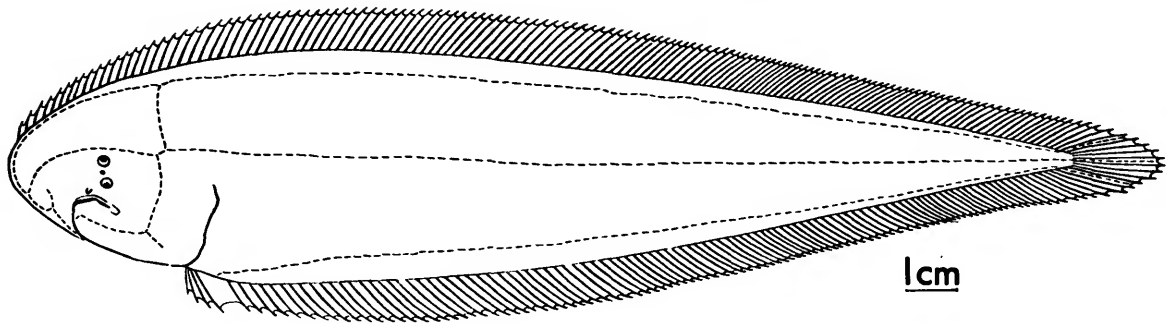


FIGURE 47.—Outline drawing of *C. gracilis*, holotype (BMNH 1873.7.30.57), from Shanghai.

front of lower eye, posterior nostril simple, in anterior half of interorbital space, or at the middle of it. Snout obtusely pointed, 35.29–46.58 ( $M = 40.25$ ) percent of length of head, rostral hook of moderate size, usually extending up to anterior nostril but sometimes reaching below anterior border of fixed eye. Maxillary extending to behind fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 47.73–57.53 ( $M = 52.14$ ), angle of mouth to branchial opening 47.37–52.73 ( $M = 48.96$ ) percent of length of head.

**Scales:** Large or moderate, ctenoid on both sides, those on blind side, particularly in large specimens, very weakly serrated with a much reduced number of ctenii.

**Lateral-Line System:** Three lateral lines on ocular side, midlateral line with 122–138 ( $M = 135$ ) scales, 19–22 ( $M = 21$ ) scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	19	20	21	22
Frequencies	2	2	9	2

**Fins:** Dorsal with 133–137 ( $M = 135$ ) rays, anal with 104–108 ( $M = 106$ ) rays, caudal 8 in 10 specimens (radiographs).

**Vertebrae:** 62–64, comprising 11 or 12 abdominal and 51–55 caudal elements in 10 specimens (radiographs).

**Coloration:** Upper side uniformly light brown, lower whitish in preserved specimens.

**Size:** Largest specimen examined, 278.0 mm, is from Liao-hu, N China.

**DISTRIBUTION.**—From South China Sea through Taiwan, Tung-hai, and Chefoo to Pusan in Korea.

**DIAGNOSIS AND AFFINITIES.**—*Cynoglossus gracilis* is closely related to *C. abbreviatus*. It is distinguished from *C. abbreviatus* by its elongate body (mean depth 20.78 percent of cf. 24.98 percent), smaller eyes (5.86 percent of head cf. 7.57 percent), and longer snout (mean length 40.25 percent of head cf. 37.52 percent).

**NOTE ON SYNONYMY.**—Günther (1873a:244) described *C. gracilis* on the basis of one specimen, 225 mm in TL, and several young ones from Shanghai and characterized it as a species having three lateral lines, the upper and the middle being separated by 21 scales, extremely small eyes, and elongated body, the depth of body being five times in total length. The descriptions of *C. microps* and *C. pellegrini* do not indicate any significant difference from *C. gracilis*, and in both these species the height of the body is contained more than four times in the TL. Jordan and Metz (1913:62) described *A. hollandi* from Fusan, Korea on the basis of a single specimen and from the description and illustration of the fish, its identity with *C. gracilis* is unmistakable.

**TYPE SPECIMENS.**—BMNH 1873.7.30.57, 206 mm SL, holotype of *C. gracilis*, Shanghai, coll. Swinhoe. 2, BMNH 1873.7.30.58a, 59b, 87, and 79.5 mm SL, paratypes of *C. gracilis*, obtained along with the holotype. NHV 43.798, 227 mm SL, 241 mm TL, from Yangtse-Kiang, selected as lectotype of *C. microps*, NHV 43.799, 190 mm SL, 203 mm TL, collected along with lectotypes is a paralectotype of *C. microps*.

OTHER MATERIAL EXAMINED.—2 specimens, BMNH 1873.9.23.20–21, Chefoo, coll. Swinhoe. 1, BMNH 1898.2.28.10, Liao-hu, N China, coll. Dr. W. Morrison. 4, BMNH 1924.12.15.54–57, Foochow, China, coll. Light. 1, BMNH 1930.7.28–12, Chekiang, China, coll. J. Chen. 1, USNM 86466, China, coll. Sowerby. 3, USNM 130547, China, coll. Sowerby. 3, USNM 130521, Shanghai, China. 3, USNM 131071, China, coll. Dale and Jony, 1881. 1, USNM 148414, Shanghai, coll. D. C. Janson. 1, USNM 11329, Hong Kong. 1, NHV 43820, Shanghai. 1, NHV 43822, Canton. 1, ANSP 52907, Hong Kong, coll. H. W. Fowler.

48. *Cynoglossus microlepis* (Bleeker)

FIGURE 48; PLATE 21

*Plagusia microlepis* Bleeker, 1951a:413 [type-locality: Borneo]; 1852:31.

*Arelia microlepis*.—Bleeker, 1859:184.

*Cynoglossus microlepis*.—Günther, 1862:495.—Bleeker, 1875:32, pl. 243: fig. 3.—Vaillant, 1893:101.—Weber and de Beaufort, 1929:190.—Smith, 1933:83; 1945:442.—Suvatti, 1950:327.—Punpoka, 1964:65.

*Cynoglossus xiphoideus* Günther, 1862:495 [type-locality: Siam].—Bleeker, 1865a:33.—Kner, 1867:294.—Hora, 1923a:

182.—Smith, 1933:83; 1945:441.—Suvatti, 1950:329.—Chabanaud, 1951c:1.

*Cynoglossus (Arelia) solum* Sauvage, 1878:92 [type-locality: MeKong River].

*Arelia solum* Sauvage, 1883:151.

*Cynoglossus feldmanni* [not Bleeker].—Weber and de Beaufort [in part], 1929:192.

*Cynoglossus trigrammus* [not Günther].—Suvatti, 1950:329.—Punpoka, 1964:75 [Gulf of Thailand].

DESCRIPTION.—Based on 4 specimens, 142.0–231.0 mm SL.

Depth of body 20.07–22.51 ( $M = 20.84$ ), length of head 19.05–20.35 ( $M = 20.21$ ) percent of standard length. Migratory eye is much in advance of fixed eye, diameter of eye 5.00–6.67 ( $M = 5.50$ ), interorbital space rather broad 6.67–8.51 ( $M = 7.54$ ) percent in length of head. Two nostrils on ocular side, anterior nostril tubular, in front of fixed eye, posterior nostril simple, in posterior half of interorbital space. Snout obtusely pointed, 40.0–45.0 ( $M = 42.82$ ) percent of length of head, rostral hook rather long, reaches below middle or posterior half

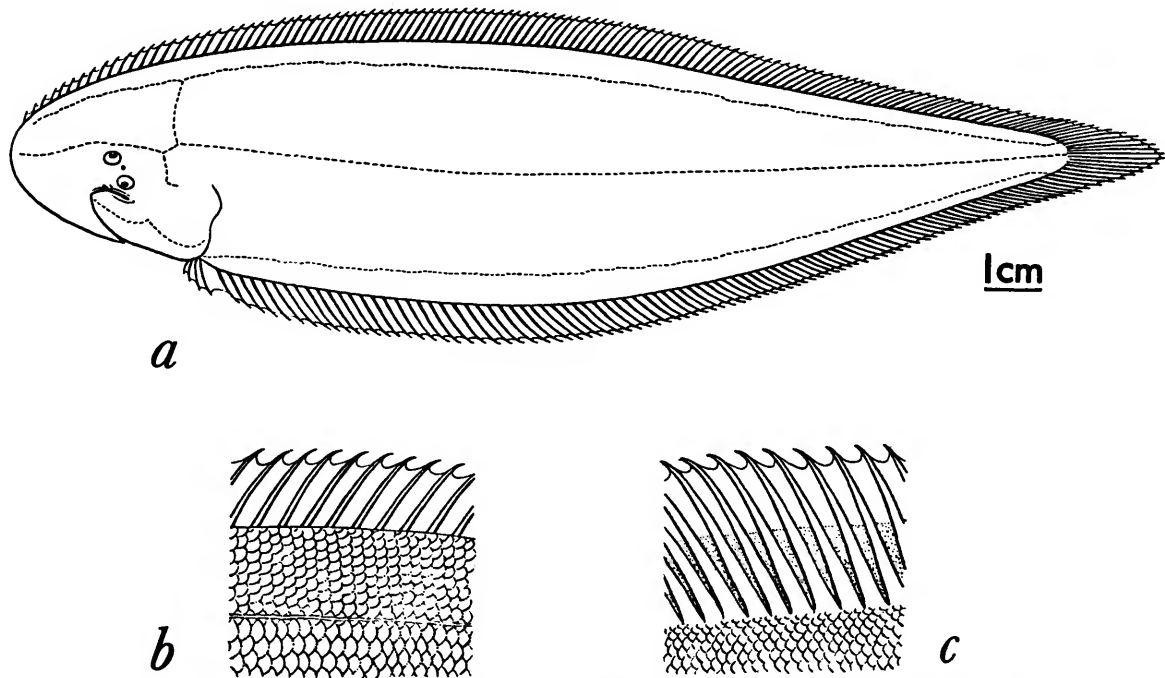


FIGURE 48.—*C. microlepis* (BMNH 1859.7.1.52) from Thailand: a, outline drawing of lateral view of ocular side; b, nature of scales along base of dorsal fin on ocular side; c, same on blind side.

of fixed eye. Maxillary extending to below posterior border of fixed eye or a little behind; angle of mouth extending to below vertical from posterior half of fixed eye, nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 54.26–55.0 (M = 54.82), angle of mouth to branchial opening 40.0–48.94 (M = 44.11) percent of length of head.

*Scales:* Small, ctenoid on both sides, those on blind side weakly serrated.

*Lateral-Line System:* Three lateral lines on ocular side, midlateral line with 116–138 scales, 21–22 scales between middle and upper lateral lines. No lateral line on blind side.

Interlinear scale rows	21	22
Frequencies	5	2

*Fins:* Dorsal with 117–119 rays, anal with 92–96 rays, caudal 8 in 4 specimens (radiographs).

*Vertebrae:* 55–56, comprising 9 abdominal and 46–47 caudal elements in 4 specimens (radiographs).

*Coloration:* Upper side reddish brown with dark spots, lower whitish in preserved specimens.

*Size:* Largest specimen examined, 304 (270 + 34) mm, is from Sarawak, Borneo.

*DISTRIBUTION.*—Thailand, Cambodia, Vietnam, Borneo, and Sumatra. In strictly fresh water.

*DIAGNOSIS AND AFFINITIES.*—*Cynoglossus microlepis* is closely related to *C. gracilis* in most morphometric and meristic characters but can be readily distinguished by the position of its migratory eye, which is placed much in advance of the fixed eye. The much smaller eyes (mean diameter 5.50 percent of head cf. 7.57 percent), broader interorbital space (mean width 7.54 percent of head cf. 6.80 percent), and longer snout (mean length 42.82 percent of head cf. 37.52 percent) further distinguish the species from *C. gracilis*. *Cynoglossus microlepis* is considered more specialized toward a burrowing mode of life than *C. abbreviatus* or *C. gracilis*.

*NOTE ON SYNONYMY.*—Bleeker (1851a:413) described *P. microlepis* on the basis of a single specimen, 94 mm in TL, from rivers of Bandjermassing in Borneo, and characterized it as having three lateral lines on ocular side, one on blind side, much elongated body, the height of the body being five times in TL, smaller eyes, and 150 scale rows along the midlateral line. Unfortunately, neither Bleeker nor Günther (1862:495) gave the number of scale

rows that separate the upper and the middle lateral lines in this species. This resulted in confusion as to the correct identity of the species, causing the creation of several new ones. *Cynoglossus xiphoideus* was described on the basis of two specimens, 150 and 229 mm in TL, from Thailand and characterized by three lateral lines on ocular side, the upper and middle being separated by 20 or 21 scale rows, one on the blind side, the interorbital space being more than that of the orbit and the upper eye considerably in advance of the lower. Many workers considered this species distinct from *C. microlepis*, though in the excellent illustration of *C. microlepis* in Bleeker's *Atlas* (pl. 243: fig. 3), 21–22 interlinear scale rows and the position of the migratory eye in advance of the fixed eye are clearly indicated. Smith (1945:441) considered the two species distinct; the principal point of differences noted was a single distinct lateral line on the blind side in the case of *C. microlepis* and the larger number of scales in the medium lateral line as compared with *C. xiphoideus*. Comparison of a large number of specimens from Thailand does not substantiate Smith's conclusions. The lateral line on the blind side is totally absent in all the specimens examined, though a somewhat lateral line-like streak is visible on the blind side, which, of course, is not pored. The type specimens of *C. xiphoideus*, in the British Museum, that were examined agree well with Bleeker's description and illustration of *P. microlepis*, and since this species has priority over *C. xiphoideus*, I have used the name *C. microlepis* for the species.

*Cynoglossus solum* described by Sauvage (1878:92) from the Mekong River and characterized as having three lateral lines on the colored side, one on the blind side, and 166 scales in the midlateral line was synonymized by Smith (1945:442) and I concur with him.

*TYPE SPECIMENS.*—Of the two type specimens of *C. xiphoideus* in the British Museum, a specimen, BMNH 1859.7.1.52, 191 mm in SL, is selected here as the lectotype and the other specimen, BMNH 1859.7.1.53, 137.5 mm SL, as the paralectotype of *C. xiphoideus*.

Among the Bleeker collection in Leiden is a specimen, cataloged as RMNH 6784, 171 mm SL, 193 mm TL, from Bandjermassin, SE Borneo, coll. J. Wolff (pers. comm., Dr. M. Boeseman), and it is here considered as the holotype of *C. microlepis*. A second specimen, RMNH 17876, 325 mm SL, 360



mm TL, is the figured specimen indicated as such by Chabanaud.

OTHER MATERIAL EXAMINED.—1 specimen, BMNH 1876.3.20.4, Laos, coll. Paris Museum. 5, BMNH 1898.4.2.130-134, Menam R., ex. Siamese Museum. 2, BMNH 1906.10.29.39-40, Sarawak, coll. S. L. Hora. 1, BMNH 1928.5.22.2, Bangkok, Thailand, coll. H. M. Smith. 1, ZMA 108.004, Indonesia, coll. Moolenburgh. 2, ANSP 89534, Gulf of Thailand, coll. R. M. de Schauensee. 1, USNM 103319, Menam Chau Phya, Thailand. 1, UMMZ 181238, Cambodia, coll. J. Bardoch. 1, ZSI F 19608, Montaburi, Thailand, coll. H. M. Smith.

### The *macrophthalmus* complex

This species is like the members of the *heterolepis* complex except that only one (posterior) nostril is present on the ocular side. The center of distribution is in Queensland and probably descended from the same ancestral stock from which the *heterolepis* complex was derived.

#### 49. *Cynoglossus macrophthalmus* Norman

##### PLATE 21

*Cynoglossus macrophthalmus* Norman, 1926:306, fig. 15 [type-locality: Southern Queensland, 20 miles off Bustard Head light].

DESCRIPTION.—Based on 2 specimens, 73.0–251.0 mm SL, including the holotype of *C. macrophthalmus*.

Depth of body 27.40–28.97 percent of standard length, length of head 23.84–24.66 percent. Diameter of eye 11.11–11.35, interorbital space 4.84–8.83 percent of length of head. Anterior nostril on ocular

side tubular, in front of lower eye, posterior nostril absent. Snout rounded, 35.06–38.89 percent of length of head, rostral hook long, reaches below posterior border of fixed eye or just beyond. Maxillary extending to just behind fixed eye; angle of mouth extending to below vertical from posterior border of fixed eye, slightly nearer to branchial opening than to tip of snout; tip of snout to angle of mouth 50.08–55.56, angle of mouth to branchial opening 47.22–48.41 percent of length of head.

*Scales*: Small, weakly ctenoid on both sides.

*Lateral-Line System*: Three lateral lines on ocular side, midlateral line with 100–103 scales, 17–18 scales between middle and upper lateral lines. No lateral line on blind side.

*Fins*: Dorsal with 110–111 rays, anal with 90–91 rays, caudal 10 in 2 specimens (radiographs).

*Vertebrae*: 53, comprising 9 abdominal and 44 caudal elements in 2 specimens (radiographs).

*Coloration*: Upper side brownish, lower whitish in preserved specimens.

*Size*: Largest specimen examined, 270 (251 + 19) mm, is the holotype from southern Queensland.

DISTRIBUTION.—Queensland; recorded from a depth of 20 fms.

DIAGNOSIS AND AFFINITIES.—Apparently related to the *C. heterolepis* complex but differing in the lack of a posterior nostril and possessing a rounded snout and a long rostral hook reaching to below posterior border of fixed eye. In its elongated body and reduced eyes it resembles *C. waandersi*.

TYPE SPECIMEN.—Holotype of *C. macrophthalmus*, AMS E 1978, 251 mm SL, 20 miles off Bustard Head light, southern Queensland.

OTHER MATERIAL EXAMINED.—1 specimen, AMS 1A 6460, from Lindeman Island, Queensland.

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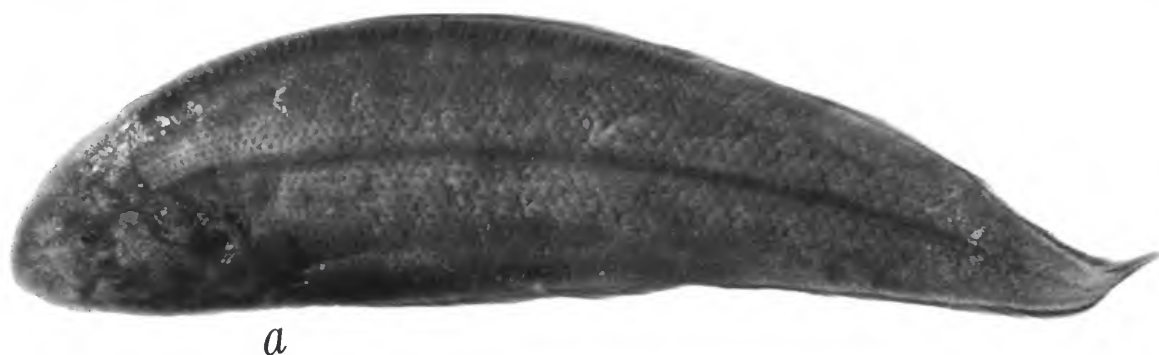


PLATE 1.—*Cynoglossus canariensis* Steindachner: *a*, lateral view of ocular side of specimen 325 mm SL (USNM 188435) from Lagos coast, Nigeria; *b*, enlarged view of anterior part of same. *Cynoglossus monodi* Chabanaud: *c*, lateral view of ocular side of specimen 314.0 mm SL (USNM 188434) from Lagos coast, Nigeria; *d*, enlarged view of anterior part of same.

*a**b**d**c*

PLATE 2.—*Cynoglossus senegalensis* (Kaup): *a*, lateral view of ocular side of specimen 355.0 mm SL (USNM 247424) from Lagos coast, Nigeria; *b*, enlarged view of anterior part of same. *Cynoglossus dubius* Day: *c*, lateral view of ocular side of specimen 370.0 mm SL (SOSC A 23) from Arabian Sea; *d*, enlarged view of anterior part of same.

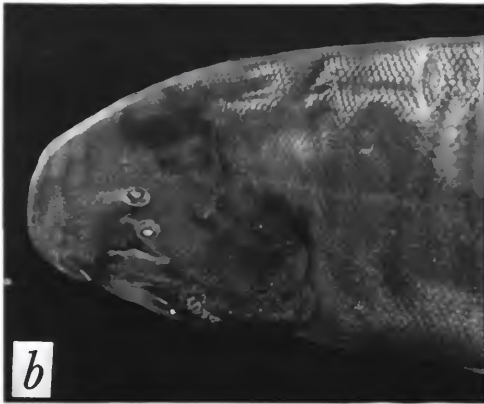
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PLATE 3.—*Cynoglossus borneensis* (Bleeker): *a*, lateral view of ocular side of specimen 271.0 mm SL (CAS., Vanderbilt collections, Reg 2582) from Shakon Province,  $\frac{3}{4}$  miles off shore, Gulf of Thailand; *b*, enlarged view of anterior part of same. *Cynoglossus browni* Chabanaud: *c*, lateral view of ocular side of specimen 305.0 mm SL (USNM 188437) caught off the coast of Nigeria; *d*, enlarged view of anterior part of same.

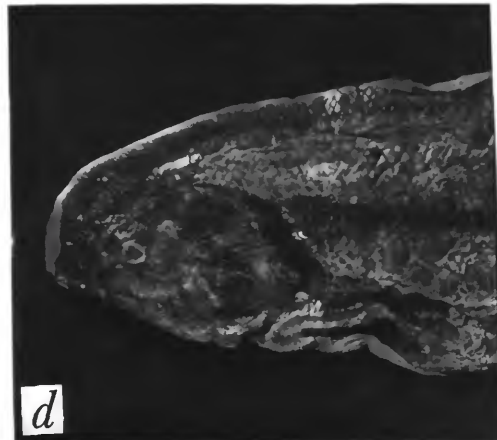
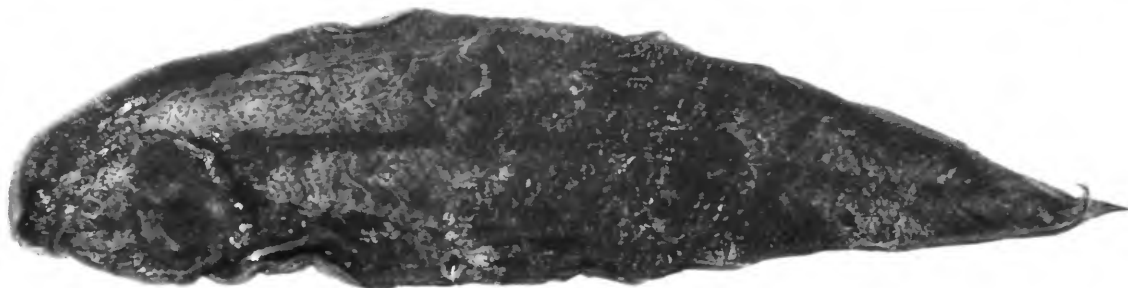
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PLATE 4.—*Cynoglossus bilineatus* (Lacépède): *a*, lateral view of ocular side of specimen 310.0 mm SL from Hong Kong; *b*, enlarged view of anterior part of same. *Cynoglossus attenuatus* Gilchrist: *c*, lateral view of ocular side of specimen 244.0 mm SL (ANSP 88867) from Delagoa Bay, South Africa; *d*, enlarged view of anterior part of same.



PLATE 5.—*Cynoglossus lachneri* Menon: *a*, lateral view of ocular side of specimen 226.0 mm SL from Silhouette Bay, Seychelles; *b*, enlarged view of anterior part of same. *Cynoglossus dispar* Day; *c*, lateral view of ocular side of specimen 303.0 mm SL (SOSC A 23) from Karachi, west of Astola Island, Pakistan, lat. 23°06'35"N, long. 63°48'65"E; *d*, enlarged view of anterior part of same.

*a**b**d**c*

PLATE 6.—*Cynoglossus kopsi* (Bleeker): *a*, lateral view of ocular side of specimen 178 mm SL (USNM 137982) from China Sea, near Hong Kong; *b*, enlarged view of anterior part of same. *Cynoglossus joyneri* Günther: *c*, lateral view of ocular side of specimen 166.0 mm SL (KU 26965) from Omuta, Fukuoka Prefecture, Japan; *d*, enlarged view of ocular side of anterior part of same.



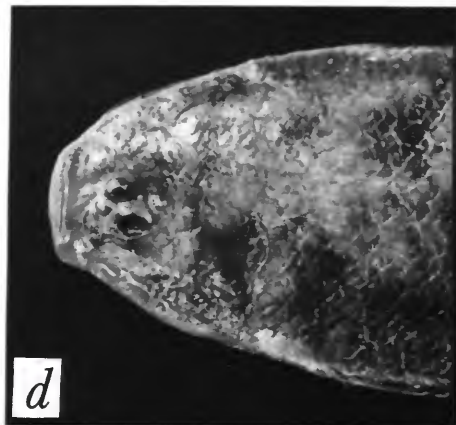
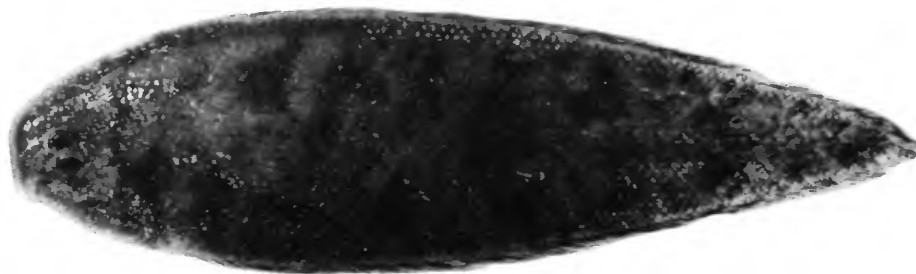
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PLATE 7.—*Cynoglossus itinus* (Snyder): *a*, lateral view of ocular side of specimen 124.0 mm SL (USNM 72023) from Tanegashima, Japan; *b*, enlarged view of anterior part of same. *Cynoglossus maculipinnis* Rendahl: *c*, lateral view of ocular side of specimen 102.0 mm SL (WAM P 11729) of *C. maculipinnis* from Exmouth Gulf; *d*, enlarged view of anterior part of same.

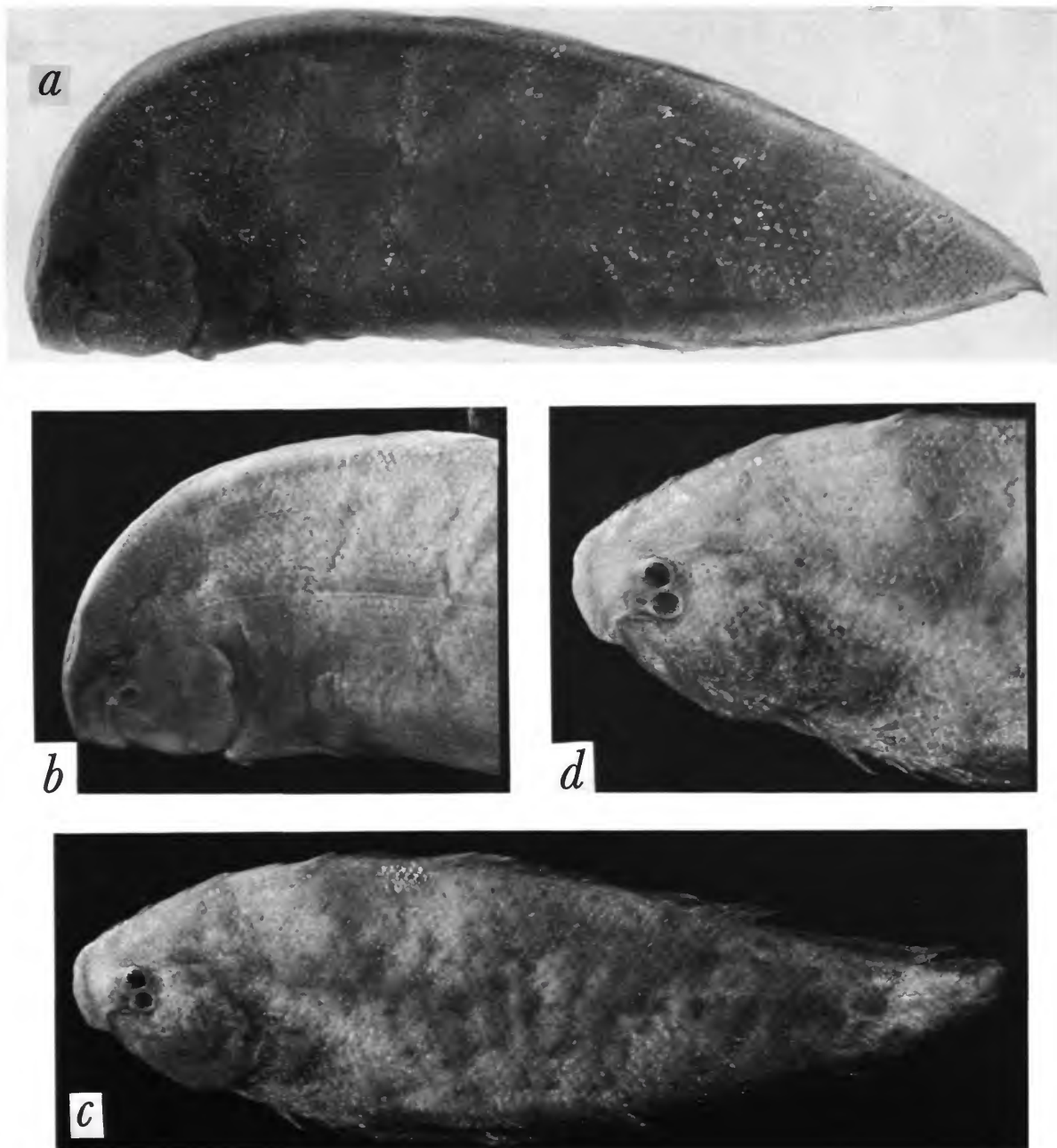


PLATE 8.—*Cynoglossus broadhursti* Waite: *a*, lateral view of ocular side of specimen 214.0 mm SL (WAM P 14741) from Shark Bay, Western Australia; *b*, enlarged view of anterior part of same. *Cynoglossus ecaudatus* Gilchrist: *c*, lateral view of ocular side of specimen 150.0 mm SL (SOSC Ref. No. 145) from Somali coast; *d*, enlarged view of anterior part of same.

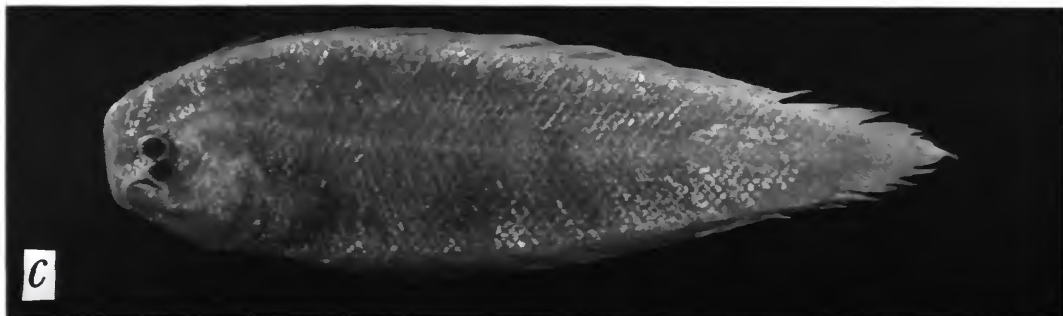
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PLATE 9.—*Cynoglossus cadenati* Chabanaud: *a*, lateral view of ocular side of holotype 145.0 mm SL (MNHP 49.20) from Senegal, west Africa; *b*, enlarged view of anterior part of same. *Cynoglossus sinusarabici* Chabanaud: *c*, lateral view of specimen 83.0 mm SY (MNHP 1967.600); *d*, enlarged view of ocular side of anterior part of same.

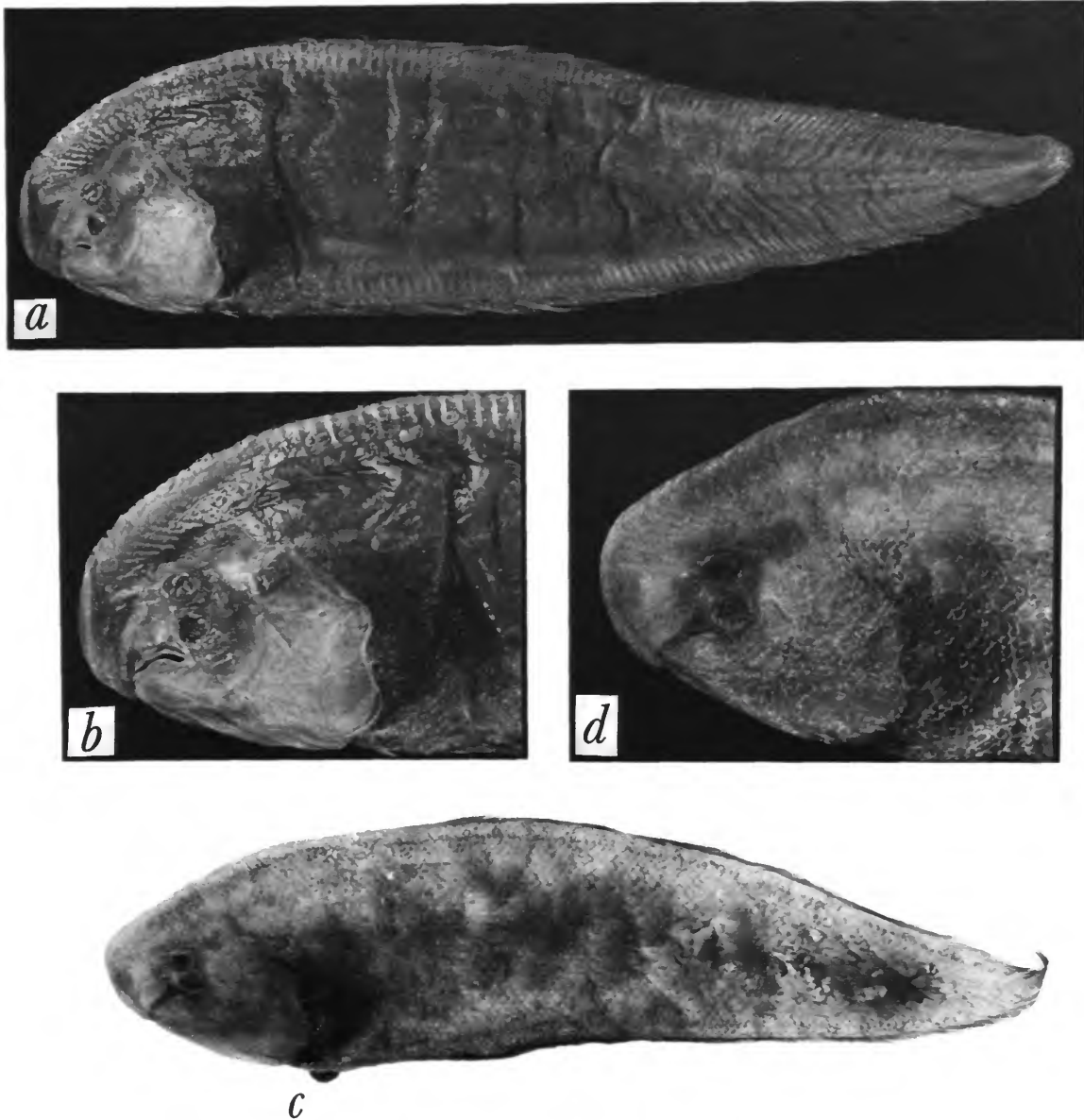


PLATE 10.—*Cynoglossus sealarki* Regan: *a*, lateral view of ocular side of paralectotype 182.0 mm SL (BMNH 1908.23.155) from Saya-de-malha Bank; *b*, enlarged view of anterior part of same. *Cynoglossus zanzibarensis* Norman: *c*, lateral view of ocular side of specimen, 154.0 mm SL (SOSC Ref. No. 170) from Mozambique coast, lat. 25°12'S, long. 40°31'E; *d*, enlarged view of anterior part of same.

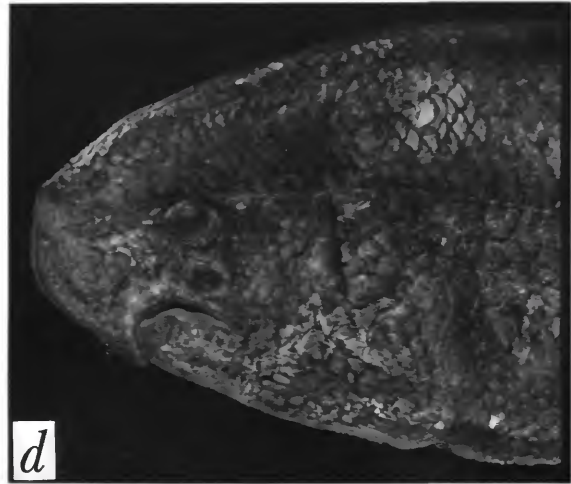
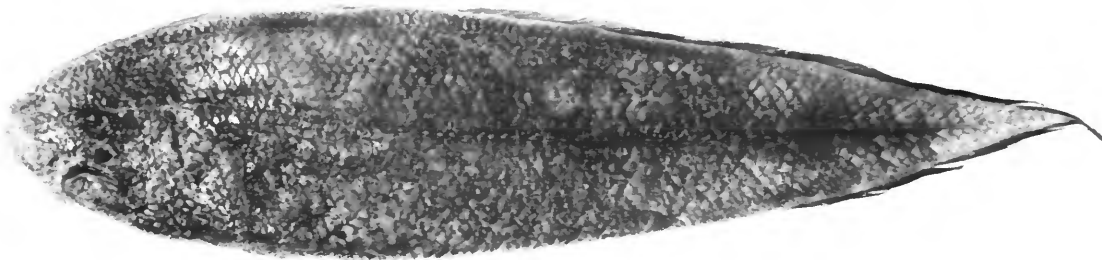
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PLATE 11.—*Cynoglossus capensis* (Kaup): *a*, lateral view of ocular side of neotype 167.0 mm SL (BMNH 1897.10.8.2) from Saldanha Bay; *b*, lateral view of anterior part of same. *Cynoglossus arel* (Schneider): *c*, lateral view of ocular side of specimen 348.00 mm SL (SOSC Ref 334) from Porto Novo, Madras, lat. 11°32'N, long. 79°53'E; *d*, enlarged view of ocular side of anterior part of same.

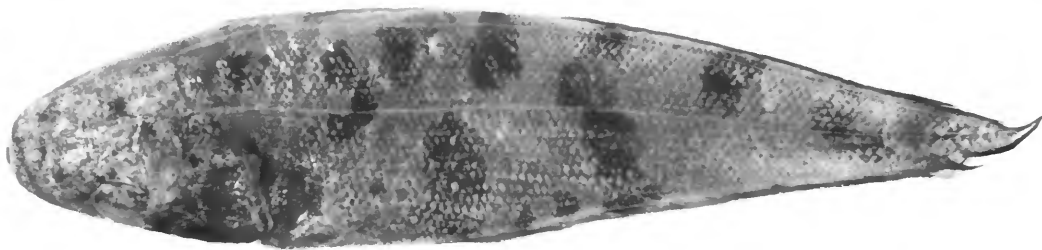
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PLATE 12.—*Cynoglossus robustus* Günther: *a*, lateral view of ocular side of specimen 340.0 mm SL (USNM 56386) from Japan; *b*, enlarged view of ocular side of anterior part of same. *Cynoglossus lingua* (Hamilton-Buchanan): *c*, lateral view of ocular side of specimen 315.0 mm SL (CAS George Vanderbilt collection 2582) from Gulf of Thailand; *d*, enlarged view of anterior part of same.

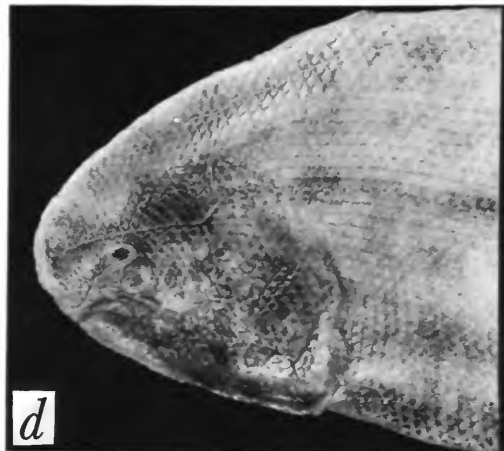


PLATE 13.—*Cynoglossus cynoglossus* (Hamilton-Buchanan); *a*, lateral view of ocular side of specimen 116.0 mm SL (ZSI 1499) from Calcutta; *b*, enlarged view of anterior part of same. *Cynoglossus semifasciatus* Day; *c*, lateral view of ocular side of specimen 114.0 mm SL (SOSC Ref 334) caught off Thirumulli Vasal Village, near Porto Novo, Madras; *d*, enlarged view of anterior part of same.

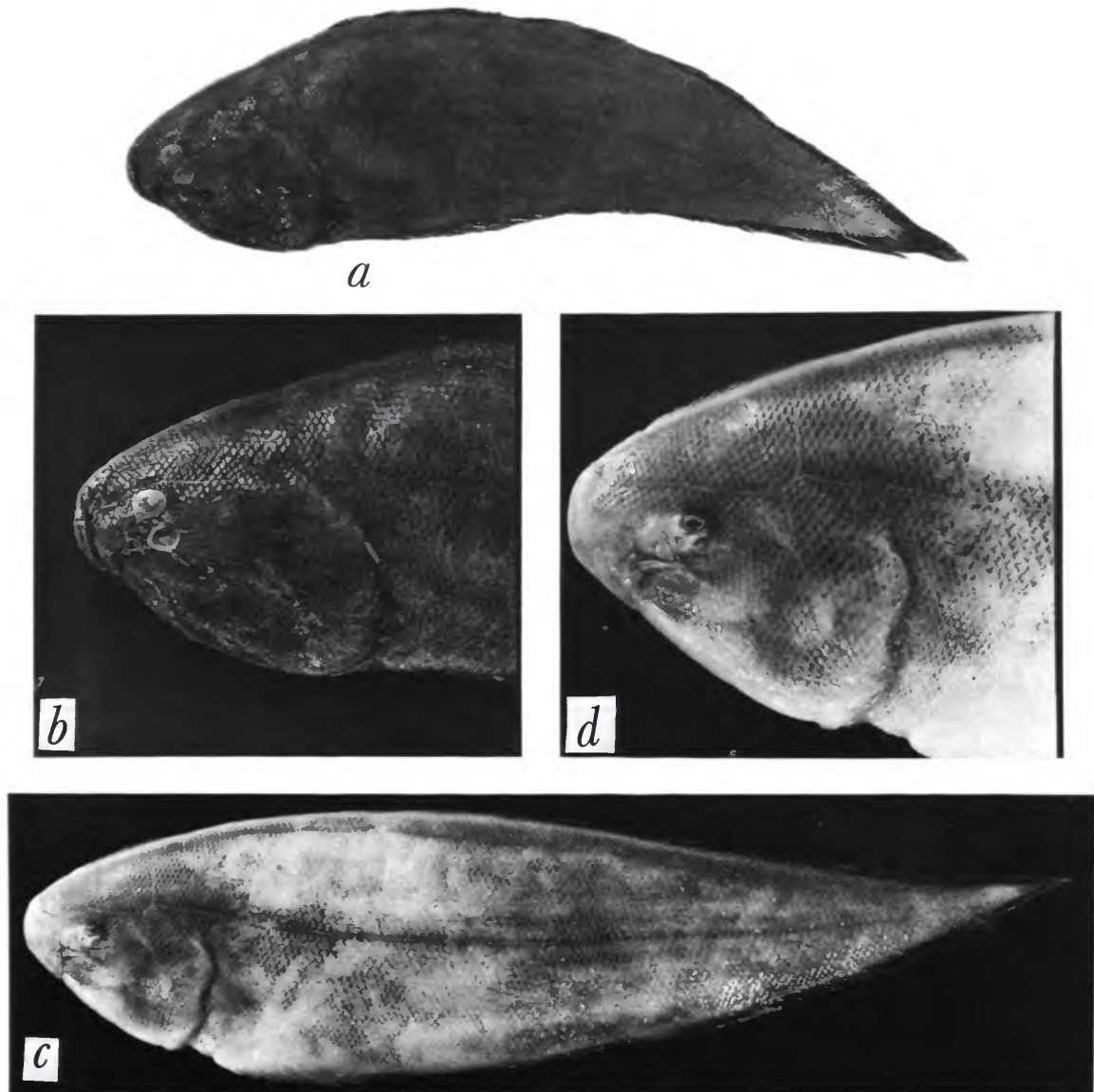


PLATE 14.—*Cynoglossus macrostomus* Norman: *a*, lateral view of ocular side of specimen 127.0 mm SL (SOSC Ref 334) from Neendakari, Kerala State; *b*, enlarged view of anterior part of same. *Cynoglossus monopus* (Bleeker): *c*, lateral view of ocular side of specimen 147.0 mm SL (GVF collection) from Gulf of Thailand; *d*, enlarged view of anterior part of same.



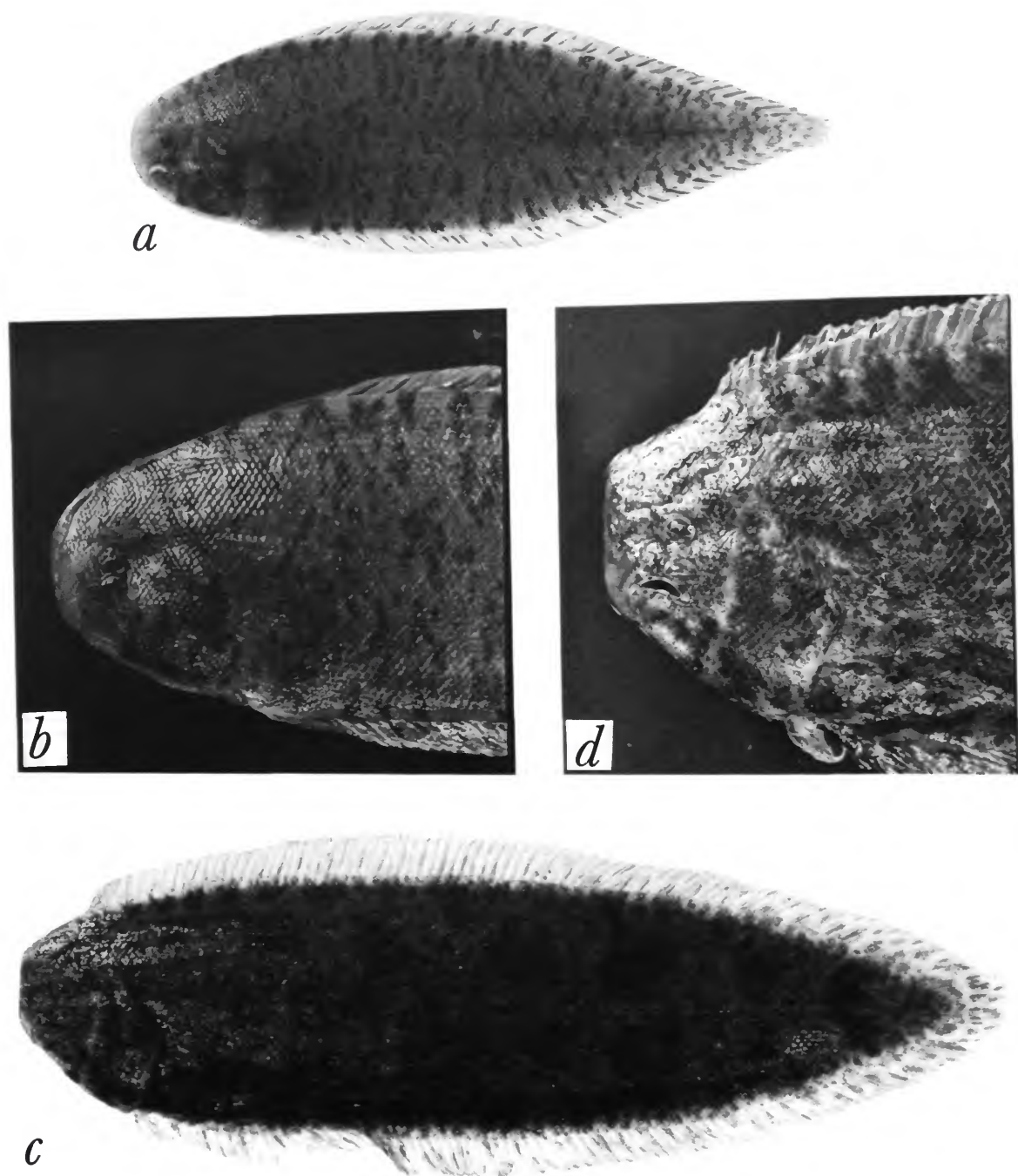


PLATE 15.—*Cynoglossus puncticeps* (Richardson): *a*, lateral view of ocular side of specimen 105.0 mm SL (GVF) from Gulf of Thailand; *b*, enlarged view of anterior part of same. *Cynoglossus durbanensis* Regan: *c*, lateral view of ocular side of specimen 153.0 mm SL (ANSP 63890) from Durban; *d*, enlarged view of anterior part of same.

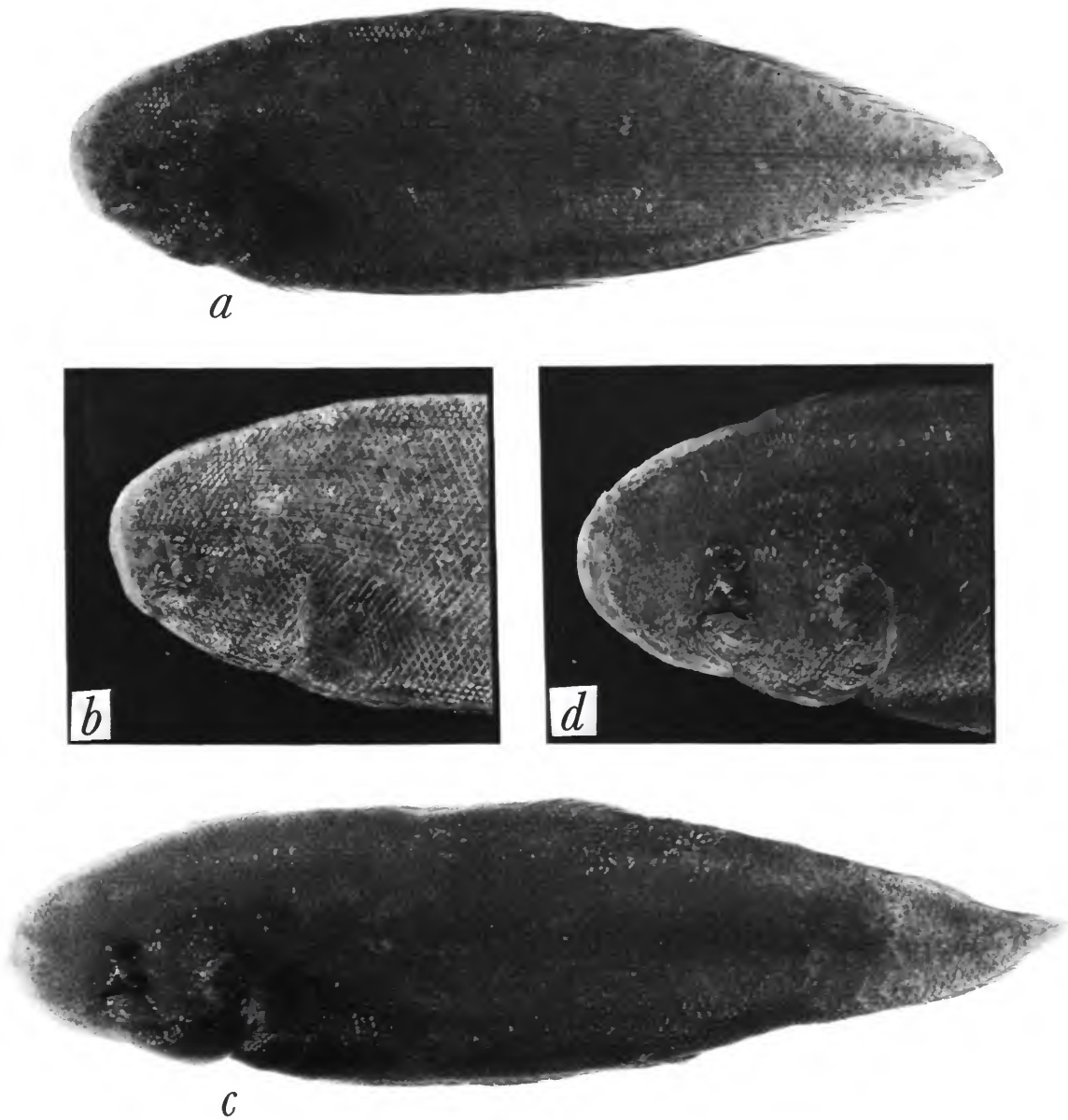


PLATE 16.—*Cynoglossus gilchristi* Regan: *a*, lateral view of ocular side of specimen 90.5 mm SL (SOSC Ref 134) from Nossi Be, Madagascar; *b*, enlarged view of anterior part of same. *Cynoglossus lida* (Bleeker): *c*, lateral view of ocular side of specimen 180.0 mm SL (SOSC Ref 170) from Mozambique coast, lat. 19°09'S, long. 36°20'E; *d*, enlarged view of anterior part of same.

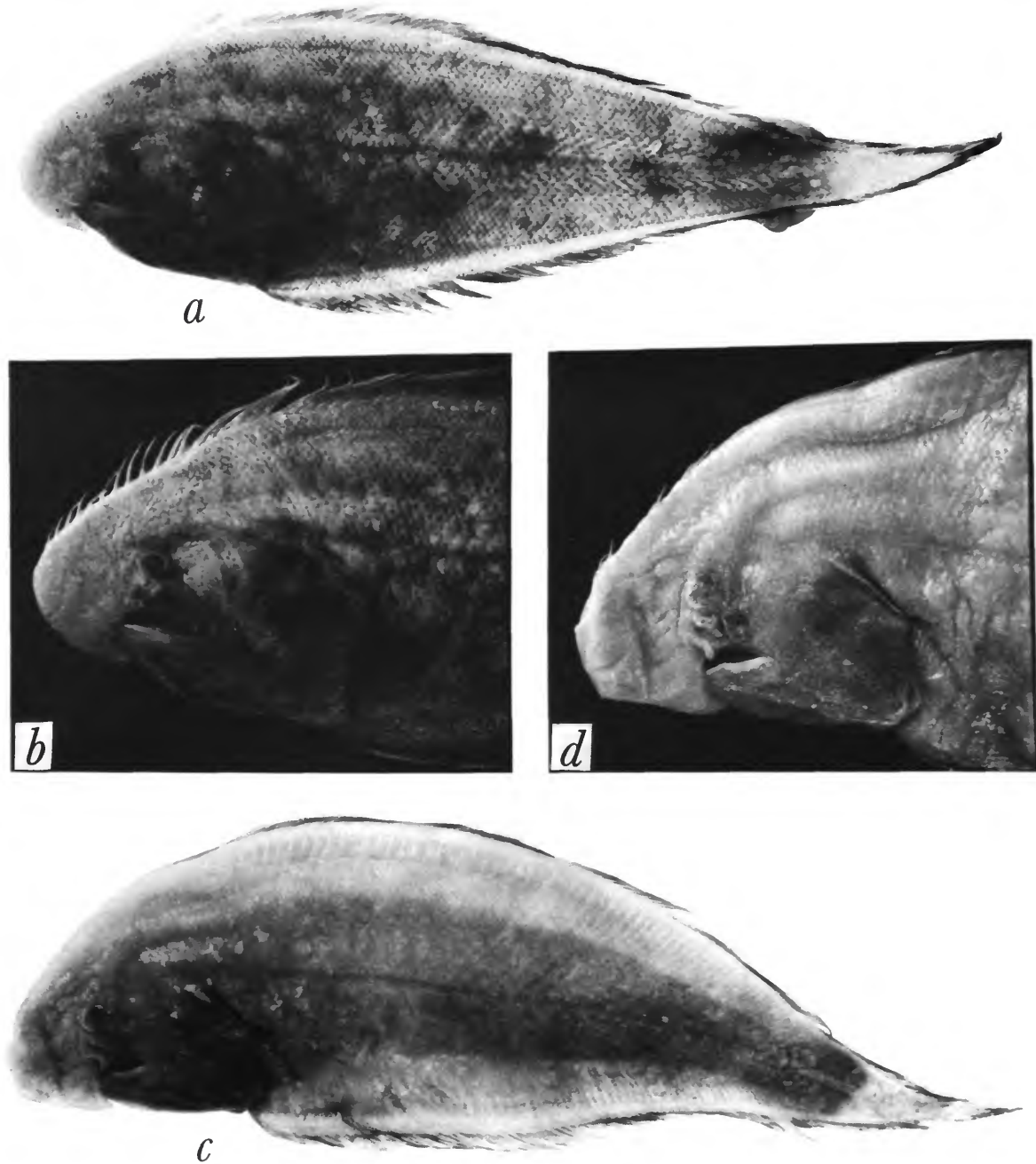


PLATE 17.—*Cynoglossus carpenteri* Alcock: *a*, lateral view of ocular side of specimen 179.0 mm SL (SOSC A 23) from Arabian sea, lat. 24°13'N, long. 65°52'E; *b*, enlarged view of anterior part of same. *Cynoglossus acutirostris* Norman: *c*, lateral view of ocular side of paralectotype 190.0 mm TL (USNM 109493) from the Gulf of Aden; *d*, enlarged view of anterior part of same.

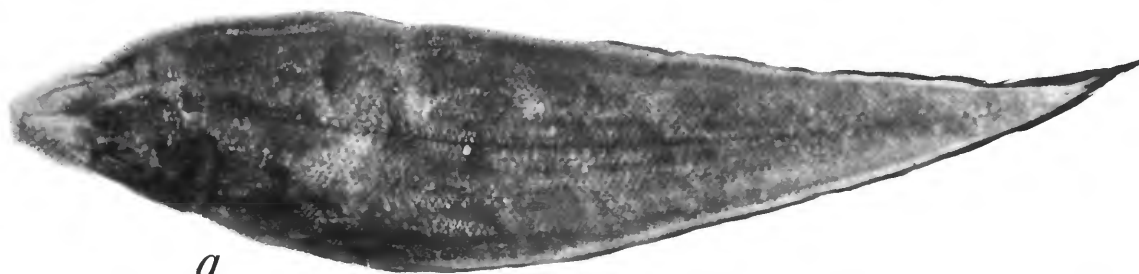
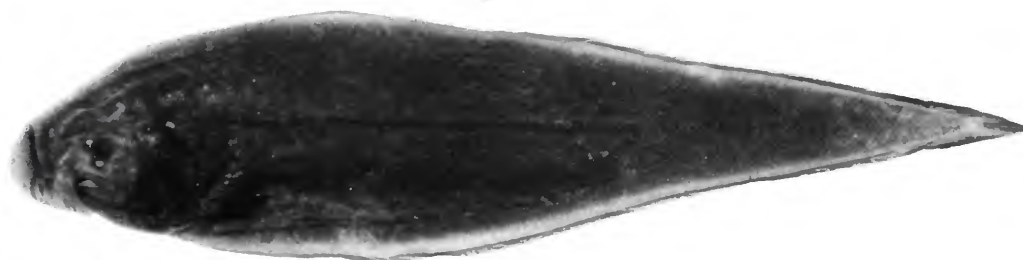
*a**b**d**c*

PLATE 18.—*Cynoglossus marleyi* Regan: *a*, lateral view of ocular side of specimen 159.0 mm SL (SOSC) caught off Natal. *Cynoglossus suyeni* Fowler: *c*, lateral view of ocular side of specimen 247.0 mm SL (USNM 137944) from the Philippine-Celebes seas; *d*, enlarged view of anterior part of same.

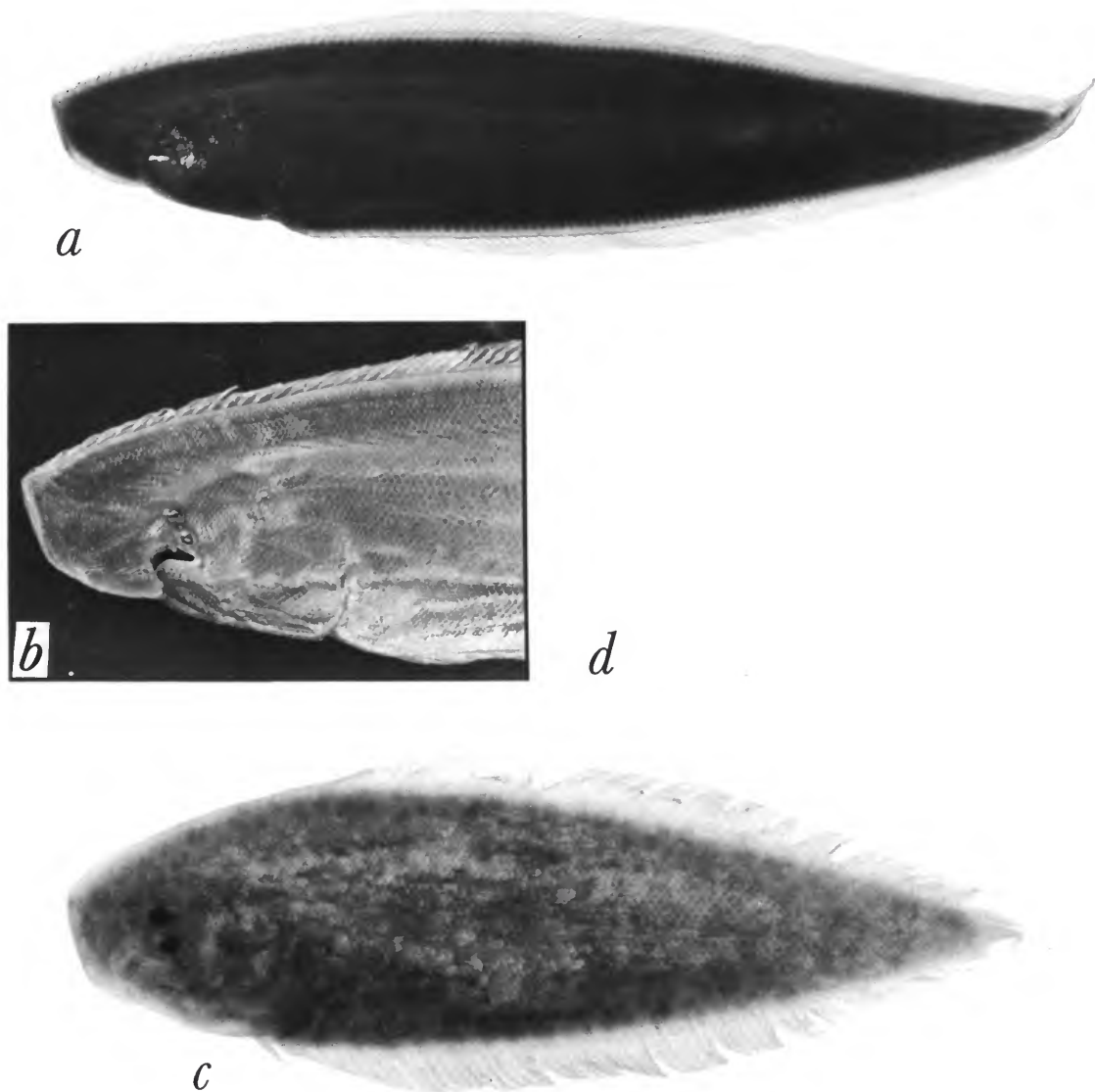


PLATE 19.—*Cynoglossus heterolepis* Weber: *a*, lateral view of ocular side of specimen 138.0 mm SL (USNM 174028) from Northern Territory, Australia; *b*, lateral view of anterior part of same. *Cynoglossus waandersi* (Bleeker): *c*, lateral view of ocular side of specimen 73.0 mm SL (UMMZ 171680) from Morsi River at Mooara, Sumatra; *d*, lateral view of anterior part of same.

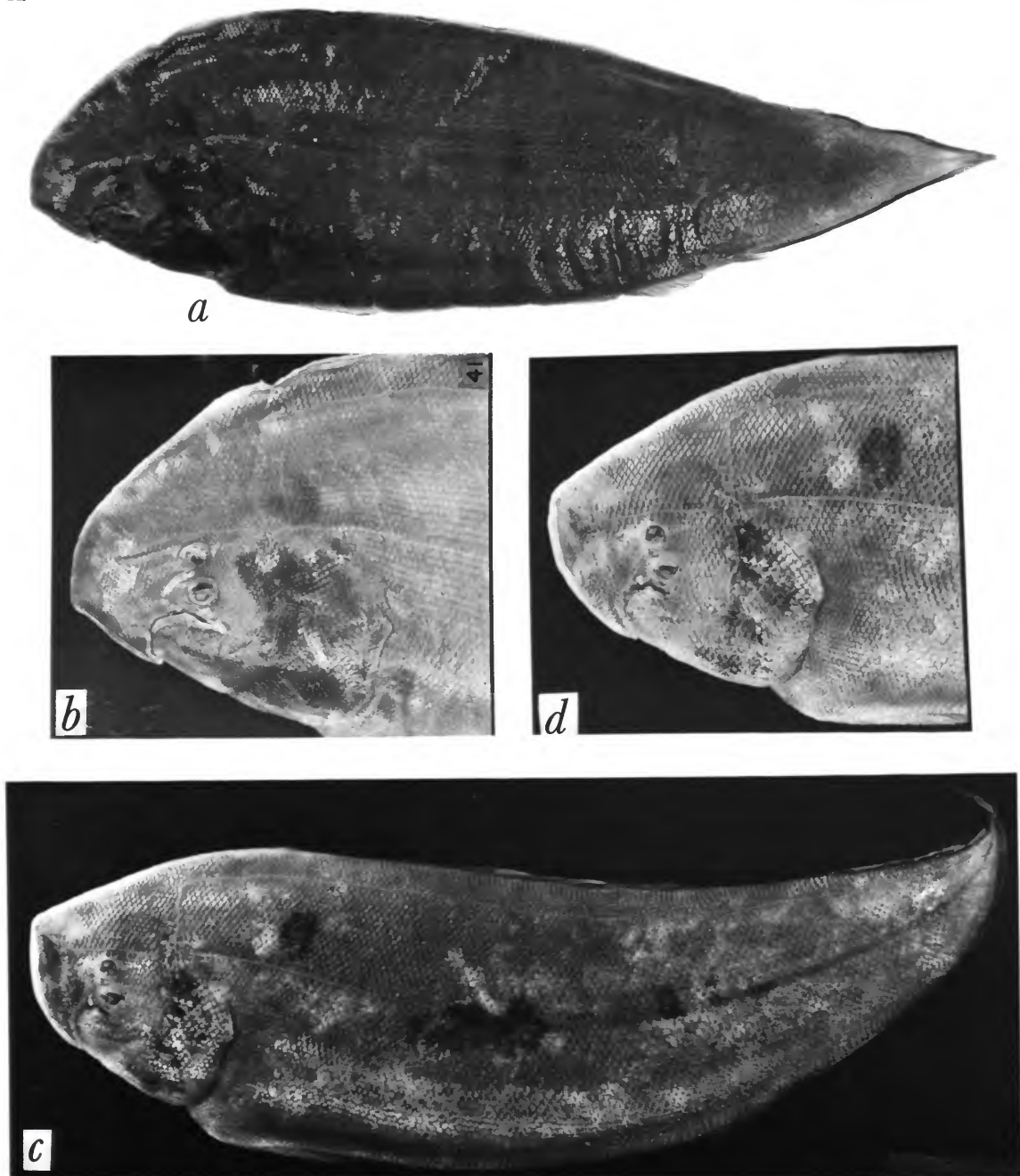
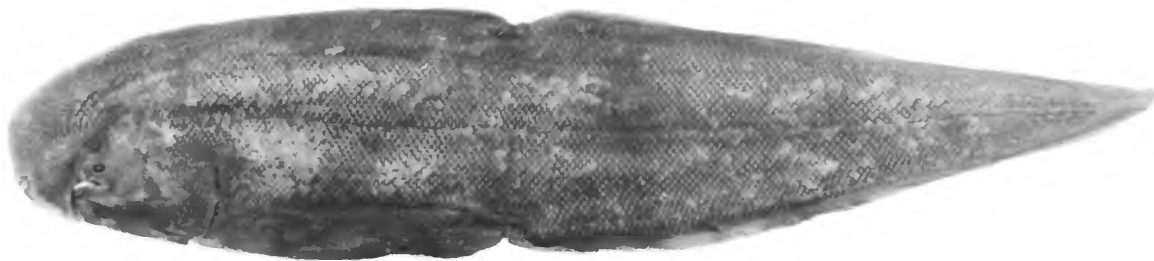


PLATE 20.—*Cynoglossus semilaevis* Günther: *a*, lateral view of ocular side of specimen 350 mm SL (BMNH 1939.1.17.56) from Hong Kong; *b*, enlarged view of anterior part of same. *Cynoglossus abbreviatus* Günther: *c*, lateral view of ocular side of specimen 270.0 mm SL (USNM) from Pearl River mouth, Hong Kong; *d*, enlarged view of anterior part of same.



a



c



d



b

PLATE 21.—*Cynoglossus gracilis* Günther: a, lateral view of ocular side of specimen 180.0 mm SL (USNM 86466) from China. *Cynoglossus microlepis* (Bleeker): b, lateral view of ocular side of specimen 215.0 mm SL (UMMZ 181238) from Cambodia; c, enlarged view of anterior part of same. *Cynoglossus macrophthalmus* Norman: d, lateral view of anterior half of ocular side of specimen 70.0 mm SL (AM 1A 6460) from Lindeman Island, Queensland, Australia.









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**A few points of style:** (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

**Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order:** (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.

