THE SYSTEMATICS AND DISTRIBUTION OF THE FISHES OF THE FAMILY CLINIDAE IN SOUTH AFRICA

with notes on the biology of some common species

by

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SUMMARY

The family Clinidae includes the klipfishes which are characteristic of the intertidal pools of the Cape Province of South Africa. These small shore fishes are particularly interesting from several points of view. They belong to a family which is widespread, occurring on the coasts of North, South, and Central America, South Africa, and the Indo-Australian region, with a few representatives in West Africa and the Mediterranean. The west and east coasts of America, the South African coast, and the Indo-Australian region have a large number of closely related endemic species. The relationships between the clinids of different parts of the world, their origins and zoogeography are of great interest.

The distribution of the different species along stretches of the American coast has been found by Hubbs (1952) to be of value in indicating the existence of oceanographic barriers, some previously unsuspected; the South African coast is a region of complex hydrographic conditions, and the distribution of the South African species is of interest in relation to them.

No detailed work has been done on the biology of the South African clinids. The South African species are unusual among marine fishes in that they are viviparous and the males have a highly developed intromittent organ for transferring sperm to the female. A further problem of their biology is the

fact that large numbers of closely related species of these small carnivorous fishes occur together in rock-pools, and it was felt that a study of the feeding habits of some of the commoner species would prove interesting from a point of view of competition for food in the intertidal zone.

However, before studies of this nature can be undertaken, it is necessary that the systematics of the group should be established on a reliable basis. This was not the case in the South African Clinidae; the taxonomy of the group was highly confused. The species were split into two artificial groups on the strength of a single character; there were numerous small genera, almost half of which were monospecific, and it was not possible to make any assumptions about the relationships within the group. In addition, a group of closely related species had been removed as a separate family. It was therefore considered that a complete revision of the South African species of Clinidae was necessary before any of the other problems could be tackled.

The present work consists of four parts: (1) systematics; (2) distribution; (3) feeding studies; (4) notes on breeding.

Part I: Systematics

In addition to the material in existing collections, large quantities of fresh material were collected from as many localities as possible, mainly by the use of a fish poison, rotenone. A total of 4,375 specimens representing 33 species were examined. A series of measurements (see fig. 3) and fin counts were made, and a number of other characters, such as the form of the male intromittent organ, not previously used in taxonomic studies, were noted. The genera were revised in such a way as to stress similarities between groups of species, and the number of genera was reduced from sixteen to five. Subgenera were used to show closer relationships in the two largest genera. All the species were redescribed according to a particular plan, and were figured, together with the male intromittent organ and parts of the lateral line. The intensive collecting done for this work resulted in the discovery of three new species, which were described separately. The first of these descriptions has been published.

The systematic section includes an appendix in which the similarities of the species were assessed by the methods of numerical taxonomy. The results of this assessment agreed well with the scheme for classification proposed in the revision. A brief discussion of the possible origin of the South African Clinidae forms part of the systematic section.

Part II: Distribution

The constitution of the intertidal fauna and flora of the South African coast and its relation to hydrographic conditions formed the subject of a survey during the period 1931 -

1940 by the Zoology Department of the University of Cape Town under the late Professor T.A. Stephenson. That survey did not include the shore fishes, although Professor Stephenson (1948) pointed out that the distribution of the South African Clinidae, with all the species endemic and the vast majority intertidal, was of great interest in connection with his work. During the present survey a very large number of new distribution records for various species were amassed, and it was also possible to obtain some idea of the geographical limits over which certain species are common, an aspect of great importance in ecological work. Professor Stephenson divided the South African coast into three main regions, the west, south, and east coasts, with fairly extensive regions of overlap between them. The agreement between the present work on clinids and the work of Professor Stephenson and his colleagues on the intertidal flora and invertebrate fauna is good, and owing to extensive work on the South West African and Namaqualand coasts it has been possible to establish the probable area of the northern boundary to which typical west coast conditions exist. No collecting of shore fishes had previously been carried out north of the Orange River on the South West African coast, and in fact the intertidal fish fauna of the Namaqualand coast was poorly known as well. Much collecting was done at localities on the South West African and Namaqualand coasts, and the shore fish fauna of these areas is now well known.

It has been established by the present work that the South African Clinidae are essentially a "Cape" group, being characteristic of the temperate waters of the Cape Province and southern South West Africa, with few species extending north-east of the Cape Province/ Natal border, such species as do enter the subtropical waters of Natal being very rare there.

Part III: Feeding

The feeding habits of six species of Clinidae common in the area between Lambert's Bay and Cape Agulhas were studied by examination of the stomach contents of 996 fish. Additional notes were made for comparative purposes on the stomach contents of 70 specimens of five species of which only small samples were available. The relative importance of the different food items was assessed by the methods of percentage by volume and percentage occurrence, and the items were identified as far as possible, usually to species. Interesting differences were found in the feeding habits of the species studied. These differences could be ascribed mainly to differences in relative mouth size and differences in types of habitat of the fishes. Competition was found to be minimised mainly by these factors.

Part IV: Notes on breeding

A detailed survey of breeding habits did not form part of the present work, as the type of field work, covering a wide range of localities, required by the systematic and distributional problems, precluded the collection of regular samples from a single locality necessary for breeding studies. However, observations were made on the gonads of six common species mainly in the Lambert's Bay/ Cape Agulhas area, and some inferences were drawn regarding the sex ratios, time of breeding, and size at maturity of those species. Breeding occurs virtually throughout the year in most of the species studied, with a period of minimal breeding activity demonstrable in three of them. It is felt that further studies on breeding in relation to temperature at different localities on the coast would yield interesting results.

Two supplementary papers entitled "Studies on the South African Clinidae. I. Description of a new species of *Pavoclinus*, and redescription of *Gynutoclinus rotundifrons* (Barnard)" and "*Ctenogobius cloatus* Smith, 1960, a synonym of *Ctenogobius saldanha* (Barnard, 1927)" (the latter with Dr. F.H. Talbot) are submitted.

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Part I.

A systematic study of the fishes of the family Clinidae in South Africa

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INTRODUCTION

The systematic section of this work is primarily a generic revision of the South African Clinidae, and a consideration of their relationships with the Clinidae in other parts of the world.

Since the Clinidae are defined as "blennioid fishes", the classification of families within the suborder Blennioidea is considered briefly. There has for almost a century been considerable controversy as to what families should be included in the Blennioidea. The consideration of this problem is of necessity merely a survey of the available literature, since detailed examinations of a very large number of representatives of each of the families in question would be necessary to establish with any certainty the limits and affinities of the suborder. Such investigations are being carried out at present on a large scale by workers in the United States of America (Dr. D. Cohen, personal communication).

The relationships within the family Clinidae are considered in some detail. Clark Hubbs (1952) discussed the relationships of the South African and American Clinidae, but did not include the Australian and Mediterranean clinids in his scheme of classification. Representative specimens of the Australian genera of Clinidae as well as specimens of the single Mediterranean species were borrowed for study, and their affinities with the rest of the group are considered.

In 1961 J.L.B. Smith described a new family of cliniform fishes, the Xenopoclinidae, to contain two genera and three species of sand-burrowing fishes from the west coast of South Africa. These fishes have numerous features in common with the South African Clinidae, but also bear an interesting resemblance to an American family of sand-burrowers, the Dactyloscopidae. An attempt is made to clarify their systematic position and relationships.

The genera of the South African Clinidae have been revised in order that the system of classification might show more clearly the natural relationships within the group than does the present system. All the species are redescribed and figured.

The South African Clinidae are considered to have originated from American Clinidae which made the Atlantic crossing and developed internal fertilization and the habit of bearing their young alive; the ancestral clinids are considered to have been very similar to a group of clinids present in the temperate waters of western America (Hubbs, 1952). The possibilities of such an origin for the group are discussed in some detail.

THE CLASSIFICATION OF THE BLENNIOID FISHES

The blennioid fishes can be defined broadly as perciform teleosts with the pelvic fins jugular or mental, consisting of a spine and one to five rays. Each element of the dorsal and anal fins is attached to its corresponding neural or haemal spine. The ascending wings of the parasphenoid may reach the descending wings of the frontals. All or most of the ribs are inserted on strong parapophyses.

The limits of the suborder Blennioidea have been subject to much change by ichthyologists during the last century, and are still far from clearly defined. Linnaeus' (1758) system of classification placed all those fishes which have the pelvic fins in front of the pectorals in a division Jugulares, and this feature has continued to be important in the classification of fishes possessing it, although it has been pointed out several times that this condition could have been developed independently by different groups of fishes not naturally closely related to one another.

Table I shows Hubbs' (1952) classification of the Blennioidea. He considered that the condition of each dorsal and anal fin element corresponding with a neural or haemal spine could have arisen separately in the Blenniicae and Zoarcicae, and that the group is diphyletic.

Table 1. The classification of fishes of the suborder Blennioidea (after Hubbs, 1952).

Superfamily Blenniicae	Superfamily Zoarcicae
*Blenniidae	Notograptidae
*Clinidae	Peronedyidae
*Tripterygiidae	Ophioclinidae
+Pterygocephalidae	Cebedichthyidae
**Chaenopsidae	Pholidae
	Xiphisteridae (Xiphidiontidae)
	Stichaeidae
	Lumpenidae
	Ptilichthyidae
	Cryptacanthodidae
	Anarhichadidae
	Anarrhichthyidae
	Xenocephalidae
	*Congrogadidae (+ Halidesmidae)
	Microdesmidae (Cerdalidae)
	Scytalinidae
	*Zoarcidae
	Lycodapodidae
	Derepodichthyidae

* Represented in South African waters

** Included by Hubbs (1952) in the Blenniidae; see Stephens (1963)

+Fossil forms

The position of the Zoarcidae and related families has been much in debate, as well as the question of whether the families Ophidiidae, Brotulidae, and Fierasferidae should be included in the suborder Blennioidea or not.

Smith (1949) lists the families Ophidiidae, Brotulidae, and Carapidae (= Fierasferidae) among the South African blennioids, following the classification of Regan (1912) in which these families are placed in a division Ophidiiformes of the suborder Blennioidea.

As early as 1872, Gill excluded the ophidiiform fishes from the Blennioidea, but Boulenger (1904) placed them in his division Jugulares together with the blenniiform fishes; his division Jugulares was, however, a very broad group containing a great diversity of families with the pelvic fins originating in front of the pectorals. Jordan (1923) proposed an order Jugulares which he divided into twelve series, including Blenniiformes, Zoarciformes, Brotuliformes, Ophidiiformes, and Carapiformes. Berg (1940) removed the Ophidiidae, Brotulidae, and Fierasferidae to a separate suborder, the Ophidioidea, having equal rank with Regan's Blennioidea, and this classification is generally accepted at present.

Various studies of particular characters have indicated that this separation is justified. Although the Ophidioidea are generally placed after the Blennioidea in schemes of classification, and are often considered to be degenerate blennies, many authors have suggested that their affinities are not with the blennioid fishes, and this view has frequently been extended to at least some of the zoarciform families as well. In Gill's (1872) classification he placed the ophidioid fishes as well as the Congrogadidae and Lycodidae with the gadids and macrurids in the order Anacanthini. Garman (1899) found that the Ophidiidae, Brotulidae, and Zoarcidae have peculiar lateral line features in common with the Gadidae and Macruridae, and believed these peculiarities to indicate a genetic relationship. Cockerell (1916) found that the Ophidiidae, Brotulidae, and Zoarcidae have scales very similar to those of certain genera of Gadidae, although other gadids have different types of scales. Trotter (1926) found several brotulid features to be similar to those of gadids and macrurids, but considered that this similarity could be caused by similar habits and environment, since all the fish which she examined came from deep water. She considered brotulids to have originated from littoral forms, so that the examination of a littoral brotulid such as the locally occurring <u>Bidenichthys capensis</u> Barnard might be of interest in this connection. Frost (1929), studying the otoliths of fishes, found that the Ophidiiformes of Regan (1912) (Ophidiidae, Brotulidae, and Fierasferidae) have extremely large otoliths which are of a different type from the very minute otoliths of the rest of Regan's Blennioidea.

Detailed studies of the origin and distribution of a branch of the seventh cranial nerve, the <u>ramus lateralis accessorius</u>, in representatives of different families of fishes by Ford (1959) and Freihofer (1963) have produced some interesting results in connection with the classification of the Blennioidea.

Ford (1959) found the ophidioids and the Zoarcicae studied to differ from the Blenniicae in that they lack a <u>ramus oticus</u> of the accessory branch of the seventh cranial nerve. He did not suggest that the Zoarcicae are related to the Ophidioidea rather than to the Blenniicae. He discussed several possible modes of origin for the Zoarcicae, the most likely one being that they originated from one or more percoid lines in which the <u>ramus oticus</u> was lacking. Modes of origin which he considered to be less probable are (i) from the Blenniicae by specialization, or (ii) from a common percoid line with the Blenniicae; in either case the <u>ramus oticus</u> would have been lost by specialization. He pointed out that elongate blennies such as <u>Stathmonotus</u> and <u>Xiphasia</u> have retained the <u>ramus oticus</u>, so that its loss is apparently not the result of elongation such as has occurred in the Zoarcicae.

Freihofer (1963) found that, while the Blenniidae and Clinidae showed a distribution of the <u>ramus lateralis accessorius</u> very similar to that found in percoid fishes such as the Serranidae, the Ophidiidae, Brotulidae, and Zoarcidae showed a different pattern, particularly in the course of the branch to the pelvic fin, suggesting that the jugular position of the pelvic fin may have been achieved in a different way from that in which it was achieved in the Blenniidae and Clinidae. He considered the pattern of the *ramus lateralis accessorius* in the Ophidiidae, Brotulidae, and Zoarcidae to be more easily derived from the type found in Gadidae than from the percoid type leading to the condition seen in the Clinidae and Blenniidae.

It seems, therefore, that the separation of the Ophidioidea from the Blennioidea is well founded, but that the systematic position and affinities of the Ophidioidea are doubtful. The systematic position and relationships of the Zoarcicae are also uncertain. However, the Blennicae as restricted by Hubbs (1952) are almost certainly of percoid origin, and their inclusion in most schemes of classification as perciform fishes appears to be well justified.

RELATIONSHIPS AND CLASSIFICATION OF THE FAMILY CLINIDAE

Family: Clinidae

Diagnosis: Small, weakly-swimming blennioid fishes. Body usually covered with cycloid scales. Sub-orbital bony ring weak and flexible. Jaw teeth conical and fixed; vomerine teeth usually present, and sometimes palatine teeth as well. Lateral line canals on head covered; lateral line runs in upper half of body in front to behind pectoral fin, then curves down fairly sharply to a mid-lateral position. Dorsal fin long, more or less continuous; first three spines may be separated to a varying degree from rest of fin; more spinous than soft elements. Anal fin long and continuous, with two spines anteriorly. Pelvic fins of a minute spine and two to three rays, jugular in position. Dorsal, anal, pectoral, and pelvic rays unbranched. Gill membranes united, forming a fold across throat. Branchiostegal rays six on either side. An upturned hook-like process on anterior border of pectoral girdle or not.

The Clinidae are distributed along both coasts of Central America, the West Indies, West Africa, South Africa, Australia, New Zealand, the East Indies, and the Mediterranean, but their greatest representation is in America, the West Indies, and the temperate waters of South Africa and Australia. They generally occur in the intertidal zone of the shore.

Relationships

Ford's (1959) work confirmed the close relationship of the Clinidae, Tripterygiidae, and Blenniidae. They are thought to be derived from a serranid-like percoid ancestor at the beginning of or a little before the Miocene period, and to have undergone rapid evolution during the Miocene (MacFarlane, 1923). The earliest clinid and blenniid fossils are known from the Miocene, during which period the genera known today were differentiated. Hubbs (1952) considered that the Blenniidae diverged early from the percoid line, since the absence of scales and the position of the eyes, well forward and high up on the head, indicate that they have specialized along different lines from the Clinidae and Tripterygiidae, and presumably must have required a considerable amount of time to perfect these specializations. Both the Clinidae and the Tripterygiidae have retained more primitive features, but neither can be said with certainty to be more primitive than the other. The compressed body of the Clinidae is more typically percoid than the depressed body of the Tripterygiidae, but the Tripterygiidae retain more branched fin rays than do the Clinidae, in which branched caudal rays appear in only a few of the most primitive members of the family. The Clinidae and the Tripterygiidae have more in common with each other than either family has with the Blenniidae, and in the vast majority of earlier works have been treated as a single family. However, Hubbs (1952), in his key to the families of the Blenniicae, gives several clear features on which the two families can be distinguished, and they have been treated as separate by later workers, in particular Rosenblatt (e.g. 1963).

The fossil family Pterygocephalidae shows a mixture of percoid and blennioid features and obviously represents a very early line, since it is known only from Eocene deposits, but it shows certain specializations which would remove it from the direct line of descent of any of the modern blennioids.

The fourth living family of Blenniicae, the Chaenopsidae, have long been of uncertain position in the blennioid classification, and have usually been either partially or completely submerged in the Clinidae or the Blenniidae. Stephens (1963), revising the group, gives them family status. They have features in some ways intermediate between those of the Clinidae and those of the Blenniidae; they lack scales, but their affinities appear on the whole to lie more with the Clinidae than with the Blenniidae (Böhlke, 1957).

Classification

Hubbs (1952) divided the Clinidae into two subfamilies, the Labrisominae and the Clininae. The latter are distinguished from the former by the presence of an upturned hook-like process on the anterior border of the cleithrum. This projection is absent in the vast majority of the Labrisominae, although in two labrisominid species, *Malacoctenus erdmani* Smith and *Malacoctenus aurolineatus* Smith, the hook is usually present in adults (Springer, 1958).

The Clininae are further distinguished by the presence of radii on all scale margins. The scales are usually smaller than those of the Labrisominae, and are often embedded in the skin.

The Labrisominae occur mainly in the tropical waters of both Pacific and Atlantic American coasts and the West Indies, and two species occur in tropical West Africa. The Clininae occur mainly in temperate waters of the west coast of America, South Africa, and Australia, with a few representatives in the East Indies and New Zealand. Hubbs (1952) divided the Clininae into two tribes, the Clinidi and the *Myxodidi*. He considered the *Myxodidi* to be the more primitive group, since they are all oviparous, and the male lacks a penis for the transmission of sperm to the female. All the American Clininae belong to this tribe. The Clinidi are distinguished by the presence in the male of a fleshy penis, and the fact that the young are born alive. All the South African clinids belong to the Clinidi. Hubbs (1952) did not mention the Australasian clinids in his scheme of classification, but since specimens of Petraites from Australia have been found to possess a fleshy penis similar to that of the South African forms, and Cristiceps, another Australasian genus, is reported to bear its young alive (Cuvier & Valenciennes, 1836; Herre, 1939), the Australasian forms are here included in the tribe Clinidi. The classification of the Clinidae is shown in table 2. Their distribution is shown in fig. 1.

Fig. 1

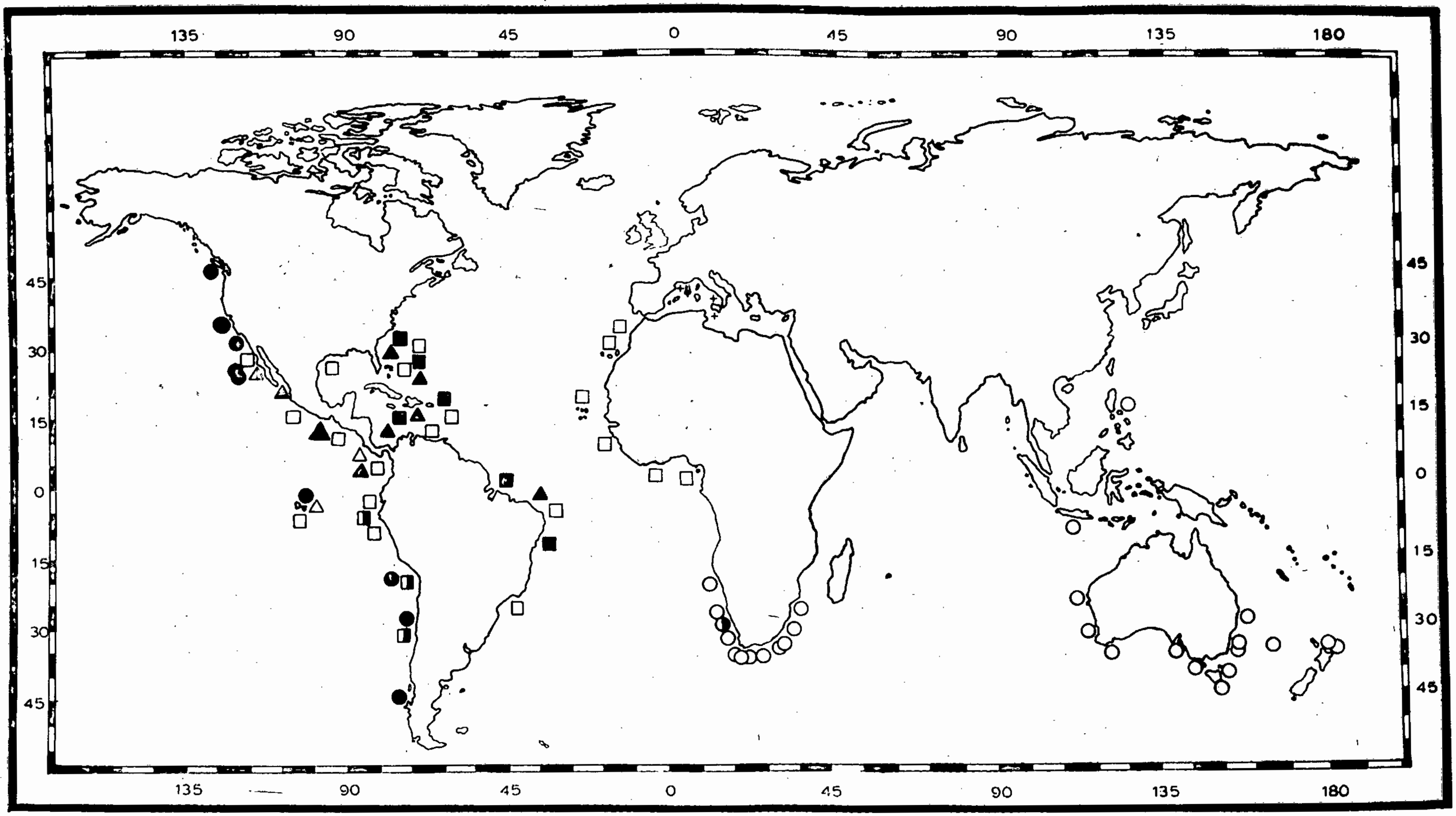
World distribution of the tribes and subtribes of the family Clinidae

Key

	Subtribe	Tribe	Subfamily
□	Labrisomini	Labrisomidi	Labrisominae
◧	Calliclinini		
■		Starksiidi	
▲		Paraclinidi	
△		Mnierpidi	
◭		Cryptotremidi	
●		Myxodidi	
○	Clinini	Clinidi	Clininae
◐	Xenopoclinini		

\+ incertae sedis

Based mainly on the works of Delfin (1898 – 1901); Griffin, 1926; Herre, 1939; Hubbs (1952, 1953); McCulloch (1908, 1929); Macleay, 1882; Scott (1935, 1939, 1959); Smith, 1949; Springer (1954, 1955, 1958); and South African Museum and British Museum records. With additional records from the following works: Beaufort & Chapman, 1951; Beebe & Tee-Van (1928, 1934); Cadenat, 1950; Caldwell, 1954; Dawson, 1960; Evermann & Marsh, 1900; Fowler (1931, 1942, 1944, 1947,



135
90
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1950, 1953); Gilbert, 1900; Herre, 1936; Hildebrand, 1946; Klausewitz, 1958; Marshall, 1957; McCulloch (1915, 1927); Mead, 1958; Metzelaar, 1922; Morrow, 1957; Ogilby, 1885; Olsen, 1958; Parr, 1930; Rosenblatt & Walker, 1963; Schultz, 1949; Smith, 1957; Starks, 1913; Whitley (1929, 1945, 1956, 1959).

Table 2. Classification of the family Clinidae (main arrangement after Hubbs, 1952; naming of certain genera modified according to Springer, 1955, and Böhlke & Springer, 1961; classification of the tribe Clinidi new).

Family: CLINIDAE Regan, 1912

Subfamily: LABRISOMINAE Hubbs, 1952

Tribe: Mnierpidi Hubbs, 1952

Mnierpes Jordan & Evermann, 1896; *Dialommus* Gilbert, 1891

Tribe: Paraclinidi Hubbs, 1952

Stathmonotus Bean, 1885; *Paraclinus* Mocquard, 1889; *Exerpes* Jordan & Evermann, 1896

Tribe: Starksiidae Hubbs, 1952

Starksia Jordan & Evermann, 1896

Tribe: Cryptotremidi Hubbs, 1952

Alloclinus C.L. Hubbs, 1927; *Cryptotrema* Gilbert, 1890

Tribe: Labrisomidi Hubbs, 1952

Subtribe: Calliclinini Hubbs, 1952

Auchenionchus Gill, 1860; *Calliclinus* Gill, 1860; *Myersichthys* Hubbs, 1952

Subtribe: Labrisomini Hubbs, 1952

Labrisomus Swainson, 1839; *Malacoctenus* Gill, 1860

Table 2 (continued)

Subfamily: CLININAE Gill, 1885

Tribe: Myxodidi Hubbs, 1952

Myxodes Cuvier, 1829; *Heterostichus* Girard, 1854; *Gibbonsia* Cooper, 1864

Tribe: Clinidi Hubbs, 1952

Subtribe: Clinini Hubbs, 1952

Clinus Cuvier, 1817; *Pavoclinus* Smith, 1945; *Clinoporus* Barnard, 1927; *Gynutoclinus* Smith, 1945; *Blennioclinus* Gill, 1860; ? *Petraites* Ogilby, 1886; *Cristiceps* Cuvier & Valenciennes, 1836

Subtribe: Xenopoclinini Hubbs, 1952

Xenopoclinus Smith, 1947; *Cancelloxus* Smith, 1961

Two of the known species of Clinidae do not fit into the scheme of classification given in table 2. *Clinus argentatus* (Risso), the Mediterranean clinid, must for the time being be regarded as *incertae sedis*. It should not be included in the genus *Clinus*, as it lacks a hook-like projection on the anterior border of the pectoral girdle, and is oviparous; the male lacks any form of penis. Guitel (1893) stated that, although Cuvier & Valenciennes (1836) believed that further examination of this species would result in the male being found to have a penis, his detailed examinations of many specimens revealed no such structure, the anal papilla always being small, and he furthermore described the breeding of this species in some detail; the female lays her eggs amongst the fronds of algae before they are fertilized by the male. The lack of a hook on the pectoral girdle excludes it from either tribe of the Clininae, by the present definition of the group, yet it more closely resembles the Clininae than the Labrisominae, particularly in the nature of the small embedded scales. It is possible that, during the long isolation of this species from the other members of the Clininae, the hook on the pectoral girdle may have been secondarily lost; or that this species separated from the line leading to the Clininae before the hook had appeared.

Clinus nematopterus Gunther was described from the Sea of China and appears to fit into the Clininae, having small embedded scales, but no mention is made of a hook on the anterior border of the pectoral girdle or of the breeding habits of this fish, Gunther (1861) stating only that the "anal papilla is distinct", which may or may not indicate the presence of a penis; the specimen may in any case have been a female. It is known from a single specimen in the British Museum. It is very probably similar to the Australasian forms and therefore one of the Clinidi.

Three genera of clinids are recognized in Australia - Clinus, Petraites, and Cristiceps. Cristiceps is a well-defined genus occurring only in the Australasian region. The Australian species of Clinus and Petraites which have been examined are very similar to one another and to the South African species of the genus Clinus. Both genera have been used for South African and

Australian Clinidae. The validity of the genus _Petraites_ is doubtful. Ogilby (1886) created the genus _Petraites_ to contain certain Australian species. McCulloch (1908) said that it cannot be clearly separated from _Clinus_, as there are several intermediate forms, but surprisingly went on to say that "no good purpose can be served by uniting the two genera" ! It seems unlikely that any good purpose is served by retaining as separate two genera which are difficult to distinguish from one another. However, a wider range of Australian material than has at present been available to me would be necessary to determine whether the genus _Clinus_ should include both Australian and South African species, and whether there is any justification for retaining the genus _Petraites_.

THE SYSTEMATIC POSITION OF THE XENOPOCLINIDAE

Smith (1947(a)) described a new genus and species of fish, Xenopoclinus kochi, from a rock-pool at Lambert's Bay on the south-western Cape coast approximately 200 miles north of Cape Town. He placed this species in the family Clinidae, but distinguished it from them by placing it in a separate "subfamily" (equivalent to subtribe in Hubbs' 1952 classification). Subsequently two more species, Xenopoclinus leprosus and Cancelloxus burrelli, obviously closely related to Xenopoclinus kochi, were found in the Lambert's Bay area and described by Smith (1961). Smith then separated the three species from the Clinidae and created for them a new family, the Xenopoclinidae.

The three species are all adapted to a sand-burrowing existence. The body is elongate, and the head is depressed with the eyes in a dorsal, anterior position. The pectoral fins are pointed, the middle rays being longer, and are used in sweeping back the sand when burrowing. The jugular pelvic fins consist of a minute spine and three rays of equal length joined by a membrane which extends almost to their tips, having somewhat the appearance of an amphibian webbed foot. In Xenopoclinus kochi, but not in the other species, the opercular membranes are expanded and overlap below. The opercular membranes of Cancelloxus burrelli are expanded slightly above to form a fold over the pectoral axil.

In other respects they are much like the Clinidae, especially the South African Clinidae. The body is covered with minute embedded cycloid scales. The jaw teeth are conical and fixed, with usually a row of villiform teeth behind, at least at the jaw symphyses. The two species of Xenopoclinus have teeth on the vomer, but in Cancelloxus the vomer is edentate. There are no palatine teeth. The lateral line canals on the head are covered; the lateral line itself is variable. In Xenopoclinus kochi it follows a similar course to that of the Clinidae but is interrupted behind the level of the pectoral fin, so that the anterior, dorsal portion is separate from the posterior, midlateral portion. In Xenopoclinus leprosus it is similar to that of the Clinidae, with no interruptions. In Cancelloxus burrelli the lateral line is continuous, but curves down very much more gently than is usual to a midlateral position.

The dorsal fin is low and continuous, the anterior spines being the shortest, and there are many more spinous than soft elements. There are two anal spines. All the soft fin rays are unbranched. The gill membranes are united, forming a fold across the throat. There are six branchiostegal rays on either side. Xenopoclinus kochi has an upturned, hook-like projection on the anterior border of the pectoral girdle, but the other two species show reduction of this feature. The young are born alive, and the male has a fleshy penis like that of all the South African clinids for the transmission of sperm.

The question arises as to whether these three species, which have so much in common with the South African Clinidae, should be placed in a separate family. The implication would then be that the South African Clinidae are more closely related to all the American Clinidae than to the Xenopoclinidae.

Smith (1961) differentiated the Xenopoclinidae from the Clinidae by the following characters: (i) the peculiar head, (ii) the expanded opercular membranes, (iii) the form of the pelvic fins, and (iv) the greater relative length of the anal fin.

The form of the head and pelvic fins are associated with the sand-burrowing habit of these fishes. The expanded opercular membranes occur in only one of the three species, so cannot be considered as a strong differentiating character; presumably this is also an adaptation to burrowing.

The meaning of the greater "relative" length of the anal fin is not entirely clear. The length of the anal fin base is somewhat greater in the xenopoclinids than in the South African clinids, being about 60% of standard length in the xenopoclinids and about 40 - 50% in the South African clinids, a difference hardly great enough to warrant separation at the family level, since clinids having the anal fin base 40% of the standard length are considered eligible for inclusion in the same family as clinids having the anal fin base 50% of the standard length. However, it is probable that by "relative" length of the anal fin Smith (1961) meant the number of anal elements relative to the degree of elongation of the body as reflected by body depth in standard length. If this is the case, then the anal fin is not relatively longer than the anal fin in the elongate species of South African clinids. Xenopoclinus kochi and Xenopoclinus leprosus, with a body depth of 6 - 8, have 29 - 30 and 28 - 34 anal rays respectively; Clinus capensis, with a body depth of 5 - 6, has 26 - 34 anal rays, Clinus dorsalis, body depth 5.5 - 7, has 25 - 31, and Clinus anguillaris, the most elongate South African clinid, with a body depth of 6 - 8, has 33 - 37 anal rays. Cancelloxus burrelli has a greater number of anal elements (38 - 43) than any of the South African clinids, but the body depth is 8 - 11, greatly elongated in comparison with the other species. If only the number of anal elements is considered, with no regard for the degree of elongation of the body, then Cancelloxus burrelli certainly has a longer anal fin than any of the South African clinids, but the anal counts of Xenopoclinus kochi and Xenopoclinus leprosus fall well within the ranges found among the elongate South African Clinidae.

It seems, then, that the differences between the South African clinids and the xenopoclinids are those concerned with the adaptation of the xenopoclinids to a burrowing existence: the depressed head with dorsally placed eyes, the modified pelvic and pectoral fins, and the expansion of the opercular membranes of Xenopoclinus kochi.

Owing to the large number of features which the xenopoclinids share with the Clinidae, particularly the South African species, it is felt that separation at the family level is unjustified, since it serves only to obscure the obvious similarity of the two groups. That the xenopoclinids were derived from the South African clinids, or at least from a common ancestor which had already developed internal fertilization and a penis in the male, is beyond question; the similarities of the two groups, particularly with regard to the reproductive organs, are too great for any other explanation of the xenopoclinids to be acceptable. Although the hook on the pectoral girdle, so characteristic of the Clininae, is apparently in the process of being lost in the xenopoclinids, it is invariably present in Xenopoclinus kochi, and its previous existence is clearly indicated in the other species. Sixteen specimens of Cancelloxus burrelli, including the type, were examined, all of which had a projecting bony lamina on the anterior border of the pectoral girdle. Of a sample of 89 specimens of Xenopoclinus leprosus examined, 32 had a small knob-like process on the anterior border of the pectoral girdle. This feature is illustrated in fig. 2.

Hubbs (1952) gave Smith's (1949) subfamily Xenopoclininae the status of a subtribe of the Clinidi. He named the subtribe Xenopoclinini. It is proposed here that this arrangement should

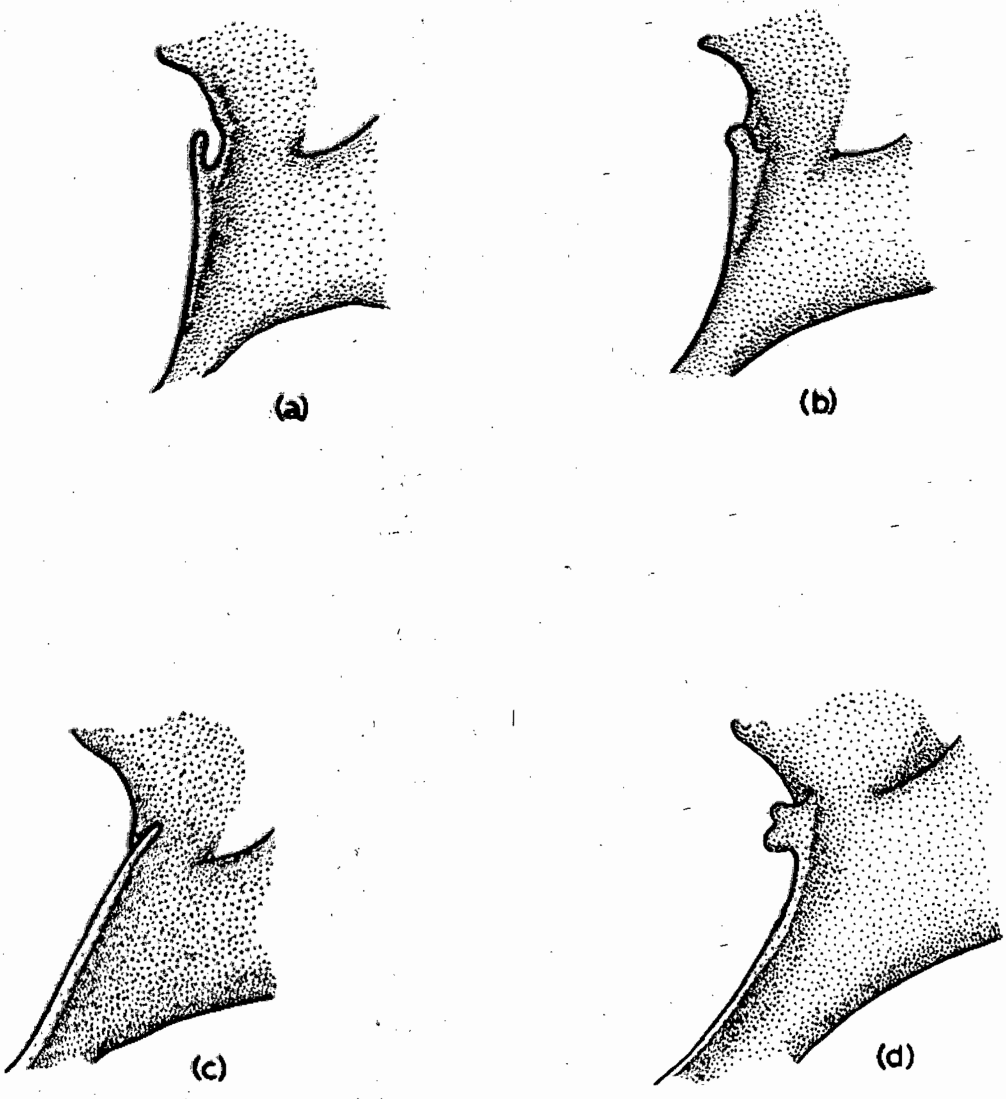


Fig. 2. Anterior border of pectoral girdle of:
(a) Clinus superciliosus (b) Xenopoclinus kochi
(c) Xenopoclinus leprosus (d) Cancelloxus burrelli

be adopted, and that the three species Xenopoclinus kochi, Xenopoclinus leprosus, and Cancelloxus burrelli be placed in the subtribe Xenopoclinini.

Note on an American sand-burrowing family, the Dactyloscopidae

The resemblance the xenopoclinids bear to the American sand-burrowing family known as the Dactyloscopidae is at first sight startling. The head, pectoral fins, and particularly the pelvic fins are strikingly similar in the two groups. Smith (1961) noted this resemblance, but pointed out that they differ in that the xenopoclinids have vomerine teeth (two of the three species), many more dorsal spines than dorsal soft rays, small, embedded, non-imbricate scales, united gill membranes forming a fold across the throat, and at least some vestige of a hook on the pectoral girdle; on the other hand, they lack skinny fringes on the opercle and lips, which are characteristic of the Dactyloscopidae. The xenopoclinids differ further from the Dactyloscopidae in having a more elongate body, unbranched caudal rays, and a fleshy penis in the male.

Smith (1961) stated that the xenopoclinids are in some ways intermediate between the Clinidae and the Dactyloscopidae. That they cannot be intermediate between these two groups is evident from the fact that both the Clinidae and the Dactyloscopidae show more primitive features than do the xenopoclinids. The xenopoclinids can easily be derived from the South African clinids by specialization and must therefore be considered to be more advanced; the Dactyloscopidae are more primitive than either the Clinini or the xenopoclinids in having large imbricating scales and branched caudal rays, and in lacking a penis in the male. For a group to be considered intermediate between two other groups, one of those groups must be more primitive than the intermediate group, and the other more advanced.

While no direct affinity between the xenopoclinids and the Dactyloscopidae is implied, the high degree of parallelism shown by the two groups does suggest a fairly close relationship between the Clinidae and the Dactyloscopidae. Regan (1912) placed the Dactyloscopidae in the division Cliniformes of his suborder Blennioidea, but detailed osteological work by Starks (1923, 1930) and Gregory (1933) has led these workers to relate them to the Uranoscopidae and the Leptoscopidae rather than to the blennies. The Uranoscopidae, Leptoscopidae, and Dactyloscopidae have been considered to be fairly closely related to the Blennioidea (see the classifications of Jordan, 1923, and Berg, 1940), but Hubbs (1952) placed the uranoscopid line of evolution close to the zoarcid line, fairly well separated from the percoid line leading to the Blenniicae. Ford (1959) stated that his work on the seventh cranial nerve of these fish did not lead him to disagree with this arrangement. However, considering that there are clearly other ways of becoming adapted to a burrowing existence (viz. Ammodytidae, Creediidae, Trypauchenidae, Taenioididae), it is felt that the striking similarity of the Dactyloscopidae and the xenopoclinids as far as adaptations to burrowing in sand are concerned indicates that the relationships of the Dactyloscopidae, Uranoscopidae, and Leptoscopidae with the Blennioidae, particularly the Clinidae, deserve careful reconsideration.

SYSTEMATICS OF THE SOUTH AFRICAN CLINIDAE

Introduction

The present state of the taxonomy of the South African Clinidae completely obscures the relationships of the species within the group. The group is divided into a very large number of genera, often on the strength of a single, not very distinctive character, as well as being split into two "subfamilies" (equivalent to the subtribes of Hubbs, 1952) by Smith (1946, 1949).

As stated by Huxley (1940), the use of the genus is primarily to unite closely related species. Very close relationships between pairs or groups of species within the genus should be indicated by subgenera. Thus a range of species might be included in a single genus, but with a group of species at each end of the range separated subgenerically from the "moderate" forms in the middle of the range. The three subgenera would, however, be more closely related to each other than to any other group of species in the family. A trinomial system which results from the use of subgenera is not advisable for general usage, but might be worth using where necessary to indicate details of apparently natural or phyletic groupings for the benefit of other taxonomists rather than for more general workers, for whom a binomial system is usually adequate. The assessment of natural relationships is not always easy or even possible, and should be based on as many characters and as wide a range of specimens as possible.

Ehrlich (1958, 1961(a),(b)) stated that the recognized taxa, particularly the species, are outdated concepts, and should be replaced by "levels of phenotypic resemblance", which could be represented by a number, or referred to as a "phenon" with a prefix denoting percentage resemblance of the phenotypes (Sneath & Sokal, 1962). Phenotypic resemblance would be determined by the methods of numerical taxonomy described in detail by Sokal & Sneath, 1963. However, unless numerical taxonomy comes into universal usage it is impossible to replace the present taxa with any device such as phenon levels. While it is understood that evolution is not static and that for this reason many groups are even now in the process of speciating, as shown by the need for taxonomic categories such as subspecies, races, etc., it is felt that the taxa recognized at present are useful taxonomic concepts which should not be dispensed with, although it is unfortunate that some, particularly the genus, have been misused to a dismaying degree. The aim of this study is to attempt to dispel the confusion caused by the somewhat indiscriminate use of the generic category in taxonomic works on South African Clinidae, and to place the members of the group in genera which convey as much information as possible about the probable natural relationships of the South African species. A simple quantitative assessment of similarity between the species using the methods of numerical taxonomy is given for comparison in Appendix A to this section.

METHODS

Although the South African Museum collection of Clinidae was available for study, it was felt that large quantities of fresh material should be collected so that size ranges of specimens and samples from different areas would be available for study. Also, fresh material is easier to study and usually yields more information than old preserved specimens, often in rather poor condition. The species of Clinidae are somewhat variable with regard to fin counts and body proportions, and misleading descriptions may result from a study of insufficient material. The same specimens could also be used for biological studies on stomach contents and gonads, for which a large quantity of material is always advisable.

Area of survey

Most of the collecting was done in the area between Sea Point on the west coast of the Cape Peninsula and Strandfontein on the east coast of the Cape Peninsula in False Bay (fig. 45 (a), (b)). Collecting trips were made to the west coast north of the Cape Peninsula to Lambert's Bay (April, 1963; January, 1964; March, 1964), southern Namaqualand (Doring Bay to the Olifants River, January, 1964), northern Namaqualand (Port Nolloth, October 1964, and Hondeklip Bay, March 1965), and South West Africa (Swakopmund, Walvis Bay, and Lüderitzbucht, September/October 1964). Collecting on the coast east of Cape Point was not as extensive as on the west coast. A trip was made to Durban in July 1963 and collecting was done at

Durban, Port St. John's, East London, Port Elizabeth, Plettenberg Bay, and Mossel Bay. Trips were made to Knysna (February, 1964), Onrust River mouth (November, 1964), Still Bay (April, 1965), and East London and Kei Mouth (June 1965). Donations of samples were obtained from Port Elizabeth, Onrust River mouth, and the Bredasdorp coast. Of the thirty-three South African species recognized in this work, fresh material of twenty-seven species was collected and examined. The other species were examined either from specimens in the South African Museum collection or from specimens in the collection of the Rhodes University Ichthyology Department at Grahamstown.

Methods of collecting

(a) Hook and line

It was found that, using a hand-line and a no. 6 Mustad hook baited with winkles or limpets, only the larger clinids could be caught. Smaller fish nibbled at the bait but only the fish with very large mouths were able to swallow it. This method was also time-consuming, and was rapidly abandoned in favour of more efficient methods except were samples of large infratidal fish were required.

(b) Traps

A simple trap consisting of a piece of $\frac{1}{2}$-inch mesh net containing bait, which could be lifted up if a fish entered, was tried, but only whelks showed any interest in the bait. Jackson (1950) found the same failure with traps, and they were abandoned as a possible means of catching clinids.

(c) Netting

In rocky areas it was found that, if crevices and hollows at the sides of the pool were covered with ½-inch mesh netting, and if rocks were then lifted in the middle of the pool, the fish which swam out could be caught fairly easily with small dip-nets. This method was used until a far more efficient and quick method (d) became available for collecting in rocky areas.

In large, open areas with dense sea-weed it was found that the only practicable means of fishing was with nets, but the small dip-nets used in rocky areas were inadequate for this type of fishing, which involved scooping rapidly through as large an area of weed as possible to dislodge the fish which were hiding among the fronds. The strain of being pulled rapidly through submerged sea-weed bent all but the strongest wire frame-works. A very successful net for this kind of collecting was made using an oblong frame of ½-inch diameter reinforcing steel strongly wired and glued with cheese-cloth and polyester to a broom-handle, with a large fine mesh net affixed to it. This net, although heavy out of water, was easy to operate in the water, and caught large numbers of fish in weedy areas. It was found that a larger area could be fished in one scoop with an oblong frame than with a round one. The net could be pushed rapidly along in front of a person walking, or pulled along behind.

It was used mainly in areas of the green grassy weed _Caulerpa_ or in kelp, and was also used fairly successfully in the _Zostera_ beds of Knysna lagoon.

In the lagoon, where the water was often too deep for it to be possible to walk about with a net, it was found that a rope was easier to hold and control while swimming than a broom handle, so a D-net was used. This consisted of a semi-circular iron frame with the curved portion above, with a long, fine-meshed net attached and a towing rope in front. This net yielded very good catches from the _Zostera_ beds, although it was not quite heavy enough and was consequently difficult to keep on the bottom.

(d) Rotenone poisons

The use of certain vegetable extracts for poisoning fishes, which can then easily be captured, is common amongst primitive peoples in many parts of the world, but it is only within this century that its usefulness in making scientific collections has been realized. Fish poisons were used with good effect for making ichthyological collections by Jordan (1905), who used chloride of lime, and Eigenmann (1912), who used native vegetable fish poisons. With the commercial production of insecticides from derris roots and other piscicidal plants such as the South American timbó, vegetable poisons became generally available to fish collectors; the first ichthyologist to use the commercial product was Dr. Carl L. Hubbs.

The poisons are usually referred to as rotenone, as this substance is thought to be the active principle in the roots, although there is some suggestion that there are other, even more potent piscicides in the roots as well (Myers & Wade, 1946). There are now many commercial names given to different rotenone-containing preparations. Rotenone is a respiratory poison, preventing gaseous exchange in the gills. The gills of fish affected by rotenone are a very bright red. The edibility of the fish thus caught is not impaired. Care should, however, be taken when handling powdered forms of rotenone poisons, as the poisons have an irritant and narcotic effect on the mucous membranes. The effect on animals in rock-pools appears to depend on their rate of metabolism, as the fishes and octopi were first affected. After some time shrimps and crabs showed signs of discomfort. On very rare occasions when the dose was stronger than usual and the tide had not risen sufficiently to cause dilution within an hour or more, polychaetes, gastropods, and ophiuroids, as well as the smaller crustaceans such as amphipods, isopods, and mysids, showed some effect. According to Myers & Wade (1946) the effect on a pool lasts a few days until organic decomposition destroys the poison, but in the intertidal zone the duration of the effect appears to be much shorter, as the incoming tide dilutes and disperses the poison to such an extent that it has no effect.

The South African Museum first attempted collection by poisoning at Sea Point in 1962, using a commercial insecticide Catakilla. This was a dry substance consisting of a rotenone poison and powdered soap. It was extremely slow acting, taking about three quarters of an hour before any fish showed signs of discomfort.

In 1962 a large quantity of powdered rotenone poison was received by the South African Museum from the United States of America, and permission to use this was obtained from the Division of Sea Fisheries after a demonstration of the effects had been given to officials of that organization.

Myers & Wade (1946) describe in some detail the use of powdered rotenone preparations. They suggest mixing the powder with water until a thin, mud-like suspension is formed. This is then emptied into the rock-pool. It was found that the efficacy of the poison was much increased by mixing a liquid detergent such as Teepol with the powder and water, as this improves the spreading ability of the poison. The poison was found to become effective within ten to fifteen minutes of placing it in a pool. The speed of action depended on the temperature of the water, being increased by warmer temperatures.

Most of the fish came to the surface and attempted to throw themselves out of the pool at the edges. Fine dip-nets were used to recover the fish. If the fish did not reach the edge the clinids, at least, sank to the bottom, but could usually be recovered fairly easily, although the water was somewhat clouded by the poison. The clinids and juveniles of infratidal fishes reacted fairly quickly to the rotenone, but blennies and gobies were not as rapidly affected. The rock sucker, Chorisochismus dentex Bloch (Gobiesocidae), which is able to withstand desiccation for long periods (Smith, 1949), remained unaffected for a considerable period, usually coming to the surface only after all the other species had been caught. At Strandfontein in False Bay the brotulid Bidenichthys capensis Barnard, which evidently lives in deep crevices between the rocks, was last to succumb. The capture of this species illustrated the efficacy of poison as a collecting method, because it was found to be quite common at Strandfontein; it was previously thought to be rare.

In 1963 a liquid preparation of a rotenone poison, Pronoxfish, was obtained from the United States of America by the South African Museum, and was found to be more effective than the powdered form, with the advantage of being mixed ready for use and having no possible effect on the users. It is a dark brown liquid which turns opaque white on contact with water, and this unfortunately makes visibility in the treated pool extremely poor. However, a small dose is sufficient for a fairly large pool, so that visibility need not be completely sacrificed if the dose is carefully controlled. It has the disadvantage that it appears to act fairly rapidly on the invertebrate population of the pool. It was therefore used only at localities where the water temperature was too low for the powdered poison to act quickly enough for it to be possible to recover all the specimens in the time allowed by the tide.

Poisoning with rotenone was found to be by far the most effective method of collecting fish in rocky areas, but in open weedy areas such as Caulerpa beds it was felt that the recovery of poisoned specimens would be too difficult, and nets were used in preference.

Methods of examination and measurements

As many characters as possible have been studied in order to re-group the South African species of Clinidae. Most of the characters used are necessarily of external morphology. An attempt was made to study the same characters in each of the thirty-three species examined, and as some of the specimens were obtained on loan or were unique specimens in the South African Museum collection, features which would have required study by dissection could not be used. From the dissections made of several species for biological purposes there was some indication that the degree of parasitism in the gonads, and particularly the occurrence of parasites in the testes, might be a study with taxonomic possibilities, but otherwise there appeared to be no significant differences in the viscera.

As large a number of specimens as possible of each species was examined; exact figures are given under the description of each species. Only a few specimens were available of rare species or species which were obtained on loan. In many cases the type material was available for study.

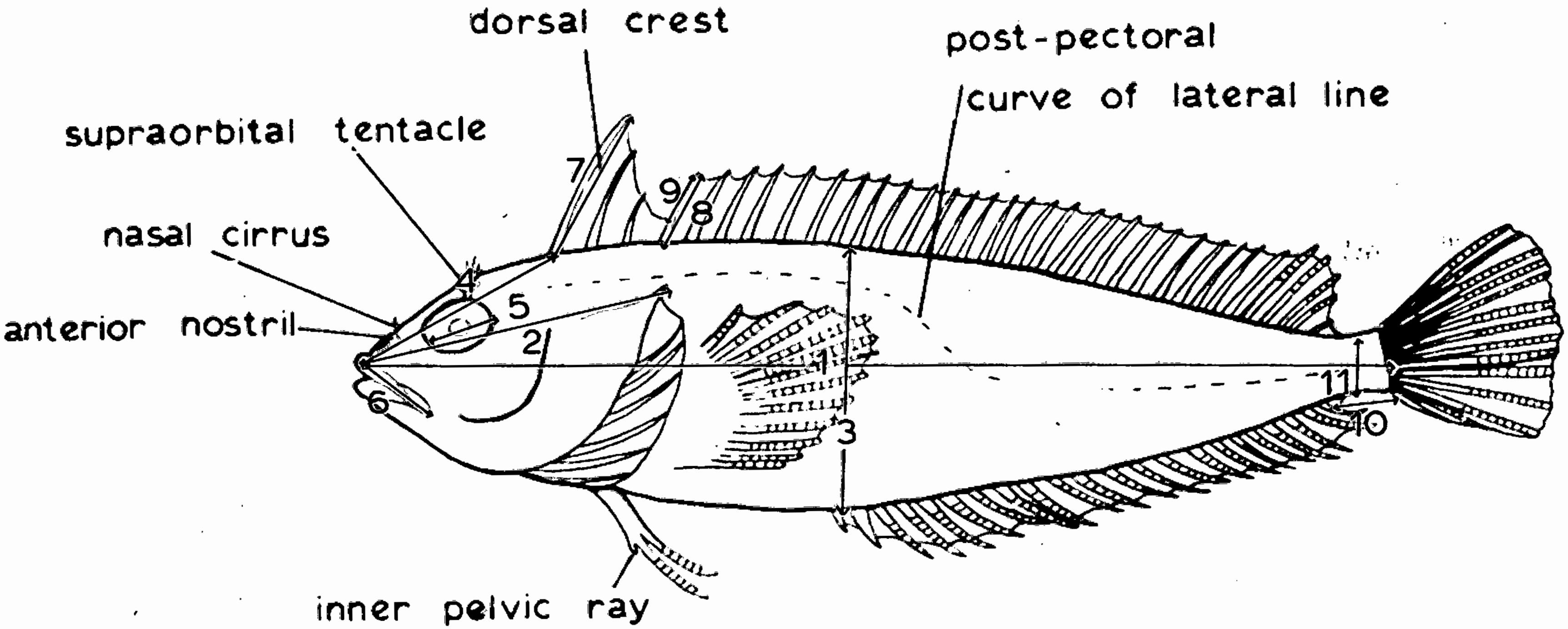
The standard length (distance from tip of snout to base of caudal fin) of each fish was measured and counts made of the spines and rays in the dorsal, anal, pectoral, pelvic, and caudal fins. The following body measurements were made (see fig. 3): head length (tip of snout to upper extremity of opercle), depth at anal origin, greatest diameter of orbit, length of upper jaw (inner edge of premaxilla to posterior end of maxilla), length of caudal peduncle (base of last anal ray to base of caudal fin), least depth of caudal peduncle, height of first dorsal spine, height of fourth dorsal spine, length of portion of fourth dorsal spine free from fin membrane. Further measurements were made for the data on which Appendix A was based. The information, with locality and sex, was recorded on previously prepared cyclostyled sheets. Head length was expressed as the number of times the head was contained in the standard length, as was body depth, and orbit diameter as the number of times it was contained in the head length, since these measurements were expressed in that way by previous authors; other measurements were expressed as percentage of standard length or of head length. Head length, body depth, orbit diameter, and caudal peduncle measurements are given under each description; other measurements

Fig. 3

Body proportions and important features used in the systematic study of the South African Clinidae

Measurements

1. Standard length
2. Head length
3. Depth of body at anal origin
4. Snout to dorsal origin
5. Orbit diameter
6. Upper jaw length
7. Height of first dorsal spine
8. Height of fourth dorsal spine
9. Length of fourth dorsal spine free from membrane (depth of notch)
10. Caudal peduncle length
11. Caudal peduncle depth


dorsal crest
post-pectoral
curve of lateral line
supraorbital tentacle
nasal cirrus
anterior nostril
inner pelvic ray
1
2
3
4
5
6
7
8
9
10
11

are given where relevant. A card was made for each species giving information of body proportions, fin counts, distribution, habitat, and any special features. To each card was attached a sketch of the head, showing the shape of the head, the form of the supra-orbital tentacle if any, the nasal cirrus, the cirri if any on the dorsal spines, and a portion of the lateral line. A sketch of the intromittent organ of the male was also attached. The dentition was examined. Conclusions were based on the summation of these data.

HISTORICAL DISCUSSION

Various attempts have been made to classify the South African Clinidae. Cuvier & Valenciennes (1836), who described many of the species, placed all the South African species which they described, as well as *superciliosus* Linnaeus, in the genus *Clinus* Cuvier, with the exception of *capensis* Cuvier & Valenciennes, for which Cuvier (1817) erected the genus *Cirrhibarbis* on the strength of the barbels present on the chin and snout of this species. This separation is somewhat arbitrary, since although the barbels of *capensis* can scarcely be said to be of more obvious significance than the presence of a tentacle over the eye, *heterodon* Cuvier & Valenciennes and *brachycephalus* Cuvier & Valenciennes, both of which lack a tentacle over the eye, are included in the genus *Clinus* together with species such as *superciliosus*, which have a supra-orbital tentacle. The separation of *capensis* from the other species at the generic level on account of the barbels is an example of attaching importance to a single difference and disregarding a far greater number of similarities.

Swainson (1839) erected various genera of Clinidae, besides recognizing Cuvier's genera Clinus and Cirrhibarbis. Besides Clinus and Cirrhibarbis, three of Swainson's genera (Clinitrachus, Blennophis, and Labrisomus) contained South African species. He used body form and form of the dorsal fin (whether raised anteriorly to form a crest or not), as well as dentition, in the definition of his genera. His inclusion of two South African species, latipennis Cuvier & Valenciennes and brachycephalus Cuvier & Valenciennes (= linearis Swainson) in the genus Labrisomus, whose representatives are now regarded as part of a separate subfamily from the South African forms (Hubbs, 1952), suggests that the basis on which at least some of Swainson's genera were founded was not particularly sound; especially as only two of the several other species which he included in Labrisomus fitted his definition of the genus (Gill, 1860), and these were later found to be a single species. Swainson's work has in general been poorly thought of by later workers (Gill, 1860; Swain, 1882; Jordan, 1923). He is said to have known little about fishes and to have based few of his conclusions on personal observation.

Gill (1860) discussed Swainson's division of Cuvier's genus Clinus. He regarded Clinus and Clinitrachus as congeneric, since he considered the presence or absence of a dorsal crest to be insufficient grounds for generic separation, but Blennophis he considered valid. He removed from the genus Labrisomus most of the species placed in it by Swainson (1839), including latipennis and brachycephalus, erecting the genus Ophthalmolophus for the former and the genus Blennioclinus for the latter. He stated that, while latipennis and brachycephalus were related, the former could be distinguished by the presence of supra-orbital tentacles. It is strange that he did not notice the similarity between latipennis and acuminatus Bloch & Schneider, which Swainson (1839) designated as the type species of the genus Clinus.

Swain (1882), reviewing Swainson's (1839) work and attempting to sort out which of his genera were valid, declared that Swainson's work was "singularly worthless as a contribution to science", and of interest only because the law of priority required that many of his names should be adopted. He followed Gill (1860) in synonymising Clinitrachus with Clinus, and considered Blennophis and Labrisomus to be subgenera of Clinus. He made little attempt to sort out exactly which species should be placed in each genus or subgenus, being concerned chiefly with the validity or otherwise of Swainson's proposed generic names.

The earlier South African workers, Gilchrist & Thompson (1908) and Barnard (1927), disregarded most of the genera then in existence, and placed the majority of the South African species in the genus Clinus as defined by Cuvier (1817). Gilchrist & Thompson (1908) placed one species, mentalis Gilchrist & Thompson, in the genus Cristiceps Cuvier & Valenciennes on account of its completely separated dorsal crest, but the removal of mentalis from the other species on those grounds was most arbitrary, as several of the other species, notably mus Gilchrist & Thompson and laurentii Gilchrist & Thompson, also with separated crests, are obviously closely related. The genus Cristiceps is an Australian one, with well defined distinctive characters not fulfilled by any of the South African species. The species of Cristiceps are very different in appearance from mentalis, having the dorsal fin originating well forward over the eye, a strikingly slender caudal peduncle, and a simple supra-orbital tentacle (cf. mentalis, fig. 25).

Barnard (1927) transferred mentalis to another Australian genus, Petraites Ogilby, and with it laurentii, but the lack of a supra-orbital tentacle in these species and many other features, as well as the doubtful limits of Petraites itself, warrant their removal from that genus. Barnard (1927) also described a new genus, Clinoporus, for Clinus biporosus Gilchrist & Thompson, which lacks scales and has clear lateral line differences from other clinids; it will be shown later that this separation is completely justified. In 1935 he described the species navalis and placed it in a new genus Climacoporus; although the lateral line differs slightly from that of the other South African species, the difference is far less marked than that of biporosus, especially when several specimens are examined.

Smith (1945) revised the South African Clinidae and divided the group into two "subfamilies" (Clininae and Myxodinae), distinguished by the presence or absence of a supra-orbital tentacle, and including fifteen genera, seven of them monospecific. He recognized nine of the old genera: Clinus, Cirrhibarbis, Blennophis, Ophthalmolophus, Petraites, Blennioclinus, Clinoporus, Climacoporus, and Myxodes Cuvier. The latter is a South American genus; the inclusion in it by Smith of the South African live-bearing species fucorum Gilchrist & Thompson was later found to be in error (Hubbs, 1952). In addition to these genera, Smith described six new genera: Muraenoclinus, Blenniomimus, Fucomimus, Pavoclinus, Labroclinus, and Gynutoclinus, four of which are monospecific. This classification, while less arbitrary than those of previous workers, is typical of the procedure of distinguishing genera on the basis of single differences rather than a combination of similarities. Differences which should be of importance only at the species level are used to differentiate higher categories, and the natural affinities within the group are completely obscured, for a classification which relies entirely on differences and disregards broad similarities cn hardly be expected to indicate relationships. A major objection to Smith's classification is his division of the South African Clinidae into two subfamilies on the basis of a single character, the presence or absence of a tentacle over the eye. Hubbs (1952) gave Smith's subfamilies the status of subtribes, but any major split in the group other than between the Clinini and the Xenopoclinini remains incorrect. Most taxonomists would agree that a number of well marked and rather basic differences are required to separate groups of species at that level, and to use a single character, ignoring the many basic features which all the members of this group have in common, is to obscure the nature of the group as a whole. Most important, however, is that the members of each subdivision should be very clearly more similar to each other than to the members of any other subdivision. This is not the case in Smith's Myxodinae, where, as it will be shown later, two if not three of the genera appear to be at least as close to those species with a tentacle over the eye (Smith's Clininae) as to the others without a supra-orbital tentacle. The "Myxodinae" give the impression of being a heterogeneous assemblage held together by the lack of a supra-orbital tentacle, and in any case to unite groups by the lack of a character is known to be a dubious procedure (Mayr, Linsley, & Usinger, 1953), since characters are so easily independently lost, and it is often impossible to tell whether they were present at any time in the evolutionary history of the animal in question.

Hubbs (1952), in a revision of the higher taxonomic categories of the Clinidae, accepted Smith's (1945) division of the South African Clinidae into two groups (having presumably seen very little South African material), but reduced them to the level of subtribes of the Clinidi, which includes all the South African species (see table 2). He renamed them the Clinini and the Blennioclinini, any form of the name Myxodes being unacceptable in view of the South American tribe Myxodidi and the fact that the genus Myxodes is not represented in South Africa; he pointed out that the South African species fucorum Gilchrist & Thompson, placed in the genus Myxodes by Smith (1945), could not be a Myxodes on account of the fleshy penis in the male and the fact that the young are born alive, and created a new genus, Smithichthys, for fucorum. He revived Swainson's (1839) genus Clinitrachus for the species superciliosus Linnaeus and robustus Gilchrist & Thompson, and used the name Clinus for the species placed by Smith (1945) in the genus Ophthalmolophus, which then became a synonym of Clinus. Apart from these changes in the nomenclature of the genera he did nothing to alter Smith's system of classification, pointing out that Smith's comprehensive work obviated further revision of the group. However, the inclusion of Clinoporus and two other genera in a group with the other species lacking a supra-orbital tentacle remains erroneous whatever the status of the groupings, and must certainly be dropped before a clear picture of the group as a whole can emerge.

Jackson (1950, unpublished M.Sc. thesis, University of Cape Town) examined the South African Clinidae and concluded that to separate the group at a higher level than the generic one was incorrect. He placed the species with a supra-orbital tentacle in one genus, Clinus, having subgenera Clinus, Blennophis, Petraites, Ophthalmolophus, Cirrhibarbis, and Climacoporus, and most of the species lacking a supra-orbital tentacle in another genus, Myxodes, having subgenera Myxodes, Blennioclinus, and Labroclinus. He left Clinoporus and Gynutoclinus, both monospecific and rare, with full generic status, mainly (he stated) owing to lack of material for study, and also Xenopoclinus.

Jackson's scheme, which was presented on somewhat scanty evidence (he dismissed most characters as taxonomically valueless in this group on account of their variability) and was never published, seems the most reasonable produced so far, and with several important modifications is one which would appear to give a more valid interpretation of the evolutionary history of the group than any of the others. His use of the generic name Myxodes is obviously inadmissible (Hubbs, 1952). His inclusion of the two species of Blennioclinus in his genus Myxodes is not acceptable, and neither are most of his subgenera. The inclusion of Blennioclinus in his Myxodes group can be blamed on the use of too few characters in his study of the group, and perhaps on too little material of Blennioclinus being available.

Jackson (1950) distinguished between his genera Clinus and Myxodes on the presence or absence of a supra-orbital tentacle and the relative size of the mouth. Clinus was defined as having a tentacle over the eye and a large mouth with powerful jaws, while Myxodes lacked a supra-orbital tentacle and had a small mouth with weak, narrow jaws. Unfortunately he gave no measurements to back up his contention about mouth size. Measurements have been made of the upper jaw of samples of all the South African species of Clinidae, and the results are shown in a diagram (fig. 4). The statistical method used in compiling the diagram was that described by Hubbs (1952); details of the method are given in the legend to the figure.

All the species which have a supra-orbital tentacle (numbers 1 - 18 in fig. 4) have an upper jaw averaging more than 40% of the head length in the specimens examined (which usually covered a reasonably wide size range). Most of the species included in Jackson's Myxodes (numbers 19 - 28 in fig. 4) have the upper jaw averaging less than 40% of the head length. However, the difference between the lower limits of the ranges of one group and the upper limits of the ranges of the other group is to my mind too small to be of much use as a definitive generic character; the overlap would render determination difficult in the case of individual specimens. There is clearly a tendency for the species with supra-orbital tentacles (genus Clinus) to have larger mouths than most of the other species, and this is certainly of importance

Fig. 4

Comparison of upper jaw lengths of the South African species of Clinini

The method of representation is that used by Hubbs (1952) for comparative morphological studies. In each diagram the base line represents the range of measurements recorded for the sample, the upright line represents the mean, the open area represents the standard deviation on either side of the mean, and the solid area represents two standard errors on either side of the mean. The standard deviation and the standard error were obtained from the following formulae given by Smith (1958)* :-

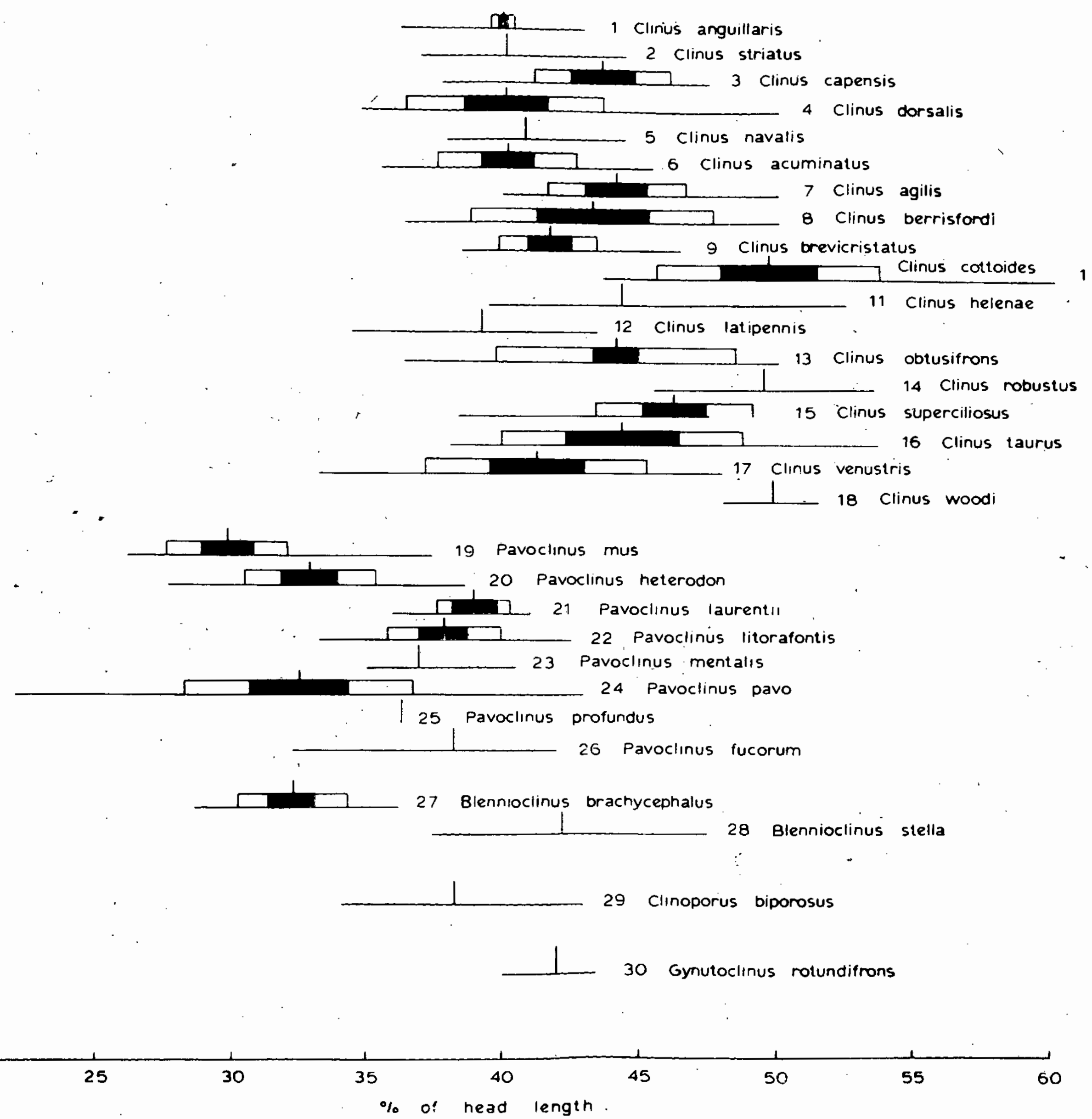
$$\text{standard deviation } (\sigma) = \sqrt{\frac{x^2}{N}}$$

$$\text{standard error } (\sigma_M) = \frac{\sigma}{\sqrt{N - 1}}$$

where x is the difference between the mean and the measurement recorded for each species, and N is the number of specimens in the sample.

Samples of 25 specimens covering the full size range available were used where possible. Where fewer then 25 specimens were available, all specimens were used. For species of which fewer than 10 specimens were used, only the range and the mean are given. A full set of data is given in the accompanying table.

*SMITH, G.M. 1958. A simplified guide to statistics for psychology and education. (3rd ed.) :1 - 109. New York.



1 Clinus anguillaris
2 Clinus striatus
3 Clinus capensis
4 Clinus dorsalis
5 Clinus navalis
6 Clinus acuminatus
7 Clinus agilis
8 Clinus berrisfordi
9 Clinus brevicristatus
Clinus cottoides
1
11 Clinus helenae
12 Clinus latipennis
13 Clinus obtusifrons
14 Clinus robustus
15 Clinus superciliosus
16 Clinus taurus
17 Clinus venustris
18 Clinus woodi
19 Pavoclinus mus
20 Pavoclinus heterodon
21 Pavoclinus laurentii
22 Pavoclinus litorafontis
23 Pavoclinus mentalis
24 Pavoclinus pavo
25 Pavoclinus profundus
26 Pavoclinus fucorum
27 Blennioclinus brachycephalus
28 Blennioclinus stella
29 Clinoporus biporosus
30 Gynutoclinus rotundifrons
20 25 30 35 40 45 50 55 60
% of head length

Data for fig. 4 (comparison of upper jaw lengths of South African Clinini)

Species	Range	Mean	Std. dev. σ	Std. err. σ_M	Std. err. x 2 $2\sigma_M$	No. of fish N
Clinus anguillaris	36.3–43.0	40.0	0.35	0.07	0.14	25
Clinus striatus	37.0–44.5	40.2	–	–	–	9
Clinus capensis	37.8–47.5	43.7	2.48	0.51	1.02	25
Clinus dorsalis	34.8–50.0	40.1	3.63	0.74	1.48	25
Clinus navalis	38.0–44.5	40.7	–	–	–	5
Clinus acuminatus	35.7–45.5	40.2	2.53	0.52	1.04	25
Clinus agilis	40.0–50.0	44.2	2.46	0.52	1.04	25
Clinus berrisfordi	36.4–50.0	43.3	3.94	1.02	2.04	16
Clinus brevicristatus	38.5–46.5	41.7	1.70	0.36	0.72	23
Clinus cottoides	43.7–60.0	49.1	4.17	0.85	1.70	25
Clinus helenae	39.5–52.5	44.3	–	–	–	3
Clinus latipennis	34.5–43.5	39.3	–	–	–	3
Clinus obtusifrons	36.4–50.0	44.2	4.26	0.87	1.74	25
Clinus robustus	45.5–53.5	49.4	–	–	–	8
Clinus superciliosus	33.3–45.0	41.2	2.85	0.58	1.16	25
Clinus taurus	38.1–53.0	44.4	4.36	0.97	1.94	19
Clinus venustris	33.3–48.0	41.2	3.92	0.82	1.64	25
Clinus woodi	48.0–51.5	49.8	–	–	–	5

Species	Range	Mean	σ	σ_M	$2\sigma_M$	N
Pavoclinus mus	26.7–37.5	29.8	2.24	0.46	0.92	25
Pavoclinus heterodon	27.6–38.6	33.0	2.45	0.51	1.02	25
Pavoclinus laurentii	36.0–41.0	39.0	1.39	0.40	0.80	12
Pavoclinus litorafontis	33.3–42.5	37.9	2.11	0.43	0.86	22
Pavoclinus mentalis	35.0–40.5	37.0	–	–	–	6
Pavoclinus pavo	22.0–43.0	32.6	4.36	0.89	1.78	25
Pavoclinus profundus	–	36.4	–	–	–	1
Pavoclinus fucorum	32.4–42.0	38.3	–	–	–	8
Blennioclinus brachycephalus	28.6–36.1	32.4	2.06	0.42	0.84	25
Blennioclinus stella	37.5–47.5	42.2	–	–	–	5
Clinoporus biporosus	34.1–43.0	38.3	–	–	–	6
Gynutoclinus rotundifrons	40–43.5	42.0	–	–	–	3

in uniting the group, although it would apparently be of little use in placing individuals in one group or the other.

Jackson suggested that ecological considerations should be taken into account in attempting to classify the South African Clinidae, stating that, while his Clinus species frequented rocky crevices and stony pools, his Myxodes species lived in sea-weed. All the species which he included in Myxodes other than those belonging to his subgenus Blennioclinus do live in sea-weed, and are modified in body form and colour for this habit (see description of the genus Pavoclinus, p. 137). The two species of Blennioclinus live in stony pools among broken pebbles and sea-urchins, and are very different from the weed-dwelling species in body form and colour. Clinus brevicristatus Gilchrist & Thompson, a rare tentacled clinid no different from the other species of Clinus in body form or colour pattern, is usually taken in sea-weed together with the sea-weed dwellers of Jackson's genus Myxodes. The inclusion of Blennioclinus in the genus Myxodes by Jackson was obviously an error, but the occurrence of Clinus brevicristatus in sea-weed, as well as various other tentacled clinids on occasions, indicates that the habitat in which any individual specimens may have been collected is not necessarily a guide to their relationships. However, the suggestion by Inger (1958) that species united by resemblance and phylogenetic considerations will usually be adapted to the same type of habitat is in general true of the South African Clinidae.

It is possible for forms which are not very closely related phylogenetically to become so adapted to the same type of habitat that they come to resemble, at least superficially, one another more than they do forms closer to their direct ancestral stock. (However, such strong parallelism between two groups may presuppose some fairly close phylogenetic connection). Such divergence of very closely related forms and convergence of not-so-closely related forms requires a considerable period of time. The process is illustrated in fig. 5.

In fig. 5, ancestors A and B are two fairly closely related forms. In time, A and B give rise to species A_1 and A_2, and B_1 and B_2, respectively. A_1 and B_1 become adapted to life in a weedy habitat, and A_2 and B_2 become adapted to a rocky habitat. For a considerable period of time A_1 will resemble A_2, occupying a different habitat, more than it will resemble B_1, occupying the same habitat, and similarly B_1 will resemble B_2 (condition I). However, in time, by adaptation to a particular habitat, weed-dwellers A_1 and B_1 may come to resemble each other more closely than A_1 resembles A_2 or B_1 resembles B_2, and similarly with rock-dwellers A_2 and B_2 (condition II) but this will probably take a considerable period of time. An approach to condition II in the Clinidae is seen in the resemblance of the sand-burrowing group Xenopoclinini to the sand-burrowing family Dactyloscopidae, but the

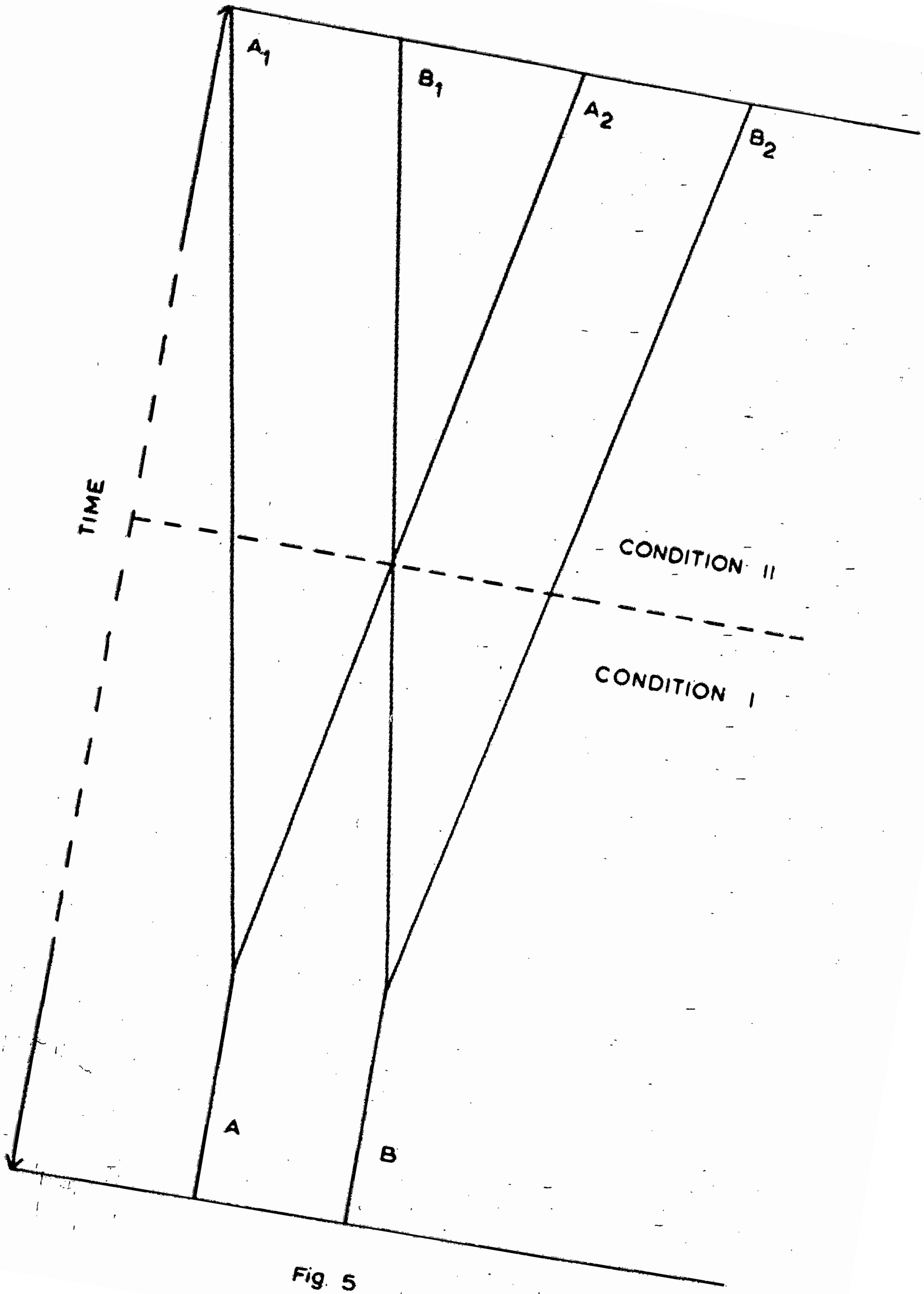


Fig. 5

small number of features which the Xenopoclinini have in common with the Dactyloscopidae in comparison with the large number of features which they share with the Clinini suggests that a considerably longer time would be required before condition II is actually reached. The Clinidae are considered to be of Miocene origin and therefore a fairly recent group; it seems certain that species which resemble one another closely, such as the non-tentacled weed-dwelling species, are probably very closely related, and not the product of parallel or convergent evolution.

A summary of the schemes of South African clinid classification discussed is given in table 3. The reasons for the choice of the name Pavoclinus for one of the genera recognized in the present work are given in the discussion of the genus Pavoclinus, p. 137.

Table 3. Summary of the various classifications of the South African Clinidae.

Cuvier & Valenciennes (1836)	Swainson (1839)	Gill (1860)
Cirrhibarbis capensis	*Cirrhibarbis capensis*	
Clinus acuminatus	*Clinus acuminatus*	*Clinus acuminatus*
Clinus anguillaris	*Blennophis anguillaris*	*Blennophis anguillaris*
Clinus cottoides	*Clinus cottoides*	*Clinus cottoides*
Clinus latipennis	*Labrisomus latipennis*	*Ophthalmolophus l.*
Clinus superciliosus	*Clinitrachus superciliosus*	*Clinus superciliosus*
Clinus brachycephalus	*Labrisomus linearis*	*Blennioclinus brachycephalus*
Clinus heterodon		

Table 3 (continued)

Gilchrist & Thompson (1908)	Barnard (1927, 1935)	Smith (1945)
Clinus capensis	Clinus capensis	Cirrhibarbis capensis
Clinus dorsalis	Clinus dorsalis	Muraenoclinus dorsalis
	Climacoporus navalis	Climacoporus navalis
Clinus anguillaris	Clinus anguillaris	Blennophis anguillaris
Clinus striatus	Clinus striatus	Blennophis striatus
Clinus cottoides	Clinus cottoides	Blenniomimus cottoides
Clinus taurus	Clinus taurus	Blenniomimus taurus
Clinus latipennis	Clinus latipennis	Ophthalmolophus latipennis
Clinus acuminatus	Clinus acuminatus	Ophthalmolophus acuminatus
Clinus venustris	Clinus venustris	Ophthalmolophus venustris
		Ophthalmolophus agilis
		Ophthalmolophus helenae
Clinus brevicristatus	Clinus brevicristatus	Petraites brevicristatus
		Petraites woodi
Clinus superciliosus	Clinus superciliosus	Clinus superciliosus
Clinus robustus	Clinus robustus	Clinus robustus
Clinus pavo	Clinus pavo	Pavoclinus pavo
Clinus heterodon	Clinus heterodon	Pavoclinus heterodon
Clinus laurentii	Petraites laurentii	Labroclinus laurentii
Cristiceps mentalis	Petraites mentalis	Labroclinus mentalis
Clinus fucorum	Clinus fucorum	Myxodes fucorum

Table 3 (continued)

Gilchrist & Thompson (1908)	Barnard (1927, 1935)	Smith (1945)
Clinus mus	Clinus mus	Fucomimus mus
Clinus brachycephalus	Clinus brachycephalus	Blennioclinus brachycephalus
		Blennioclinus stella
Clinus biporosus	Clinoporus biporosus	Clinoporus biporosus
	Clinus rotundifrons (1937)	Gynutoclinus rotundifrons

Table 3 (continued)

Jackson (1950, unpublished)	Scheme for reclassification used in this work
Clinus (Cirrhibarbis) capensis	Clinus(Cirrhibarbis)capensis
Clinus(Blennophis)anguillaris	Clinus(Blennophis)anguillaris
Clinus(Blennophis)striatus	Clinus(Blennophis)striatus
Clinus(Blennophis)dorsalis	Clinus(Climacoporus)dorsalis
Clinus(Climacoporus)navalis	Clinus(Climacoporus)navalis
Clinus(Ophthalmolophus)acuminatus	Clinus(Clinus)acuminatus
Clinus(Ophthalmolophus)agilis	Clinus(Clinus)agilis
	Clinus(Clinus)berrisfordi
Clinus(Petraites)brevicristatus	Clinus(Clinus)brevicristatus
Clinus(Clinus)cottoides	Clinus(Clinus)cottoides
Clinus(Ophthalmolophus)helenae	Clinus(Clinus)helenae
Clinus(Ophthalmolophus)latipennis	Clinus(Clinus)latipennis
	Clinus(Clinus)obtusifrons
Clinus(Clinus)robustus	Clinus(Clinus)robustus
Clinus(Clinus)superciliosus	Clinus(Clinus)superciliosus
Clinus(Clinus)taurus	Clinus(Clinus)taurus
Clinus(Ophthalmolophus)venustris	Clinus(Clinus)venustris
Clinus(Petraites)woodi	Clinus(Clinus)woodi
Myxodes(Myxodes)mus	Pavoclinus(Fucomimus)mus
Myxodes(Labroclinus)mentalis	Pavoclinus(Labroclinus)mentalis
Myxodes(Myxodes)heterodon	Pavoclinus(Pavoclinus)heterodon

Table 3 (continued)

Jackson (1950, unpublished)	Scheme for reclassification used in this work
Myxodes(Labroclinus)laurentii	*Pavoclinus(Pavoclinus)laurentii*
	Pavoclinus(Pavoclinus)litorafontis
Myxodes(Myxodes)pavo	*Pavoclinus(Pavoclinus)pavo*
	Pavoclinus(Pavoclinus)profundus
Myxodes(Myxodes)fucorum	*Pavoclinus(Smithichthys)fucorum*
Myxodes(Blennioclinus)brachycephalus	*Blennioclinus brachycephalus*
Myxodes(Blennioclinus)stella	*Blennioclinus stella*
Clinoporus biporosus	*Clinoporus biporosus*
Gynutoclinus rotundifrons	*Gynutoclinus rotundifrons*

SYSTEMATICS

Subfamily: Clininae

Diagnosis: Clinidae having on the anterior edge of the cleithrum an upturned, hook-like bony process. Scales usually small and embedded, with radii on all margins. Caudal rays always unbranched. No nuchal cirri.

Tribe: Clinidi

Diagnosis: Clininae which bear their young alive. Males with a fleshy penis. Always a cirrus above the anterior nostril. Body scales usually small and embedded, exceptionally absent. Hook on pectoral girdle usually well developed, rarely reduced or absent.

Subtribe: Clinini

Diagnosis: Clinidi with hook always present on pectoral girdle. Head compressed, eyes lateral. Pelvic rays free from membrane for greater part of length.

Remarks

There are few characters which can be used to differentiate between the South African members of the Clinini above the species level, since this group is very homogeneous in most respects, and many features are common to the group as a whole. It has been found, however, that the group can be divided into five genera, somewhat unevenly; there are two large genera which between them contain twenty-six of the thirty recognized species. Of the other three genera, two are monospecific and rare, and the third contains two species. It is not easy to decide in the case of monospecific genera which features are purely specific and which would be more widely applicable if there were more species, but the species involved here are so clearly different from each other and from the rest of the group that there is ample justification for the recognition of the two monospecific genera. A summary of the five genera is given in table 4.

<u>Key to the genera of South African Clinini</u>

1. Body covered with small scales 2

   No scales .... <u>Clinoporus</u>

2. A tentacle or minute papilla over the eye 3

   No tentacle or papilla over the eye 4

3. A minute, simple papilla over the eye ...... <u>Gynutoclinus</u>

   A fringed or branched tentacle over the eye ...... <u>Clinus</u>

4. Posterior dorsal spine much shorter than first dorsal soft ray, causing a deep notch in the profile of the dorsal fin before the soft rays .... <u>Blennioclinus</u>

   No deep notch in the profile of the dorsal fin before the soft rays .... <u>Pavoclinus</u>

Table 4. Comparison of the South African genera of Clinini

Blennioclinus	Clinoporus	Gynutoclinus
Absent	Absent	A minute, simple papilla
Minute, not imbricating	Absent	Minute, not imbricating
Anterior pores double; posterior part of short horizontal tubes with a pore at each end	Pores very large opening above or below irregularly throughout	Anterior pores single, opening medially; posterior part of short horizontal tubes with a pore at each end
Basal part short to moderate; tip long, slender, ensheathed	Basal part long; tip small, bifid, not ensheathed	Basal part long; tip small, ensheathed
30 – 45% of head length	Less than 40% of head length	More than 40% of head length
Moderate	Robust, eel-like	Highly compressed
Present	Absent	Absent
Much shorter	About equal	About equal
Absent	Absent	Present
Short	Short	Short
Open flush	Open flush	Open on papillae

Genus: Clinus Cuvier, 1817

Clinus Cuvier, 1817 :173 (type species Blennius acuminatus Bloch & Schneider.)

Cirrhibarbis Cuvier, 1817 :174 (type species Cirrhibarbis capensis Cuvier & Valenciennes)

Clinitrachus Swainson, 1839 :75 (in part) (type species Blennius variabilis Rafinesque)

Blennophis Swainson, 1839 :75 (type species Clinus anguillaris Cuvier & Valenciennes)

Ophthalmolophus Gill, 1860 :104 (type species Clinus latipennis Cuvier & Valenciennes)

Climacoporus Barnard, 1935 :646 (type species Climacoporus navalis Barnard)

Muraenoclinus Smith, 1945 :538 (type species Clinus dorsalis Castelnau)

Blenniomimus Smith, 1945 :538 (type species Clinus taurus Gilchrist & Thompson)

Diagnosis: A distally flattened, at least bifid tentacle over the eye. Lateral line usually of double pores and/or single pores opening above and below the line in front; behind post-pectoral curve usually of short separate horizontal tubes with a pore at either end. Intromittent organ usually of a fairly long basal portion with a small tip retractile between one or two pairs of fleshy lips. Body covered with small, often embedded cycloid scales. Two bands of villiform teeth in the jaws, outer row larger. Vomer always toothed. Upper jaw averages more than 40% of head length. Body moderately robust. Caudal peduncle short.

Note on the type species of Clinus

There is some doubt as to which species should be regarded as the type species of Clinus. No type species was designated by Cuvier (1817). Clinus superciliosus (Linnaeus) has generally been regarded as the type species of the genus, and was so designated by Swain (1882). It is evident from the expanded description of the genus Clinus by Cuvier & Valenciennes (1836), in which the male organ is discussed in some detail, that the description was based chiefly on specimens of Clinus superciliosus. However, prior to Swain's designation of the type species, Swainson (1839) designated Clinus acuminatus (Bloch & Schneider) as the type species of the genus Clinus. It seems that Swainson's designation must be accepted according to the rules of the International Code of Zoological Nomenclature (1961), Article 69 (a) (iii): "In the absence of a prior valid type-designation for a nominal genus, an author is considered to have designated one of the originally included nominal species as type-species, if he states that it is the type (or type-species), for whatever reason, right or wrong, and if it is clear that he himself accepts it as the type species." Clinus acuminatus, one of the originally included nominal species of the genus *Clinus*, is in no way ineligible by the rules of the international code for designation as the type species, although one might consider *Clinus superciliosus* as more suitable. *Clinus acuminatus* is therefore accepted as the type species of the genus *Clinus*.

Hubbs' (1952) recommendations regarding the nomenclature of *Clinus* and *Clinitrachus* for South African species fall away, as *Clinitrachus* is considered to be a synonym of *Clinus*.

Discussion

Most of the eighteen species of the genus *Clinus* are small and occur almost exclusively in the intertidal zone; a few extend into the infratidal zone, and a few reach a fairly large size (150 - 350 mm.). Most species live in rock-pools amongst stones and in crevices, although many species frequently hunt in sea-weed as well, and one species habitually occurs in beds of the green alga *Caulerpa filiformis*; none, however, have the highly modified body form displayed by the weed-dwellers of the genus *Pavoclinus*. They are well camouflaged and able to change pattern and colour almost instantaneously, although there is generally a basic pattern of pigmentation which remains for a considerable time after preservation. This pattern may be of blotches and cross-bars, and there is almost invariably an ocellate spot on the shoulder, anterior fin spines, or opercle. They are entirely carnivorous, but the diet is very varied, both between species and between individuals of the same species (see part III). There is a tendency in many species to develop a notch in the membrane joining the third and fourth dorsal spines. The first three dorsal spines are often elevated to form a crest; this is considered to be a primitive feature in the family Clinidae (Hubbs, 1953). In one species with a very well developed crest the crest shows sexual dimorphism. The other species show little or no sexual dimorphism other than the development of a penis in the male.

An examination of the gonads (see part IV) of many individuals of several species of this genus suggests that, while parasitism of the ovaries by trematodes occurs to a varying degree, the testes of the males are normally not affected.

Jackson (1950) divided this genus into subgenera which, with one exception, corresponded with Smith's (1945) genera (see table 3). In attempting to group the eighteen species contained in the genus Clinus as defined above, one is confronted with the difficulty of deciding on a method which will reflect what appear to be the natural relationships of the species within the genus. This is a problem, because, while the genus Clinus is not completely homogeneous, and there is an indication of development along at least two major and several minor lines within it, most of the species form a more or less generalized group in which each minor line of development is represented by a range rather than a cluster of species, and in which there is so much overlap between apparent lines that the species involved in each line of development are not clearly delimited.

It is proposed to use four subgenera, one of which must contain a large number of generalized species. The other three are believed to represent particular lines of development and are easily defined; they appear to be more closely related to each other than to the more generalized species.

Clinus navalis, C. dorsalis, C. anguillaris, C. striatus, and C. capensis, previously distributed among the genera Climacoporus, Muraenoclinus, Blennophis, and Cirrhibarbis, are all rather elongate, eel-like species. Smith (1945) separated them from each other generically for the following reasons: (1) Clinus navalis has only one soft dorsal ray, and the lateral line pores are double for most of the length of the line, sometimes the whole length; it was placed in the genus Climacoporus by Barnard (1935) and retained in that genus by Smith (1945). (2) Clinus dorsalis has only one soft dorsal ray, and the lateral line is of the usual type posterior to the post-pectoral curve (i.e. of short horizontal tubes with a pore at either end); it was placed alone in the genus Muraenoclinus by Smith (1945). (3) Clinus anguillaris and Clinus striatus have 2 - 4 dorsal soft rays and scaly cheeks, and were placed in the genus Blennophis. (4) Clinus capensis has barbels on the chin and snout, and scaly cheeks, and was placed in the genus Cirrhibarbis.

<u>Clinus anguillaris</u> and <u>Clinus striatus</u> are the two most eel-like species. They have small scales on the cheeks as well as on the bases of the dorsal, anal, and caudal fins. They are very alike and form a distinct pair of species; it is proposed to show their close relationship by placing them together in a subgenus <u>Blennophis</u>.

<u>Clinus capensis</u> cannot be confused with any other species on account of the barbels on the chin and snout. In some families e.g. Brotulidae this feature is considered sufficient grounds for generic distinction, but in view of the fact that <u>Clinus capensis</u> resembles the other species of <u>Clinus</u> in all other respects, having the same type of supra-orbital tentacle, lateral line, and intromittent organ, it seems preferable to regard this species as a member of the genus <u>Clinus</u>. Since, however, it is set apart from the others by the facial barbels, it may be placed in a subgenus <u>Cirrhibarbis</u>.

The lateral line of <u>Clinus navalis</u> appears to be of the same type as that found in the other species of <u>Clinus</u>, but the pores continue to be double for a varying distance behind the post-pectoral curve, often along the whole length of the lateral line. As in <u>Clinus dorsalis</u>, there is one soft ray in the dorsal fin, and the cheeks are naked, as in the majority of species. The supra-orbital tentacle is present and similar in <u>Clinus navalis</u> and <u>Clinus dorsalis</u>. Since it is very difficult to distinguish between juvenile specimens of these two species except on fin counts, it is considered that generic or even subgeneric separation is untenable. It is proposed to place these two species together in a subgenus for which the name Climacoporus Barnard, 1935 must be used, as it is the older of the two generic names which have been used for them.

The remaining thirteen species constitute the subgenus Clinus.

Clinus taurus and Clinus cottoides were placed in a genus Blenniomimus by Smith (1945) on account of a bony ridge over the eye, which makes the interorbital appear concave instead of flat. This ridge is by no means striking in small specimens of Clinus cottoides; and it is slightly developed in Clinus latipennis and Clinus helenae, which Smith placed in the genus Ophthalmolophus. Clinus taurus and Clinus cottoides should therefore not be separated generically or even subgenerically from the other species, since they, particularly Clinus taurus, represent the extreme of the range of development of a particular feature. Jackson (1950) also felt that the bony ridge over the eye was a character insufficient for differentiation even at the subgeneric level, and placed Clinus taurus and Clinus cottoides in his subgenus Clinus together with Clinus superciliosus and Clinus robustus. However, it is unlikely that Jackson saw Clinus latipennis or Clinus helenae, both rare species; if he had he would probably have noticed that these two species are much more similar to Clinus cottoides than that species is to Clinus superciliosus and Clinus robustus, while Clinus latipennis and Clinus helenae are too similar again to other species lacking any sign of a ridge over the eye to warrant separation from them.

Clinus superciliosus, C. robustus, C. brevicristatus, and C. woodi were previously separated from the rest of the tentacled species because the first three dorsal spines were higher than the succeeding ones, forming a crest. Clinus superciliosus and Clinus robustus were placed in the genus Clinus in a restricted sense, having a notch in the membrane between the third and fourth dorsal spines less than 50% of the length of the fourth spine. Clinus brevicristatus and Clinus woodi were placed in the genus Petraites, having the notch over 50% of the length of the fourth spine (McCulloch, 1908), although Smith (1945) stated that in Petraites the notch is complete, the membrane from the third spine barely reaching the base of the fourth spine. McCulloch (1908) stated that the two genera Clinus and Petraites are barely distinguishable from one another, and this is certainly true of the South African species involved, since Clinus superciliosus resembles Clinus woodi more closely than it does Clinus robustus, and Clinus brevicristatus is as close to forms such as Clinus agilis, Clinus venustris, and Clinus cottoides as it is to Clinus woodi. In Clinus superciliosus the depth of the notch varies from 0 - 100% of the fourth spine, but is generally 40 - 60% (see table 5). Clinus robustus has an extremely shallow notch. In Clinus woodi the membrane from the third spine barely reaches the base of the fourth spine. In Clinus brevicristatus the notch varies from 25 - 100% of the fourth spine, but is usually 50 - 75%, and only rarely 100%. The crest is high and triangular in Clinus woodi and particularly in mature male specimens of Clinus superciliosus, and is very low, scarcely elevated, in Clinus robustus and Clinus brevicristatus. Among the other species, Clinus agilis and Clinus taurus have a notch in the membrane between the third and fourth spines but the first three spines are not elevated, and Clinus venustris (placed by Smith in the genus Ophthalmolophus) typically has the second and third dorsal spines somewhat elevated. It seems therefore that there is a range of crest reduction and notch depth in this genus, and that to base generic or subgeneric distinctions on these features would be false and indeed impossible, since it is often difficult to decide whether individual specimens of Clinus robustus and Clinus brevicristatus have a crest at all, while in others it is quite marked. It is also possible that the crest has been reduced or lost separately and even for different reasons in the various species, and that its retention does not indicate close affinity; there are no other features to suggest a closer affinity amongst all the crested species than between crested and non-crested species.

Table 5. Depth of notch in membrane between third and fourth dorsal spines (expressed as % of fourth dorsal spine free from membrane). The numbers represent actual number of specimens from each sample having a particular depth of notch).

Species	0 - 9%	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90-99%	100%
Clinus superciliosus	3	0	3	12	15	40	57	19	16	2	7
Clinus woodi	0	0	0	0	0	0	0	0	0	0	5
Clinus robustus	1	0	2	2	1	1	0	0	0	0	0
Clinus brevicristatus	0	0	1	0	2	2	7	4	7	0	4
Clinus agilis	4	1	1	9	3	32	34	7	9	0	0
Clinus taurus	0	0	0	1	1	0	8	4	1	0	0

The five species previously contained in the genus _Ophthalmolophus_ were apparently placed there in the absence of any of the structures whereby the other genera were distinguished. It is in this group particularly that one encounters difficulties in dividing the group as a whole into subgenera such as those recognized by Jackson (1950). It has already been pointed out that _Clinus latipennis_ and _Clinus helenae_ show signs of a bony ridge over the eye, and may in that feature represent stages in approaching the condition seen in _Clinus taurus_ and to a lesser extent in _Clinus cottoides_, so that the classification should in some way relate them to these species, or should at least not set them apart. _Clinus agilis_, with a notch in the membrane between the third and fourth dorsal spines but with low anterior dorsal spines, is too similar to _Clinus brevicristatus_ on the one hand, with a deeper notch and the first three dorsal spines elevated, and to species such as _Clinus acuminatus_ on the other hand, with no notch or crest, to be separated even subgenerically from either. _Clinus venustris_ shows rudiments of a crest (the second and third dorsal spines are usually higher than the others), but this is not sufficiently marked in every individual for it to be defined as having a crest. Apart from the variations of the fin, the thirteen species placed in the subgenus _Clinus_ are united by so many common features and are often so hard to distinguish from one another, that any attempt at separation into subgenera would be unwarranted.

It is felt that while the subgenera used do represent different lines of evolution within the genus Clinus, the species contained in the genus as a whole form a well-defined group of species which are more closely related to each other than to the remaining South African clinid species. However, should another worker wish to separate the eel-like subgenera Blennophis, Cirrhibarbis, and Climacoporus from the subgenus Clinus and place them in a separate genus, there would be little reason for serious objection to such an arrangement.

Distribution of the genus Clinus

This genus in South Africa occurs in temperate waters. Three species are confined to the waters north-east of Cape Agulhas; most of the species are restricted to the coast south of the Kei River (see fig. 45(a)). Only one species is known to extend north of Durban to Inhambane, where it is rare, and it does not reach the waters of the tropics north of that point. On the north-west coast, two species reach the tropics at Walvis Bay, but as the coast in that region is under the influence of the cold Benguela current, conditions of water temperature and fauna are far from tropical. The common species of the Cape coast west of the Cape Peninsula all belong to the genus Clinus. Twelve of the eighteen species have been recorded definitely from the waters west of Cape Point, only one of these being common north-east of Algoa Bay. The other five species are fairly rare throughout the South African coastal region. It seems that this genus has its greatest distribution in the colder regions of the South African coast.

Range: North of Swakopmund (South West Africa) to Inhambane (Mozambique).

Key to the subgenera of the genus Clinus

1. Scales on the cheeks 2

   No scales on the cheeks 3

2. Barbels on chin and snout .... Cirrhibarbis

   (one species, capensis)

   No barbels on chin and snout .... Blennophis

   (two species)

3. One soft dorsal ray .... Climacoporus

   (two species)

   More than one soft dorsal ray .... Clinus

   (thirteen species)

Subgenus: _Blennophis_ Swainson, 1839

Blennophis Swainson, 1839 :75 (type species _Clinus anguillaris_ Cuvier & Valenciennes)

Diagnosis: Elongate eel-like clinids with small scales on the cheek and dorsal, anal, and caudal fin bases, as well as over the general body surface. Body robust. Dorsal fin low, even. No cirri at dorsal spine tips. No barbels on chin or snout. Dorsal soft rays 2 - 4.

Two species, one becoming common west of Cape Point, the other rare throughout its range, but encountered more frequently east of Cape Point. Both reach a large size and are found infratidally as well as in intertidal rock-pools.

Key to the species of Blennophis

1. Inner pelvic ray stout, equal to other two .... _Clinus (Blennophis) anguillaris_

   Inner (third) pelvic ray minute or absent .... _Clinus (Blennophis) striatus_

<u>Clinus</u> (<u>Blennophis</u>) <u>anguillaris</u> Cuvier & Valenciennes, 1836

(fig. 6)

<u>Blennius</u> <u>rubescens</u> Lichtenstein, 1823 :117

<u>Clinus</u> <u>anguillaris</u> Cuvier & Valenciennes, 1836 :390; Gilchrist & Thompson, 1908 :133; Barnard, 1927 :862

<u>Blennophis</u> <u>anguillaris</u>: Swainson, 1839 :75; Smith, 1945 :539; Smith, 1949 :352

<u>Blennophis</u> <u>rubescens</u>: Smith, 1962 :40

Description: D. XLVI - L (XLVIII - L) 2 - 4 (3 - 4); A. II 33 - 37; P. 13 - 14 (13); V. I 3; C. 13. Dorsal fin long, low, even. No clusters of cirri on dorsal spine tips. Pectoral fin rounded. Inner pelvic ray well-developed, stout, equal to others. Caudal peduncle very short, length 15.5 - 25% of head length, depth 28.5 - 35.5% of head length. Caudal fin short, subtruncate.

Body elongate, robust, eel-like, with small scales extending on to caudal, dorsal, and anal fin bases, upper edge of opercle, and cheeks. Depth 6 - 7.75. Head bluntly wedge-shaped, 4.75 - 5.75 in standard length. Eye 3.25 - 5 in head, relative size of eye decreasing with increase in size of fish. Orbital tentacle prominent, with a flat stalk and a fine fringe of cirri at the tip. Cirrus on anterior nostril elongate, simple, with serrated edges. Upper jaw 38 - 42.5% of head length. Lips thick. Vomer toothed.

Lateral line of one or two double pores and mostly single pores opening below line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 6(c)). Intromittent organ of male with a moderate base and a single pair of oval dorso-lateral lips (fig. 6(b)).

Colouring: Variable, reddish to dark maroon, or pink with reddish blotches. Fins red-or white-tipped. Sometimes a light-edged dark ocellus on shoulder, always present in juveniles. Often two dark radiating bars from eye across cheek. Snout white in large, dark-red specimens.

Material examined: 34 specimens, 65 - 256 mm. in standard length. 11 from Lüderitzbucht, S.A.M. 24208; 1 from Gert du Toit Bay, southern Namaqualand, S.A.M. 24019; 4 from Doring Bay, southern Namaqualand, S.A.M. 24020; 2 from Lambert's Bay, S.A.M. 23887, S.A.M. 24010; 1 from Kommetje, Cape Peninsula, S.A.M. 23874; 9 from St. James, False Bay, S.A.M. 10526, S.A.M. 13721; 2 from Dalebrook, False Bay, S.A.M. 21538, S.A.M. 21539; 1 from Still Bay, April 1965, S.A.M. not catalogued; 1 from East London, S.A.M. 19745; 2, no locality, S.A.M. 21708, S.A.M. 21709.

Remarks

The scales on the fin bases and particularly the head in this and the related species, Clinus (Blennophis) striatus, are primitive features, as is the degree of development of the inner pelvic ray of this species.

Nomenclature

Smith (1962) pointed out that Lichtenstein's (1823) description of a fish which he called Blennius rubescens from the Cape of Good Hope fits Clinus anguillaris Cuvier & Valenciennes, and that the name rubescens therefore takes priority over anguillaris. However, the name anguillaris has been used for this species since 1836, while Lichtenstein's name has not been used for well over a hundred years until Smith revived it in 1962. According to the International Code of Zoological Nomenclature (1961), Article 23(b), unless the International Commission should decide otherwise, "a name that has remained unused as a senior synonym in the primary zoological literature for more than fifty years is considered to be a forgotten name (nomen oblitum)". Forgotten names may not be used unless the Commission so directs. Smith (1962) did not place the matter before the Commission. The name anguillaris Cuvier & Valenciennes, 1836 is thus retained for this species.

Distribution: The known range at present is Lüderitzbucht (South West Africa) to East London. Fairly common on the west coast as far south as Lambert's Bay, becoming rather rare east of Cape Point. Small specimens occur under stones in shallow pools near the top of the shore, but larger specimens occur only at the bottom of the shore, and extend into the sublittoral fringe.

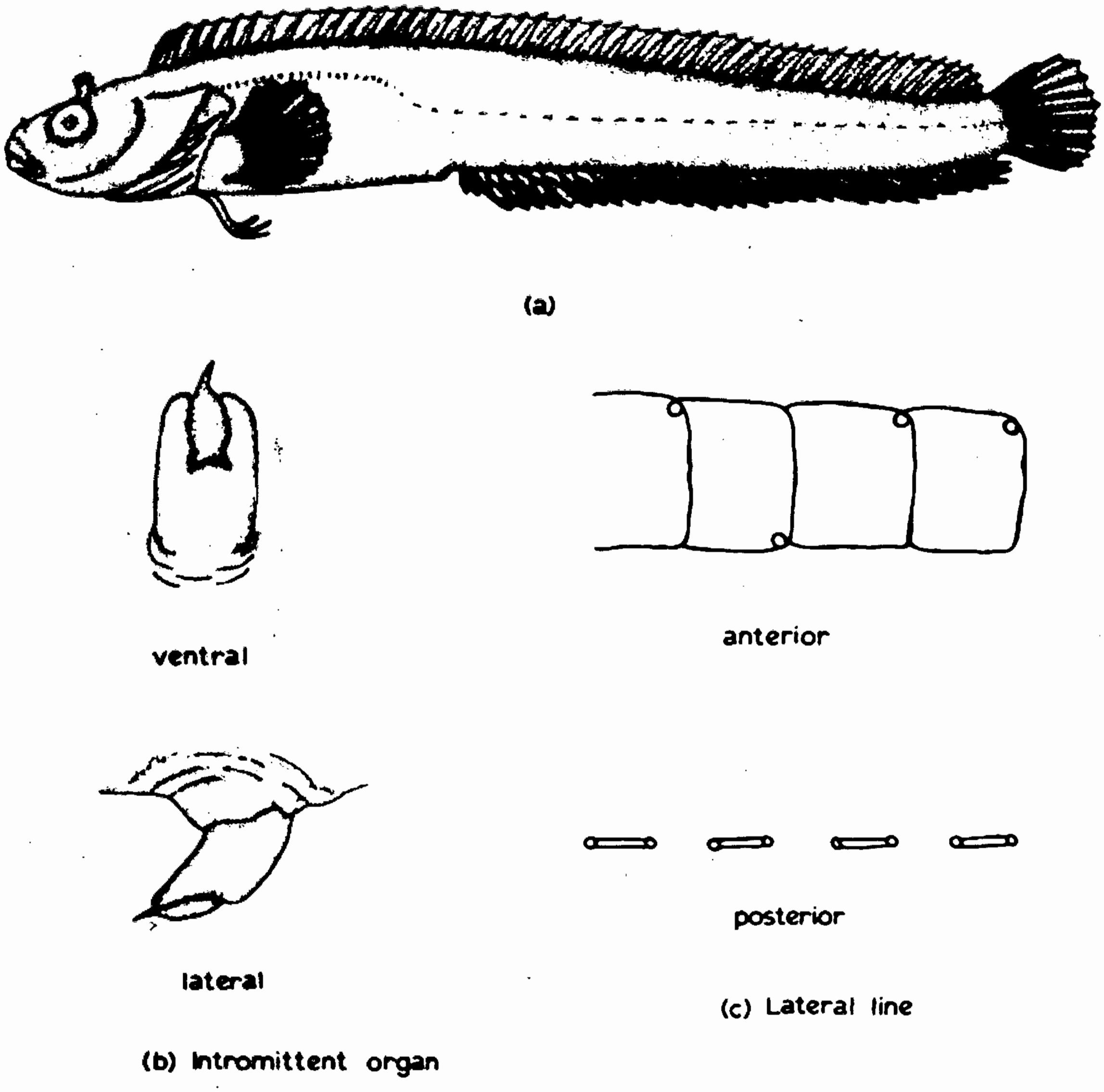


Fig. 6. Clinus (Blennophis) anguillaris

<u>Clinus</u> (<u>Blennophis</u>) <u>striatus</u> Gilchrist & Thompson, 1908

(fig. 7)

<u>Clinus striatus</u> Gilchrist & Thompson, 1908 :134; Barnard, 1927 :862

<u>Blennophis striatus</u>: Smith, 1945 :539; Smith, 1949 :353

Description: D. XL - XLV 2 - 4 (2 - 3); A. II 28 - 31 (30 - 31); P. 12 - 13 (13); V. I 2 - 3; C. 13. Dorsal fin long, low, even. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray reduced or absent. Caudal peduncle very short, length 10 - 20% of head length, depth 23 - 27% of head length. Caudal fin short, subtruncate.

Body elongate, robust, eel-like, with small scales extending on to caudal, dorsal, and anal fin bases, upper edge of opercle, and cheeks. Depth 6 - 8.25. Head bluntly wedge-shaped, 4.5 - 5.25 in standard length. Eye 3.5 - 5 in head. Orbital tentacle prominent, with a flat stalk and a fringe of fine cirri at the tip. Cirrus on anterior nostril elongate, end spatulate and slightly lobed ventrally. Upper jaw 37 - 44.5% of head length. Lips thick. Vomer toothed.

Lateral line as in <u>Clinus anguillaris</u>, mainly of single pores opening below the line in front to post-pectoral curve, then of short, separate horizontal tubes with a pore at either end (fig. 7(c)). Intromittent organ of male with a moderate basal portion and a single pair of narrow, crescentic dorso-lateral lips (fig. 7(b)).

Colouring: Pink with brownish-red to dark-red mottling, fins usually reddish. Adults occasionally have faint white longitudinal stripes. A light-edged dark ocellus on shoulder. Two dark radiating lines from eye across cheek. Juveniles white with longitudinal black stripes.

Material examined: 11 specimens, 42 - 145.5 mm. in standard length. 1 from Saldanha Bay, S.A.M. 23878; 3 from Simon's Bay, False Bay, S.A.M. 10527 (syntypes); 2 from Kalk Bay, False Bay, S.A.M. 17844, S.A.M. 18086; 3 from Strandfontein, False Bay, S.A.M. 24240; 2, no locality, S.A.M. 21710, S.A.M. 21796.

Remarks

This species is very similar to Clinus anguillaris, differing from it only in the fin counts and in the degree of reduction of the inner pelvic ray.

Distribution: The known range at present is from Saldanha Bay to East London. The juveniles occur high up on the shore, but larger specimens are taken at the bottom of the shore and infratidally. Rare.

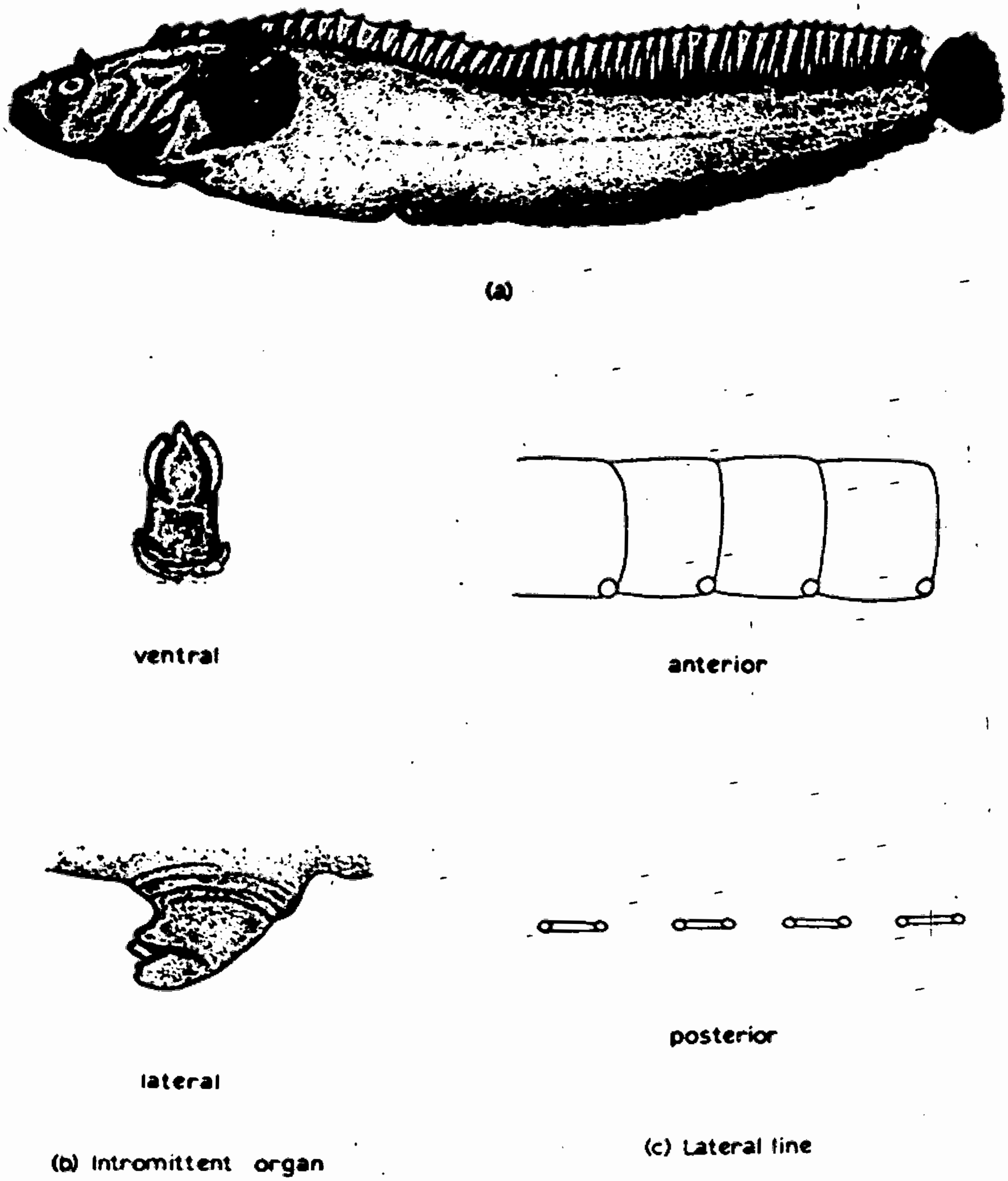


Fig. 7. Clinus (Blennophis) striatus

Subgenus: *Cirrhibarbis* Cuvier, 1817

Cirrhibarbis Cuvier, 1817 :174 (type species *Cirrhibarbis capensis* Cuvier & Valenciennes)

Diagnosis: Elongate clinids. Snout pointed, with three stout, simple cirri at the tip; chin with eight stout, simple cirri. Small scales on cheek, dorsal, caudal, and anal fin bases, as well as over the general body surface. Dorsal fin low, even, with clusters of fine cirri at tips of spines.

One species, *Clinus* (*Cirrhibarbis*) *capensis* (Cuvier & Valenciennes).

Clinus (*Cirrhibarbis*) *capensis* (Cuvier & Valenciennes, 1836)
(fig. 8)

Cirrhibarbis capensis Cuvier & Valenciennes, 1836 :406; Swainson, 1839 :277; Smith, 1945 :539; Smith, 1949 ;352

Clinus capensis: Gunther, 1861 :269; Gilchrist & Thompson, 1908 :131; Barnard, 1927 :853

Description: D. XXXVII - XLIV (XXXVIII - XLI) 5 - 9 (6); A. II 26 - 34 (26 - 29); P. 12 - 14 (13); V. I 2 - 3; C. 13. Dorsal fin low, even. Clusters of 3 - 5 fine cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray reduced, with free tip very short, or absent. Caudal peduncle short, length 20 - 30% of head length, depth 18 - 26% of head length. Caudal fin subtruncate.

Body elongate, slightly compressed, covered with small scales extending on to the dorsal, daudal, and anal fin bases, and cheeks. Depth 5 - 6, occasionally greater. Head narrow, pointed, 3.5 - 4.5 in standard length. Snout with three stout, simple cirri at the tip; chin with eight stout, simple cirri clustered about the lower jaw symphysis. Orbital tentacle prominent, with a broad flat stalk and a fringe of fine cirri at the tip. Eye 3.5 - 5.5 in head. Cirrus on anterior nostril large, spatulate, with about four shallow, flat lobes at the tip. Upper jaw 37.5 - 47.5% of head length. Lips thick. Vomer toothed.

Lateral line of about 30 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at each end (fig. 8(c)). Intromittent organ of male with a long basal portion; one pair of large confluent dorsal lips and one pair of small ventral lips ensheathing the tip (fig. 8(b)).

Colouring: Variable, pinkish, grey, or greenish mottled. A light-edged dark ocellus on shoulder. Fins and facial cirri usually red. A juvenile specimen from Lambert's Bay and two specimens from the west coast of the Cape Peninsula, one juvenile and one adult, were milky white with longitudinal black stripes and red fins and facial cirri.

Material examined: 95 specimens, 28 - 222 mm. in standard length. 1 from Lambert's Bay, S.A.M. 24237; 1 from Kommetje, S.A.M. 23926; 1 from Froggy Pond, False Bay, S.A.M. 23930; 2 from Kalk Bay, False

Bay, S.A.M. 18224, S.A.M. 18276; 11 from Dalebrook, False Bay, 19/2/1965 and 18/4/1965, S.A.M. not catalogued; 14 from St. James, False Bay, S.A.M. 10530, S.A.M. 12018, S.A.M. 23583, and 1962, S.A.M. not catalogued; 29 from Strandfontein, False Bay, S.A.M. 23975, S.A.M. 24236; 1 from Gordon's Bay, False Bay, S.A.M. 23290; 4 from Onrust River Mouth, S.A.M. 24238; 10 from Still Bay, April 1965, S.A.M. not catalogued; 4 from Mossel Bay, S.A.M. 23929; 4 from Port Elizabeth, S.A.M. 23928; 2 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 8 from East London, S.A.M. 23927; 3 from Gonubie River Mouth, East London, 28/6/1965 S.A.M. not catalogued.

Remarks

This species can be distinguished at once from all other species by the facial cirri, but it is considered similar enough to the other tentacled species to be included in the genus *Clinus*. It is most similar to the eel-like forms of the subgenus *Blennophis* in body form, type of habitat, and the very short caudal peduncle, as well as the scaly cheeks; the clusters of cirri at the tips of the dorsal spines, the intromittent organ with its two pairs of lips, and the dorsal soft ray count indicate affinity with some of the species of the subgenus *Clinus*.

Distribution: The known range at present is Lambert's Bay to East London. It is rare west of Cape Point, but is fairly common from False Bay eastwards. It lives in shallow pools when small, but large adults occur only at the bottom of the shore and infratidally.

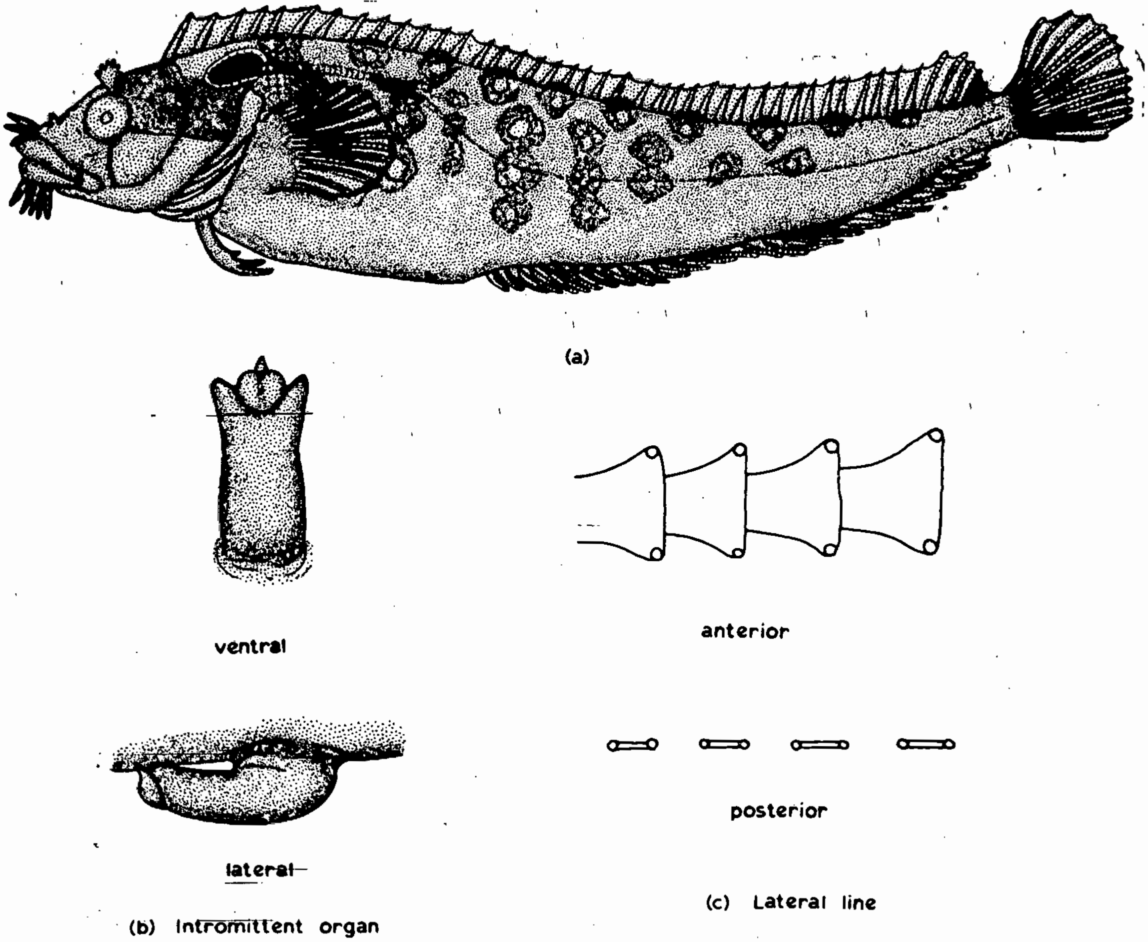


Fig. 8. Clinus (Cirrhibarbis) capensis

Subgenus: Climacoporus Barnard, 1935

Climacoporus Barnard, 1935 :646 (type species Climacoporus navalis Barnard)

Nemacoclinus Smith, 1937 :195 (referring to Climacoporus navalis Barnard)

Muraenoclinus Smith, 1945 :538 (type species Clinus dorsalis Castelnau)

Diagnosis: Elongate clinids with one dorsal soft ray. No scales on cheeks. Dorsal fin low, even. No clusters of cirri at tips of dorsal spines. No barbels on chin or snout.

Two species, both small and intertidal. One is fairly common on the west coast, less so eastwards to the south coast of Natal; the other occurs only east of Cape Agulhas and is rare.

Key to the species of Climacoporus

1. 35 - 38 dorsal spines .... Clinus (Climacoporus) navalis

41 - 48 dorsal spines .... Clinus (Climacoporus) dorsalis

<u>Clinus</u> (<u>Climacoporus</u>) <u>dorsalis</u> Castelnau, 1861

(fig. 9)

<u>Clinus</u> <u>dorsalis</u> Castelnau, 1861 :54; Gilchrist & Thompson, 1908 :132;
Barnard, 1927 :861

<u>Muraenoclinus</u> <u>dorsalis</u>: Smith, 1945 :538; Smith, 1949 :352

Description: D. XLI – XLVIII (XLV – XLVI) I; A. II 25 – 31 (26 – 29); P. 11 – 13 (12); V I 2 – 3; C. 13. Dorsal fin low, even. No clusters of cirri at dorsal spine tips. Pectoral fin rounded. Inner pelvic ray reduced, often absent, if present minute. Caudal peduncle very short, length 16.5 – 28% of head length, depth 26 – 33.5% of head length. Caudal fin short, subtruncate.

Body elongate, eel-like, slightly compressed, covered with small scales not extending on to fin bases or head. Depth 5.5 – 7. Head narrowly wedge-shaped, snout acutely pointed, head 3.5 – 5 in standard length. Eye 3 – 4.5 in head. Supra-orbital tentacle prominent, with a flat stalk and a terminal fringe of fine cirri. Cirrus on anterior nostril narrow at base, tip broadly spatulate, with a deeply serrated edge. Upper jaw 34.5 – 46% of head length. Lips thick. Vomer toothed.

Lateral line of single pores opening above and below the line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 9(c)). Intromittent organ of male with a long basal portion and a single pair of large, rounded dorso-lateral lips ensheathing the tip (fig. 9(b)).

Colouring: Plain dark green or red, or light greenish or brownish mottled with darker greens, browns, and mauves. Mottled specimens have an ocellate spot on the shoulder. A broad white stripe from base of first dorsal spine to tip of snout. Fins the same as the general body colour. Juveniles usually uniform light brown or black with a white stripe from dorsal origin to tip of snout.

Material examined: 138 specimens, 23 - 71.5 mm. in standard length. 26 from Lüderitzbucht, S.A.M. 10535, S.A.M. 24207; 17 from Port Nolloth, S.A.M. 24222; 22 from Lambert's Bay, S.A.M. 23931; 3 from Saldanha Bay, S.A.M. 17913; 6 from Sea Point, S.A.M. 23932 and 17/2/1965, S.A.M. not catalogued; 14 from Kalk Bay, S.A.M. 10536; 2 from Dalebrook, False Bay, S.A.M. 24239 and 18/4/1965, S.A.M. not catalogued; 20 from St. James, False Bay, 1962, S.A.M. not catalogued; 1 from Muizenberg beach, False Bay, S.A.M. 23935; 1 from False Bay, S.A.M. 23934; 5 from Onrust River Mouth, S.A.M. 24258; 1 from Hermanus, S.A.M. 23933; 9 from Die Dam, Bredasdorp district, S.A.M. 24505; 3 from Still Bay, S.A.M. 18077 and April, 1965, S.A.M. not catalogued; 4 from Great Fish Point and East London, S.A.M. 18091; 4 from East London, S.A.M. 23936.

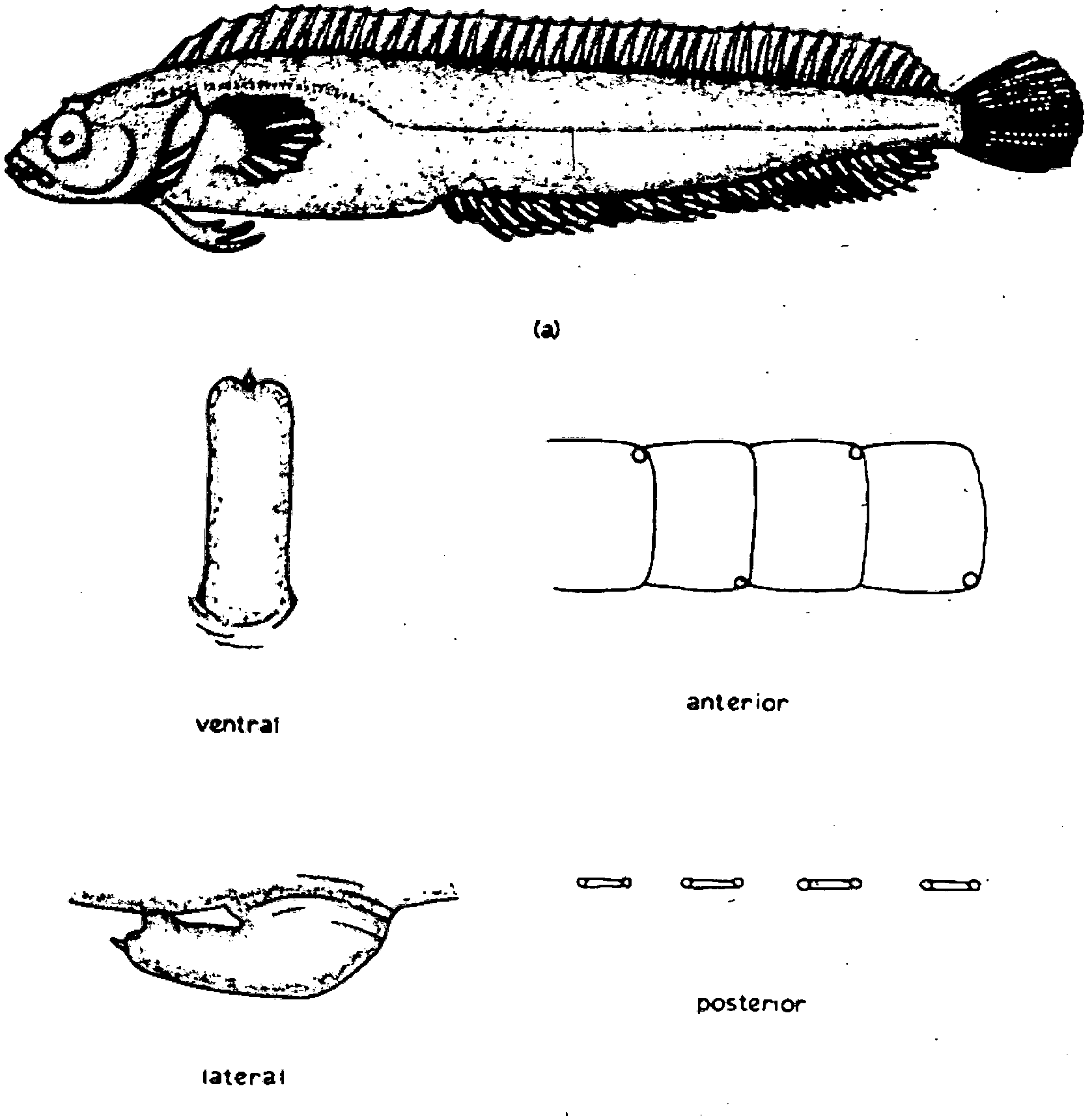
Remarks

Clinus dorsalis most closely resembles Clinus navalis. Jackson (1950) placed it in his subgenus Blennophis with Clinus anguillaris and Clinus striatus, but in view of the naked cheeks and the single soft dorsal ray it seems more appropriate to relate it to Clinus navalis, from which it is scarcely distinguishable in the juvenile stages, in spite of the lateral line differences.

Note on the author of Clinus dorsalis

Gilchrist & Thompson (1908), Thompson (1918), Barnard (1927), and Smith (1945, 1949) gave Bleeker (1860) as the author of this species, but this appears to be incorrect. The first record of the species was published by Bleeker (1860), but was listed as Clinus dorsalis Castelnau, although Castelnau's description of the species was published a year later, in 1861. In a brief not published in 1860 Castelnau discussed the fish fauna of South Africa and stated that he would be producing a memoir on the ichthyological fauna of southern Africa, in which 69 new species would be described. It seems probable that Bleeker saw and quoted from Castelnau's list of species prior to its publication in 1861. He should not be regarded as the author of the species, since he acknowledged Castelnau as the author, and the full description of the species was written and published by Castelnau.

Distribution: The known range of this species is Lüderitzbucht (South West Africa) to the Natal South Coast. Usually found among stones in pools high on the shore, but occurs at all levels in the intertidal region. It appears to be more common west of Cape Agulhas.



(c) Lateral line

(b) Intromittent organ

Fig 9 Clinus (Climacoporus) dorsalis

Clinus (Climacoporus) navalis (Barnard, 1935)

(fig. 10)

Climacoporus navalis Barnard, 1935 :646; Smith, 1945 :538; Smith, 1949 :352

Nemacoclinus navalis: Smith, 1937 :195

Description: D. XXXV - XXXVIII 1; A. II 23; P. 12; V. I 2 - 3; C. 13. Dorsal fin low, even. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner ray of pelvic fin reduced or absent. Caudal peduncle short, length 25 - 33.5% of head length, depth 25 - 33.5% of head length. Caudal fin subtruncate.

Body elongate, slightly compressed, covered with small scales extending on to dorsal, caudal, and anal fin bases but not head. Depth 5 - 6.25. Head 4 - 5.25 in standard length, snout rounded. Eye 3 - 4 in head. Supra-orbital tentacle prominent, with a flat stalk and a fringe of fine cirri terminally. Cirrus on anterior nostril small, flap-like, slightly emarginate below apex. Upper jaw 38 - 44.5% of head length. Lips thick. Vomer toothed.

Lateral line of double pores throughout; narrows and may become obscure towards tail (fig. 10(c)). Intromittent organ of male with a long, worm-like basal portion and a small pair of lips at the tip (fig. 10(b)).

Colouring: Yellow-brown to greenish, mottled and barred irregularly with darker green or brown; head green or reddish brown; belly cream.

A light-edged dark ocellus on shoulder.

Material examined: 10 specimens, 18 - 57 mm. in standard length. 1 from ship's bottom, Simonstown, False Bay, S.A.M. 18287 (holotype); 2 from Still Bay, April 1965, S.A.M. not catalogued; 1 from Port Elizabeth, S.A.M. 23889; 1 from Boknes Point, R.U.C.*; 2 from Great Fish Point, R.U.C.; 1 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 2 from Xora Mouth, R.U.C.

Remarks

The arrangement of the double pores of the lateral line of this species is exactly the same as the arrangement seen in the anterior part of the lateral line of other species which have double pores, such as *Clinus capensis*, and in view of the many features which *Clinus navalis* has in common with other species of the genus *Clinus*, particularly *Clinus dorsalis*, it is felt that to set this species apart on account of the lateral line would obscure its relationships with the rest of the group.

Distribution: The known range at present is Still Bay to Port St. John's. The species is rare.

* R.U.C. refers to the collection of the Rhodes University Ichthyology Department at Grahamstown

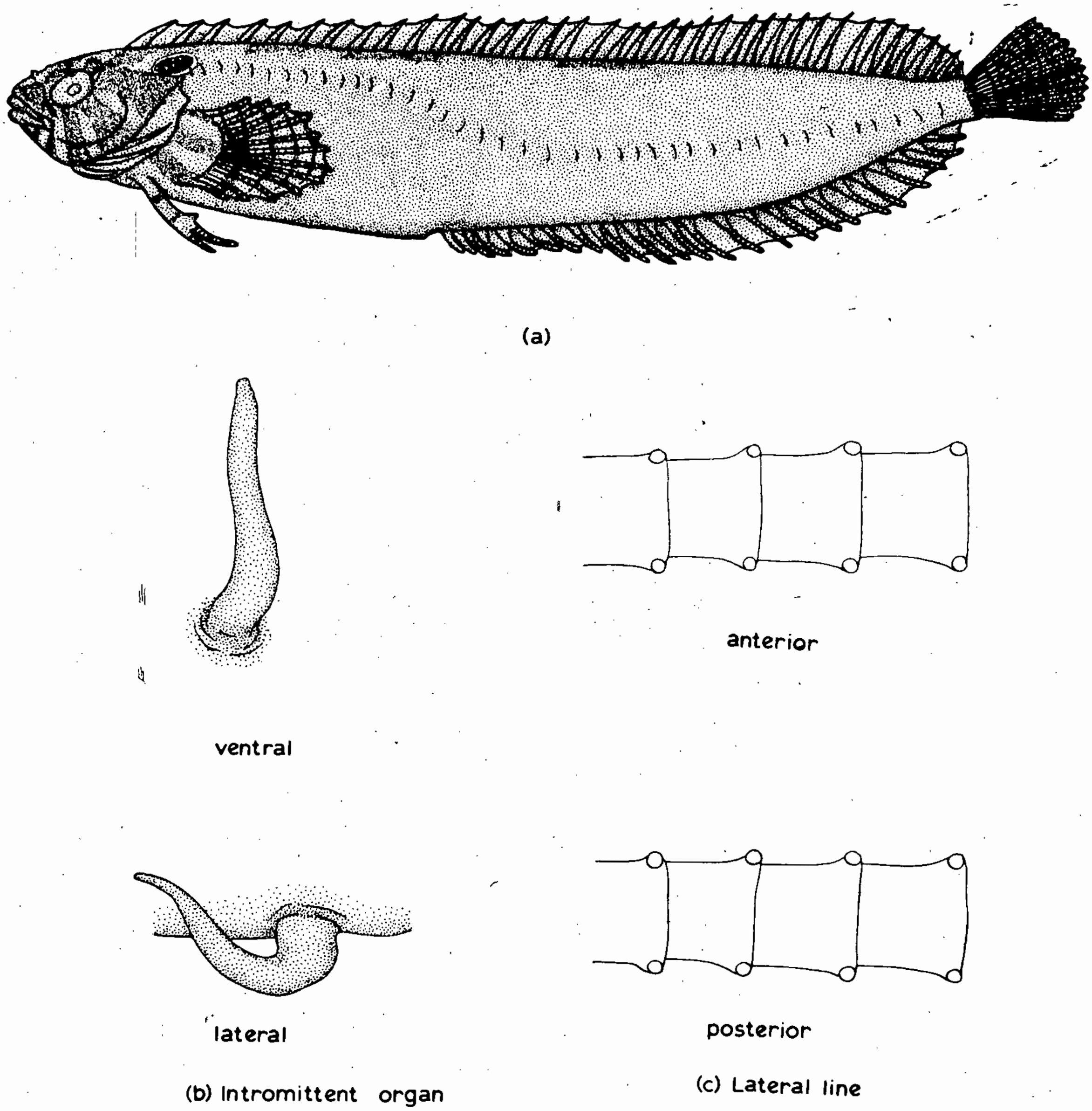


Fig. 10. Clinus (Climacoporus) navalis

Subgenus: Clinus Cuvier, 1817

Clinus Cuvier, 1817 :173 (type species Blennius acuminatus Bloch & Schneider)

Clinitrachus Swainson, 1839 :75 (in part) (type species Blennius variabilis Rafinesque)

Ophthalmolophus Gill, 1860 :104 (type species Clinus latipennis Cuvier & Valenciennes)

Blenniomimus Smith, 1945 :538 (type species Clinus taurus Gilchrist & Thompson, 1908)

Diagnosis: Body not elongate. Head naked. No barbels on chin or snout. More than one soft dorsal ray.

Thirteen species, occurring mainly among rocks in intertidal pools. These species are difficult to identify from a key, as they are extremely variable. Two keys are given, by means of which a correct identification should be able to be made, but species should always be compared with the description as well.

Key to the species of the subgenus Clinus

1. Anterior three dorsal spines, or at least the second and third dorsal spines, elevated, higher than fourth dorsal spine 2

   Anterior three dorsal spines equal to or shorter than fourth dorsal spine 6

2. Dorsal soft rays three or less. Second spine highest;no notch in membrane between third and fourth dorsal spines .... Clinus (Clinus) venustris

Dorsal soft rays four or more; a notch of varying depth in membrane between third and fourth dorsal spines 3

3. Pectoral rays 15 or more ...... Clinus (Clinus) superciliosus

Pectoral rays 14 or less 4

4. Crest high, triangular; dorsal fin originates over hind margin of eye .... Clinus (Clinus) woodi

Crest low, rectangular to rounded; dorsal fin originates over hind margin of preopercle 5

5. Lips with vertical corrugations; dorsal soft rays 9 or more .... Clinus (Clinus) robustus

Lips smooth; dorsal soft rays 7 or less ...... Clinus (Clinus) brevicristatus

6. A notch of varying depth in membrane between third and fourth dorsal spines 7

No notch in membrane between third and fourth dorsal spines..8

7. Interorbital concave, strong bony ridges over eyes; occiput with deep transverse groove .... Clinus (Clinus) taurus

Interorbital flat, no ridges over eyes; no deep occipital groove .... Clinus (Clinus) agilis

8. Interorbital strongly concave, bony ridges over eye; occipital groove deep; dorsal soft rays 6 or less .... Clinus (Clinus) cottoides

Interorbital flat, or only slightly concave; occipital grooves if present shallow 9

9. Dorsal soft rays 8 - 9 .... Clinus (Clinus) latipennis

Dorsal soft rays 7 or less 10

10. Dorsal soft rays 2 - 3 .... Clinus (Clinus) venustris

Dorsal soft rays 4 - 7 11

11. Dorsal spines 34 - 37 12

Dorsal spines 33 or less 13

12. Mucous pores on head open on papillae; snout bluntly rounded.. .... Clinus (Clinus) helenae

Mucous pores on head open flush with surface; snout more or less wedge-shaped .... Clinus (Clinus) berrisfordi

13. First dorsal spine shorter than fourth spine; pectoral rays usually 12; intromittent organ of male broad and flattened towards the tip .... Clinus (Clinus) acuminatus

First dorsal spine equal to or very slightly longer than fourth; pectoral rays 13; intromittent organ of male slender, cylindrical .... Clinus (Clinus) obtusifrons

Alternative key to the species of the subgenus Clinus

No. of soft dorsal rays		
2 - 3	1. Dorsal spines 39 - 41	*Clinus* (*Clinus*) *venustris*
	Dorsal spines 34 - 37	*Clinus* (*C.*) *agilis*
4	1. Interorbital concave	*Clinus* (*C.*) *cottoides*
	Interorbital flat 2	
	2. First 3 dorsal spines higher than fourth, forming a crest 3	
	First 3 dorsal spines lower than fourth, not forming a crest 4	
	3. Pectoral rays 15 or more	*Clinus* (*C.*) *superciliosus*
	Pectoral rays 14 or less	*Clinus* (*C.*) *brevicristatus*
	4. A notch in membrane between third and fourth dorsal spines; dorsal spines 34 - 37..	*Clinus* (*C.*) *agilis*
	No notch in membrane between third and fourth dorsal spines; dorsal spines 33 or less..	*Clinus* (*C.*) *acuminatus*
5	1. First 3 dorsal spines higher than fourth, forming a crest 2	
	First 3 dorsal spines lower than or equal to fourth, not forming a crest 4	

No.of soft

dorsal rays

5 2. Pectoral rays 15 or more ..... <u>Clinus</u> (<u>C.</u>) <u>superciliosus</u>

Pectoral rays 14 or less 3

3. Crest high, triangular, originates over hind margin of eye .... <u>Clinus</u> (<u>C.</u>) <u>woodi</u>

Crest low, originates over hind margin of pre-opercle .... <u>Clinus</u> (<u>C.</u>) <u>brevicristatus</u>

4. A notch in membrane between third and fourth dorsal spines .... <u>Clinus</u> (<u>C.</u>) <u>taurus</u>

No notch in membrane between third and fourth dorsal spines 5

5. A large round black spot on the opercle .... <u>Clinus</u> (<u>C.</u>) <u>cottoides</u>

No large black spot on opercle....6

6. First dorsal spine lower than fourth... 7

First dorsal spine equal to or a little longer than fourth .... <u>Clinus</u> (<u>C.</u>) <u>berrisfordi</u>

7. Dorsal spines 33 or less; pectoral rays 12 ... . <u>Clinus</u> (<u>C.</u>) <u>acuminatus</u>

Dorsal spines 34 or more; pectoral rays 13 ... . <u>Clinus</u> (<u>C.</u>) <u>helenae</u>

No. of soft

dorsal rays

6 1. First three dorsal spines high, forming a crest 2

First three dorsal spines not forming a crest 3

2. Pectoral rays 15 or more ...... Clinus (C.) superciliosus

Pectoral rays 14 or less ...... Clinus (C.) brevicristatus

3. A notch in membrane between third and fourth dorsal spines .... Clinus (C.) taurus

No notch in membrane between third and fourth dorsal spines 4

4. A large round black spot on the opercle .... Clinus (C.) cottoides

No large black spot on opercle. 5

5. First dorsal spine lower than fourth ... 6

First dorsal spine equal to or a little longer than fourth 7

6. Pectoral rays 12; dorsal spines 33 or less .... Clinus (C.) acuminatus

Pectoral rays 13; dorsal spines 34 or more .... Clinus (C.) helenae

No. of soft dorsal rays

6 7. Pectoral rays 12 .... Clinus (C.) berrisfordi

Pectoral rays 13 .... Clinus (C.) obtusifrons

7 1. First three dorsal spines high, forming a crest 8

First three dorsal spines not forming a crest 9

8. Pectoral rays 15 or more ..... Clinus (C.) superciliosus

Pectoral rays 14 or less ..... Clinus (C.) brevicristatus

9. First dorsal spine lower than fourth; pectoral rays 12; intromittent organ of male broad and flattened toward the tip .... Clinus (C.) acuminatus

First dorsal spine equal to or a little higher than fourth; pectoral rays 13; intromittent organ of male slender, cylindrical .... Clinus (C.) obtusifrons

8 1. First three dorsal spines high, forming a crest .. .. Clinus (C.) superciliosus

First three dorsal spines not forming a crest .... Clinus (C.) latipennis

9 1. Lips with vertical corrugations ... Clinus (C.) robustus

Lips smooth 2

No. of soft dorsal rays	
9	2. First three dorsal spines high, forming a crest .... *Clinus* (*C.*) *supercillosus*
	First three dorsal spines not forming a crest .... *Clinus* (*C.*) *latipennis*
10	1. Lips with vertical corrugations .... *Clinus* (*C.*) *robustus*
	Lips smooth .... *Clinus* (*C.*) *supercillosus*
11 - 14	.... *Clinus* (*C.*) *robustus*

<u>Clinus</u> (<u>Clinus</u>) <u>acuminatus</u> (Bloch & Schneider, 1801)

(fig. 11)

<u>Blennius acuminatus</u> Bloch & Schneider, 1801 :169

<u>Clinus acuminatus</u>: Cuvier, 1817 :173; Cuvier & Valenciennes, 1836 :370; Swainson, 1839 :75; Gilchrist & Thompson, 1908 :124; Barnard, 1927 :859; Hubbs, 1952 :106

<u>Ophthalmolophus acuminatus</u>: Smith, 1945 :342; Smith, 1949 :355

Description: D. XXXI – XXXIII (XXXII – XXXIII) 5 – 7; A. II 20 – 24 (21 – 22); P. 12 – 13 (12); V. I 2 – 3; C. 13. Dorsal fin low, even. Clusters of 2 – 3 cirri at tips of dorsal spines for about half length of dorsal fin. Pectoral fin rounded. Inner pelvic ray reduced or absent. Caudal peduncle short, length 20.5 – 33.5% of head length, depth 20 – 35% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to dorsal fin base; caudal and anal fin bases and head naked. Depth 4.5 – 6. Head large, 3.2 – 4 in standard length, snout wedge-shaped, angle of profile acute. Eye 2.75 – 5 in head. Supra-orbital tentacle prominent, with a short, flattened stalk terminating in a number of short, simple branches. Cirrus on anterior nostril short, flattened, trilobed. Upper jaw 34.5 – 50% of head length, increasing with size of fish. Lips moderate. Vomer toothed.

Lateral line usually of 2 – 4 double pores in front above opercle, then of mainly single pores opening above and below the line to post-pectoral curve; after that of short separate horizontal tubes with a pore at either end (fig. 11(c)). Intromittent organ of male large, flattened, and spade-shaped, with a moderately long, thick basal portion, a pair of small dorsal lips, and a large, broad pair of ventro-lateral lips ensheathing the tip (fig. 11(b)). Tip roughly crescent-shaped.

Colouring: Light green with broad, well-defined dark brown cross-bars, or with black speckling in sparse large spots with a mosaic-like pattern. Tips of all fins and of supra-orbital tentacles reddish orange. Belly silvery white. A dark ocellate spot on shoulder, and two dark radiating bands from eye across cheek. Small juveniles white with well-defined black cross-bars.

Material examined: 182 specimens, 19 - 113.5 mm. in standard length. 17 from Lüderitzbucht, S.A.M. 10544, S.A.M. 24206; 38 from McDougall's Bay, Port Nolloth, S.A.M. 24220; 12 from Port Nolloth, 12/7/1960, R.U.C.; 15 from Lambert's Bay, S.A.M. 21477, S.A.M. 23922, and 17/1/1964, S.A.M. not catalogued; 18 from Lambert's Bay, R.U.C.; 2 from Lambert's Bay, University of Cape Town; 2 from Schaapen Island, Langebaan, S.A.M. 23925; 8 from Sea Point, S.A.M. 22840, S.A.M. 23211; 3 from Kommetje, S.A.M. 10541; 3 from Froggy Pond, False Bay, S.A.M. 23924; 28 from St. James, False Bay, S.A.M. 12023 and 1962, S.A.M. not catalogued; 2 from St. James, False Bay, R.U.C.; 21 from False Bay, S.A.M. 10542; 2 from Cape Peninsula, University of Cape Town; 4 from Onrust River Mouth, 6/11/1964, S.A.M. not catalogued; 2 from Die Dam, Bredasdorp district, S.A.M. 24508; 5, no locality, R.U.C.

Remarks

Clinus acuminatus is similar on the one hand to Clinus agilis, having a flat interorbital, and on the other hand to species such as Clinus cottoides, Clinus obtusifrons, Clinus latipennis, and Clinus helenae, which lack a notch in the membrane between the third and fourth dorsal spines. It is also very similar to Clinus berrisfordi. Small specimens are rather similar in appearance to Clinus dorsalis, and occupy the same type of habitat. Smith's (1931) suggestion that Clinus agilis may be found to be a subspecies of Clinus acuminatus is not supported by a comparison of the two species, since they are not sufficiently alike in appearance to be confused even in the field, and differ in the dorsal and pectoral fin counts and the shape of the intromittent organ, as well as in the presence or absence of a notch in the membrane between the third and fourth dorsal spines.

Distribution: The known range at present is Lüderitzbucht (South West Africa) to Cape Agulhas. It is more common west of Cape Point. This species occurs in shallow pools under stones and ledges at the top of the intertidal region of the shore.

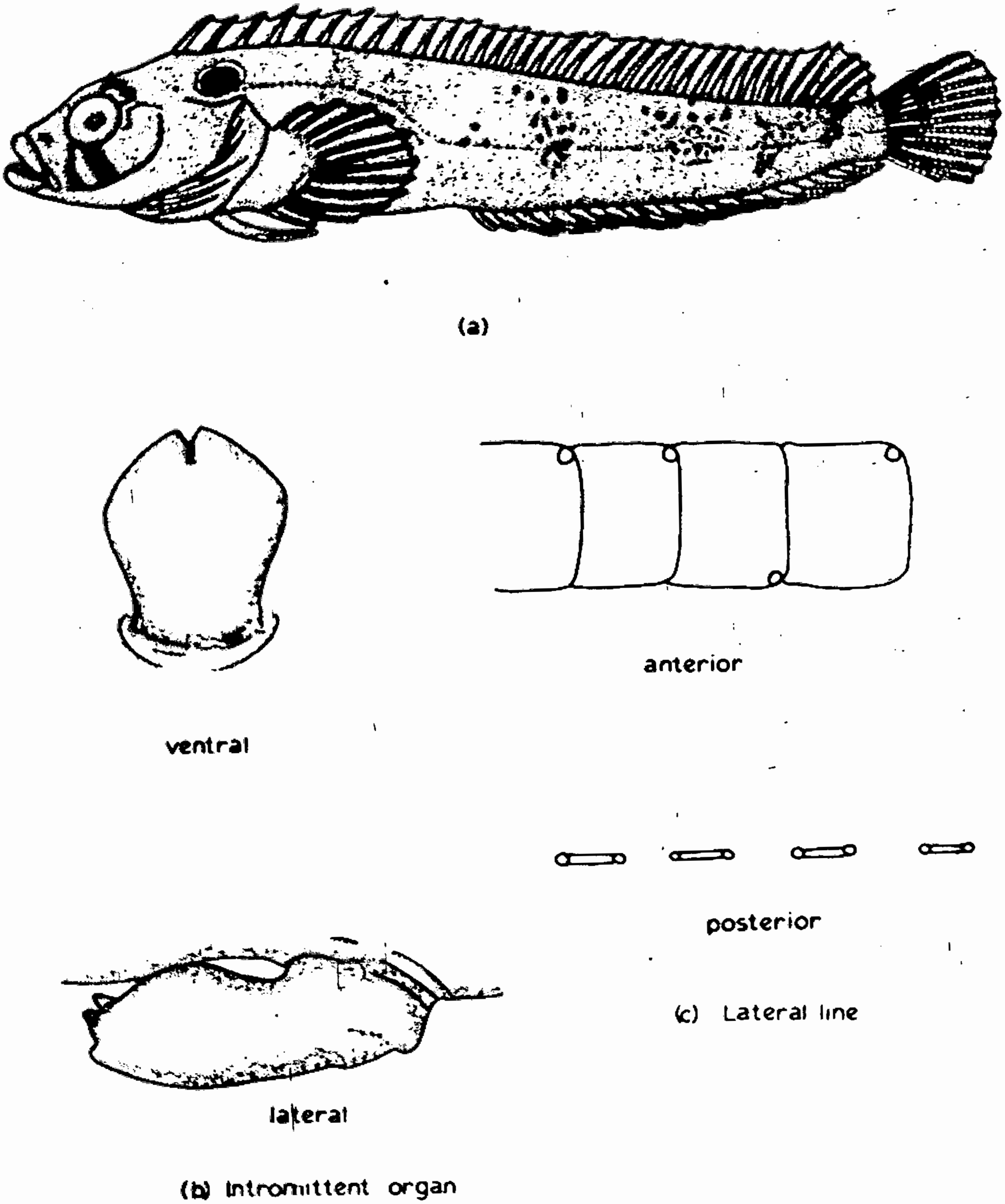


Fig. 11 Clinus (Clinus) acuminatus

<u>Clinus</u> (<u>Clinus</u>) <u>agilis</u> Smith, 1931

(fig. 12)

<u>Clinus</u> <u>agilis</u> Smith, 1931 :154

<u>Ophthalmolophus</u> <u>agilis</u>: Smith, 1945 :541; Smith, 1949 :355

<u>Ophthalmolophus</u> <u>anne</u> Smith, 1947 :733; Smith, 1949 :355

Description: D. XXXII - XXXVIII (XXXV - XXXVII) 2 - 4 (3); A. II 20 - 25 (22 - 23); P. 13 - 15; V. I 2 - 3; C. 13. Dorsal fin low, the first three spines not elevated to form a crest, but a notch in the membrane between the third and fourth dorsal spines, varying in depth, rarely absent (see table 5). Clusters of 3 - 4 cirri at tips of dorsal spines for about half length of fin. Pectoral fin rounded. Inner pelvic ray, if present, minute; usually absent. Caudal peduncle short, length 23 - 31% of head length, depth 25.5 - 29% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales not extending on to fin bases or head. Depth 4.5 - 5.25. Head 3.5 - 4.5 in standard length, snout rounded. Eye 3 - 4.25 in head. Supra-orbital tentacle prominent, with a flat stalk dividing into several short simple branches at the tip. Cirrus on anterior nostril long, narrow, pointed. Upper jaw 40 - 50% of head length. Lips fairly thick. Vomer toothed.

Lateral line of sometimes a few double pores but mostly of single pores opening above and below the line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 12(c)). Intromittent organ of male with a long basal portion; tip completely ensheathed by a fleshy fold presumably formed by the ensheathing lips becoming confluent. A pair of rounded fleshy lobes within the fold, between which is the minute tip (fig. 12(b)).

Colouring: Ground colour usually dark greyish or greenish, with about 7 distinct dark red and green cross-bars. Occasional specimens have pinkish or milky ground colour with darker pink cross-bars, or a vermilion ground colour with dark brown cross-bars. Fins dark, irregularly barred; a characteristic translucent area in membrane joining dorsal soft rays. Belly silvery white to greyish. Sometimes a sprinkling of white spots over body. Head with irregular lacy patterns in body colours, or plain dark grey. Usually a light-edged dark ocellate spot on shoulder. Juveniles white with well-defined red cross-bars.

Material examined: 666 specimens, 17 – 95 mm. in standard length. 191 from Lüderitzbucht, S.A.M. 24205; 1 from Sinclair's Island, R.U.C.; 3 from Orange River Mouth, 5 fms, S.A.M. 23964; 246 from Port Nolloth, S.A.M. 24214; 6 from Gert du Toit Bay and 4 from Doring Bay, southern Namaqualand, S.A.M. 24232; 108 from Lambert's Bay, S.A.M. 23919; 1 from Lambert's Bay, R.U.C.; 13 from Steenberg's Cove, St. Helena Bay, 1962, S.A.M. not catalogued; 3 from Saldanha Bay, S.A.M. 22072, S.A.M. 23921; 5 from Langebaan, S.A.M. 21475, S.A.M. 21479; 38 from Sea Point, S.A.M. 23212, S.A.M. 23920, and 17/2/1965, S.A.M. not catalogued; 6 from Froggy Pond, False Bay, S.A.M. 23906; 2 from Dale brook, False Bay, 19/2/1965, S.A.M. not catalogued; 1 from Knysna, S.A.M. 18278 (paratype); 38 from Knysna, S.A.M. 24233.

Remarks

It has been felt for some time at the South African Museum that this species and Ophthalmolophus anne Smith, 1947 are probably conspecific, since, in attempting to identify large samples from the west coast one might arrive at either species in Smith's (1949) key, or at both species for different specimens of the same sample. Smith (1931) created agilis for seven specimens taken from Knysna estuary, ranging in size from 55 - 65 mm. In 1947 he created anne for five specimens, 24 - 50 mm., from the west coast, mainly Lambert's Bay. He differentiated anne from agilis on the following points:- (1) Number of dorsal spines (34 - 35 for agilis, 36 - 37 for anne); (2) eye size (3 - 4 in head in agilis, 4.2 - 4.5 in head in anne); (3) snout length greater in anne (no figures given); (4) pectoral length (greater in anne, no figures given); (5) Pelvic length (less in anne, no figures given). Since so few specimens were examined, and the size range of the samples did not overlap at all, the four points relating to body proportions may safely be ignored. In the Clinidae body proportions have been found to vary considerably with size, so that comparable size ranges are essential for the comparison of body proportions of different species; furthermore, the ranges found for body proportions tend to be very wide in the Clinidae, so that other features are usually more important for delimiting species. In any case, the orbit diameter of 19 specimens of Clinus agilis, all from the west coast and therefore falling in Smith's species anne, was measured, and was found to be 2.6 - 4.25 in head (size range of specimens 31 - 93 mm. in standard length), very close to the range found by Smith (1931) for his Knysna specimens. 15 specimens from Knysna, ranging from 31 - 59 mm. in standard length, showed an orbit diameter range of 2.5 - 3.5 (see table 6). As far as the dorsal spine count is concerned, in a sample of 94 specimens from Lambert's Bay counts were found to vary from 33 to 38, most fishes having 35 - 36 dorsal spines, while a sample of 44 specimens from Knysna and False Bay was found to have a range of 32 - 36 spines, most specimens having 34 - 35 (table 7). This suggests a clinal difference between east and west coasts such as is seen also in the dorsal spine counts of Clinus superciliosus, rather than a specific difference. A further clinal difference is seen in the number of pectoral rays, being usually 13 in east coast specimens (i.e. east of Cape Point) and usually 14 in specimens from localities west of Cape Point, although there is much overlap (table 8). The identical intromittent organ of east and west coast specimens is the strongest argument in favour of joining these species, since the shape of the intromittent organ is strongly species-specific in the genus *Clinus*.

Smith (1947) stated that if the seven Knysna specimens and the five west coast (Lambert's Bay) specimens had not been so widely separated geographically he would have placed them in the same species. A study of clinid distribution in South Africa has shown that there are few species from the west coast of South Africa which do not occur at least as far east as Port Elizabeth, so that the occurrence of a species at both Lambert's Bay and Knysna is not unexpected, particularly when the species has been recorded from False Bay on several occasions as well.

It is proposed therefore that *Ophthalmolophus anne* Smith, 1947 should become a synonym of *Clinus agilis* Smith, 1931, since the two species are indistinguishable. *Clinus agilis* is common on the west coast of South Africa but becomes rare east of Cape Point.

Barnard (1948) suggested that *Clinus agilis* might be the young of *Clinus taurus* Gilchrist & Thompson, but the two species are easily distinguishable in all stages by the shape of the interorbital, which is strongly concave in *Clinus taurus* and flat in *Clinus agilis*, and by the number of dorsal soft rays (2 - 4 in *Clinus agilis* and 5 - 6 in *Clinus taurus*).

Table 6. Comparison of orbit diameter of <u>Clinus agilis</u> from south-east and south-west coasts of the Cape

East coast (<u>agilis</u> Smith)		West coast (<u>anne</u> Smith)	
Std. length (mm.)	Eye in head	Std. length (mm.)	Eye in head
31	3.3	31	3.3
31	2.7	31	2.8
32	3.3	31	3.3
33	3.3	33	3.3
35	3.0	35	2.9
37	3.0	37	2.7
39	2.5	38	2.6
39	3.0	39	3.1
42	2.9	42	3.0
48	2.9	47	3.0
49	3.4	49.5	3.3
51	3.5	51	3.4
52	3.5	53	3.5
55	2.9	55	3.1
59	3.3	60	3.4
		67	3.5
		70	3.6
		82	4.25
		93	3.8

Table 7. Dorsal spine counts of <u>Clinus agilis</u> from south-east and south-west coasts of the Cape

Locality	Number of dorsal spines						
	32	33	34	35	36	37	38
East coast (no. of specimens)	2	4	12	21	5	0	0
West coast (no. of specimens)	0	1	5	31	39	17	1

Table 8. Pectoral ray counts of <u>Clinus agilis</u> from south-east and south-west coasts of the Cape

Locality	Number of pectoral rays		
	13	14	15
East coast (no. of specimens)	39	5	0
West coast (no. of specimens)	13	76	5

<u>Clinus agilis</u> is in some ways intermediate between forms with a low, even dorsal fin and no notch in the membrane joining the third and fourth dorsal spines, such as <u>Clinus acuminatus</u>, and forms with a low dorsal crest and a notch in the membrane joining the third and fourth dorsal spines, such as <u>Clinus brevicristatus</u>. There is a marked similarity in appearance between <u>Clinus agilis</u> and <u>Clinus brevicristatus</u> both in body form and colour pattern,

but in the latter the first three dorsal spines are elevated, forming a crest, and there are more soft dorsal rays.

Distribution: The known range at present of this species is Lüderitzbucht (South West Africa) to Knysna and Port Alfred, common on the west coast in pools at all levels of the shore and also taken infratidally, but on the whole rare on the east coast, although a fairly large number of specimens was taken in Knysna lagoon.

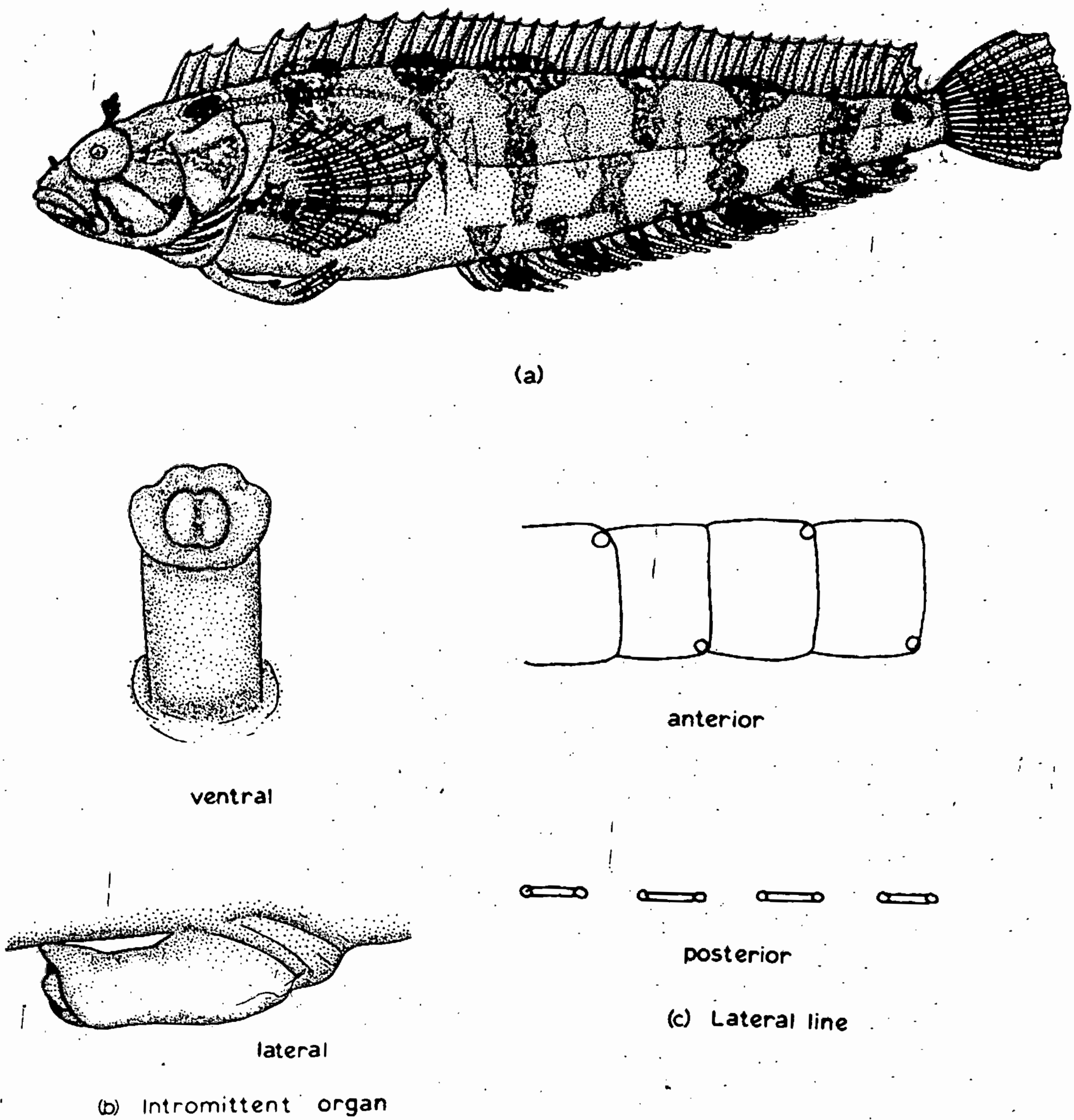


Fig. 12. Clinus (Clinus) agilis

Clinus (Clinus) berrisfordi Penrith (in press)

(fig. 13)

Clinus berrisfordi Penrith (in press)

Description: D. XXXIII - XXXVI (XXXIV - XXXV) 5 - 6; A. II 23 - 25 (23 - 24); P. 11 - 12 (12); V. I 3; C. 13. First three dorsal spines not elevated to form a crest, but equal to or a little longer than fourth dorsal spine. No notch in membrane between third and fourth dorsal spines. Dorsal spines with clusters of 3 fine cirri at tips for about half length of fin. Pectoral fin rounded. Inner pelvic ray minute but present in all specimens examined. Caudal peduncle short, length 20 - 35% of head length, depth 20 - 35% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 4.5 - 5 in standard length. Head 3.4 - 4 in standard length, snout wedge-shaped, profile acute. Eye 3 - 4.2 in head. Supra-orbital tentacle prominent, with a flattened stalk ending in a number of long slender filaments. Cirrus on anterior nostril with a narrow stalk and a flattened, bilobed tip. Upper jaw 36.4 - 50% of head length. Lips moderate. Vomer toothed.

Lateral line of usually about 27 double pores in front to post-pectoral curve, sometimes a few single pores opening above or below the line, then of short separate horizontal tubes with a pore at either end (fig. 13(c)). Intromittent organ of male with a long basal portion and a small upturned tip, lateral lips not prominent, rounded (fig. 13(b)).

Colouring: Reddish orange with about seven faint broad darker cross-bars. Two dark radiating lines from eye across cheek. A dark ocellate spot on shoulder. Fins reddish orange, faintly mottled and barred.

Material examined: 16 specimens, 37.5 - 106 mm. in standard length. 16 from Onrust River Mouth, S.A.M. 24601 (holotype), S.A.M. 24221 (paratypes).

Remarks

This species is similar in appearance to *Clinus acuminatus* and *Clinus obtusifrons*, but differs from the former in the dorsal and anal fin counts, the form of the intromittent organ, the height of the first dorsal spine, the form of the supra-orbital tentacle, the anterior part of the lateral line, and the habitat, occurring at a much lower level on the shore. It differs from the latter in the dorsal, anal, and pectoral fin counts, the intromittent organ (although of all the species of *Clinus*, *Clinus berrisfordi* and *Clinus obtusifrons* have the most similar form of intromittent organ), the anterior part of the lateral line, the clusters of cirri on the dorsal spines, and in having a narrower interorbital.

Distribution: So far taken only at Onrust River Mouth, near Hermanus. The sixteen specimens were taken from a weedy pool at the bottom of the intertidal region.

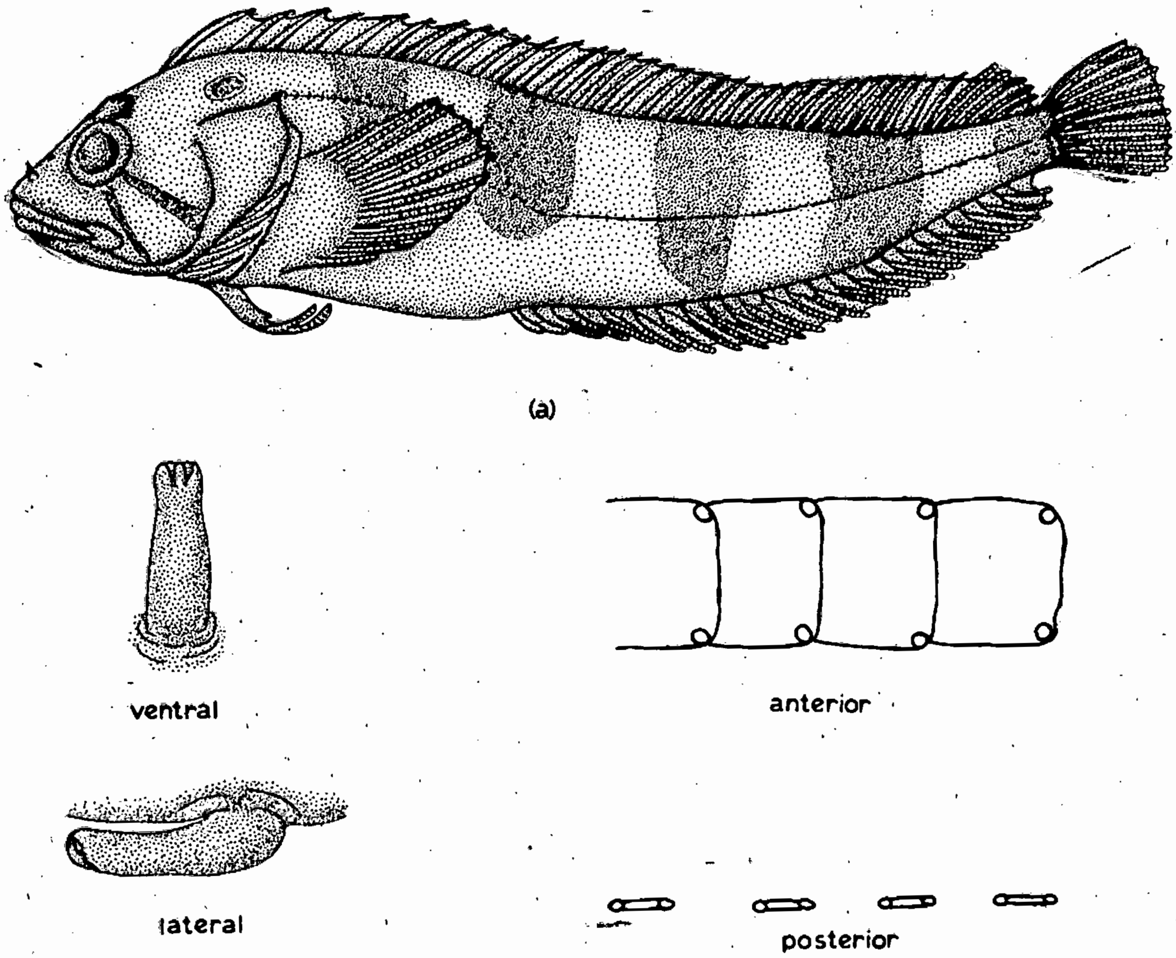


Fig. 13. Clinus (Clinus) berrisfordi

Clinus (_Clinus_) _brevicristatus_ Gilchrist & Thompson, 1908

(fig. 14)

Clinus brevicristatus Gilchrist & Thompson, 1908 :118; Barnard, 1927 :856

Petraites brevicristatus: Smith, 1945 :540; Smith, 1949 :353

Description: D. XXXIII - XXXVI (XXXV - XXXVI) 4 - 7 (5); A. II 21 - 24; P. 12 - 14 (12 - 13); V. I 3; C. 13. First three dorsal spines elevated to form a low crest, fourth dorsal spine 70% to over 90% of first dorsal spine. A notch of varying depth in membrane between third and fourth dorsal spines (see table 5). Clusters of 4 - 6 cirri at tips of all dorsal spines. Pectoral fin rounded. Inner pelvic ray minute. Caudal peduncle short, length 21 - 34.5% of head length, depth 21 - 28% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to dorsal fin base but not caudal or anal fin bases or head. Depth 4.5 - 5. Head 3.75 - 4.75 in standard length, snout bluntly rounded. Eye 2.75 - 3.25 in head. Supra-orbital tentacle prominent, with a short subcylindrical stalk and a round, flattened tip ending in several simple branches. Cirrus on anterior nostril prominent, elongate, flat and narrow, with a slightly indented margin. Upper jaw 40 - 48.5% of head length. Lips fairly thin. Vomer toothed.

Lateral line of usually about 25 double pores in front (a few may be single opening above or below the line), to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 14(c)). Intromittent organ of male with a fairly long basal portion and a single pair of ovate lateral lips ensheathing the base of the tip, which is slightly swollen, narrowing terminally (fig. 14 (b)).

Colouring: Ground colour usually light grey, with about seven vermilion cross-bars, having shorter brown bars between them. The cross-bars may, however, be various shades of green, brown, or deep red. The cross-bars extend on to dorsal and anal fins, but membrane joining dorsal soft rays has irregular translucent patches. Caudal and pectoral fins finely barred with dark brown. A 3-shaped dark mark at base of pectoral fin, and a dark stripe from edge of branchiostegal membrane to ventral edge of pectoral fin base. Operculum with an irregular dark mark; two irregular dark bands radiate from eye across cheek. Pelvic fins barred with brown. Belly silvery white to greyish. Head grey or pinkish.

Material examined: 36 specimens, 29 - 79 mm in standard length. 2 from Lambert's Bay, R.U.C.; 1 from Simon's Bay, False Bay, S.A.M. 24243; 1 from Kalk Bay, False Bay, S.A.M. 9988 (holotype); 5 from Dalebrook, False Bay, S.A.M. 23870 and 18/12/1964, S.A.M. not catalogued; 1 from St. James, False Bay, 16/5/1965, S.A.M. not catalogued; 26 from Strandfontein, False Bay, S.A.M. 23871, S.A.M. 23872, S.A.M. 23954, S.A.M. 23971, S.A.M. 23976, S.A.M. 24242.

Remarks

Clinus brevicristatus is very similar to the species with a low dorsal fin such as *Clinus cottoides*, *Clinus acuminatus*, *Clinus venustris*, and particularly *Clinus agilis*. The species was described from a single female specimen from Kalk Bay, in False Bay. During this study further specimens of both sexes and covering a fairly wide size range have been collected from weedy areas at Strandfontein and Dalebrook in False Bay. This species is no more similar to *Clinus woodi*, with which it was placed in the genus *Petraites* by Smith (1945), then it is to *Clinus venustris* or *Clinus agilis*; in fact it resembles the latter two species far more closely. The development of the crest is poor in both male and female specimens, unlike in *Clinus woodi*, in which the crest is high and triangular in both sexes, and almost entirely separate from the rest of the fin. In *Clinus brevicristatus* the crest is low and rounded, and in fact resembles the condition in *Clinus agilis* (with a notch in the membrane between the third and fourth dorsal spines and the first three dorsal spines not elevated) more closely than it does the condition in *Clinus woodi*. The intromittent organ is very similar to that of Clinus cottoides. *Clinus brevicristatus* does not appear to reach a large size. This species is peculiar in the genus *Clinus* in that it lives almost exclusively in weed-beds.

Distribution: The known range at present is from Lambert's Bay to False Bay. It is not common. Taken at low tide in False Bay from dense beds of the green weed *Caulerpa filiformis*, intertidal.

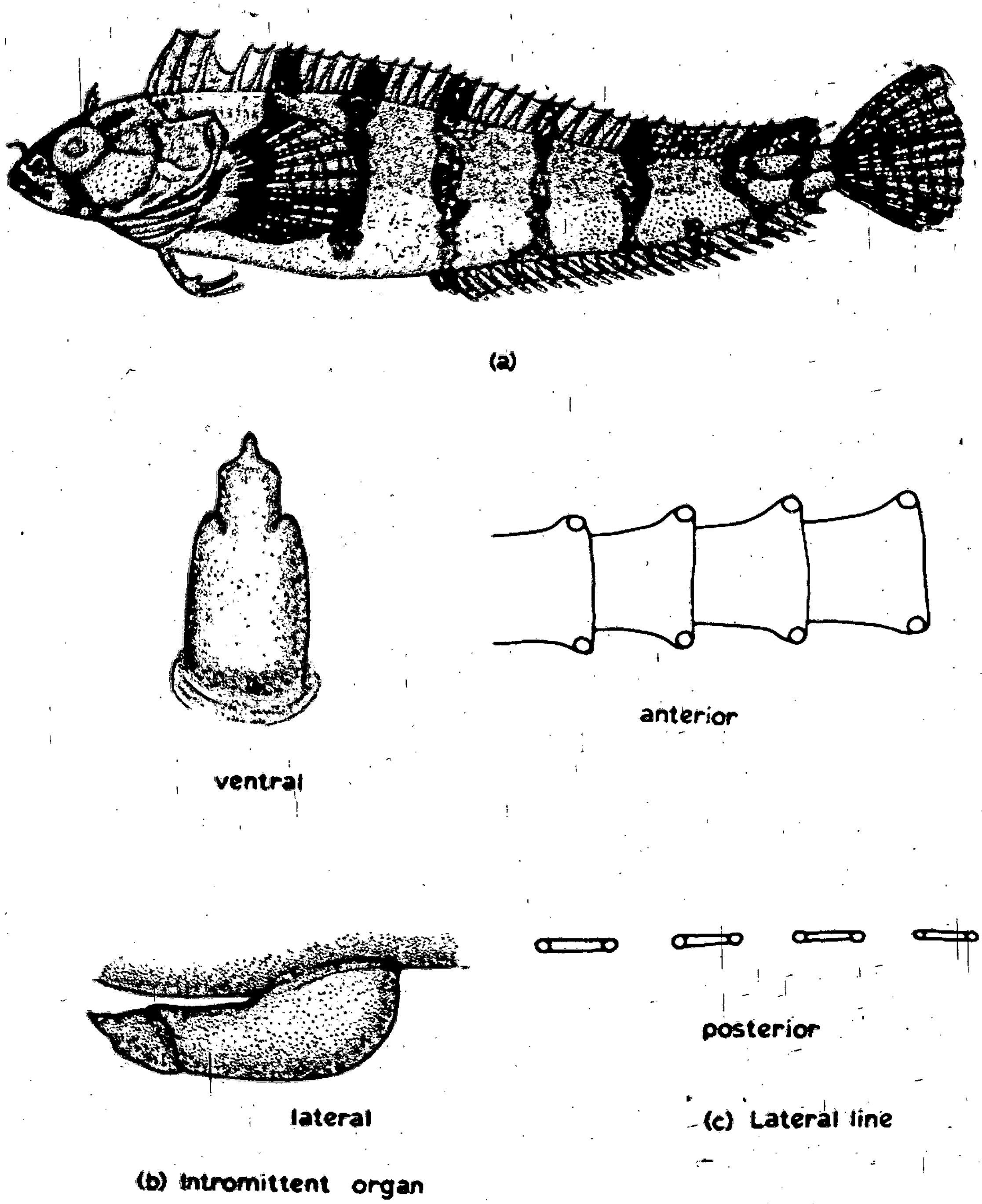


Fig. 14. Clinus (Clinus) brevicristatus

Clinus (Clinus) cottoides Cuvier & Valenciennes, 1836

(fig. 15)

Clinus cottoides Cuvier & Valenciennes, 1836 :367; Swainson, 1839 :276; Gilchrist & Thompson, 1908 :125; Barnard, 1927 :858

Blenniomimus cottoides: Smith, 1945 :539; Smith, 1949 :353

Description: D. XXXI – XXXVI (XXXIII – XXXIV) 4 – 6 (5 – 6); A. II 21 – 25; P. 12 – 14 (12 – 13); V. I 2 – 3; C. 13. Dorsal fin low, even, anterior spines shortest; no notch in membrane between third and fourth dorsal spines. Pectoral fin rounded. Inner pelvic ray minute or absent. Caudal peduncle short, length 30.5 – 34.5% of head length, depth 21 – 26% of head length. Caudal fin subtruncate.

Body slightly compressed, tapering markedly towards tail, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 4.5 – 5.5. Head very large, heavy, 3.25 – 4.25 in standard length. Snout bluntly rounded. Head becomes heavier in relation to body with age. Eye very large, 2.25 – 3.5 in head. Interorbital concave, a bony ridge above each eye. Deep grooves across occiput. Supra-orbital tentacle prominent, on bony ridge, with a flattened stalk and numerous long filamentous cirri terminally. Cirrus on anterior nostril short, flattened, with about four short, simple branches terminally. Mouth large, increasing with size of fish, upper jaw 42 - 60% of head length. Lips thin. Vomer toothed.

Lateral line usually of about 18 - 20 double pores, interspersed with or followed by a few single pores opening above or below the line, in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 15(c)). Intromittent organ of male with a fairly long basal portion and a single pair of rounded dorso-lateral lips between which the tip, which is slightly swollen at the base with a narrow termination, protrudes (fig. 15(c)).

Colouring: Ground colour slaty grey or dull greenish with irregular mottling, often in a lacy pattern with vague cross-bars extending on to dorsal and anal fins, chiefly dark grey, dark red, and whitish. Fins dusky, faintly mottled and barred. Three small dark lines on pectoral base. A prominent round black spot on opercle. A dark mark behind centre of eye, below which two narrow dark lines radiate from eye across cheek. Head and lips dusky to slate-grey; terminal filaments of supra-orbital tentacle white. Belly white to greyish. Juveniles milky with fine lacy dark markings particularly in upper half of body; opercular spot well defined at all stages.

Material examined: 970 specimens, 18 - 120 mm. in standard length. 26 from Doring Bay, southern Namaqualand, S.A.M. 24229; 4 from southern Namaqualand, R.U.C.; 101 from Lambert's Bay, S.A.M. 23940;

12 from Lambert's Bay, R.U.C.; 3 from Saldanha Bay, S.A.M. 17914; 1 from Langebaan, S.A.M. 21480; 6 from Mouille Point, Cape Peninsula, 5/5/1965, S.A.M. not catalogued; 42 from Sea Point, S.A.M. 23941, S.A.M. 23942, and 17/2/1965, S.A.M. not catalogued; 1 from Hout Bay, S.A.M. 12013; 2 from Miller's Point, False Bay, S.A.M. 22906, S.A.M. 23937; 164 from Froggy Pond and Miller's Point, False Bay, S.A.M. 23939; 113 from Dalebrook, False Bay, 19/2/1965, 3/3/1965, and 18/4/1965, S.A.M. not catalogued; 25 from St. James, False Bay, S.A.M. 10540; 80 from Strandfontein, False Bay, S.A.M. 23978, and 12/1/1964 and 13/8/1964, S.A.M. not catalogued; 33 from Onrust River Mouth, S.A.M. 23938, S.A.M. 24230; 2 from hermanus, S.A.M. 18095; 4 from Die Dam, Bredasdorp district, S.A.M. 24510; 59 from Still Bay, April 1965, S.A.M. not catalogued; 35 from Mossel Bay, S.A.M. 23947; 4 from Knysna, S.A.M. 24230; 53 from Plettenberg Bay, S.A.M. 23946; 72 from Port Elizabeth, S.A.M. 23945, S.A.M. 23985; 1 from Kidd's Beach, East London, 1/7/1965, S.A.M. not catalogued; 14 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 104 from East London, S.A.M. 23943, S.A.M. 23944, S.A.M. 24228, and 27/6/1965, S.A.M. not catalogued; 2 from Gonubie River Mouth, East London, 28/6/1965, S.A.M. not catalogued; 2 from Kei Mouth, 30/6/1965, S.A.M. not catalogued; 1 juvenile from Mozambique Island, R.U.C.

Remarks

Smith (1945) considered the concave interorbital of this species and of Clinus taurus to be of significance at the generic level. However, it has been found that _Clinus latipennis_, large specimens of _Clinus obtusifrons_, and to a slight degree _Clinus helenae_, also have a concave interorbital with low bony ridges over the eyes, so that instead of a clear-cut division there is a series, from _Clinus obtusifrons_, in which the supra-orbital ridges are only noticable in large specimens, to _Clinus taurus_, in which the ridges are very heavy. These species all appear to be closely related to each other and to species lacking the ridge, such as _Clinus acuminatus_ and _Clinus berrisfordi_.

Specimens of _Clinus cottoides_ from East London were carefully compared with specimens from Lambert's Bay, and no east-west clinal differences were found in the fin counts of this species. _Clinus cottoides_ does, however, attain a considerably greater size on the west coast than east of Cape Point.

Distribution: The known range at present is from southern Namaqualand (Olifants River Mouth) to the Kei River. It is one of the most abundant species from Lambert's Bay to the Kei River, particularly from False Bay eastwards. A single tiny juvenile from Mozambique Island was seen in the Rhodes University Ichthyology Department, but this seems to be well outside the normal range for this species, which has not been recorded otherwise much north of the Kei River. _Clinus cottoides_ was recorded by Kner (1865 - 67) from Java, but de Beaufort & Chapman (1955) stated that this record is certainly erroneous; its occurrence outside South African waters is most improbable.

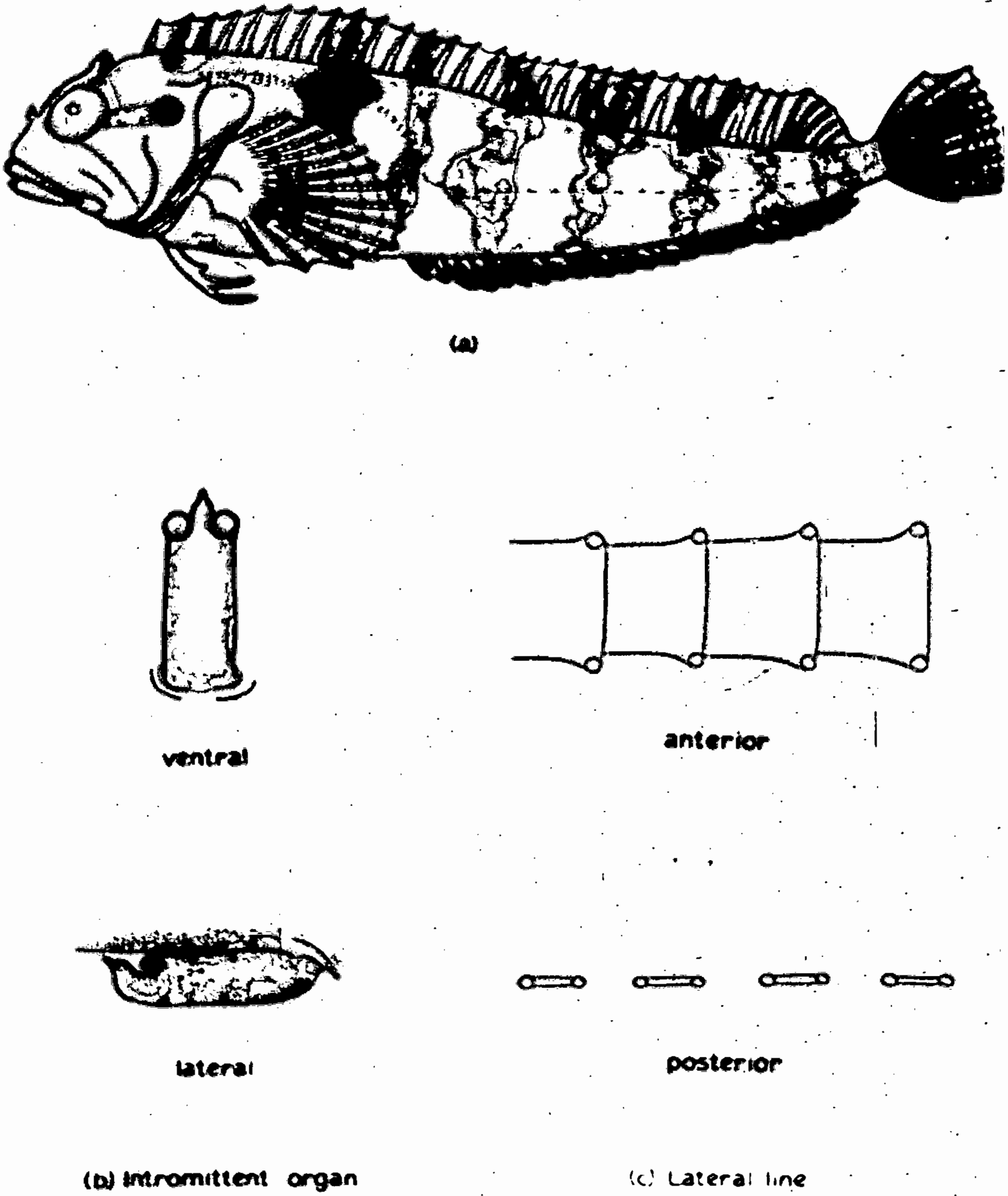


Fig 15 Clinus (Clinus) cottoides

<u>Clinus</u> (<u>Clinus</u>) <u>helenae</u> (Smith, 1945)

(fig. 16)

<u>Ophthalmolophus</u> <u>helenae</u> Smith, 1945 :542; Smith, 1949 :355

Description: D. XXXIV - XXXVII 5 - 6; A. II 24 - 25; P. 13; V. I 3; C. 13. Dorsal fin low, even; no notch in membrane between third and fourth dorsal spines. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray minute. Caudal peduncle short, length 30 - 35.5% of head length, depth 20 - 24% of head length, noticably longer than deep. Caudal fin subtruncate.

Body slightly compressed, covered with small scales not extending on to dorsal, anal, or caudal fin bases or head. Depth 4.5 - 5. Head 3.75 - 4.75 in standard length, snout bluntly rounded. Interorbital slightly concave, low bony ridges over the eyes; occipital grooves moderately deep. Eye 3 - 5 in head. Supra-orbital tentacle prominent, with a flattened stalk and a terminal fringe of long fine filamentous cirri. Cirrus on anterior nostril small, simple, flap-like. Upper jaw 39.5 - 52.5% of head length. Lips moderately thick. Vomer toothed.

Lateral line of mainly double pores, with a few single pores opening above or below the line, in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 16(c)). Intromittent organ of male with a moderately long basal portion; a small pair of circular dorsal lips and a large pair of ventro-lateral lips with finely serrated ventral margins ensheathing the tip. A small pair of lateral lobes on basal portion (fig. 16 (b)).

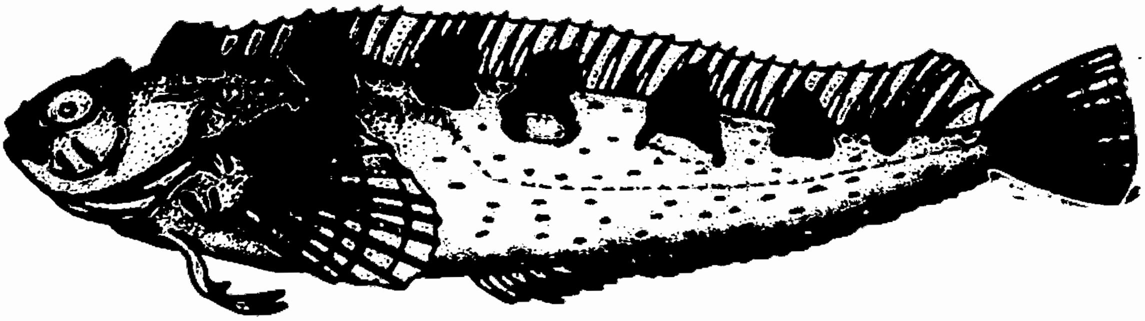
Colouring: A single fresh specimen from Kei Mouth was light grey, with darker mottling in the form of irregular cross-bars; body and head speckled with white. Smith (1945) described the colouring of his specimens as "light brown, with seven darker broken cross-bands. Darker spots and speckles on head and body". The fins are finely spotted and barred.

Material examined: 8 specimens, 67.5 - 78.5 mm. in standard length. 4 from Boknes Point, R.U.C.; 3 from Cape Morgan, R.U.C.; 1 from Kei Mouth, 30/6/1965, S.A.M. not catalogued.

Remarks

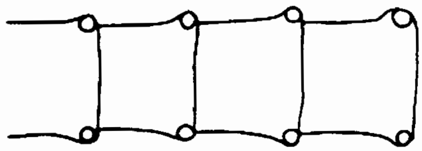
Clinus helenae resembles *Clinus cottoides*, *Clinus taurus*, and particularly *Clinus latipennis* in the form of the head, although the concave interorbital is least marked in this species, and an attempt to use the form of the interorbital as a subgeneric distinction would be rendered difficult by this species. It is also similar to *Clinus obtusifrons* (in which the interorbital becomes concave only in large specimens), *Clinus berrisfordi*, and *Clinus acuminatus*. The intromittent organ is similar to that of *Clinus latipennis*, the only other species which has a pair of subsidiary lobes on the basal portion.

Distribution: The known range at present is Port Alfred to the Bashee River; rare.



(a)

ventral



anterior

lateral

posterior

(b) Intromittent organ

(c) Lateral line

Fig 16 Clinus (Clinus) helenae

Clinus (Clinus) latipennis Cuvier & Valenciennes, 1836

(fig. 17)

Clinus latipennis Cuvier & Valenciennes, 1836 :394; Barnard, 1927 :860; Hubbs, 1952 :106

Clinus latipinnis: Gilchrist & Thompson, 1908 :127

Labrisomus latipennis: Swainson, 1839 :277

Ophthalmolophus latipinnis: Gill, 1860 :104; Smith, 1945 :542

Ophthalmolophus latipennis: Smith, 1949 :355

Description: D. XXXIII - XXXVI 8 - 9; A. II 23 - 26; P. 13 - 14; V. I 2 - 3; C. 13. Dorsal fin low, even; no notch in membrane between third and fourth dorsal spines. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray minute or absent. Caudal peduncle short, length 27.5 - 33.3% of head length, depth 20 - 33% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to dorsal fin base; caudal and anal fin bases and head naked. Depth 4.85 - 5.2. Head 3.5 - 5.5 in standard length, snout bluntly rounded. Interorbital slightly concave, a low bony ridge over eye. Occipital grooves moderately deep. Eye 3.2 - 4.6 in head. Supra-orbital tentacle prominent, with a flattened stalk, an expanded tip, and a terminal fringe of fine filamentous cirri. Cirrus on anterior nostril flattened, narrow at the base with an expanded, trilobate tip. Upper jaw 35 - 43.5% of head length. Lips moderately thin. Vomer toothed.

Lateral line of about 28 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 17 (c)). Intromittent organ of male with a moderately long basal portion and a squarish tip ensheathed by a pair of large, flattened ventral lobes. Three small rounded lobes at base of organ, two lateral and one anterior (fig. 17 (b)).

Colouring: Pinkish brown with faint irregular darker mottling and speckling. Fins whitish, dorsal with about seven dark cross-bars not reaching upper edge of fin. Pectoral and caudal fins with clusters of small black dots forming irregular spots. Head grey-brown, mottled. A few white spots on pectoral base and along sides.

Material examined: 3 specimens, 52 - 102 mm. in standard length. 1 from St. James, S.A.M. 10533; 2 from Die Dam, Bredasdorp district, March 1965, S.A.M. not catalogued.

Remarks

This species is poorly known, although it was one of the earliest described species. There are three specimens in the South African Museum, two of which were acquired recently so that fresh material was available for study. This species is extremely similar to Clinus helenae, particularly in the occurrence of basal lobes around the intromittent organ. It is distinguished from Clinus helenae by the higher number of dorsal soft rays. It is also very similar in appearance to *Clinus cottoides*.

Distribution: The known range at present is from Table Bay to Cape Agulhas; rare.

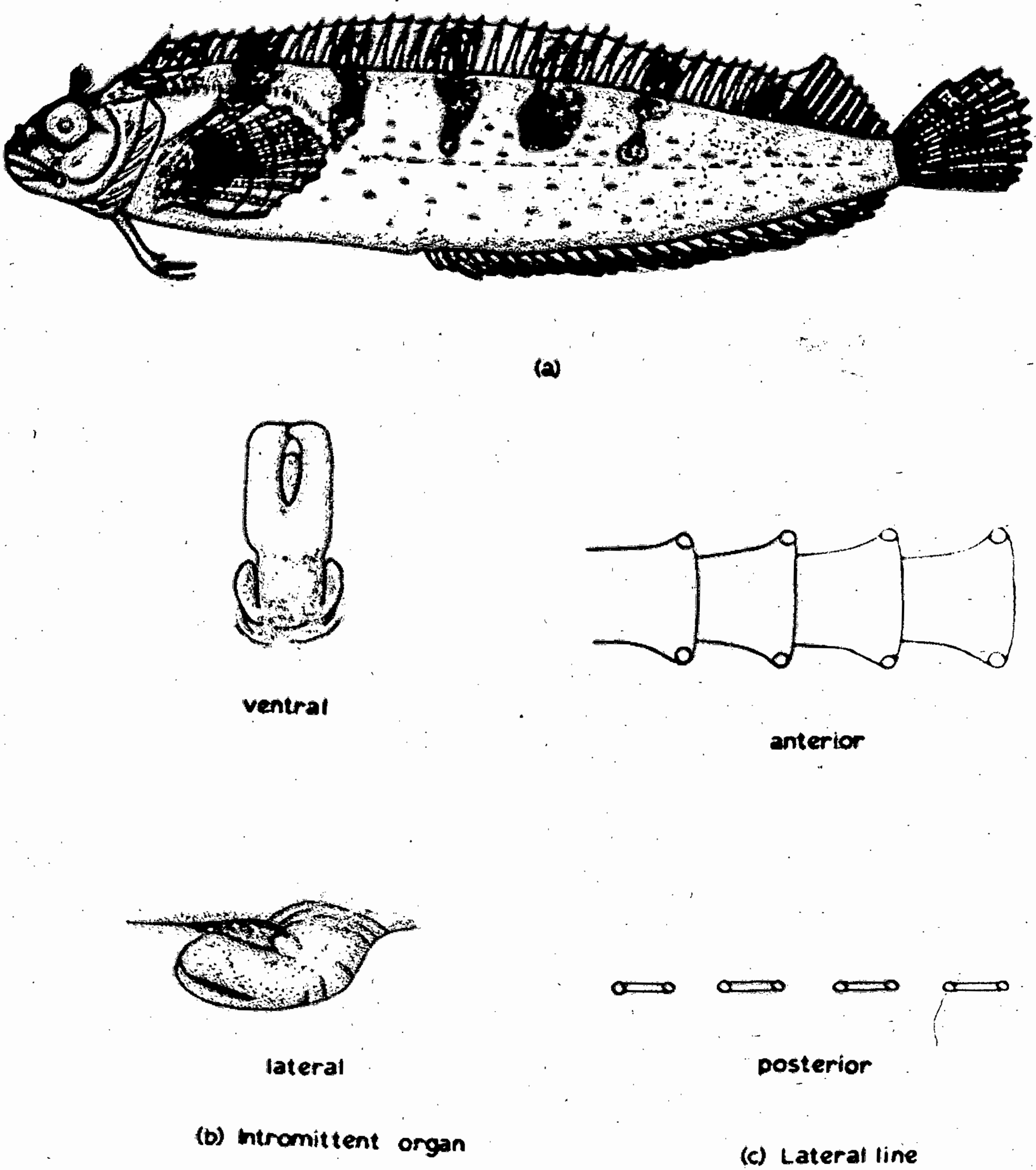


Fig. 17. Clinus (Clinus) latipennis

Clinus (Clinus) obtusifrons Penrith, 1965

(fig. 18)

Clinus obtusifrons Penrith, 1965 (in press)

Description: D. XXX - XXXII (XXX - XXXI) 6 - 7; A. II 20 - 22 (20 - 21); P. 13; V. I 2 - 3; C. 13. First three dorsal spines not forming a crest, but equal to or a little longer than fourth spine, second spine longest. No notch in membrane between third and fourth dorsal spines. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray minute or absent. Caudal peduncle short, length 20 - 35% of head length, depth 25 - 37.5% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to the dorsal and caudal fin bases; anal fin base and head naked. Depth 4 - 5. Head heavy, 3.2 - 4.5 in standard length. Interorbital concave with low supra-orbital ridges in large specimens. snout bluntly rounded, angle of profile obtuse. Eye 3 - 4.5 in head. Supra-orbital tentacle prominent, with a flattened stalk terminating in several short, simple branches. Cirrus on anterior nostril flattened, expanded and roughly triangular at the tip. Upper jaw 36.4 - 50% of head length, increasing with size of fish. Lips moderate. Vomer toothed.

Lateral line of single pores opening above or below the line, interspersed with a few double pores, in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 18 (c)). Intromittent organ of male with a moderately long basal portion and a slender, upwardly hooked tip between a pair of small rounded lateral lips (fig. 18 (b)).

Colouring: Dusky or slaty with darker grey irregular lacy cross-bars, speckled with white and sometimes dark blue when fresh. Tips of anal and pelvic rays red. A prominent blue-edged spot on shoulder. Two dark radiating bars across cheek. Tips of dorsal fin and orbital tentacles white.

Material examined: 112 specimens, 20 - 116 mm. in standard length. 1 from Milestone 26, north of Swakopmund, S.A.M. 24201; 2 from Lüderitzbucht, S.A.M. 24211; 1 from Sinclair's Island, August 1947, R.U.C.; 12 from Port Nolloth, S.A.M. 24216; 5 from Port Nolloth, 27/4/1960, R.U.C.; 4 from Hondeklip Bay, March 1965, S.A.M. not catalogued (holotype and paratypes); 1 from Hondeklip Bay, 28/4/1960, R.U.C.; 3 from Gert du Toit Bay, southern Namaqualand, S.A.M. 24253; 1 from Doring Bay, southern Namaqualand, 26/4/1960, R.U.C.; 58 from Lambert's Bay, R.U.C.; 3 from Yzerfontein, 20/2/1948, R.U.C.; 7 from Sea Point, 9/4/1963, S.A.M. not catalogued; 6 from False Bay, March 1947, R.U.C.; 8, no locality, R.U.C.

Remarks

This species has very similar dorsal counts to *Clinus acuminatus*, but can be distinguished from that species by the shape of the intromittent organ, the shape of the snout and profile, the height of the first three dorsal spines, the greater width of the interorbital, and the number of pectoral rays. Large specimens of _Clinus obtusifrons_ can be distinguished from _Clinus acuminatus_ by the concave interorbital and supra-orbital ridges. The intromittent organ is similar to the type found in _Clinus berrisfordi_, _Clinus cottoides_, and _Clinus brevicristatus_.

Distribution: The known range at present is from north of Swakopmund (South West Africa) to False Bay. It is fairly common in pools in the middle and lower regions of the intertidal zone on the coast west of Cape Point, but is extremely rare in False Bay.

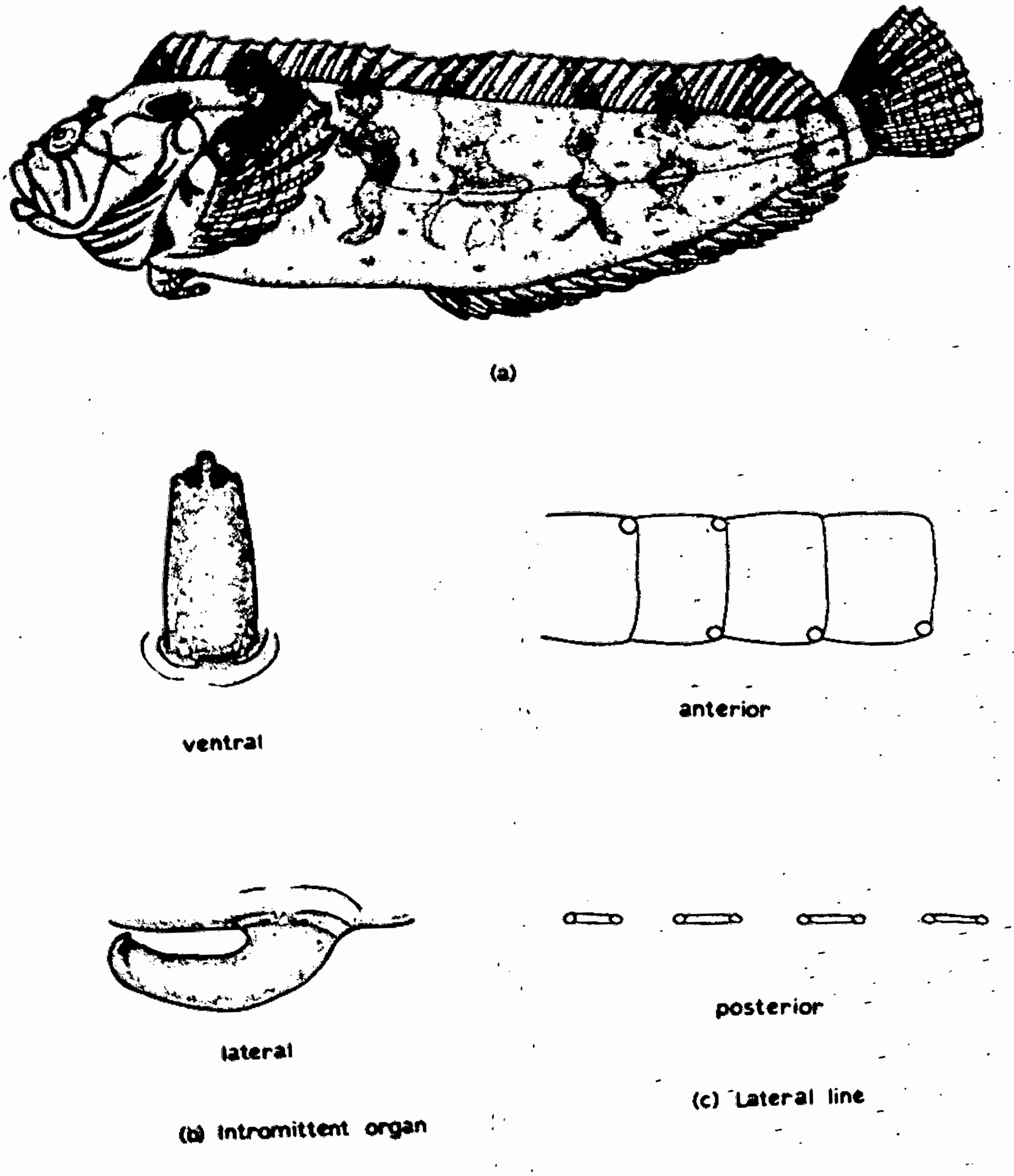


Fig. 18. Clinus (Clinus) obtusifrons

Clinus (_Clinus_) _robustus_ Gilchrist & Thompson, 1908

(fig. 19)

Clinus robustus Gilchrist & Thompson, 1908 :128; Barnard, 1927 :860; Smith, 1945 :541; Smith, 1949 :354

Clinetrachus robustus: Hubbs, 1952 :107

Description: D. XXXII - XXXIV (XXXIII) 9 - 14 (10 - 11); A. II 26 - 28 (26 - 27); P. 12; V. I 3; C. 13. First three dorsal spines slightly elevated, forming a low crest, second spine longest (first dorsal spine .5 - 4 mm. longer than fourth spine). A shallow notch in membrane between third and fourth dorsal spines, depth variable (see table 5). Anterior dorsal spines with clusters of 3 - 4 cirri at tips. Inner pelvic ray well developed, at least half length and thickness of other rays. Caudal peduncle short, length 25 - 33.3% of head length, depth 24 - 30% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to bases of dorsal and caudal fins but not anal fin base or head. Depth 4.5 - 5.5. Head large, heavy, 3.25 - 4 in standard length, snout bluntly rounded in large specimens, somewhat subconical in smaller ones. Eye 5 - 7.5 in head. Supraorbital tentacle prominent, with a flattened stalk and an expanded flat tip, terminating in several short, flat, simple branches. Cirrus on anterior nostril somewhat elongate, narrower at base, margin irregularly indented. Mouth large, upper jaw 45.5 - 53.5%

of head length. Lips thick, with distinct vertical corrugations. Vomer toothed.

Lateral line of sometimes a few double pores, mainly of single pores opening above and below the line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 19 (c)). Intromittent organ of male with a moderately long basal portion and two pairs of lips ensheathing the tip, a small dorsal pair and a large ventro-lateral pair, the latter with faintly serrate ventral margins (fig. 19 (b)).

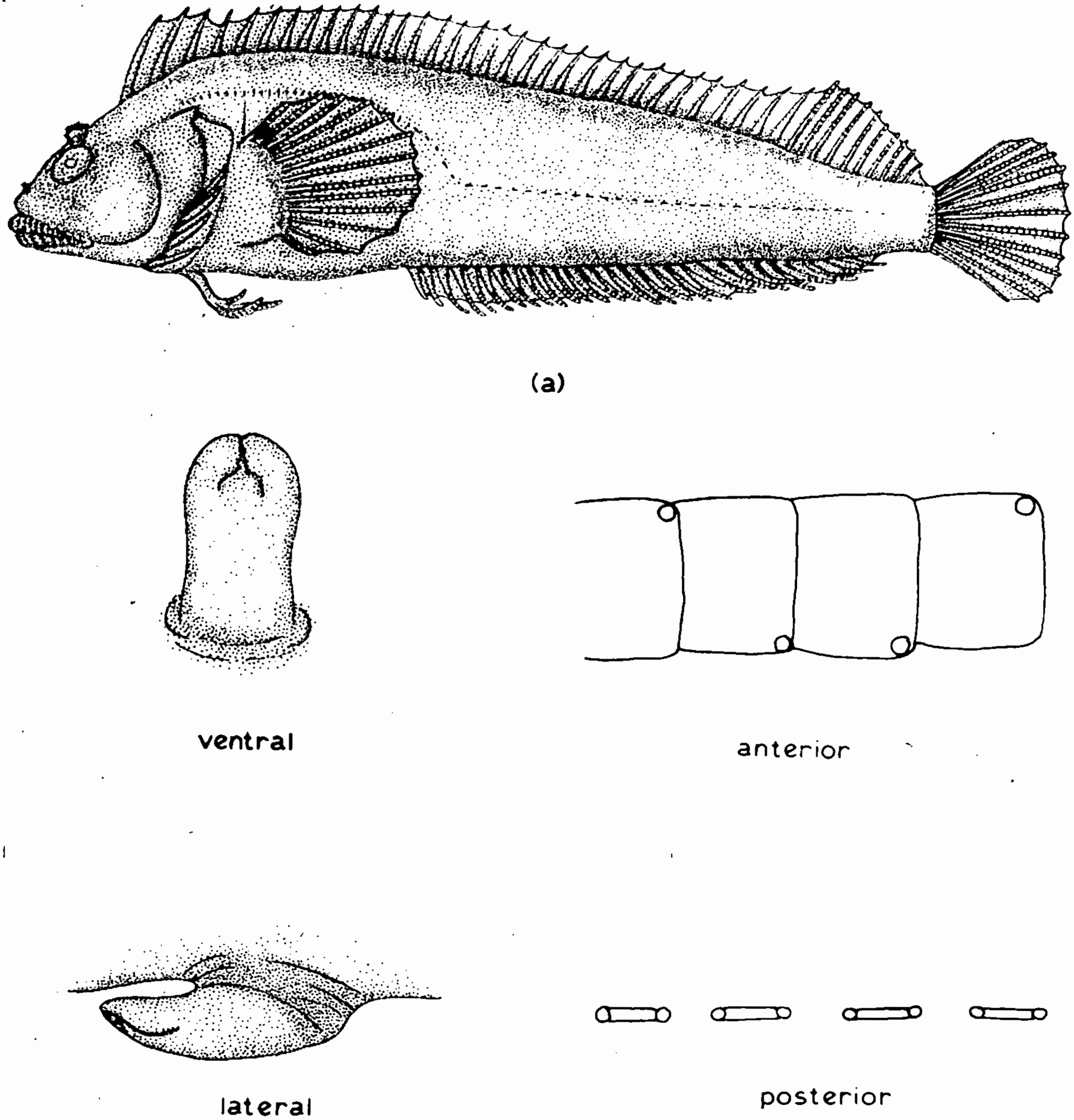
Colouring: Variable, olive yellow to dusky, with speckling in dark olive, red, black, green, and white, forming obscure cross-bars continuing on to dorsal and anl fins, or dark greyish brown with vague mottling. Sometimes a few bright orange speckles along anterior part of lateral line. Pectoral, pelvic, and caudal fins barred. Dorsal, anal, and pelvic fins red- or orange-tipped. Usually two dark radiating lines from eye across cheek.

Material examined: 12 specimens, 123 - 314 mm. in standard length. 1 from Melkbosch, S.A.M. 24072; 8 from Kalk Bay, False Bay, S.A.M. 10537 (holotype), S.A.M. 10538, S.A.M. 10539 (Paratypes), S.A.M. 18087; 2 from Dalebrook, False Bay, S.A.M. 23873; 1 from St. James, False Bay, S.A.M. 12019.

Remarks

Although Smith (1945), and following him Hubbs (1952), treated this species as if it were very close to Clinus superciliosus, the similarity in size and habit between these two species probably accounted for this treatment as much as actual resemblance, as they are not easily confused. Clinus robustus appears to be a rather primitive and generalized species; it is at least as closely related to forms such as Clinus taurus and Clinus agilis as to Clinus superciliosus, and at smaller sizes bears a superficial resemblance to large specimens of Clinus acuminatus. The well-developed inner pelvic ray and the high number of dorsal soft rays are considered to be primitive features.

Distribution: The known range at present is west coast of the Cape Peninsula to East London, infratidal except in the young stages. Appears to be rare.



(b) Intromittent organ

(c) Lateral line

Fig. 19. Clinus (Clinus) robustus

Clinus (Clinus) supercilliosus (Linnaeus, 1758)

(fig. 20)

Blennius supercilliosus Linnaeus, 1758 :257

Blennius mustelaris Linnaeus, 1758 :257; Gronovius, ed. Gray, 1854 :98 (mustellaris)

Blennius punctulatus Lacépède, 1800 :460

Blennius mustela Lacépède, 1800 :459

Blennius spadiceus Bloch & Schneider, 1801 :172

Blennius capensis Forster, in Bloch & Schneider, 1801 :175

Clinus supercilliosus: Cuvier, 1817 :173; Cuvier & Valenciennes, 1836 :360; Gilchrist & Thompson, 1908 :113; Thompson, 1918 :149; Barnard, 1927 :855; Smith, 1945 :541; Smith, 1949 :354

Cliniitrachus supercilliosus: Swainson, 1839 :276; Hubbs, 1952 :106 (Clinetrachus)

Blennius versicolor Pappe, 1853 :27

Blennius mycterizans Gronovius, ed. Gray, 1854 :97

Blennius ignobilis Gronovius, ed. Gray, 1854 :98

Clinus dubius Castelnau, 1861 :51

Clinus pantherinus Castelnau, 1861 :52

Clinus marmoratus Castelnau, 1861 :52

Clinus ornatus Gilchrist & Thompson, 1908 :116

Clinus supercilliosus var. arborescens Gilchrist & Thompson, 1908 :115

Doubtful synonym: Blennius varius Seba, 1758 :90, 93

Description: D. XXXI - XLII (XXXIV - XXXVI) 5 - 10 (7 - 8); A. II 21 - 30 (24 - 27); P. 15 - 18 (15 - 16); V. I 2; C. 13. Dorsal fin with first three spines considerably elevated to form a crest, higher in mature males than in females and juveniles (table 9). A notch of varying depth in membrane between third and fourth dorsal spines (table 5). Pectoral fin rounded. Third pelvic ray invariably absent; present in two specimens of whole sample examined. Caudal peduncle short, length 24 - 26.5% of head length, depth 29 - 33.5% of head length. Caudal fin subtruncate. Clusters of cirri usually present at tips of first three dorsal spines.

Body slightly compressed, covered with small scales extending on to dorsal and caudal fin bases; anal fin base and head naked. Depth 4 - 5. Head 3.25 - 4 in standard length, snout conical to rounded in large specimens. Eye 2.5 - 3.75 in head. Supra-orbital tentacle variable, usually small, with a narrow, subcylindrical stalk and a flattened spatulate tip with a few short, simple branches, but occasionally more prominent, with a fairly long subcylindrical stalk giving off many fine filamentous branches towards the tip. Cirrus on anterior nostril small, flap-like. Upper jaw 33 - 55.5% of head length, increasing in relative size with size of fish. Lips thick. Vomer toothed.

Lateral line of usually 25 - 30 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 20 (c)). Intromittent organ of male with a moderately long basal portion and the tip ensheathed by a complicated skinny fold, presumably derived from confluent lips, appearing square when retracted (fig. 20 (b)).

Colouring: Very variable. Usually a mottled and blotched pattern with conspicuous dark, roughly diamond-shaped blotches, lighter in the centre, along the base of, and continued on to, the dorsal fin. Ground colour usually buff or grey, with red and darker mottling, but plain scarlet, crimson, bronze, and green specimens with fine black speckling, and red, bright green, or olive specimens with the usual pattern in a darker shade occur. A round dark spot, which may appear metallic blue when fresh, on the dorsal crest. Head dark above, barred and reticulated below with longitudinal stripes of lighter and darker shades, rising from lips to eye and curving down again across cheek. A dark, comma-shaped mark on opercle, joined to eye by a dark stripe. A dark, crook-shaped mark below this. Belly mainly white; may have reticulate markings. Branchiostegal membranes with reticulate markings. Fins irregularly barred; often with bright red and orange markings in mature males. Juveniles milky with faint dark marks along dorsal base.

Material examined: 1118 specimens, 29 - 251 mm. in standard length. 57 from Swakopmund and Milestone 26, S.A.M. 24200; 56 from Walvis Bay, S.A.M. 1381, S.A.M. 9866, S.A.M. 24203; 127 from Lüderitzbucht, S.A.M. 24204; 28 from Port Nolloth, S.A.M. 24215; 1 from Kleinsee, Namaqualand, S.A.M. 18225; 17 from Hondeklip Bay, March 1965, S.A.M. not catalogued; 53 from Gert du Toit Bay and Doring Bay, southern Namaqualand, S.A.M. 24225; 417 from Lambert's Bay, S.A.M. 23905, S.A.M. 23914; 4 from Hoetjes Bay, Saldanha Bay, S.A.M. 9868, S.A.M. 9869; 9 from Saldanha Bay, S.A.M. 23907, S.A.M. 23911; 4 from Robben Island, Table Bay, S.A.M. 9859; 3 from Green Point, Cape Peninsula, S.A.M. 22779; 88 from Sea Point, S.A.M. 23912, S.A.M. 23915; and 17/2/1965, S.A.M. not catalogued; 1 from Hout Bay, Cape Peninsula, S.A.M. 23908; 2 from Kommetje, Cape Peninsula, S.A.M. 9865; 32 from Froggy Pond and Miller's Point, False Bay, S.A.M. 23910; 8 from Kalk Bay, False Bay, S.A.M. 9875; 11 from Dalebrook, False Bay, S.A.M. 23913, S.A.M. 23916, S.A.M. 23917, and 18/4/1965 and 16/5/1965, S.A.M. not catalogued; 41 from Strandfontein, False Bay, S.A.M. 23977, S.A.M. 24223; 10 from Strandfontein and Dalebrook, 19/2/1965, S.A.M. not catalogued; 9 from False Bay, S.A.M. 9871, S.A.M. 9872, S.A.M. 9873, S.A.M. 9874; 51 from Onrust River Mouth, S.A.M. 23904, S.A.M. 24226; 13 from Die Dam, Bredasdorp district, S.A.M. 24507, S.A.M. 24547; 10 from Still Bay, April 1965, S.A.M. not catalogued; 2 from Mossel Bay, S.A.M. 23909; 5 from Knysna (Leisure Isle and the Heads) S.A.M. 24227; 44 from Port Elizabeth, S.A.M. 23918, S.A.M. 23986, S.A.M. 24224; 2 from Kidd's Beach, East London, 1/7/1965, S.A.M. not catalogued; 3 from Kei Mouth, 30/6/1965, S.A.M. not catalogued.

Remarks

Clinus superciliosus is the most abundant South African clinid, and also, as suggested by the extensive synonymy, the most variable. A species *Clinus ornatus* was described by Gilchrist & Thompson (1908) for nine mature male specimens from Table Bay; these specimens had rather different markings from the usual form (which is, however, extremely variable), a better developed supra-orbital tentacle, and the dorsal fin originating further forward than in the usual variety (see table 12). It seems that, as stated by Smith (1945), these specimens are simply an unusual variety of male *Clinus superciliosus*, and unless females and juveniles can be found to correspond with the *ornatus* males, they must be included in the species *superciliosus*. This species shows greater tendencies to sexual dimorphism than the other clinid species, since, apart from the intromittent organ, the crest is higher in mature males, a condition not found in any of the other crested species (see table 9).

A variety *arborescens* was also described by Gilchrist & Thompson (1908) for specimens which have the larger, more filamentous type of tentacle over the eye, but this also appears to be a feature which develops only in some mature males. A few specimens with tentacles of this type were taken in a large sample obtained from Onrust River mouth (January, 1963), and there were no other differences between them and the other specimens of the sample.

Clinus superciliosus resembles *Clinus woodi* most closely of all the species of *Clinus*, but has higher fin counts, and the dorsal fin origin further back (table 12). The crest of *Clinus woodi*, which is also high and well-developed, does not appear to show sexual dimorphism. *Clinus superciliosus* resembles *Clinus robustus* mainly in the size attained and habit.

In a study of large samples of this species, two east-west clines have become apparent; the height of the crest of mature males increases eastwards, and the number of dorsal spines decreases eastwards. This is shown in tables 10 and 11. The crest requires further study, as no large mature males were obtained east of Hermanus, but there was a marked difference between Hermanus district specimens and specimens from Lambert's Bay, St. Helena Bay, Saldanha Bay, and Sea Point on the coast west of the Cape Peninsula, although the water at Hermanus is cold for the coast east of the Cape Peninsula. Jackson (1950) also noted the occurrence of such a cline in *Clinus superciliosus*, but did not give measurements. The fin counts, of course, do not vary with the size of the fish, and the east-west cline in this feature is quite distinct (table 11).

Distribution: The known range at present is north of Swakopmund (South West Africa) to the Kei River. It is exceedingly common from Swakopmund to Port Elizabeth, less common eastwards. Inter- and infratidal.

Table 9. Height of dorsal crest in Clinus superciliosus

	Height of crest (% of standard length)									
	10%	10 - 10.9%	11 - 11.9%	12 - 12.9%	13 - 13.9%	14 - 14.9%	15 - 15.9%	16 - 17.9%	18 - 19.9%	20%
Females (no. of fish)	13	14	23	13	4	2	0	0	0	0
Juvenile males (no. of fish)	0	2	11	12	11	9	1	0	0	0
Mature males (no. of fish)	0	0	1	1	0	2	4	12	11	26

Table 10. Comparison of height of dorsal crest of mature male Clinus superciliosus from south-east and south-west coasts of the Cape

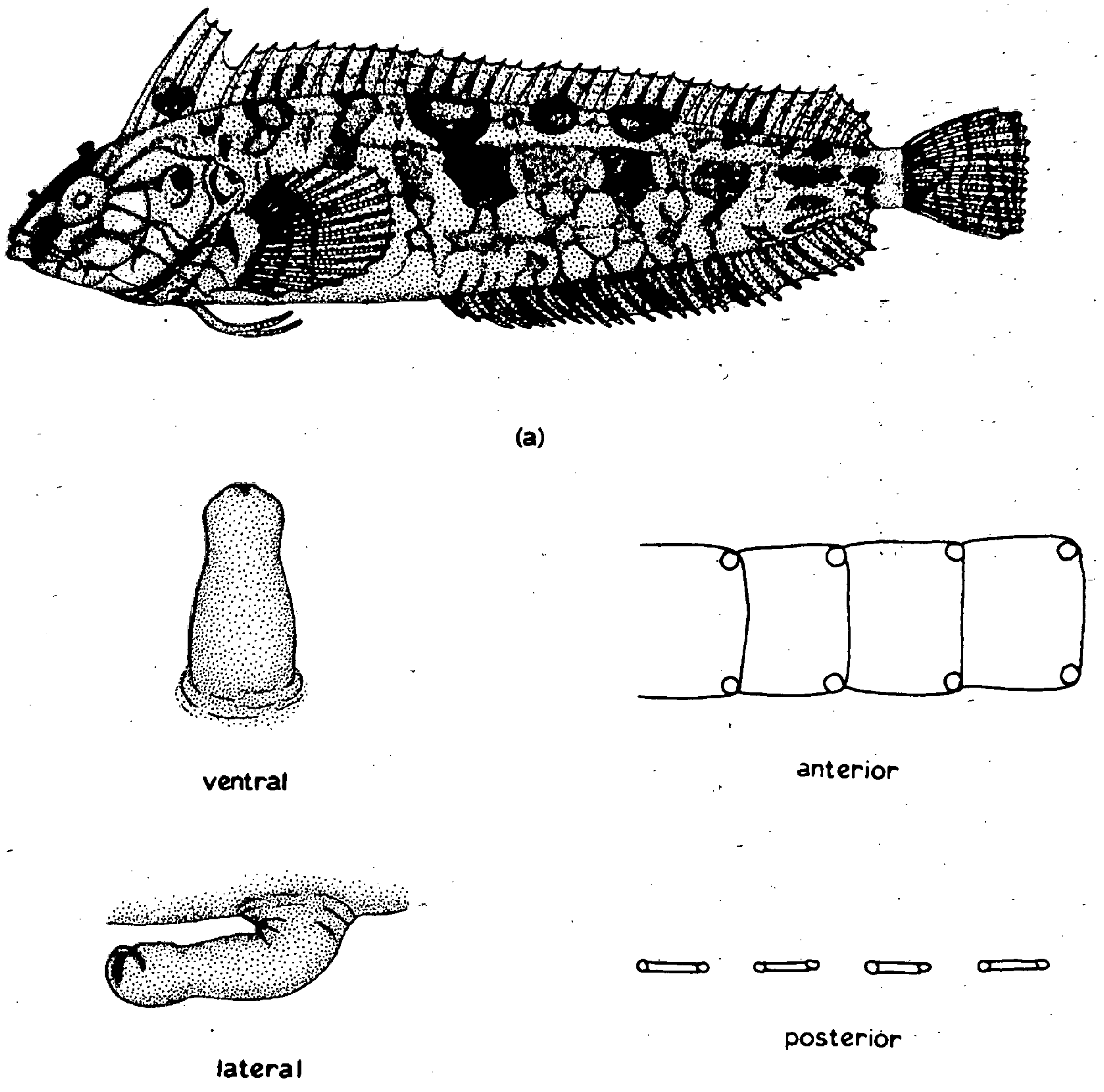
	Height of dorsal crest (% of standard length)					
	11 - 16.9%	17 - 19.9%	20 - 21.9%	22 - 24.9%	25%	Total
East coast (no.of fish)	6	7	7	9	5	34
West coast (no.of fish)	5	9	4	0	0	18

Table 11. Dorsal spine counts of Clinus superciliosus from the east and west coasts of the Cape

No. of spines	31	32	33	34	35	36	37	38	Total no. of fish
East coast (no. of fish)	0	0	11	39	29	7	0	1	86
West coast (no. of fish)	1	1	13	26	82	71	20	3	217

Table 12. Comparison of Clinus superciliosus (mature males), "ornatus" males, and Clinus woodi (males & females) (Abbreviations: S.L.= standard length; H.L.= head length; Snt.= snout; D.O.= dorsal fin origin)

	S.L. (mm)	H.L. (mm)	Snt.-D.O. (mm)	H.L. as % of S.L.	Snt.-D.O. as % H.L.
superciliosus	163	41	32	25.2	78.0
	165	44	35	26.6	79.5
	103	27.5	22	26.7	80.0
	112	27	26	24.0	96.5
	131	34	26	26.0	76.5
"ornatus"	70	17	11.5	24.2	67.5
	88.5	22	15	24.8	68.0
	72	18.5	13	25.7	70.5
	151	35	24.5	23.2	70.0
	166.5	38	26.5	22.8	70.0
	141	34	22.5	24.0	66.0
	177	42	26	23.8	62.0
	167	38	26	22.8	68.5
woodi	81	23	14	28.4	61.0
	96	28	16.5	29.2	59.0
	95	26	14	27.4	54.0
	112	31	19	27.6	61.0
	146	39.5	23	27.0	58.0



(b) Intromittent organ

(c) Lateral line

Fig. 20. Clinus (Clinus) superciliosus

<u>Clinus</u> (<u>Clinus</u>) <u>taurus</u> Gilchrist & Thompson, 1908

(fig. 21)

<u>Clinus taurus</u> Gilchrist & Thompson, 1908 :126; Barnard, 1927 :858

<u>Blenniomimus taurus</u>: Smith, 1945 :539; Smith, 1949 :353

Description: D. XXX – XXXVI (XXXII – XXXIV) 5 – 6; A. II 20 – 24 (21 – 23); P. 12; V. I 2 – 3; C. 13. Dorsal fin low, even. A notch in membrane between third and fourth dorsal spines (table 5). No clusters of cirri at tips of dorsal spines. Pectoral fin rounded. Inner pelvic ray minute or absent. Caudal peduncle short, length 20 – 32% of head length, depth 21 – 23.5% of head length. Caudal fin subtruncate.

Body slightly compressed, tapering towards tail, covered with small scales extending on to dorsal and caudal fin bases but not on to anal fin base or head. Depth 4 – 5. Head very heavy, 3.5 – 4.25 in standard length. Snout bluntly rounded. Interorbital markedly concave, heavy bony ridges over eyes. Occipital grooves deep. Eye 3 – 4.5 in head. Supra-orbital tentacle prominent, with a flattened stalk and a terminal fringe of fine cirri, filamentous. Cirrus on anterior nostril small, flattened, flap-like. Mouth large, upper jaw 42 – 53% of head length. Lips moderately thin, Vomer toothed.

Lateral line of about 28 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at each end (fig. 21 (c)). Intromittent organ of male with a fairly long basal portion; a pair of crescentic dorsal lips and a pair of rounded, confluent ventral lips ensheathing the slender tip (fig. 21 (b)).

Colouring: Ground colour in the fresh specimens examined pale green or yellow, with about seven heavy dark brown cross-bars; head mottled with lilac. Fins orange-tipped.

Material examined: 17 specimens, 74 - 188.5 mm. in standard length. 1 from Lambert's Bay, S.A.M. 24008; 1 from Kommetje, Cape Peninsula, S.A.M. 10454 (paratype); 4 from Strandfontein, False Bay, S.A.M. 24234; 11 from False Bay, S.A.M. 10450, S.A.M. 10451, S.A.M. 10452, S.A.M. 10453 (paratypes).

Remarks

Clinus taurus resembles *Clinus cottoides*, *Clinus latipennis*, *Clinus helenae*, and *Clinus obtusifrons* in the concave interorbital, and represents the greatest development of the bony supra-orbital ridges. It attains a larger size than the other species with a concave interorbital, and differs from them in having notches in the membrane between four or five anterior dorsal spines, deepest between the third and fourth spines. In these respects it resembles *Clinus robustus* more closely, although the latter species has a crest.

Distribution: The known range of this species at present is Lambert's Bay to Port Alfred. It is rare, and occurs at the bottom of the intertidal zone and infratidally.

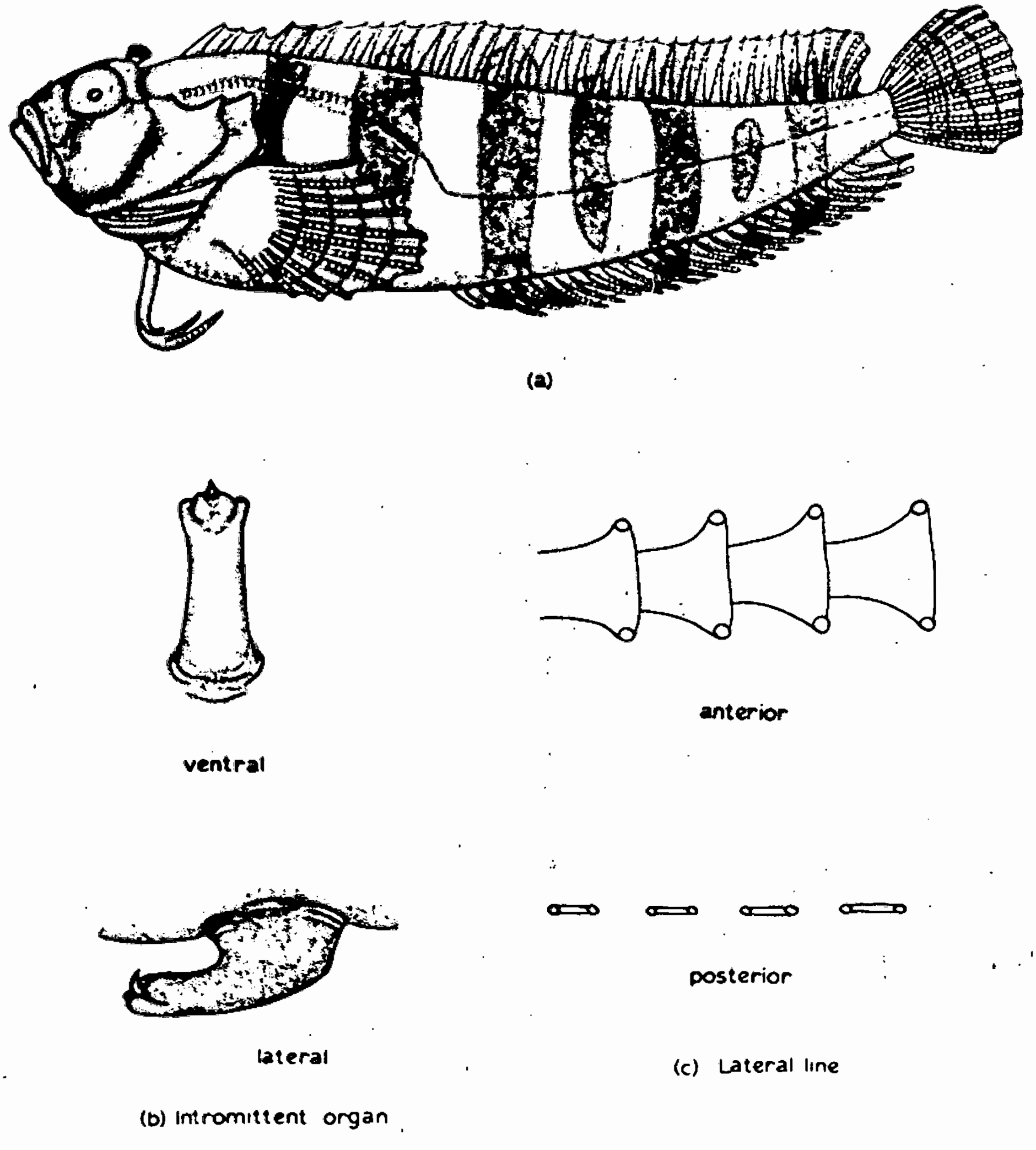


Fig 21 Clinus (Clinus) taurus

<u>Clinus</u> (<u>Clinus</u>) <u>venustris</u> Gilchrist & Thompson, 1908

(fig. 22)

<u>Clinus venustris</u> Gilchrist & Thompson, 1908 :130; Barnard, 1927 :861

<u>Ophthalmolophus venustris</u>: Smith, 1945 :542; Smith, 1949 :355

Description: D. XXXVII - XLI (XXXIX - XLI) 2 - 3; A. II 23 - 28 (24 - 27); P. 14; V. I 2; C. 13. First dorsal spine low, about equal to fourth; second, and to a lesser extent third, dorsal spines elevated, second spine .5 - 3 mm. higher than first or fourth spines. No notch in membrane between third and fourth dorsal spines, but second and third spines project above membrane. Clusters of 2 -3 cirri at tips of dorsal spines for about half length of fin. Pectoral fin rounded. Third pelvic ray absent. Caudal peduncle short, length 26.5 - 33% of head length, depth 23.5 - 29% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales not extending on to fin bases or head. Depth 4 - 5. Head 3.75 - 4.75 in standard length, forehead sloping rather steeply to eyes. Snout bluntly rounded. Eye 2.25 - 3.75 in head, noticably large. Supra-orbital tentacle with a short, flattish stalk and a flattened tip ending in several short, simple branches. Cirrus on anterior nostril flattened and spoon-shaped, margin shallowly indented. Upper jaw 39 - 48% of head length. Lips moderately thick. Vomer toothed.

Lateral line of about 24 - 25 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 22 (c)). Intromittent organ of male with a moderately long basal portion; a small pair of dorsal lips and a large pair of ventrolateral lips with serrate inner margins ensheathing the slender tip (fig. 22 (b)).

Colouring: Very variable. Specimens from the coast north of Lambert's Bay pale buff with brown streaks, speckles, and reticulations. A bright blue red-edged spot over first three dorsal spines. Fins red-tipped, anal fin often entirely red. Branchiostegal membranes pale with fine black dots. A characteristic dark line along edge of united gill membranes. Four specimens taken at Sea Point were plain crimson.

Material examined: 43 specimens, 40 - 106 mm. in standard length. 13 from Lüderitzbucht, S.A.M. 24212; 2 from Port Nolloth, S.A.M. 24217; 1 from Hondeklip Bay, March 1965, S.A.M. not catalogued; 1 from southern Namaqualand, S.A.M. 24017; 7 from Saldanha Bay, S.A.M. 18462; 4 from Sea Point, S.A.M. 23948 and 17/2/1965, S.A.M. not catalogued; 15 from Fish Hoek, False Bay, S.A.M. 10543 (syntypes).

Remarks

This species is not strikingly similar to any of the other species, and appears to be almost as close to forms such as *Clinus superciliosus* and *Clinus woodi* as to forms such as *Clinus acuminatus* and *Clinus agilis*. The form of the dorsal fin is different from that of any of the other species.

Distribution: The known range at present is from Lüderitzbucht (South West Africa) to Port Alfred. This species occurs in pools at the bottom of the intertidal region and is rare.

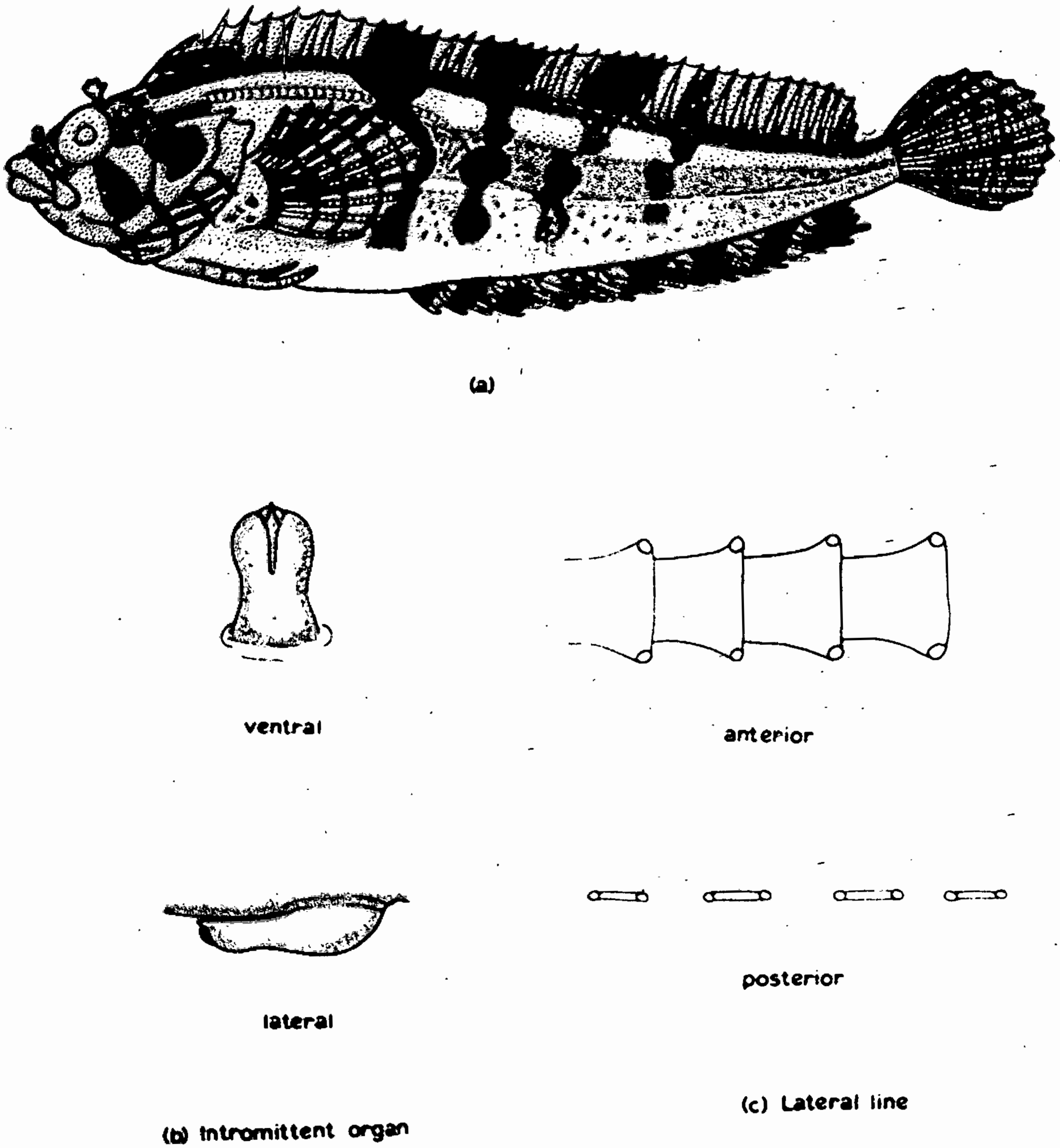


Fig. 22. Clinus (Clinus) venustris

Clinus (Clinus) woodi (Smith, 1945)

(fig. 23)

Petraites woodi Smith, 1945 :540; Smith, 1949 :353

Description: D. XXVIII - XXXII 5; A. II 21 - 24; P. 12 - 13; V. I 2; C. 13. First three dorsal spines elevated, forming a high, triangular crest; third and fourth dorsal spines widely separated, membrane from third spine barely reaches base of fourth (table 5). First dorsal spine originates far forward, over hind margin of eye (table 12). Clusters of cirri at tips of at least the first three dorsal spines. Pectoral fin rounded. Third pelvic ray absent. Caudal peduncle short, length 21.5 - 33.5% of head length, depth 21.5 - 23.5% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 3.5 - 4. Head 3.5 - 4 in standard length, snout rounded, rather more conical in smaller specimens. Eye 3 - 4 in head. Supra-orbital tentacle with a cylindrical stalk giving off fine filamentous branches towards the tip. Cirrus on anterior nostril short, flattened, bilobed. Mouth large, upper jaw 50 - 53.5% of head length. Lips moderately thick. Vomer toothed.

Lateral line narrow in front, of about 20 double pores to post-pectoral curve, then of short separate horizontal tubes with a pore at each end (fig. 23 (c)). Intromittent organ of male with a fairly long basal portion; tip ensheathed by a small pair of round dorsal lips and a large pair of ventro-lateral lips, almost confluent, with a constriction in the centre (fig. 23 (b)).

Colouring: No fresh specimens seen. Smith (1945) described the colouring as "vivid in marbled olive, brown, and red, with obscure irregular cross-bars. one or two red oblique bars across cheek".

Material examined: 6 specimens, 81 - 146 mm. in standard length. 1 from Xora Mouth, S.A.M. 24241; 5 from Xora Mouth, R.U.C.

Remarks

Clinus woodi appears to be very close to Clinus superciliosus. The range of distribution of these two species does not overlap, but they are clearly specifically distinct. The male Clinus superciliosus described by Gilchrist & Thompson (1908) as Clinus ornatus approach Clinus woodi in the forward displacement of the dorsal origin and the form of the supra-orbital tentacle. The intromittent organ of Clinus woodi approaches the type found in Clinus agilis, and also is rather similar to that of Clinus superciliosus, in which the lips are not distinct and the tip is surrounded by an almost continuous fold of skin.

Distribution: The known range at present is Kei Mouth to Inhambane (Mozambique). It is said to be fairly common.

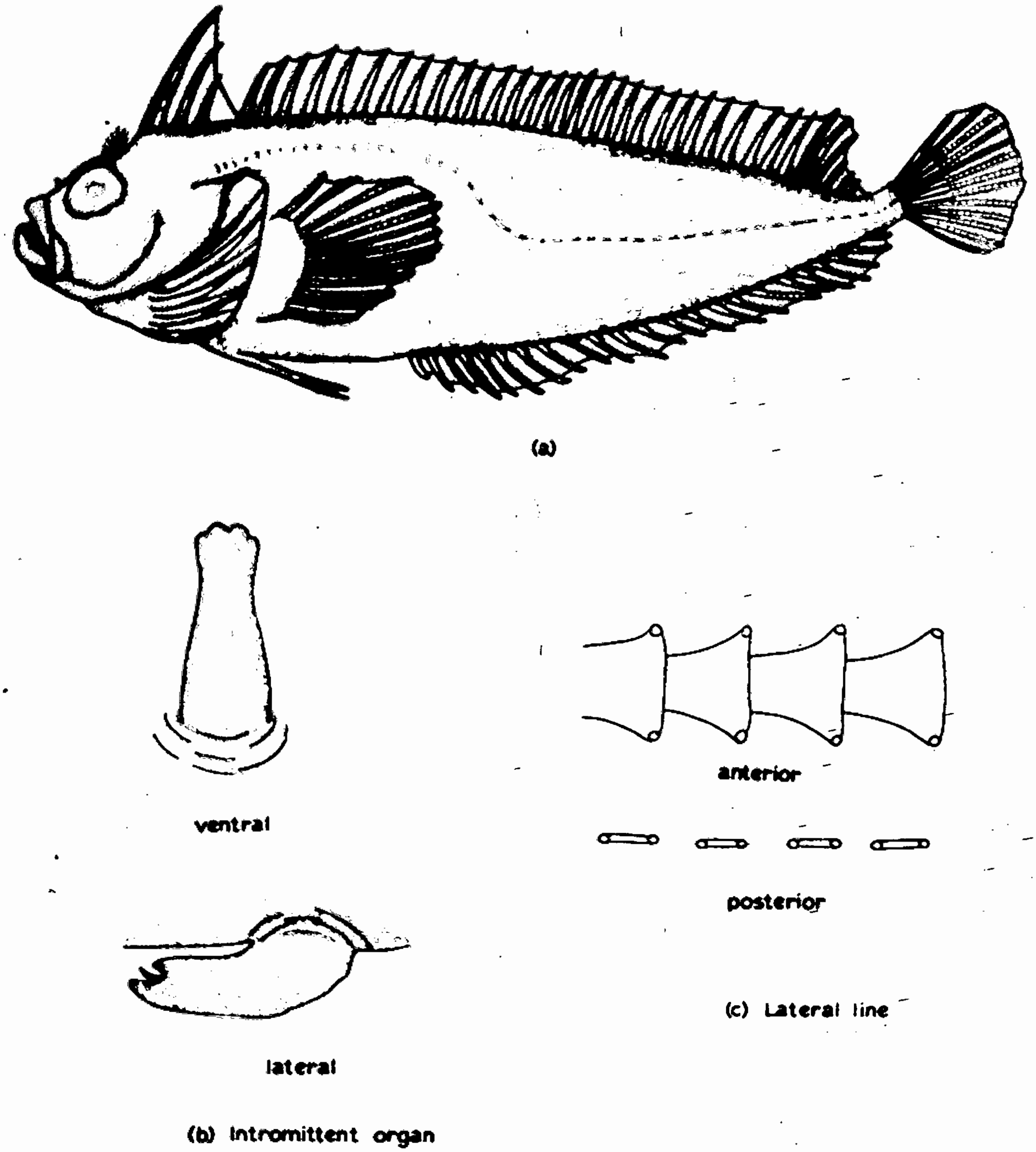


Fig. 23. Clinus (Clinus) woodi

Genus _Pavoclinus_ Smith, 1945

Cristiceps (_non_ Cuvier & Valenciennes) Gilchrist & Thompson, 1908 :138 (type species _Cristiceps australis_ Cuvier & Valenciennes)

Pavoclinus Smith, 1945 :545 (type species _Clinus pavo_ Gilchrist & Thompson)

Labroclinus Smith, 1945 :544 (type species _Cristiceps mentalis_ Gilchrist & Thompson)

Fucomimus Smith, 1945 :544 (type species _Clinus mus_ Gilchrist & Thompson)

Myxodes (_non_ Cuvier) Smith, 1945 :544 (type species _Myxodes viridis_ Cuvier & Valenciennes)

Smithichthys Hubbs, 1952 :107 (type species _Clinus fucorum_ Gilchrist & Thompson)

Diagnosis: No tentacle over eye. Lateral line narrow in front, mainly of single pores opening medially or above and below line to post-pectoral curve, then of short separate horizontal tubes with a pore at either end. Body covered with small cycloid scales, imbricating or not. Intromittent organ of male with a short basal portion and a very large conical tip surrounded at the base by a single pair of dorso-lateral lips. Body compressed, sometimes deep. Caudal peduncle usually elongate. Vomer toothed or not. Usually an anterior crest of the elevated first three dorsal spines, separated from the rest of the fin or not. Exclusively weed-dwelling species. Mouth fairly small, upper jaw averages less than 40% of head length. No clusters of cirri at tips of dorsal spines.

Discussion

Smith (1945) arranged six species in four genera as follows:

1) Pavoclinus: forms with teeth on the vomer, and the first three dorsal spines elevated to form a crest, which is not separated from the rest of the fin by a notch in the membrane between the third and fourth spines. Two species, pavo Gilchrist & Thompson and heterodon Cuvier & Valenciennes. Two further species have subsequently been added to this group, profundus Smith, 1960 and litorafontis Penrith, 1965.

2) Labroclinus: forms with teeth on the vomer, and the first three dorsal spines elevated to form a crest which is separated from the rest of the fin by a deep notch, the membrane from the third spine barely reaching the base of the fourth. Two species, mentalis Gilchrist & Thompson and laurentii Gilchrist & Thompson.

3) Fucomimus: forms lacking teeth on the vomer, with two bands of teeth in the jaw. One species, mus Gilchrist & Thompson.

4) Myxodes: forms lacking teeth on the vomer, with a single row of teeth in the jaw. One species, fucorum Gilchrist & Thompson. Hubbs (1952) pointed out that, as Myxodes is a South American genus of oviparous Clinidae, lacking a fleshy penis in the male,

and having external fertilization, fucorum, with a penis in the male and internal fertilization, cannot be a member of the genus Myxodes, and he proposed a monotypic genus, Smithichthys, for that species.

It is felt that the features uniting the eight species mentioned above are too numerous and important to allow their separation into more than one genus, and they are therefore placed together in the genus Pavoclinus. The name Pavoclinus Smith, 1945 is used for this genus because, of the genera Fucomimus, Labroclinus, and Pavoclinus defined by Smith in 1945, the description of Pavoclinus can best be expanded to include all the species.

Although the similarities of form and colour in this genus have apparently been brought about by adaptation to a weed-dwelling habit, they are too many and various to be the result of convergence, and appear to indicate close relationship. Clinus brevicristatus, one of the tentacled species, is also habitually a weed-dweller, as is Gynutoclinus rotundifrons, but these two species do not share the features common to the Pavoclinus species. There is considerable uniformity in the form of the intromittent organ of the Pavoclinus species, which, unlike that of the Clinus species, does not vary much interspecifically. It is felt that to divide this group into more than one genus would obscure the relationships of the species. Jackson (1950) also included the species *pavo*, *heterodon*, *laurentii*, *mentalis*, *fucorum*, and *mus* in the same genus, but wrongly called it *Myxodes*.

The elongation of the caudal peduncle, compression of the body, and the colouration, including the frequently occurring translucent patches in the fin membranes, are presumably all modifications to a weed-dwelling existence. Camouflage to appear to be part of the weed is very important, as there are no places of total concealment in sea-weed such as there are in rocky habitats. The species belonging to this group do not appear to move about much and are sluggish swimmers, although they will jump out of the weed when disturbed and swim fairly rapidly for a distance of a foot or two to find another place in the weed.

Their colouring is very variable to blend with their surroundings, and there is usually no fixed pattern which remains for long after death. The decrease in size of the mouth is probably related to the fact that small food organisms such as minute amphipods, isopods, worms, and very tiny molluscs are readily available in growths of sea-weed, so that large strong jaws and a wide gape are unnecessary. The type of food eaten probably also accounts for the reduction of dentition in *mus* and *fucorum*.

Four subgenera are used to indicate the relationships of the species within the genus. Three of these are monospecific, and the fourth contains a closely united group of species.

The lack of vomerine teeth in the two species mus and fucorum appears to warrant separation from the remaining species at a subgeneric level. Moreover, these two species differ sufficiently from one another to justify the retention of Smithichthys and Fucomimus as separate subgenera, although it is possible that they are closer to one another than to any of the other species. Jackson (1950) dropped these subgenera, including both species in his Myxodes (Myxodes). However, they differ from one another as follows:-

mus	fucorum
(1) 2 rows of teeth in the jaw	(1) One row of teeth in the jaw
(2) Snout normal, not upturned	(2) Snout upturned, pug-like
(3) Mouth very small	(3) Mouth moderate
(4) Dorsal fin originates on nape above posterior margin of preopercle	(4) Dorsal fin originates above hind margin of eye
(5) Dorsal crest of 3 spines	(5) Dorsal crest of 4 - 5 spines
(6) Membrane from third dorsal spine barely reaches base of fourth	(6) No notches in membrane between dorsal spines
(7) Fin counts very low	(7) Fin counts more or less average
(8) 11 caudal rays (unique in South African Clinidae)	(8) 13 caudal rays

These differences appear to be sufficient to indicate a subgeneric separation of these two highly modified species.

Jackson (1950) dealt with the remaining four species described at that time as follows: (1) He dropped the name Pavoclinus and placed pavo and heterodon in his Myxodes (Myxodes) group with mus and fucorum. (2) He retained Labroclinus, containing mentalis and laurentii, as a subgenus of Myxodes. This arrangement is far from logical, since, if Jackson used the character of the notch in the dorsal fin alone, mus should have been placed with laurentii and mentalis. Apparently no other feature was used; it would be difficult to find another feature whereby laurentii and mentalis could together be separated from pavo and heterodon. The species pavo, heterodon, and laurentii are so similar that even subgeneric distinction on account of the separation or otherwise of the dorsal crest is quite unwarranted. Although this was the feature which Smith (1945) used to separate Labroclinus from Pavoclinus, he apparently did not regard this feature as being of the same importance in the tentacled species, since both his Ophthalmolophus and Blenniomimus groups of species contained species with and species without a notch in the membrane between the third and fourth dorsal spines. Furthermore, the close union of laurentii and mentalis appears to be incorrect, although they have been regarded as closely related by both Barnard (1927) and Smith (1945). heterodon, pavo, and laurentii all have a fairly low number of dorsal spines (less than 35) and anal rays (less than 25), while _mentalis_ is markedly elongate, with a high number of dorsal and anal elements (35 – 39 dorsal spines and 29 – 30 anal rays). _mentalis_ is characterised by the presence of a long skinny projection at the lower jaw symphysis, and reaches a very large size. On account of its peculiar features, and to emphasise the particularly close relationship between the species _pavo_, _heterodon_, _laurentii_, _litorafontis_, and probably _profundus_, _mentalis_ is placed in a separate subgenus _Labroclinus_.

Pavoclinus heterodon and _Pavoclinus laurentii_ are the two least strongly modified species, having a fairly normal body shape rather like that of most of the species contained in the subgenus _Clinus_ (_Clinus_). _Pavoclinus pavo_ and _Pavoclinus litorafontis_ are somewhat more compressed, with rather longer caudal peduncles. It is proposed to include these four species in a subgenus _Pavoclinus_, together with, provisionally, _Pavoclinus profundus_, which is at present known only from the unique type.

Jackson (1950) included _Blennioclinus_ as a subgenus of _Myxodes_, but it has been kept separate in the present work.

A comparative table of the eight species of _Pavoclinus_ is given (table 13).

Distribution: west to east coasts of South Africa, mainly east of Cape Point, in sea-weed.

Table 13. Comparison of the species of *Pavoclinus*

Abbreviations: S.L. = standard length; H.L. = head length; U. jaw = upper jaw; d.s. = dorsal spine; C.P.L. = caudal peduncle length; C.P.D. = caudal peduncle depth; D.O. = dorsal fin origin; preoperc. or preop. = preopercle

Characters	*mus*	*mentalis*	*heterodon*
Dorsal spines	25–28 (26–27)	35–39 (36–37)	30–35 (32–33)
Dorsal rays	3 – 4 (3)	6 – 8 (6 – 7)	4 – 6 (5)
Anal rays	14–18 (15–17)	27–32 (29–30)	21–24 (22–23)
Pectoral rays	10	11 – 12	12
Caudal rays	11	13	13
3rd pelvic ray	Moderate	Well developed	Moderate
H.L. in S.L.	4 – 5	4 – 4.75	3.5 – 4.75
Body depth	3.5 – 4.5	4.5 – 5.5	4 – 5
U.jaw (% H.L.)	27 – 33.5	35 – 40	30 – 36
Eye in H.L.	2.5 – 3.75	4.75 – 5.75	2.5 – 3.75
1st d.s.(% S.L.)	8 – 12.5	9 – 10.75	6.5 – 11
C.P.L.(% H.L.)	60 – 75	35 – 40	26.5 – 38.5
C.P.D.(% H.L.)	24 – 27.5	20 – 25	26 – 31
Vomerine teeth	Absent	Present	Present
Notch 3/4 d.s.	Present, deep	Present, deep	Absent
Position of D.O.	Over preoperc.	Over preoperc.	Over preoperc.

laurentii	*litorafontis*	*pavo*	*profundus*	*fucorum*
29-33 (30-32	29-32 (31-32)	30-36 (31-33)	30	28-31 (29-30)
4 - 5	7 - 8	2 - 4 (3)	4	4 - 6 (5 - 6)
20-22 (21-22)	20 - 23 (23)	20-23 (20-22)	21	19 - 21
12	11 - 12	11 - 12 (12)	12	12 - 13 (12)
13	13	13	13	13
Moderate	Well developed	Minute	Minute	Moderate
4.25 - 4.75	3.75 - 5	3.5 - 4.75	3.9	4 - 4.75
4 - 5.5	4.5 - 5.75	3.75 - 5	4.8	3.5 - 4.0
36 - 41	33.5 - 41.5	22 - 36.5	36.4	32 - 42
2.75 - 3.75	3.75 - 5	3 - 4	3	3 - 5
8 - 13	9 - 16.5	5.5 - 10.5	5.8	13.75 - 21.5
33 - 47	58.5 - 75	40 - 46.5	36.4	47 - 62.5
22 - 25	22.5 - 33.5	26.5 - 31	27.2	23.5 - 30
Present	Present	Present	Present	Absent
Present, deep	Absent	Absent	Absent	Absent
Over preoperc.	Over preop.	Over preop.	Over preop.	Over hind margin of eye

Key to the species of Pavoclinus

1. Vomer toothed 2

   Vomer edentate 7

2. A prominent projecting flap of skin on the lower jaw at the symphysis .... Pavoclinus (Labroclinus) mentalis

   No flap of skin at lower jaw symphysis 3

3. First three dorsal spines raised to form a crest 4

   First three dorsal spines not forming a crest .... Pavoclinus (Pavoclinus) profundus

4. Membrane from third dorsal spine barely reaches base of fourth .... Pavoclinus (Pavoclinus) laurentii

   Membrane from third dorsal spine reaches more than halfway up fourth 5

5. Inner pelvic ray stout, equal to others; 7 – 8 dorsal soft rays .... Pavoclinus (Pavoclinus) litorafontis

   Inner pelvic ray reduced; 6 or less dorsal soft rays .. 6

6. Dorsal soft rays 4 – 6; caudal peduncle less than 40% of head length; snout subconical .. Pavoclinus (Pavoclinus) heterodon

   Dorsal soft rays 2 – 4; caudal peduncle more than 40% of head length; snout acute .... Pavoclinus (Pavoclinus) pavo

7. Snout upturned, pug-like; one row of teeth .... Pavoclinus (Smithichthys) fucorum

   Snout normal; 2 rows of teeth .... Pavoclinus (Fucomimus) mus

Subgenus _Fucomimus_ Smith, 1945

Fucomimus Smith, 1945 :544 (type species _Clinus mus_ Gilchrist & Thompson)

Diagnosis: Vomer edentate; two rows of teeth in jaw. First three dorsal spines elevated to form a crest. Membrane from third spine barely reaches base of fourth. Snout not pug-like. Body highly compressed. Scales minute, embedded, non-imbricating. Lateral line scales not distinct. Caudal peduncle long. Caudal rays 11.

One species, _Pavoclinus_ (_Fucomimus_) _mus_ (Gilchrist & Thompson).

Pavoclinus (_Fucomimus_) _mus_ (Gilchrist & Thompson, 1908)
(fig. 24)

Clinus mus Gilchrist & Thompson, 1908 :119; Barnard, 1927 :854
Fucomimus mus: Smith, 1945 :544; Smith, 1949 :356

Description: D. XXV - XXVIII (XXVI - XXVIII) 3 - 4 (3); A. II 14 - 18 (15 - 17); P. 10; V. I 3; C. 11. First three dorsal spines elevated to form a low crest, well separated from the rest of the fin by a wide gap between the third and fourth dorsal spines; membrane from third dorsal spine barely reaches base of fourth. Pectoral fin rather narrow, upper edge straight. Inner pelvic ray always present, about half length and diameter of other two rays. Dorsal spines in groups of 2 - 4 with translucent membranes between groups of spines. Caudal peduncle long, length 60 - 75% of head length, depth 24 - 27.5% of head length. Caudal fin subtruncate.

Body highly compressed, covered with minute scales not extending on to dorsal, caudal, or anal fin bases, or head. Depth 3.5 - 4.5, deepening with age. Head 3.75 - 5 in standard length, snout rounded. Eye 2.5 - 4 in head. No supra-orbital tentacle. Cirrus on anterior nostril slightly elongate, curved forward over nostril. Upper jaw 27 - 33.5% of head length, mouth small. Lips moderately thick. Vomer edentate.

Lateral line narrow in front, of single more or less medially opening pores to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 24 (c)). Intromittent organ of male with a short thick basal portion, a long, fairly slender conical tip, and a pair of somewhat frilly dorso-lateral lips (fig. 24 (b)).

Colouring: Very variable. Ground colour various shades of green or brown, mottled and streaked in intricate patterns with yellow, mauve, olive, black, white, dark green, dark brown, and silver. Dorsal and caudal fins with translucent patches. Other fins green or brown. Belly not lighter than general ground colour. Juveniles uniform dark brown.

Material examined: 310 specimens, 22 - 86 mm. in standard length. 2 from Froggy Pond, False Bay, S.A.M. 23893; 1 from Glencairn, False Bay, S.A.M. 23883; 2 from Kalk Bay, False Bay, S.A.M. 17936, S.A.M. 18075; 82 from Dalebrook, False Bay, S.A.M. 23880, SA.M. 23895, S.A.M. 23897, and 18/12/1964, 19/2/1965, and 18/4/1965, S.A.M. not catalogued; 20 from St. James, False Bay, S.A.M. 10531 (syntypes), S.A.M. 12021, and 16/5/1965, S.A.M. not catalogued; 173 from Strandfontein, False Bay, S.A.M. 23879, S.A.M. 23884, S.A.M. 23961, S.A.M. 23973, S.A.M. 24246, and 19/2/1965, S.A.M. not catalogued; 4 from Strandfontein and Dalebrook, False Bay, S.A.M. 23882; 1 from Cape Peninsula, S.A.M. 23890; 1 from Gordon's Bay, False Bay, S.A.M. 23292; 9 from Onrust River Mouth, S.A.M. 24247; 6 from Still Bay, April 1965, S.A.M. not catalogued; 1 from Kidd's Beach, East London, 1/7/1965, S.A.M. not catalogued; 1 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 4 from Gonubie Mouth, East London, 28/6/1965, S.A.M. not catalogued; 3 from Kei Mouth, 30/6/1965, S.A.M. not catalogued.

Remarks

Pavoclinus mus is a highly modified weed-dwelling species. The deep, strongly compressed body and the elongate caudal peduncle are like those of *Pavoclinus fucorum*, but the difference in dentition is considered important enough in conjunction with other features to separate these two species at the subgeneric level, especially since *Pavoclinus mus* has on the whole as many or more features in common with the species placed in the subgenus *Pavoclinus* than with *Pavoclinus fucorum*, which has a very peculiar and distinctive appearance. *Pavoclinus mus* is rather similar to *Pavoclinus pavo*, having an extremely small mouth, a similar, although more exaggerated, body shape, and a rather delicate build compared with the other species.

Distribution: The known range at present is False Bay to the Kei River. Quite abundant in dense growths of sea-weed, particularly in the green alga *Caulerpa filiformis*. Intertidal.

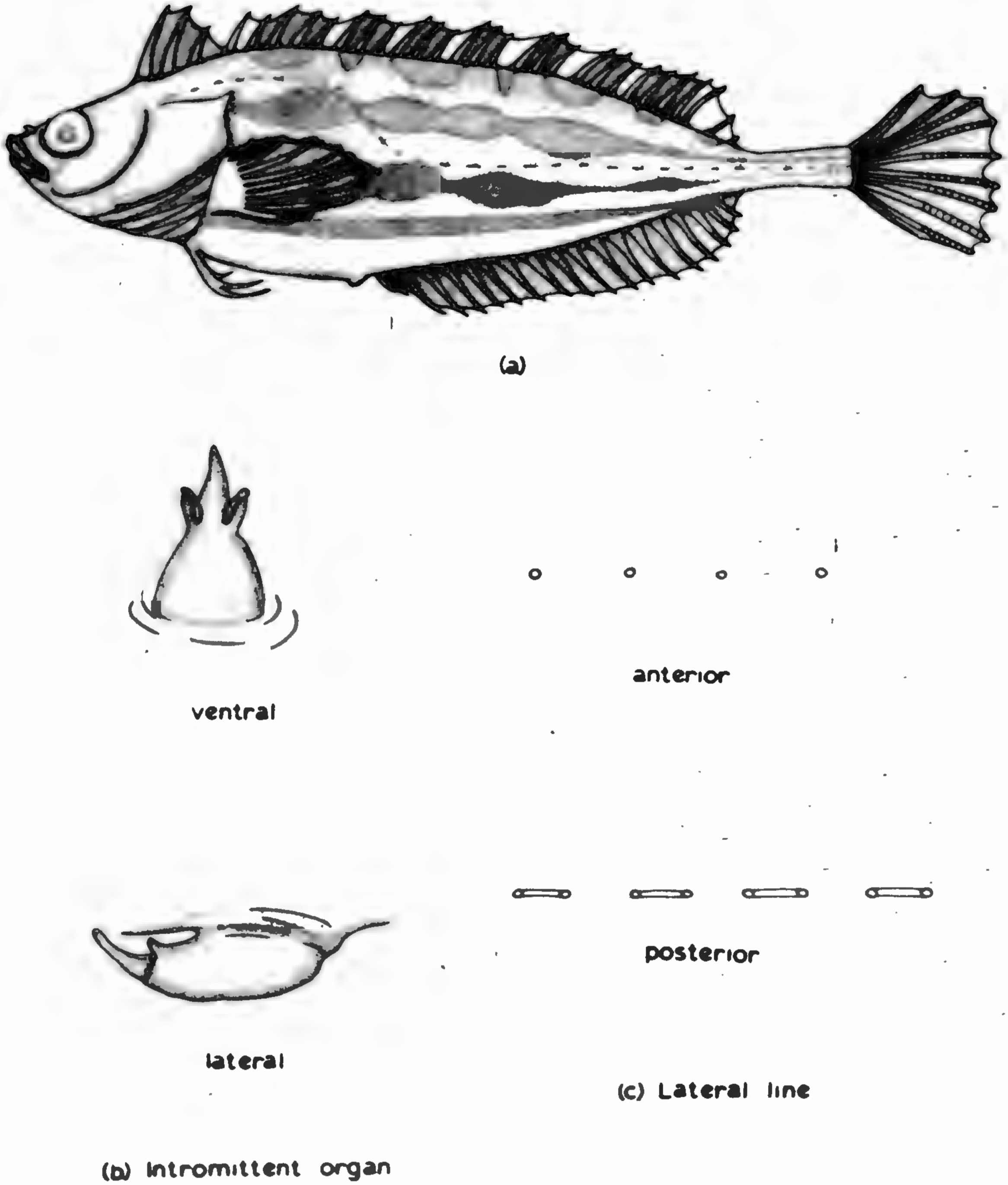


Fig 24 Pavoclinus (Fucomimus) mus

Subgenus *Labroclinus* Smith, 1945

Labroclinus Smith, 1945 :544 (type species *Cristiceps mentalis* Gilchrist & Thompson)

Diagnosis: Vomer toothed; two rows of teeth in the jaw. First three dorsal spines form a high crest. Membrane from third dorsal spine barely reaches base of fourth. Anal rays more than 25. Scales imbricating on front half of body. Caudal rays 13. A prominent skinny flap on lower jaw symphysis.

One species, *Pavoclinus* (*Labroclinus*) *mentalis* (Gilchrist & Thompson).

Pavoclinus (*Labroclinus*) *mentalis* (Gilchrist & Thompson, 1908)
(fig. 25)

Cristiceps mentalis Gilchrist & Thompson, 1908 :139

Petraites mentalis: Barnard, 1927 :866

Labroclinus mentalis: Smith, 1945 :544; Smith, 1949 :357

Description: D. XXXV - XXXIX (XXXVI - XXXVIII) 6 - 8 (6 - 7); A. II 27 - 32 (29 - 30); P. 11 - 12; V. I 3; C. 13. First three dorsal spines elevated to form a crest, separated from the rest of the fin by a wide gap between the third and fourth dorsal spines. Membrane from third dorsal spine barely reaches base of fourth. Pectoral fin with upper edge more or less straight. Inner pelvic ray stout, equal to others. Caudal peduncle fairly long, length 35 - 40% of head length, depth 20 - 25% of head length. Caudal fin subtruncate.

Body highly compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal base or head. Depth 4.5 - 5.5. Head 4 - 4.75 in standard length, snout narrowly pointed. Eye 4.25 - 5.75 in head. No supra-orbital tentacle. Cirrus on anterior nostril small, flap-like over nostril. Upper jaw 35 - 40% of head length. Lips thick. A prominent flap of skin on lower jaw at symphysis. Vomer toothed.

Lateral line of mainly single pores opening above line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 25 (c)). Intromittent organ of male with a short basal portion and a large conical tip with a pair of crescentic dorso-lateral lips ensheathing it at the base. (fig. 25 (b)).

Colouring: No fresh specimens seen. According to Smith (1949), "most vivid and brilliant colouring, rather varied, aptly named 'Rainbow-fish'. The young with brilliant silvery iridescent spots along body".

Material examined: 8 specimens, 131 - 224 mm. in standard length. 1 from East London, S.A.M. 9889 (holotype); 4 from East London, R.U.C.; 2 from Bizana Coast, R.U.C.; 1 from Xora Mouth, R.U.C.

Remarks

Pavoclinus mentalis was placed by Gilchrist & Thompson (1908) in the genus *Cristiceps* Cuvier & Valenciennes on account of the fully separated dorsal crest, although the same authors placed all the other South African Clinidae then described in the genus *Clinus*. Smith (1945, 1949) gives the type species of his genus *Labroclinus* as *Clinus mentalis* Gilchrist & Thompson, but this is incorrect, as *mentalis* has never been placed in the genus *Clinus*. The genus *Cristiceps* is Australasian and the species included in it are characterised by a high, sickle-shaped separate dorsal crest which originates well forward over the eye, an elongate, very slender caudal peduncle, and a long, simple tentacle over the eye. *Pavoclinus mentalis* has no supra-orbital tentacle, the crest originates in the usual position over the hind margin of the preopercle, and the caudal peduncle, although somewhat elongate, is of the usual width. The species therefore could not be included in the genus *Cristiceps*.

Barnard (1927) commented on the similarity between *mentalis* and *laurentii* and placed them in the genus *Petraites*, also Australian. This genus has a fringed supra-orbital tentacle and is probably not distinct from *Clinus*, so that the inclusion of *mentalis* and *laurentii* in it was unsuitable. In 1945 Smith erected the genus *Labroclinus* for them. The uniting of *mentalis* and *laurentii* by these authors appears to have been based entirely on the separation of the dorsal crest, and may also have been influenced by the very similar distribution of the two species. As has been pointed out, neither of these species should be separated from the species of the genus <u>Pavoclinus</u>, but <u>mentalis</u> is considered to differ sufficiently from <u>laurentii</u> and the other species to warrant subgeneric separation.

Distribution: The known range at present is Port Alfred to St. Lucia Bay. It is rare, and occurs infratidally as well.

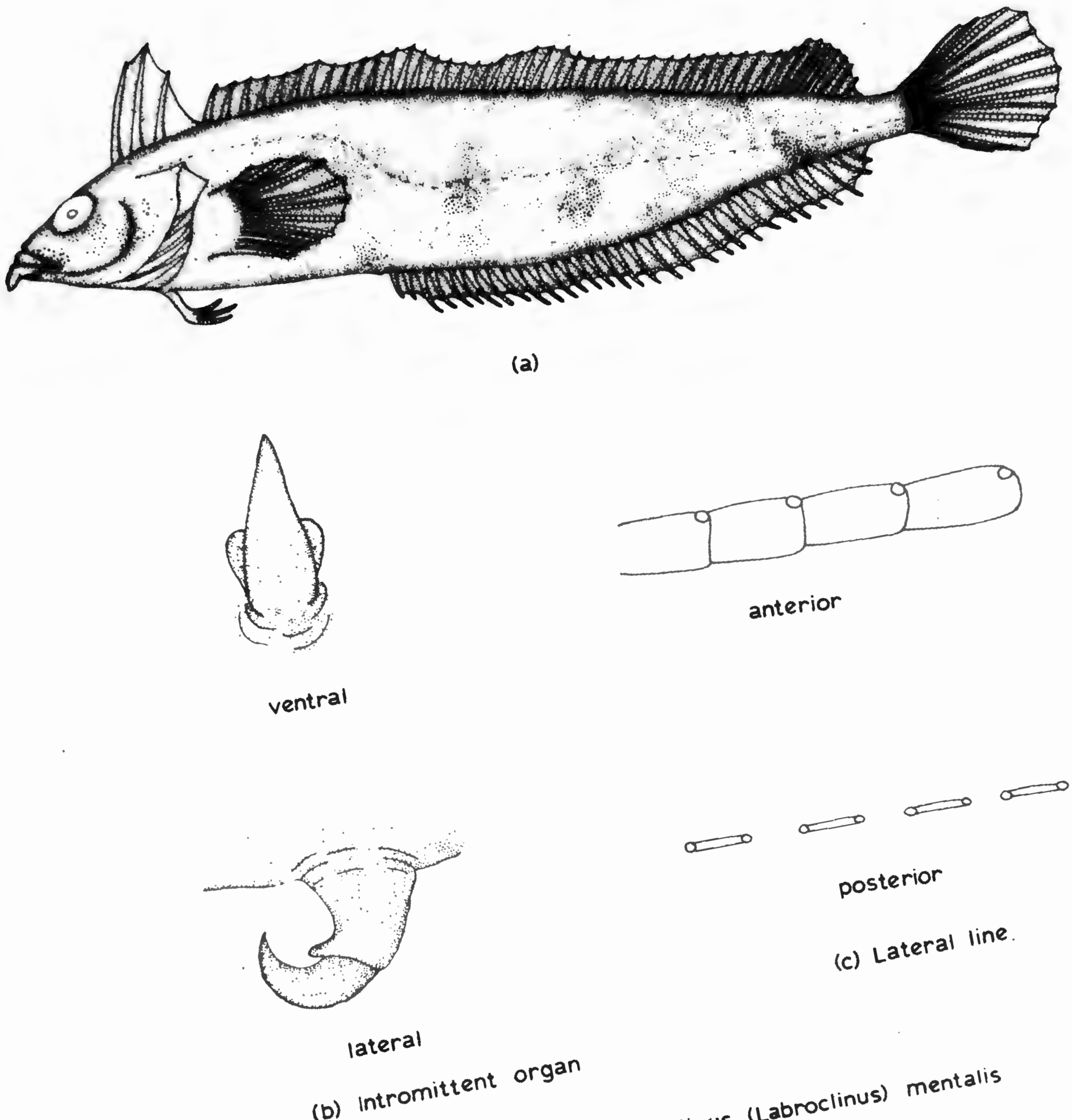


Fig. 25. Pavoclinus (Labroclinus) mentalis

Subgenus _Pavoclinus_ Smith, 1945

Pavoclinus Smith, 1945 :545 (type species _Clinus pavo_ Gilchrist & Thompson)

Diagnosis: Vomer toothed; two rows of teeth in jaw. First three dorsal spines forming a crest or not. With or without a notch in membrane between third and fourth dorsal spines. Scales imbricating on at least front half of body. Body compressed. Caudal rays 13. No skinny flap on lower jaw symphysis. Anal rays less than 25.

Five species. _Pavoclinus heterodon_ is the most generalized species, having the shortest caudal peduncle and the least compression of the body. _Pavoclinus laurentii_ has a rather longer caudal peduncle but is also not greatly compressed. _Pavoclinus pavo_ and _Pavoclinus litorafontis_ are highly compressed forms with an elongate caudal peduncle. _Pavoclinus profundus_ is a peculiar infratidal species known only from the unique type; it resembles the species of this subgenus more closely than it does any of the other clinids, but the dorsal fin is without any crest and the caudal peduncle is quite short.

<u>Pavoclinus</u> (<u>Pavoclinus</u>) <u>heterodon</u> (Cuvier & Valenciennes, 1836)

(fig. 26)

<u>Clinus heterodon</u> Cuvier & Valenciennes, 1836 :394; Gilchrist & Thompson, 1908 :138; Barnard, 1927 :863

<u>Clinus graminis</u> Gilchrist & Thompson, 1908 :136

<u>Pavoclinus heterodon</u>: Smith, 1945 :545; Smith, 1949 :357

Description: D. XXX - XXXV (XXXII - XXXIII) 4 - 6 (5); A. II 21 - 24 (22 - 23); P. 12; V. I 3; C. 13. First three dorsal spines elevated to form a crest, fairly low, second spine highest. No notch in membrane between third and fourth dorsal spines. Pectoral fin with upper edge more or less straight. Inner pelvic ray slender, about half length and diameter of others. Caudal peduncle moderate, 26.5 - 38.5% of head length, depth 26 - 31% of head length. Caudal fin subtruncate.

Body moderately compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 4 - 5. Head 3.5 - 4.75 in standard length, snout rounded to bluntly conical. Eye 2.5 - 3.75 in head. No supra-orbital tentacle. Cirrus on anterior nostril very small, flap-like, covering nostril. Upper jaw 30 - 36% of head length, mouth small. Lips moderately thick. Vomer toothed.

Lateral line of single pores opening above or below the line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 26 (c)). Intromittent organ of male with a short basal portion and a large conical tip emerging between a pair of curved dorso-lateral lips (fig. 26 (b)).

Colouring: Very variable, green, brown, red, often mottled, streaked, or with cross-bars of yellow, silver, or deeper shades of the ground colour; pearly spots on body in young specimens, which are usually otherwise plain red. Fins plain or barred, with small translucent areas particularly on dorsal and caudal fins. Belly usually not lighter than ground colour. Colours tend to brighter and more variable further east along the coast.

Material examined: 100 specimens, 24 - 141 mm. in standard length. 1 from Miller's Point, False Bay, S.A.M. 23899; 8 from Dalebrook, False Bay, S.A.M. 23896, S.A.M. 23900, and 18/12/1964 & 18/4/1965, S.A.M. not catalogued; 12 from St. James, S.A.M. 10523 (syntypes of <u>Clinus graminis</u> Gilchrist & Thompson), and 16/5/1965, S.A.M. not catalogued; 12 from Strandfontein, False Bay, S.A.M. 23885, S.A.M. 23901, S.A.M. 24249; 4 from Still Bay, April 1965, S.A.M. not catalogued; 4 from Kidd's Beach, East London, 1/7/1965, S.A.M. not catalogued; 4 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 22 from East London, S.A.M. 23903, and June 1965, not catalogued; 4 from Gonubie Mouth, East London, 28/6/1965, S.A.M. not catalogued; 12 from Kei Mouth, 30/6/1965, S.A.M. not catalogued; 17 from Port St. John's, S.A.M. 23902.

Remarks

Pavoclinus heterodon was described from the Cape by Cuvier & Valenciennes (1836), and listed by Gilchrist & Thompson (1908), who stated that they had not rediscovered the species here. They did not recognize the specimens from which they described Clinus graminis as heterodon of Cuvier & Valenciennes. The syntypes of Clinus graminis have been examined and are undoubtedly heterodon, as pointed out by Barnard (1927).

Distribution: The known range at present is False Bay to Inhambane (Mozambique), becoming more common eastwards. Usually intertidal, in weed.

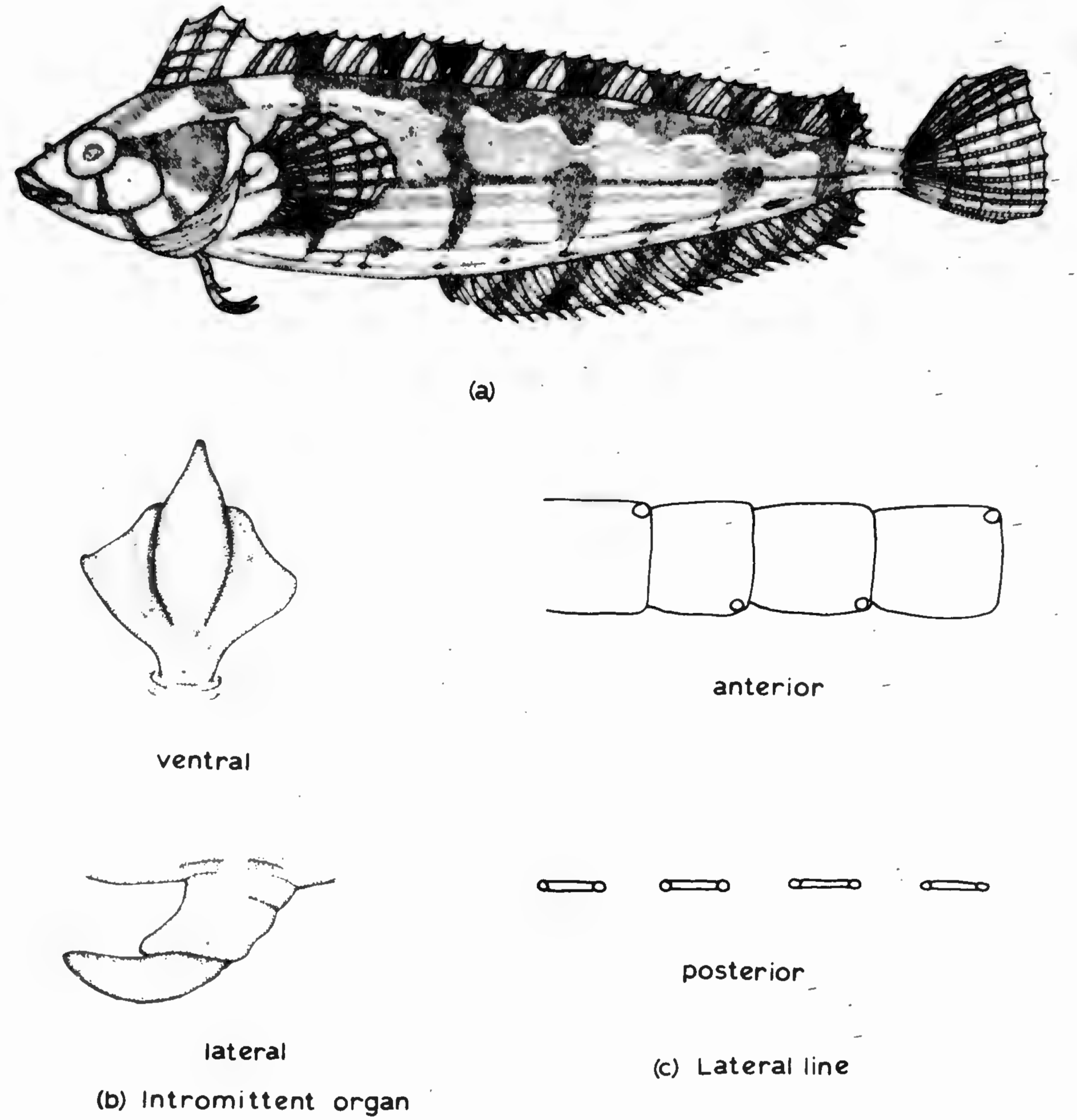


Fig. 26. Pavoclinus (Pavoclinus) heterodon

<u>Pavoclinus</u> (<u>Pavoclinus</u>) <u>laurentii</u> (Gilchrist & Thompson, 1908)

(fig. 27)

<u>Clinus laurentii</u> Gilchrist & Thompson, 1908 :120; Smith, 1937 :218

<u>Petraites laurentii</u>: Barnard, 1927 :866

<u>Labroclinus laurentii</u>: Smith, 1945 :544; Smith, 1949 :357

Description: D. XXIX - XXXIII (XXX - XXXII) 4 - 5; A. II 20 - 22 (21 - 22); P. 12; V. I 3; C. 13. First three dorsal spines elevated to form a crest. Membrane from third to fourth dorsal spine barely reaches base of fourth. Crest moderate, second spine highest. Pectoral fin somewhat rounded, but upper edge fairly straight. Inner pelvic ray about half length of other two, very slender. Caudal peduncle moderate, length 33 - 47% of head length, depth 22 - 33% of head length. Caudal fin subtruncate.

Body moderately compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 4 - 5.5. Head 4.25 - 4.75 in standard length, snout rounded to bluntly conical. Eye 2.75 - 3.75 in head. No supra-orbital tentacle. Cirrus on anterior nostril small, flap-like. Upper jaw 36 - 41% of head length. Lips moderately thick. Vomer toothed.

Lateral line of single, more or less medially placed pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 27 (c)). Intromittent organ of male with a short basal portion and a large, conical tip, ensheathed at the base by a pair of dorso-lateral lips (fig. 27 (b)).

Colouring: No fresh specimens seen. Smith (1949) described the colouring as "most variable, but beautiful and delicate colours and markings, brown, red, yellow, green, mottled and marbled."

Material examined: 15 specimens, 66 - 117 mm. in standard length. 3 from Xora Mouth, R.U.C.; 1 from Bizana Coast, R.U.C.; 1 from Port St. John's, R.U.C.; 1 from Isipingo, R.U.C.; 7 from Natal, S.A.M. 9888 (syntypes), S.A.M. 10927, S.A.M. 16157, S.A.M. 18515; 1 from Inhaca Island, Mozambique, R.U.C.; 1 from Inhambane, Mozambique, R.U.C.

Remarks

Pavoclinus laurentii is similar to Pavoclinus mentalis in the separation of the dorsal crest and distribution, but resembles Pavoclinus heterodon in body shape, head shape, fin counts, and relative size of eye, and appears to be closer to the more generalized species than to Pavoclinus mentalis.

Distribution: Port Alfred to Inhambane is the known range at present. The species is said to be not uncommon (Smith, 1949).

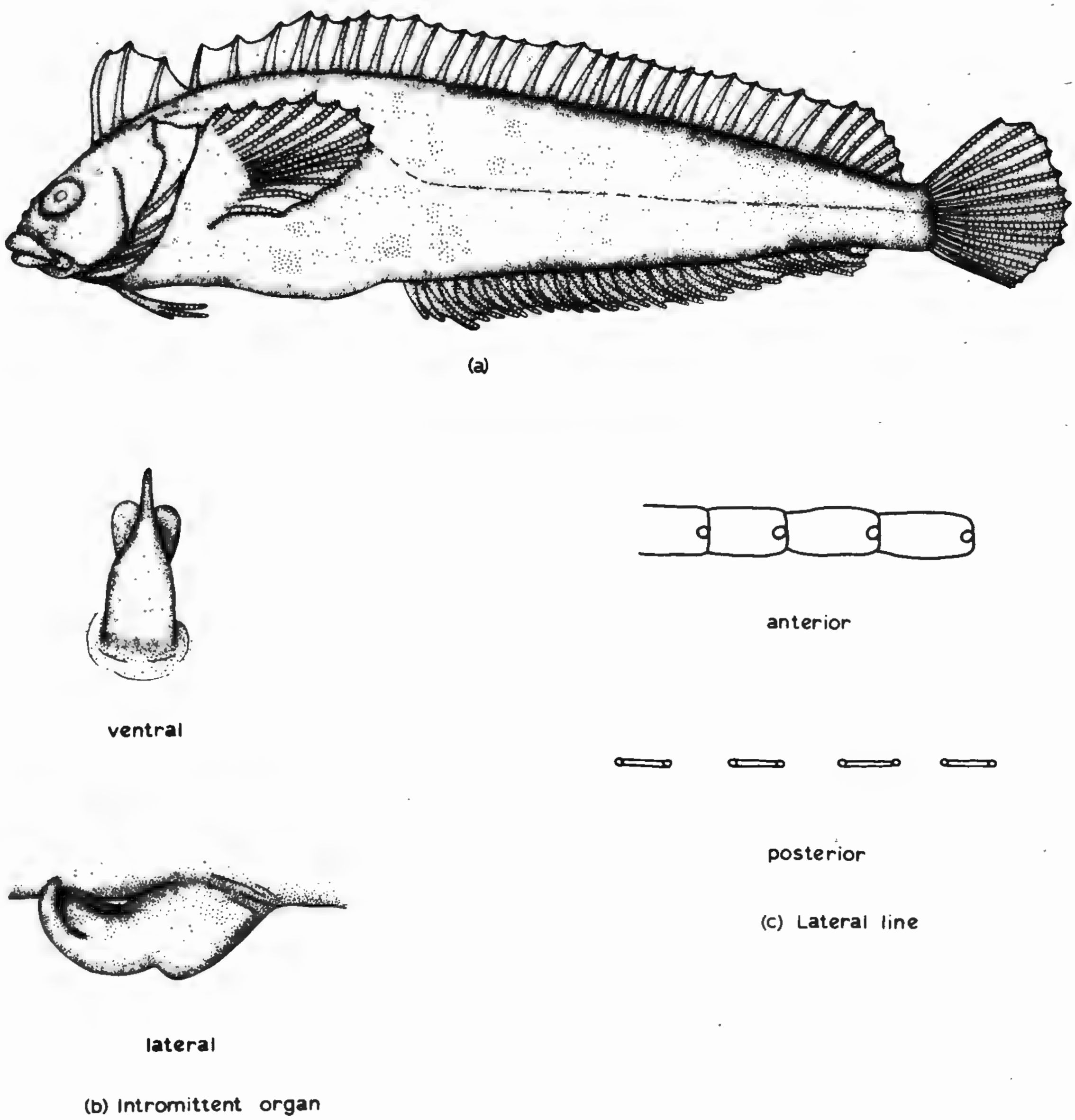


Fig. 27. Pavoclinus (Pavoclinus) laurentii

Pavoclinus (Pavoclinus) litorafontis Penrith, 1965

(fig. 28)

Pavoclinus litorafontis Penrith, 1965 :

Description: D. XXIX - XXXII (XXXI - XXXII) 7 - 8; A. II 20 - 23 (23); P. 11 - 12; V. I 3; C. 13. First three dorsal spines elevated to form a crest, decreasing in relative height with increase in size of fish. No notch in membrane between third and fourth dorsal spines. Upper edge of pectoral fin more or less straight. Inner pelvic ray stout, equal to others. Caudal peduncle long, length 58.5 - 75% of head length, depth 22.5 - 33.5% of head length. Caudal fin subtruncate.

Body compressed, covered with small scales extending on to dorsal and caudal fin bases but not anal fin base or head. Depth 4.5 - 5.75. Head 3.75 - 5 in standard length, snout subconical. Eye 3.5 - 4.25 in head. No supra-orbital tentacle. Cirrus on anterior nostril very small. Upper jaw 33.5 - 41.5% of head length. Lips moderately thick. Vomer toothed.

Lateral line of single pores opening more or less medially in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 28 (c)). Intromittent organ of male with a short basal portion and a large, conical tip; a single pair of crescentic dorso-lateral lips ensheathing the base of the tip (fig. 28 (b)).

Colouring: Green, striped in shades of darker green, yellow, and silver longitudinally. Usually a yellow or silver stripe across cheek. Fins green, usually with translucent patches; always translucent patches in the caudal fin. Belly no lighter than ground colour, underparts green. Juveniles green or brown with a broad silver longitudinal stripe mid-laterally.

Material examined: 22 specimens, 27 - 190 mm. in standard length. 14 from Strandfontein, False Bay, S.A.M. 23876, S.A.M. 23877, S.A.M. 23952, S.A.M. 23962, S.A.M. 23972, S.A.M. 24052 (holotype), S.A.M. 24248, and March 1965, S.A.M. not catalogued; 8 from Onrust River Mouth, S.A.M. 24081, S.A.M. 24257.

Remarks

Pavoclinus litorafontis appears to be the most strongly modified member of the subgenus *Pavoclinus*, and has the most elongate caudal peduncle in that subgenus. It is closest to *Pavoclinus heterodon* in the form of the dorsal fin and the head. It resembles *Pavoclinus mentalis* in the body proportions but not the fin counts other than the number of soft dorsal rays and the strong development of the inner pelvic ray. It attains a larger size than the other species of the subgenus *Pavoclinus*. Juveniles have a very poorly developed intromittent organ and it is usually impossible to sex small specimens externally.

Distribution: The knwon range at present is False Bay to Cape Agulhas; not common, in sea-weed low down on the shore.

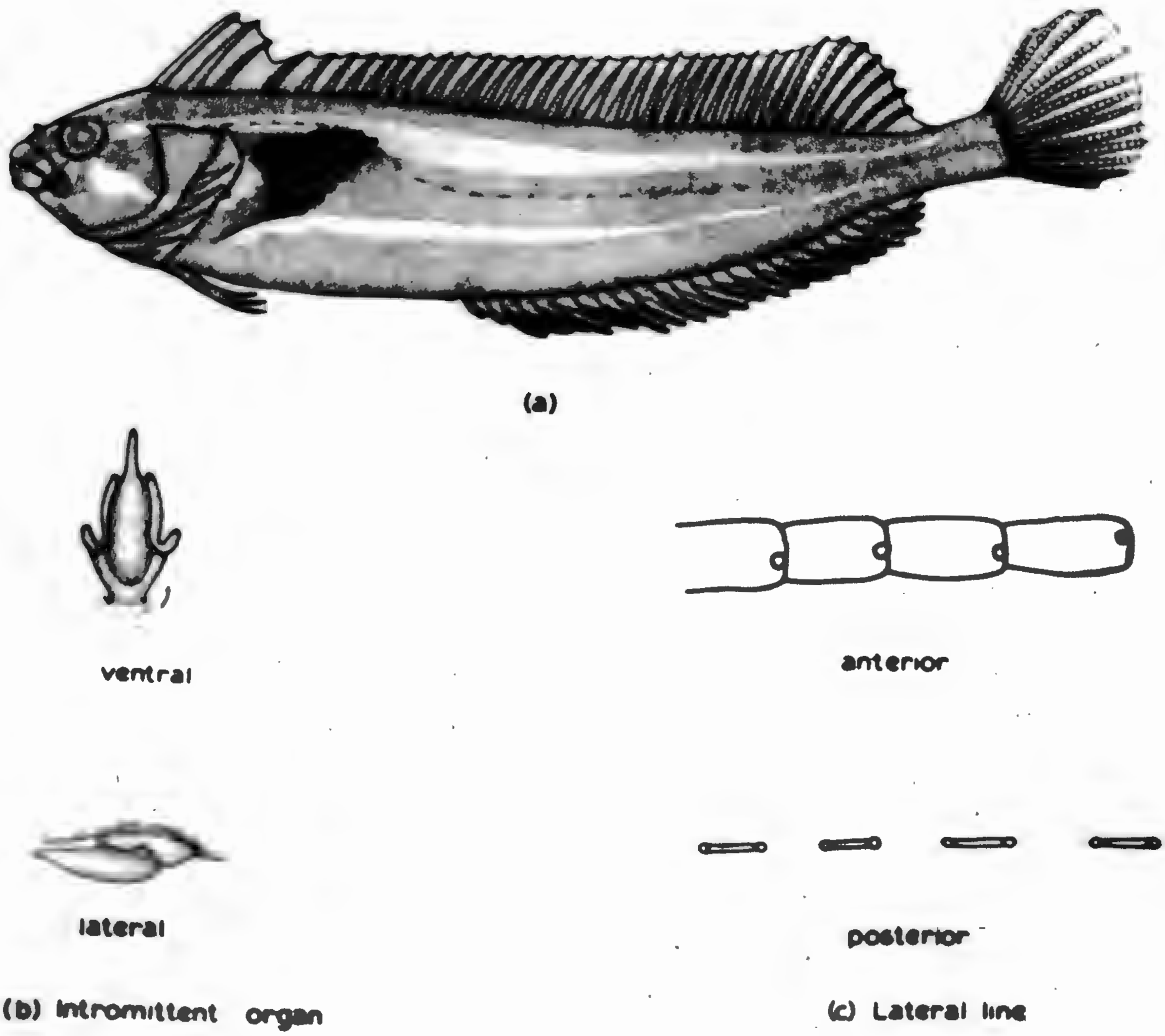


Fig 28 Pavoclinus (Pavoclinus) litorafontis

<u>Pavoclinus</u> (<u>Pavoclinus</u>) <u>pavo</u> (Gilchrist & Thompson, 1908)

(fig. 29)

<u>Clinus</u> <u>pavo</u> Gilchrist & Thompson, 1908 :123; Barnard, 1927 :857

<u>Pavoclinus</u> <u>pavo</u>: Smith, 1945 :545; Smith, 1949 :357

Description: D. XXX - XXXVI (XXXI - XXXIII) 2 - 4 (3); A. II 20 - 23 (20 - 22); P. 11 - 12 (12); V. I 2 - 3; C. 13. First three dorsal spines elevated to form a crest, second spine longest. No notch in membrane between third and fourth dorsal spines. Pectoral fin with upper edge more or less straight. Inner pelvic ray minute or absent. Caudal peduncle long, 40 - 47% of head length, depth 20 - 30% of head length. Caudal fin subtruncate.

Body compressed, covered with small scales extending on to base of dorsal fin but not caudal and anal fin bases or head. Depth 3.75 - 5, body deepening with age. Head 3.5 - 4.75 in standard length, snout narrow, acutely pointed. Eye 3 - 4 in head. No supra-orbital tentacle. Cirrus on anterior nostril flattened, flap-like, curving forward over nostril. Upper jaw 22 - 36.5% of head length, mouth small. Lips thick. Vomer toothed.

Lateral line of single pores opening above and below line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 29 (c)). Intromittent organ of male with a short basal portion and a large, conical tip, swollen at the base, and surrounded basally by a large fleshy pair of ovoid dorso-lateral lips (fig. 29 (b)).

Colouring: Variable, green, brown, or red, sometimes mottled and striped longitudinally with yellow, lighter shades of the main colour, and silvery white. Belly of same shade as ground colour. Often pearly spots on body. Dorsal and caudal fin with translucent patches. A specimen taken from kelp at Hondeklip Bay was olive yellow, with three turquoise blue ocellate spots on side and a turquoise blue line across cheek.

Material examined: 59 specimens, 15 - 111 mm. in standard length. 1 from Shearwater Bay, Lüderitzbucht, S.A.M. 24213; 2 from Port Nolloth, S.A.M. 24218; 3 from Hondeklip Bay, March 1965, S.A.M. not catalogued; 3 from Lambert's Bay, S.A.M. 23250; 1 from Langebaan, S.A.M. 21476; 1 from Melkbosch, 20/10/1964, S.A.M. not catalogued; 1 from Table Bay, S.A.M. 4728; 1 from Miller's Point, False Bay, S.A.M. 23894; 1 from Glencairn, False Bay, S.A.M. 23891; 1 from Kalk Bay, False Bay, S.A.M. 17935; 9 from Dalebrook, False Bay, S.A.M. 23888, S.A.M. 23898, and 18/4/1965, S.A.M. not catalogued; 6 from St. James, False Bay, S.A.M. 10532 (syntypes), and 16/5/1965, S.A.M. not catalogued; 3 from Onrust River Mouth, S.A.M. 24251; 15 from Kidd's Beach, East London, 1/7/1965, S.A.M. not catalogued; 4 from Igoda Mouth, East London, 29/6/1965, S.A.M. not catalogued; 1 from East London, S.A.M. 23892; 6 from Kei Mouth, 30/6/1965, S.A.M. not catalogued.

Remarks

Pavoclinus pavo is apparently the only species of the genus *Pavoclinus* which occurs on the coast west of Cape Point, although it is much more common east of Cape Agulhas. It is smaller and more delicately built than the other species which occur intertidally.

Distribution: The known range at present is Lüderitzbucht (South West Africa) to the Kei River. It is nowhere very common, but is not uncommon towards the eastern limit of its range. It lives intertidally in sea-weed.

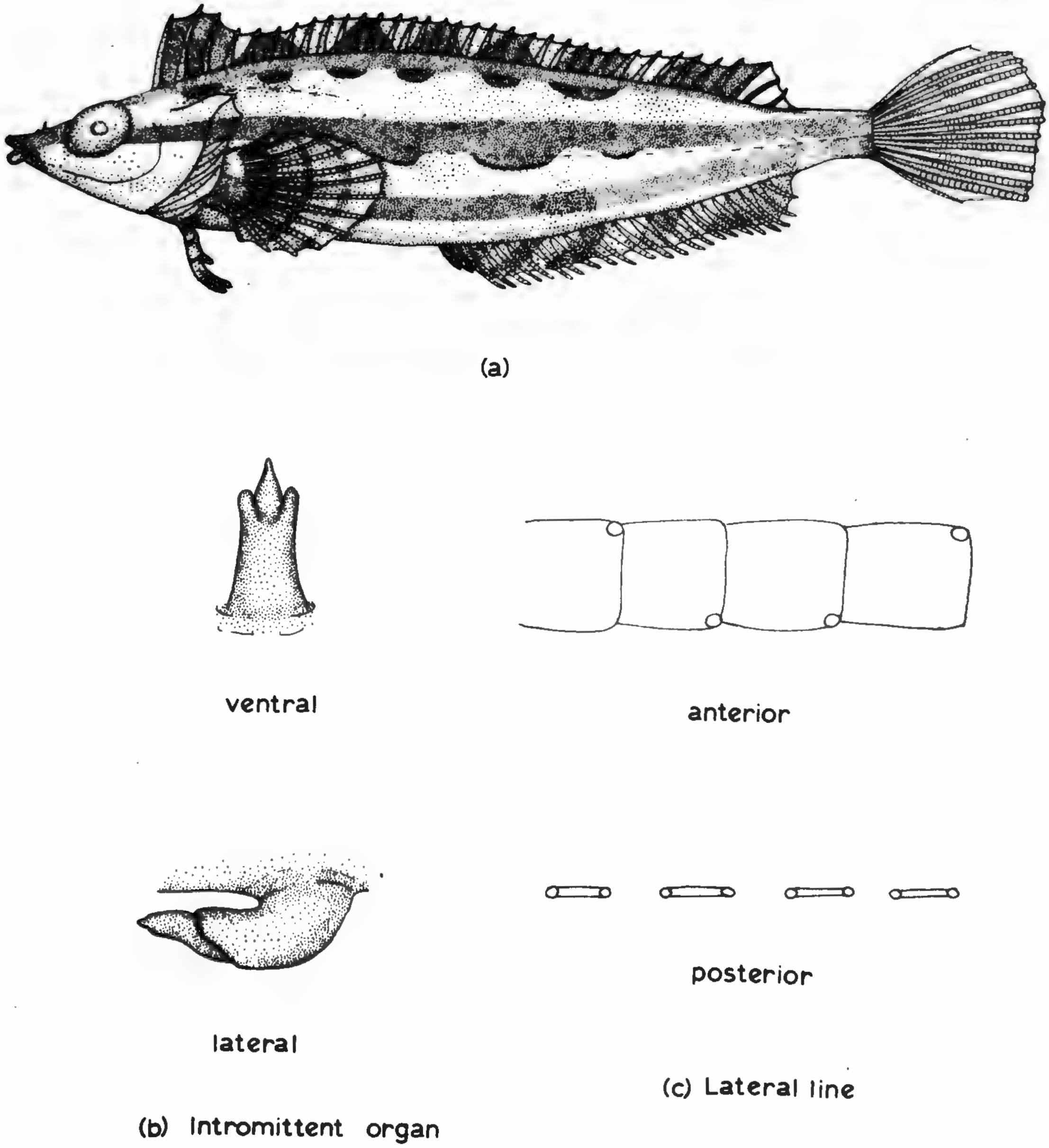


Fig. 29. Pavoclinus (Pavoclinus) pavo

<u>Pavoclinus (Pavoclinus) profundus</u> Smith, 1960

(fig. 30)

<u>Pavoclinus profundus</u> Smith, 1960 :689

Description: D. XXX 4; A. II 21; P. 12; V. I 3; C. 13. First three dorsal spines not elevated to form a crest, but fourth spine slightly shorter than third or fifth. No notch in membrane between third and fourth dorsal spines. Upper edge of pectoral almost straight. Inner pelvic ray minute, bound to outer rays by membrane, tip not free. Caudal peduncle moderate, length 36.4% of head length, depth 27.2% of head length. Caudal fin subtruncate.

Body highly compressed, covered with small scales. Head naked. Depth at anal origin 4.8. Head 3.9 in standard length, snout acutely pointed. Eye 3 in head. No supra-orbital tentacle. Cirrus on anterior nostril a small flap. Upper jaw 36.4% of head length, mouth small. Lips moderately thin. Vomer toothed.

Lateral line of single pores opening above or below the line in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end, becoming obscure on caudal peduncle (fig. 30 (c)). Intromittent organ of male with a short basal portion and a large conical tip; a pair of elongate fleshy dorso-lateral lips partially ensheathing the tip (fig. 30 (b)).

Colouring: Only the preserved type seen. Detailed description of fresh colouring given by Smith (1960).

Material examined: 1 specimen, 43 mm. in standard length. Knysna, 20 fms., R.U.C. (holotype).

Remarks

This species is known only from the unique type specimen, and in spite of the lack of a marked dorsal crest it has so many features in common with the other members of the subgenus Pavoclinus that it is placed in the same subgenus. Not least of these similarities is the form of the intromittent organ. The type specimen was stated by Smith (1960) to be a female, but the specimen is clearly a male with an intromittent organ of a type very similar to that of the other species of Pavoclinus.

Distribution: Known from one locality, Knysna; dredged in 20 fathoms from a rocky bank.

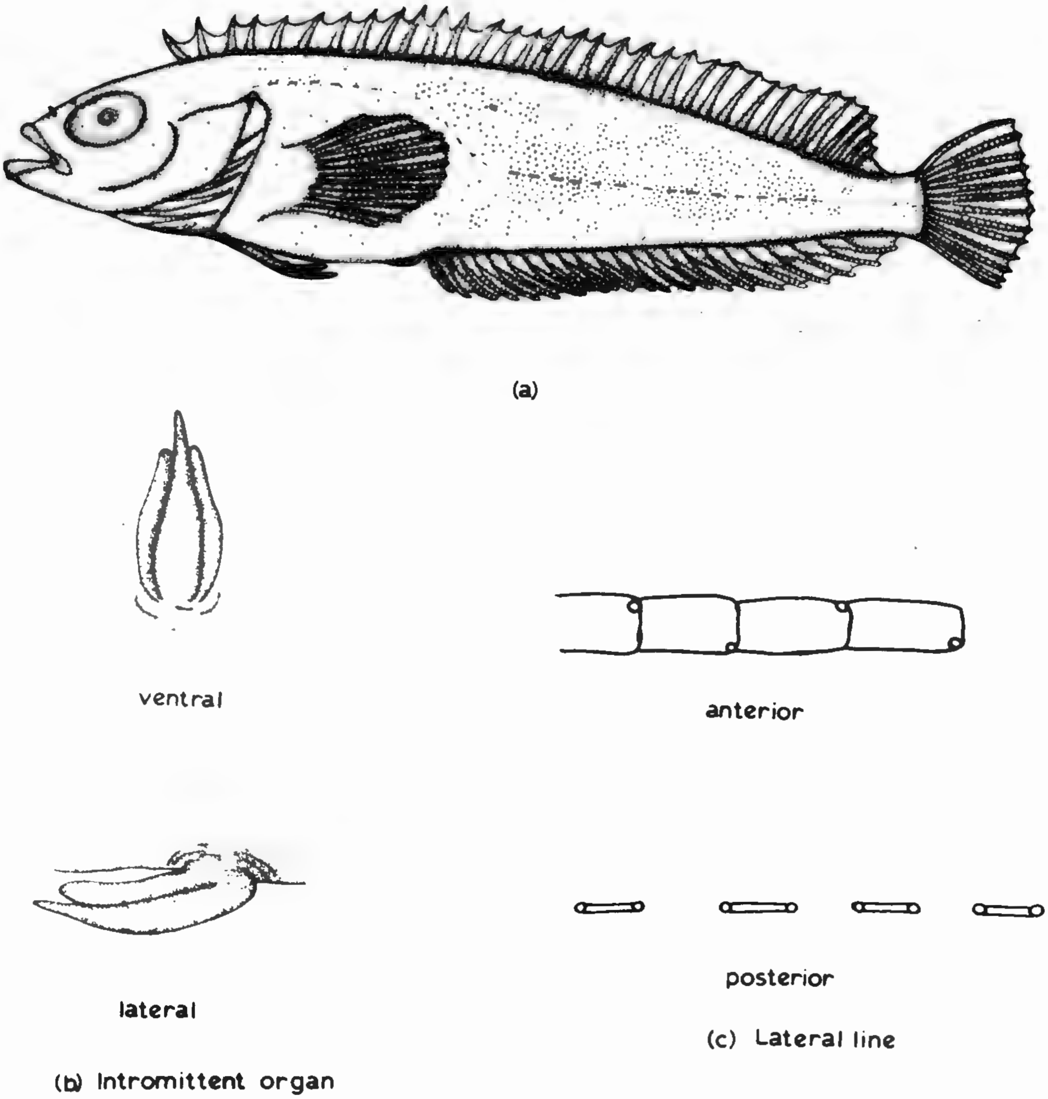


Fig. 30. Pavoclinus (Pavoclinus) profundus

Subgenus *Smithichthys* Hubbs, 1952

Myxodes (*non* Cuvier) Smith, 1945 :544 (type species *Myxodes viridis* Cuvier & Valenciennes)

Smithichthys Hubbs, 1952 :107 (type species *Clinus fucorum* Gilchrist & Thompson)

Diagnosis: Vomer edentate; a single row of teeth in jaw. Snout upturned, pug-like. First four or five dorsal spines elevated to form a high, rounded dorsal crest. Body highly compressed. Scales minute, non-imbricating. Caudal peduncle elongate; Caudal rays 13.

One species, *Pavoclinus* (*Smithichthys*) *fucorum* (Gilchrist & Thompson).

Pavoclinus (*Smithichthys*) *fucorum* (Gilchrist & Thompson, 1908)

(fig. 31)

Clinus fucorum Gilchrist & Thompson, 1908 :121; Barnard, 1927 :853

Myxodes fucorum: Smith, 1945 :544; Smith, 1949 :356

Smithichthys fucorum: Hubbs, 1952 :107; Smith, 1953 :356

Description: D. XXVIII - XXXI (XXIX - XXX) 4 - 6 (5 - 6); A. II 19 - 21; P. 12 - 13 (12); V. I 3; C. 13. First dorsal spine originates well forward, over hind margin of eye. First four or five dorsal spines elevated to form a high, rounded crest. No notch in dorsal fin membrane between any of the spines; all spines evenly placed. Dorsal spines of varying lengths, giving the outline of the fin a markedly undulating appearance. Pectoral fin more or less rounded, upper edge somewhat straight. Inner pelvic ray stout, almost equal to others. Caudal peduncle long, length 47 - 62.5% of head length, depth 23.5 - 30% of head length. Caudal fin subtruncate, very large.

Body highly compressed, deep, covered with small scales not extending on to fin bases or head. Depth 3.5 - 4. Head 4 - 4.75 in standard length, snout rounded, upturned, pug-like. Eye 3 - 5 in head. No supra-orbital tentacle. Cirrus on anterior nostril short, with an expanded trilobate tip. Upper jaw 32 - 42% of head length. Lips fairly thick. Vomer edentate; a single row of teeth in jaw.

Lateral line of single pores opening more or less medially in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 31 (c)). Intromittent organ of male with a short basal portion and a long, conical tip, bilobed terminally, with a wing-like pair of dorso-lateral lips ensheathing it basally (fig. 31 (b)).

Colouring: Uniform dark brown or olive, edges of fins lighter or transparent; two irregular translucent patches in caudal fin. A bright silvery iridescent spot behind pectoral fin.

Material examined: 13 specimens, 42 - 196 mm. in standard length.

9 from St. James, False Bay, S.A.M. 10524 (syntypes), S.A.M. 12020, and 16/5/1965, S.A.M. not catalogued; 2 from Muizenberg, False Bay, S.A.M. 10525; 2 from Strandfontein, False Bay, S.A.M. 23886, and March, 1965, S.A.M. not catalogued.

Remarks

Pavoclinus fucorum is a peculiar, rare, highly specialized weed-dwelling species. It resembles Pavoclinus mus in the lack of vomerine teeth, but otherwise apparently differs from it in as many ways as it does from the members of the other subgenera of Pavoclinus.

Distribution: The known range at present is False Bay to the Bashee River; rare, in sea-weed. At the bottom of the intertidal region and infratidal.

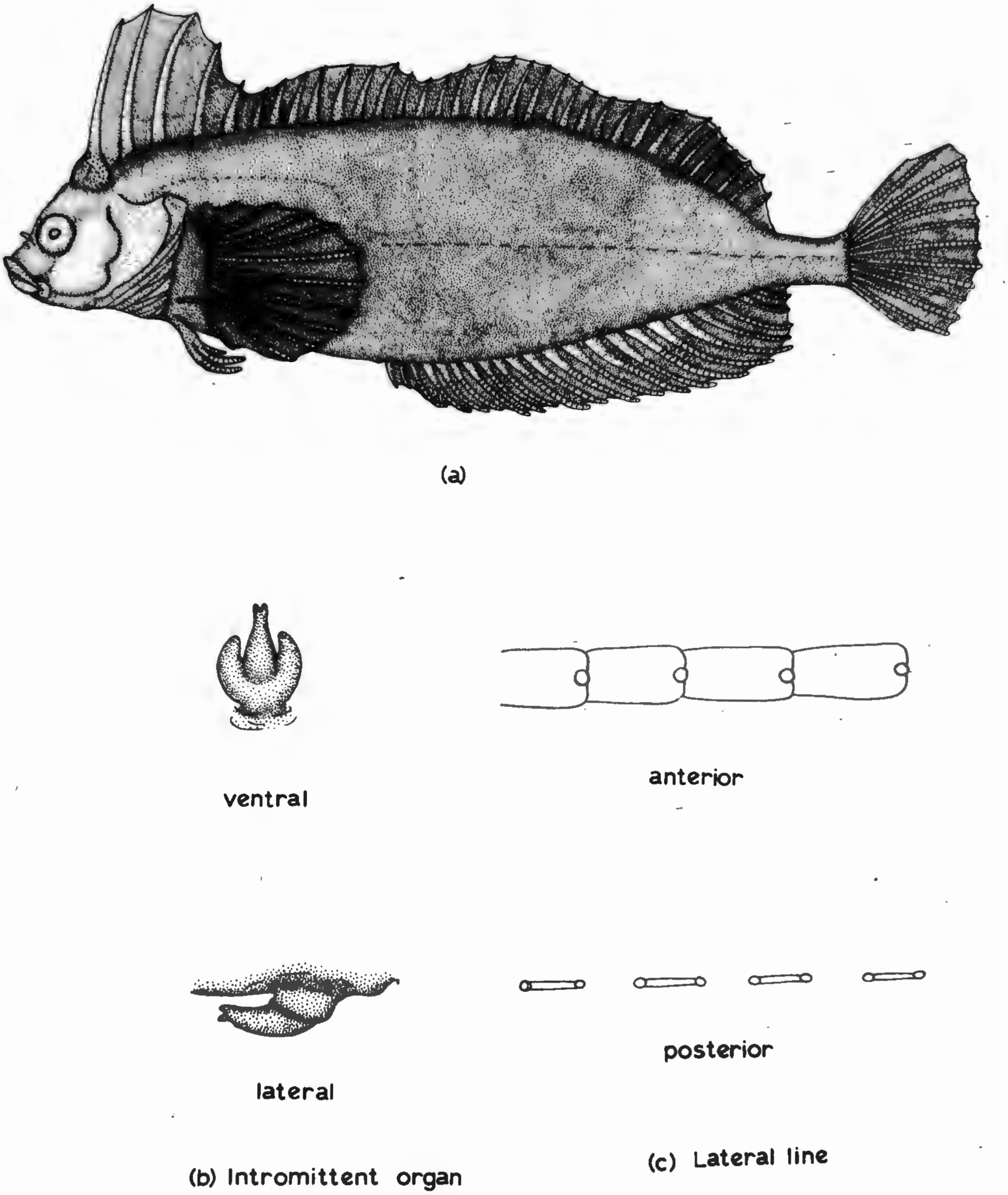


Fig. 31. Pavoclinus (Smithichthys) fucorum

Genus *Blennioclinus* Gill, 1860

Blennioclinus Gill, 1860 :103 (type species *Clinus brachycephalus* Cuvier & Valenciennes)

Diagnosis: No supra-orbital tentacle. Last dorsal spine about half length of first dorsal ray, a deep notch in profile of dorsal fin before dorsal soft rays. Lateral line of double pores anteriorly to post-pectoral curve, then of short separate horizontal tubes with a pore at either end. Intromittent organ of male with a short or moderate basal portion and a long slender tip concealed between a pair of very large lateral lips. Body covered by small embedded cycloid scales, not extending on to fin bases or head. First three dorsal spines elevated to form a low crest. A notch in membrane between third and fourth dorsal spines. Clusters of cirri at tips of at least the anterior dorsal spines. Vomer toothed. Head short, profile rounded.

Two species.

Discussion

The genus *Blennioclinus* was included by Smith (1945) in his Myxodinae on account of the lack of a supra-orbital tentacle. Jackson (1950) placed its two species in a separate subgenus of *Myxodes* (=*Pavoclinus*), stating that they are related to other species of that genus by their small mouths and weed-dwelling habit. However, neither of the two species are weed-dwellers, and *Blennioclinus stella* has a relatively large mouth. The two species are further set apart from the genus *Pavoclinus* by the notch in the profile of the dorsal fin before the dorsal soft rays, the clusters of cirri at the tips of the dorsal spines, the body form, and the type of intromittent organ, as well as by the high number of double pores in the anterior part of the lateral line. They are set apart from the genus *Clinus* mainly by the notch before the dorsal soft rays and the lack of a supra-orbital tentacle. The genus *Blennioclinus* is therefore regarded as distinct from the other clinid genera.

Distribution: West and east coasts of South Africa.

Key to the species of *Blennioclinus*

1. 8 - 11 dorsal soft rays .... *Blennioclinus brachycephalus*
   6 - 7 dorsal soft rays .... *Blennioclinus stella*

Blennioclinus brachycephalus (Cuvier & Valenciennes, 1836)

(fig. 32)

Clinus brachydephalus Cuvier & Valenciennes, 1836 :371; Gilchrist & Thompson, 1908 :135; Barnard, 1927 :852

Labrisomus linearis Swainson, 1839 :277

Blennioclinus brachycephalus: Gill, 1860 :103; Smith, 1945 :543; Smith, 1949 :356

Description: D. XXVI – XXX (XXVIII – XXIX) 8 – 11 (9 – 11); A. II 19 – 25 (21 – 24); P. 12 – 15 (13 – 14); V. I 3; C. 13. First three dorsal spines slightly elevated, first spine 0 – 2 mm. longer than fourth, crest very low. Third and fourth dorsal spines more widely spaced than others, a very shallow notch in membrane between them. Dorsal spines decrease in height posteriorly, last spine very short, dorsal soft rays much higher; a deep notch in profile of dorsal fin before dorsal soft rays. Clusters of 3 – 4 cirri at tips of most dorsal spines. Pectoral fin rounded. Inner pelvic ray short, slender. Caudal peduncle moderate, 35 – 40% of head length, depth 23 – 31% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with minute scales not extending on to dorsal, caudal, or anal fin bases or head. Depth 5 – 5.75. Head short, bluntly rounded, 4 – 5 in standard length. Eye 2.5 – 3.5 in head. No supra-orbital tentacle. Cirrus on anterior nostril flattened, irregularly trilobed. Upper jaw 28.5 – 34% of head length, mouth small. Lips thin. Vomer toothed.

Lateral line of about 30 - 35 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 32 (c)). Intromittent organ of male with a moderate basal portion and a slender tip, ensheathed by a large pair of frilled dorso-lateral lips (fig. 32 (b)).

Colouring: Ground colour creamy fawn, much overlain with dark brown blotches and reticulations, denser dorsally. Belly creamy or bright yellow, with a dark band running from the isthmus towards the vent, having broad dark vertical bands branching off it symmetrically and running up to the densely mottled area above. Sometimes fine orange stripes alternate with the dark bands. A red-edged bright blue semi-circular spot behind pectoral fin. Head dark above to lighter brown below. Two mauve wavy lines on preopercle and opercle. A dark irregular band from below eye to angle of jaw. Spinous dorsal dark brown, with red tips to spines. Dorsal soft rays dark brown, membrane joining them cream barred with brown between first five rays, then plain cream. Anal fin with broad brown cross-bars, ground colour creamy, tips of rays red. Pectoral fin cream with dark brown cross-bars. Pelvic fins dark at base, then cream with two narrow red bars distally. Caudal fin cream with irregular dark brown markings. Branchiostegal membranes mauve, with dark brown cross-bars. Juveniles plain dark red with a longitudinal row of large silvery spots along side.

Material examined: 222 specimens, 17 - 93.5 mm. in standard length. 12 from Lüderitzbucht, S.A.M. 24210; 2 from Simon's Bay, False Bay, S.A.M. 10534; 13 from Dalebrook, False Bay, 18/12/1964, 19/2/1965, 18/4/1965, and 16/5/1965, S.A.M. not catalogued; 2 from St. James, False Bay, S.A.M. 12014; 146 from Strandfontein, False Bay, S.A.M. 23875, S.A.M. 23953, S.A.M. 23970, S.A.M. 23974, and 20/11/1964 and 13/8/1964, S.A.M. not catalogued; 1 from Gordon's Bay, False Bay, S.A.M. 23293; 1 from Die Dam, Bredasdorp district, March 1965, S.A.M. not catalogued; 25 from Still Bay, S.A.M. 18265, and April 1965, S.A.M. not catalogued; 1 from Port Elizabeth, S.A.M. 24244; 2 from East London, S.A.M. 18092; 2 from Kei Mouth, 30/6/1965, S.A.M. not catalogued.

Remarks

Blennioclinus brachycephalus is the more widely distributed and common of the two species of *Blennioclinus*. It is also the larger. The notched profile of the dorsal fin is interesting, since the same condition is found in some of the American Labrisominae e.g. *Labrisomus* and *Malacoctenus*, but not in any of the other Clininae, yet in all other features the two species are obviously Clininae.

Distribution: Lüderitzbucht (South West Africa) to the Kei River; locally common east of Cape Point, in pools at the low tide mark, usually among pebbles and sea-urchins.

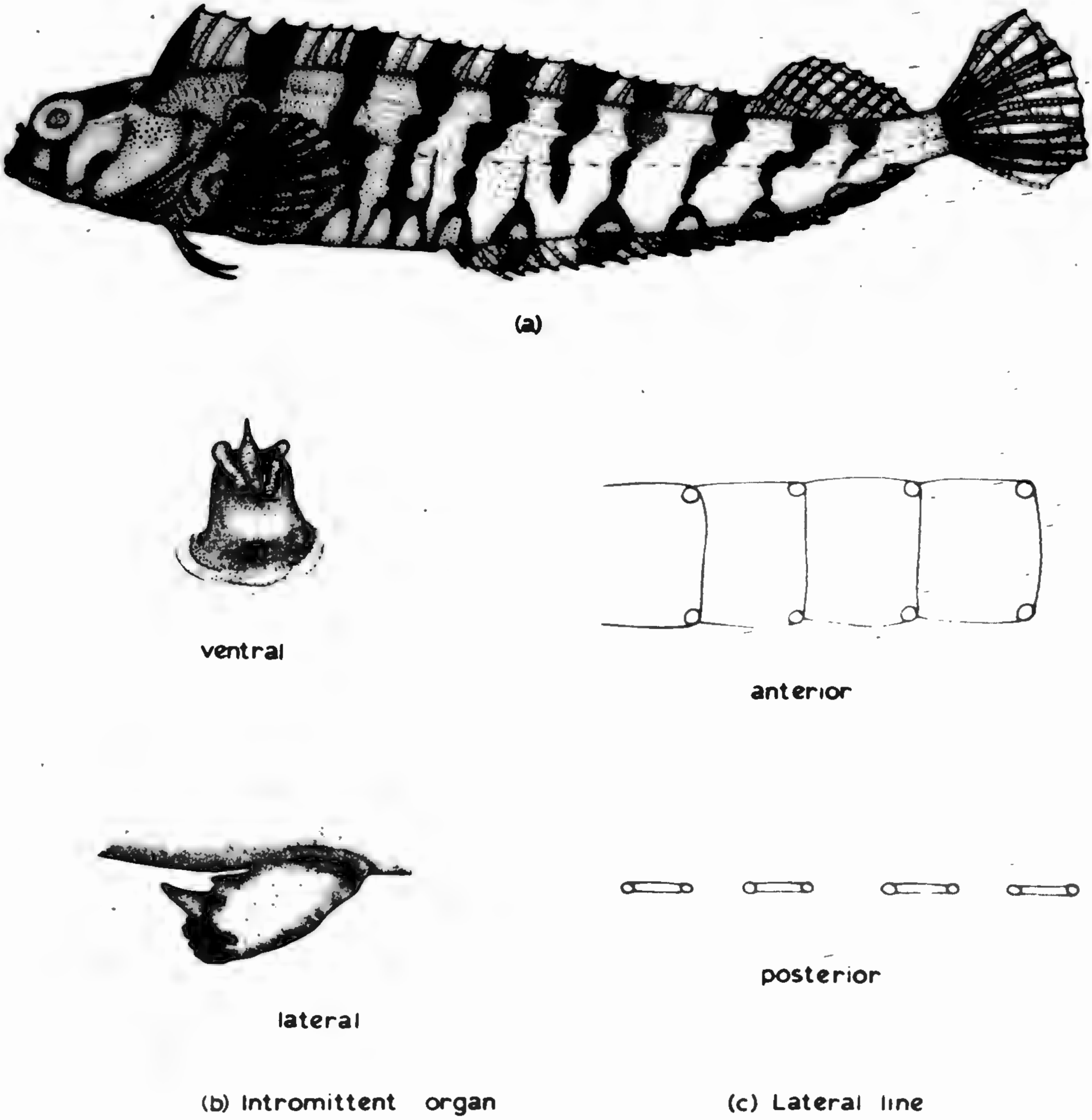


Fig 32 Blennioclinus brachycephalus

Blenniocliпus stella Smith, 1945

(fig. 33)

Blennioclinus stella Smith, 1945 :543; Smith, 1949 :356

Description: D. XXIV - XXVIII 6 - 7; A. II 19 - 21; P. 12; V. I 3; C. 13. First three dorsal spines elevated to form a low crest. Gap between third and fourth spines wider than between other spines; a deep notch in membrane between third and fourth spines. Dorsal spines decrease in height posteriorly, last spine very short, dorsal soft rays much longer, resulting in a deep notch in profile of dorsal fin before dorsal soft rays. Clusters of cirri at tips of first three dorsal spines. Pectoral fin rounded. Inner pelvic ray minute. Caudal peduncle short, length 27.5 - 33% of head length, depth 27.5 - 33.5% of head length. Caudal fin subtruncate.

Body slightly compressed, covered with small scales not extending on to dorsal, caudal, or anal fin bases or head. Depth 5.25 - 5.75. Head 3.75 - 5.25 in standard length, snout rounded. Eye 2.5 - 3.25 in head. No supra-orbital tentacle. Cirrus on anterior nostril elongate, narrow proximally, with the tip expanded and deeply serrate. Upper jaw 37.5 - 47.5% of head length. Lips moderately thick. Vomer toothed.

Lateral line of about 25 double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 33 (c)). Intromittent organ of male with a short basal portion and a long, slender tip ensheathed by a pair of large, flat ventro-lateral lips, with serrate inner margins (fig. 33 (b)).

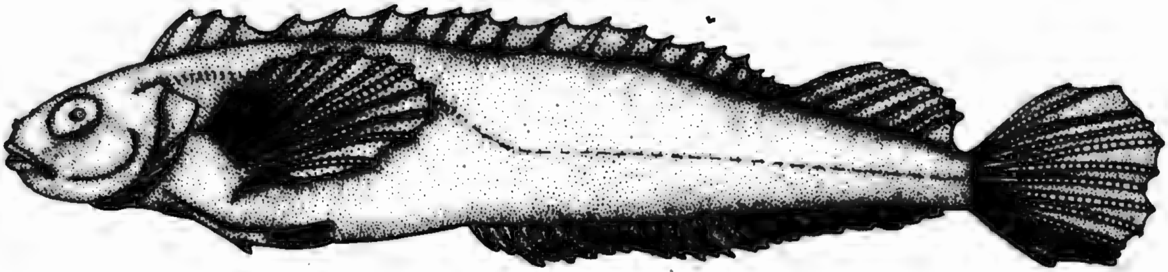
Colouring: No entirely fresh specimens seen. Smith (1945) described the colouring as "variably brown red and orange mottled. Three narrow bars across head, one through eye to cheek. Eight to ten cross-bars on body, spreading to dorsal fin. Sometimes iridescent silvery patches along flanks". Two very small freshly preserved juvenile specimens examined were yellowish red, mottled and barred.

Material examined: 7 specimens, 26 - 38 mm. in standard length. 2 from Port Elizabeth, S.A.M. 24245; 3 from Cape Morgan, R.U.C.; 2 from Xora Mouth, August 1947, R.U.C.

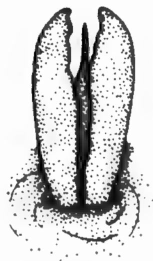
Remarks

Blennioclinus stella is the smallest of the South African Clinidae. It is very similar to Blennioclinus brachycephalus, but can be distinguished from it by the lower number of dorsal soft rays.

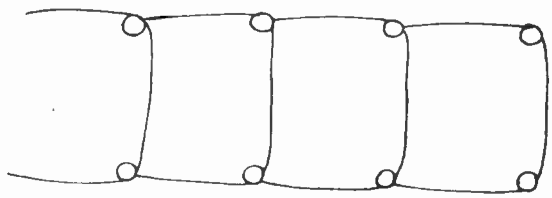
Distribution: Port Elizabeth to Port Edward; not common, in shallow pools at the bottom of the shore, among pebbles.



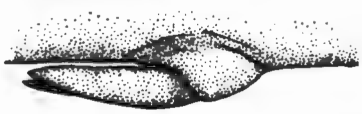
(a)



ventral



anterior



lateral

posterior

(b) Intromittent organ

(c) Lateral line

Fig. 33 *Blennioclinus stella*

Genus *Clinoporus* Barnard, 1927

Clinoporus Barnard, 1927 :864 (type species *Clinus biporosus* Gilchrist & Thompson)

Diagnosis: No scales; whole body naked, elongate, robust. No supra-orbital tentacle. Dorsal fin low, even, anterior spines not raised to form a crest. Lateral line of large pores opening above and below line throughout, very broad and conspicuous. Pores on head large. Vomer toothed.

One species, *Clinoporus biporosus* (Gilchrist & Thompson).

Discussion

Clinoporus is a peculiar genus whose only known representative is infra- rather than intertidal. The lateral line is very distinctive and unlike that of any other clinid. The lack of scales is unique in the Clinidae. C.L. Smith (1957) investigated the possibility of the degree of scaling of clinids being related to the amount of water movement in the environment of the adult, but concluded that the two factors are not correlated.

The inclusion of *Clinoporus biporosus* in the "Myxodinae" by Smith (1945), together with *Pavoclinus*, *Blennioclinus*, and *Gynutoclinus*, solely on the basis of the lack of a supra-orbital tentacle is quite unjustifiable, since this species bears no resemblance whatsoever to either the weed-dwellers of the genera *Pavoclinus* and *Gynutoclinus*, or to the species of *Blennioclinus*.

Clinoporus biporosus (Gilchrist & Thompson, 1908)

(fig. 34)

Clinus biporosus Gilchrist & Thompson, 1908 :137

Clinoporus biporosus: Barnard, 1927 :864; Smith, 1945 :546;

Smith, 1949 :358

Description: D. XXXVIII – XLI 3; A. II 27 – 28; P. 12 – 13; V. I 3; C. 13. Dorsal fin low, even, no notch in membrane between third and fourth dorsal spines. No clusters of cirri at tips of dorsal spines. Pectoral fin rounded, inner pelvic ray minute. Caudal peduncle short, length 23 – 26% of head length, depth 28.5 – 31% of head length. Caudal fin subtruncate.

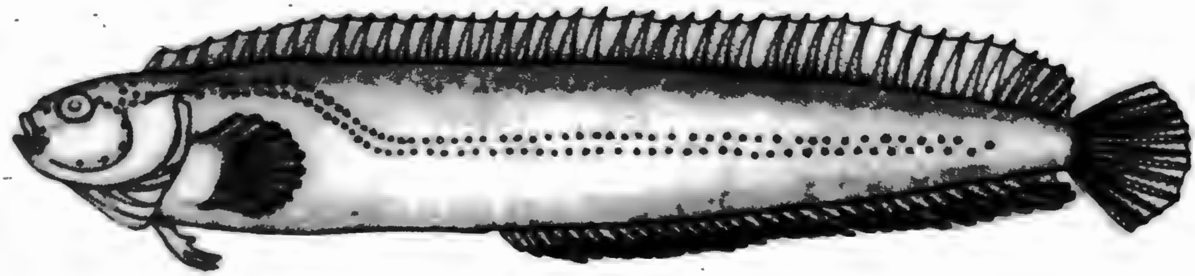
Body robust, elongate, naked. Depth 6.25 – 6.85. Head 4.5 – 6.25 in standard length, snout rounded. Mucus pores large and conspicuous. Eye 2.75 – 4.25 in head. No supra-orbital tentacle. Cirrus on anterior nostril small, flap-like. Upper jaw 34 – 43% of head length. Lips moderately thick. Vomer toothed.

Lateral line throughout of large pores opening above and below line, close together and numerous; line broad; ends in a single pore on caudal peduncle (fig. 34 (a)). Intromittent organ of male with a long basal portion and a small bifid tip protruding from between two rounded lateral lips (fig. 34 (b)).

Colouring: No fresh specimens seen; uniform red, brown, or orange (Smith, 1949).

Material examined: 7 specimens, 46 - 116 mm. in standard length. 3 from Saldanha Bay, S.A.M. 18463; 2 from St. James, False Bay, S.A.M. 10529 (syntypes); 1 from False Bay, 14 fathoms, S.A.M. 10528 (syntype); 1 from False Bay, dredged, S.A.M. 23949.

Distribution: Saldanha Bay to False Bay is the known range at present; rare, mainly infratidal.



(a)

ventral lateral

(b) Intromittent organ

Fig 34 Clinoporus biporosus

Genus _Gynutoclinus_ Smith, 1945

Gynutoclinus Smith, 1945 :545 (type species _Clinus rotundifrons_ Barnard)

Diagnosis: A minute simple papilla over eye. Body highly compressed. Head spherical, inflated, with pores opening on prominent papillae. Body covered with minute embedded cycloid scales not extending on to the median fin bases or head. Lateral line of single, more or less medially opening pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end, becoming obscure caudally. Intromittent organ of male with a long basal portion and the tip ensheathed by two pairs of lips. Vomer toothed.

A single, rare species, _Gynutoclinus rotundifrons_ (Barnard).

Gynutoclinus rotundifrons (Barnard, 1937)

(fig. 35)

Clinus rotundifrons Barnard, 1937 :63

Gynutoclinus rotundifrons: Smith, 1945 :545; Smith, 1949 :358

Description: D. XXX - XXXII 8; A. II 22 - 23; P. 12 - 14; V. I 3; C. 13. First four dorsal spines slightly elevated to form a low, rounded crest, second and third spines highest. All spines evenly placed. No clusters of cirri at tips of dorsal spines. No notches in membrane between any of the dorsal spines. Profile of dorsal fin undulating. Pectoral fin rounded. Inner pelvic ray reduced, not more than half other two rays. Caudal peduncle short, length 28.6 - 36.4% of head length, depth 27.3 - 32% of head length. Caudal fin subtruncate.

Body highly compressed, deepening with age, covered with small scales not extending on to bases of dorsal, caudal, or anal fins, or head. Depth 3.5 - 5.2. Head 3.7 - 4.15 in standard length, spherical, inflated, broad, with pores opening on raised papillae. Eye 3.5 - 5 in head. A minute simple papilla over eye. Anterior nostril tubular, cirrus large, flat, deeply bilobed. Posterior nostril conspicuous, surrounded by short skinny lobes. Upper jaw 42.5 - 54.5% of head length. Lips very thin. Vomer toothed.

Lateral line of single, more or less medially opening pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 35 (c)), obsolete on caudal peduncle on largest specimen, the holotype. Intromittent organ of male with a long basal portion and a club-shaped tip, ensheathed by a pair of thin, crescentic lateral lips and a minute pair of more or less confluent dorsal lips (fig. 35 (b)).

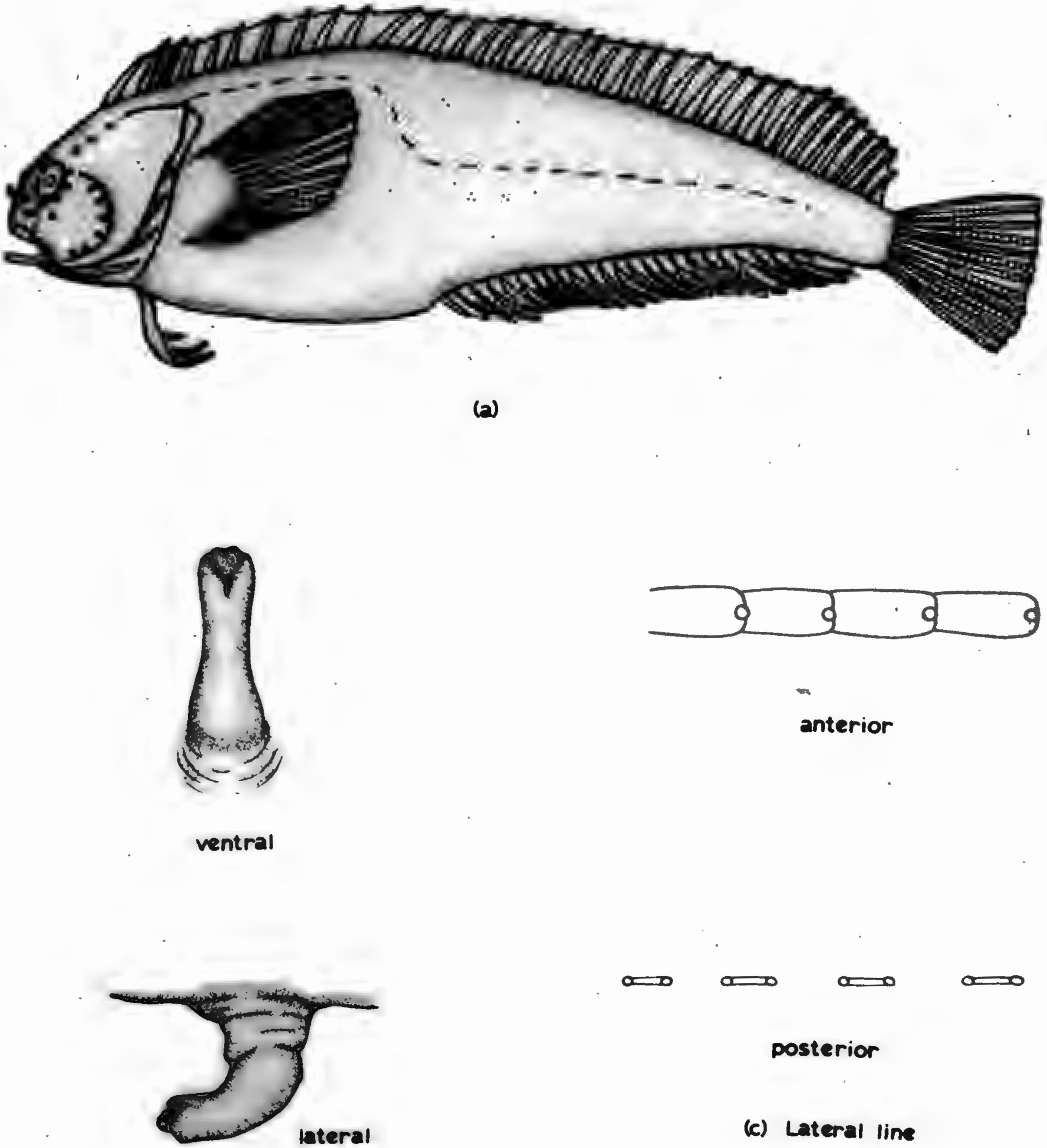
Colouring: Male from Lambert's Bay: ground colour pale brown with about seven darker brown irregular cross-bars, edged with iridescent blue fine broken lines. A very dark brown narrow vertical line behind and above the pectoral axil, and another at end of caudal peduncle. Cross-bars continued on to dorsal fin, with translucent patches between; small black dots on translucent areas. Dorsal fin dark brown posteriorly, with a single small translucent patch near beginning of dorsal soft rays at base. Caudal fin translucent, with very faint brown cross-bars, darkening at margins so that margins appear to be spotted. Pectoral fin translucent with four very fine dark cross-bars, the proximal one curved. Anal fin mainly dark brown, with two translucent patches. Head mainly light brown below. A dark stripe from below eye forwards in front of inflated cheek to angle of jaw. Head above and opercular region deep pink. Snout pink with a darker pink bar between eyes and another above upper lip; a fine darker pink line down middle. Eye silvery with brown radii. Chin and lips light brown mottled heavily with darker brown. Branchiostegal membranes and jugular region silvery grey with fine black speckling. Pelvic fins light brown with dark brown cross-bars. Belly silvery with a golden brown sheen. Intromittent organ greyish with fine black speckling. Juvenile from Lambert's Bay yellow, underparts lighter. Dorsal fin with alternating pink and translucent patches. Anal fin yellow. Caudal and pectoral fins translucent. Pelvic fins yellow with brown cross-bars.

Material examined: 7 specimens, 26 - 95 mm. in standard length. 2 from Lambert's Bay, S.A.M. 24007, S.A.M. 24082; 4 from Lambert's Bay, R.U.C.; 1 from Oudekraal, Cape Peninsula, S.A.M. 18587 (holotype).

Remarks

This very rare species does not appear to be very close to any of the other species, although it has certain modifications for a weed-dwelling habit such as the strong compression of the body. It is known from seven specimens, three in the South African Museum, and four in the Rhodes University Ichthyology Department, the latter taken from the stomachs of sea-birds at Lambert's Bay and therefore in rather poor condition. The species was included by Smith (1945) in the "Myxodinae", but in fact it has a small supra-orbital tentacle, although this is not very distinct in the long-preserved holotype. It is quite prominent in fresh specimens. The intromittent organ of this species is very similar to the type found in the genus Clinus.

Distribution: The known range at present is Lambert's Bay to Cape Point; in kelp at the bottom of the shore. Apparently very rare.



(b) Intromittent organ

Fig. 35. Gynutoclinus rotunditrons

Clinid, gen. et sp. indet.

(fig. 36)

Description: D. XXX 7; A. II 23; P. 14; V. I 2; C. 13. First three dorsal spines elevated to form a triangular crest, high, fourth spine 43% of first. A shallow notch in membrane between third and fourth dorsal spines. Dorsal fin originates over hind margin of preopercle. Pectoral fin rounded. Inner pelvic ray absent. Caudal peduncle short, length 30% of head length, depth 34.0% of head length. Caudal fin subtruncate. No clusters of cirri at tips of dorsal spines.

Body slightly compressed, not elongate, covered with small cycloid scales. Head naked. Depth at anal origin 4.4. Head 4 in standard length, snout subconical. Eye 3 in head. Supra-orbital tentacle narrow, cylindrical, simple; tip not flattened and branched. Cirrus on anterior nostril a small flap. Upper jaw 46% of head length. Lips moderate. Vomer toothed.

Lateral line narrow in front, of single pores opening above and below the line to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 36 (b)). Intromittent organ not known.

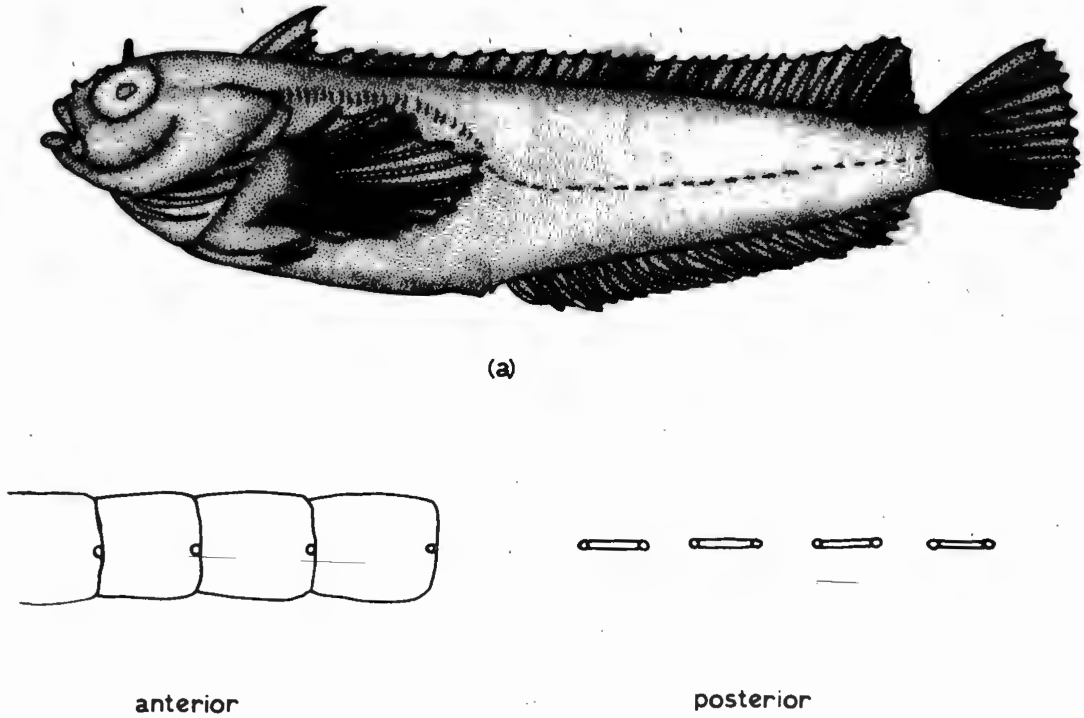
Hook on anterior edge of pectoral girdle well defined.

Colouring: in spirit, uniform dull red. Fins translucent.

Material examined: 1 specimen (female) 52 mm. in standard length, Richard's Bay, Zululand, S.A.M. 21938.

Remarks

This specimen is distinguished from all other South African clinids by the possession of a well-developed unbranched supra-orbital tentacle, which resembles neither the distally flattened and branched tentacle of the genus Clinus nor the minute, simple papilla of Gynutoclinus. A similar long, simple tentacle is found in the Australasian genus Cristiceps, but the specimen shows none of the other peculiar features of that genus. For this reason it is not possible to assign it even to a genus at present. It is considered undesirable to describe a new genus from a single, not very well preserved female specimen. It is felt, however, that the existence of the specimen should be put on record, in case of further specimens being collected.



(b) Lateral line

Fig. 36. Clinid, gen. et sp. indet.

Subtribe: Xenopoclinini

<u>Diagnosis</u>: Clinidi with the hook on the pectoral girdle sometimes reduced or absent. Head depressed; eyes dorsal. Pelvic fins of three slender, equal rays, united from base to tips by a membrane. Dorsal fin low, even.

<u>Key to the genera of the Xenopoclinini</u>

1. Vomer toothed. Lateral line curves down sharply behind pectoral fin, may be discontinuous over curve. A simple papilla or flap above the eye .... <u>Xenopoclinus</u>

   Vomer edentate. Lateral line curves down very gently from front to median position. No papilla or flap above the eye .... <u>Cancelloxus</u>

Genus *Xenopoclinus* Smith, 1947

Xenopoclinus Smith, 1947 :732 (type species *Xenopoclinus kochi* Smith)

Diagnosis: A disc-like, fleshy papilla or a simple flap over eye. Body elongate, compressed, covered with minute embedded cycloid scales not extending on to median fin bases or head. Vomer toothed. Lateral line curves down sharply to medial position behind pectoral fin, discontinuous over curve or not.

Discussion

Smith (1961) divided this genus into two subgenera on the basis of the presence or absence of a hook on the pectoral girdle, and whether or not the opercular membranes were expanded and overlapped below. However, it is felt that, since the primary purpose of subgenera is to indicate relationships between pairs or groups of species in large genera, the use of the subgeneric rank in a genus containing only two species is not warranted. The two species included in the genus *Xenopoclinus* are obviously more closely related to one another than to the species for which the other genus, *Cancelloxus*, was erected, and therefore should be included in one genus.

Key to the species of Xenopoclinus

1. Hook on pectoral girdle well developed. Opercular membranes expanded, overlapping below .... *Xenopoclinus kochi*

Hook on pectoral girdle reduced to a small knob, or absent. Opercular membranes not expanded and overlapping below ... . *Xenopoclinus leprosus*

Xenopoclinus kochi Smith, 1947

(fig. 37)

Xenopoclinus kochi Smith, 1947 :732; Smith, 1949 :358

Xenopoclinus (Xenopoclinus) kochi: Smith, 1961 :352

Description: D. XXXIII - XXXVII (XXXIV - XXXV) 8 - 11 (9); A. II 29 - 30; P. 12 - 13 (12); V. I 3; C. 13. Dorsal fin low, even, anterior spines shortest. Third spine a little shorter than first or fourth. No notch in membrane between third and fourth dorsal spines; spines evenly placed. Soft dorsal rays a little longer than spines. Spines fairly soft. No clusters of cirri at tips of dorsal spines. Pectoral fin with central rays elongate, upswept, fin pointed; lower rays short, curling forward. Pelvic fin of three rays, equal in length, united by membrane from base to tips, resembling a frog's foot. Caudal peduncle short, length 30 - 40% of head length, depth 23 - 35% of head length. Caudal fin subtruncate.

Body elongate, compressed, covered with minute scales not extending on to bases of dorsal, caudal, or anal fins, or head. Depth 6 - 7.5. Head depressed, 3.75 - 5 in standard length. Snout subacute. Lower jaw projects. Eyes dorsally situated, almost adjacent, 4 - 6.5 in head. A flat, fleshy papilla over eye. Anterior nostril tubular, cirrus a short simple flap. Upper jaw 30 - 40% of head length. Lips moderate. Vomer toothed.

Opercular membranes expanded, overlapping below.

Lateral line of double pores in front to behind pectoral fin; ends abruptly there, and is continued below in the mid-lateral line, consisting of short separate horizontal tubes with a pore at either end (fig. 37 (c)). Intromittent organ of male with a fairly long basal portion and a rounded tip ensheathed below by two rounded ventro-lateral lips and above by a hood-like fold (fig. 37 (c)).

Hook on anterior edge of pectoral girdle well developed.

Colouring: Ground colour a stony pinkish mauve with about six irregular olive green cross-bars, running into vague olive mottling posteriorly. Cross-bars edged with darker olive. On head behind eyes are two adjacent olive rings. Fins hyaline except dorsal, where olive cross-bars may continue on to fin. Pectoral base olive. Belly whitish. A dark olive bar at caudal base. Two dark olive blotches on preopercle, sometimes a lighter one between; an olive stripe from front of eye to upper lip on either side. Speckled and mottled all over body and head with silvery white. Cross-bars more distinct in juveniles. Pupil black, iris gold; papilla over eye white.

Material examined: 13 specimens, 26 - 73 mm. in standard length. 8 from Lambert's Bay, 28 - 30/3/1964, S.A.M. not catalogued; 5 from Lambert's Bay and Doring Bay, R.U.C.

Distribution: Known only from Lambert's Bay and Doring Bay in southern Namaqualand. Not common, in pools and gullies at the bottom of the intertidal zone with much kelp. Burrow in coarse shingly sand.

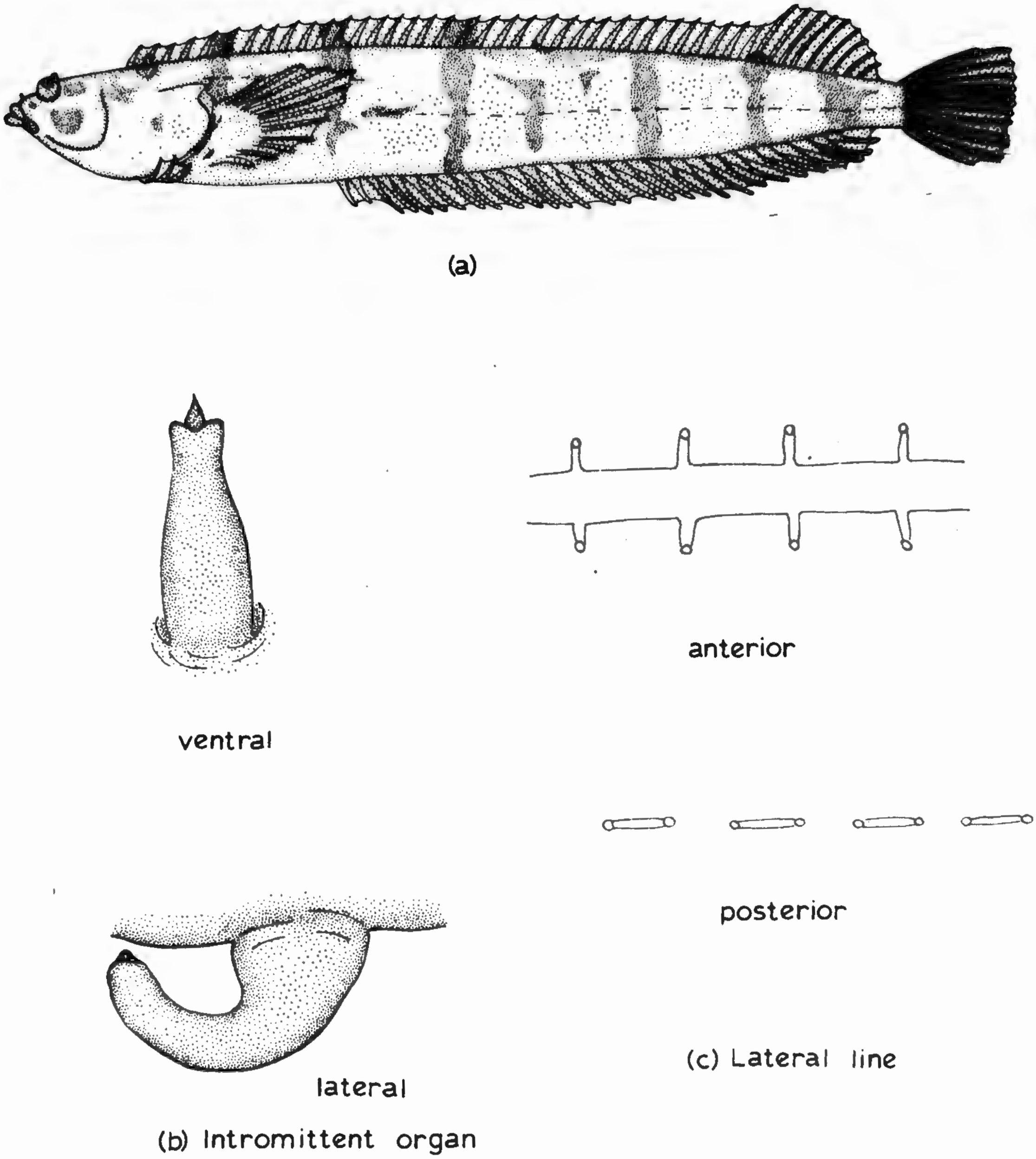


Fig. 37 Xenopoclinus kochi

Xenopoclinus leprosus Smith, 1961

(fig. 38)

Xenopoclinus (Xenopoclinops) leprosus Smith, 1961 :354

Description: D. XXXII - XXXVI (XXXIV - XXXV) 7 - 12 (9 - 11); A. II 28 - 34 (31 - 32); P. 11 - 13 (11 - 12); V. I 3; C. 13. Dorsal fin low, even, spines increasing in height posteriorly. Third spine a little lower than fourth or second, first may be slightly higher, especially in juveniles. Soft dorsal rays a little longer than spines. Spines soft. Pectoral fin not elongate, slightly upswept, lower rays thickened. Pelvic fin of three equal rays joined throughout length by a membrane, resembling a webbed foot. Caudal peduncle short, length 20 - 33% of head length, depth 20 - 33% of head length. Caudal fin subtruncate.

Body elongate, compressed, covered with minute scales not extending on to dorsal, caudal, or anal fin bases or head. Depth 6.25 - 8.75. Head depressed, 4.75 - 5 in standard length in adults, 4 - 4.5 in standard length in juveniles. Snout sub-acute. Eyes dorsal, adjacent, 4 - 6.5 in head. A flattened, flap-like tentacle over eye, edge irregularly and shallowly notched. Anterior nostril tubular, cirrus flap-like, sometimes terminally notched. Upper jaw 33 - 43.5% of head length. Lips moderate. Vomer toothed. Opercular membranes normal, not expanded or overlapping below.

Lateral line of double pores in front to post-pectoral curve, then of short separate horizontal tubes with a pore at either end (fig. 38 (c)). Intromittent organ of male with a fairly long basal portion and the short tip ensheathed by a pair of united ventro-lateral lips (fig. 38 (b)).

Hook on anterior border of pectoral girdle usually absent, if present, reduced to a small knob.

Colouring: Ground colour light brown below grading to chocolate above. Three large white saddles in upper half of body. Head white, except for an area enclosed by a line on each side from dorsal origin to eye and from eye vertically down cheek, which is sand-coloured in life, becoming dark brown or jet black on preservation in spirit. Pectoral base yellow. Dorsal fin brown above dark areas on body, hyaline above white saddles. Other fins hyaline. Iris golden, pupil jet black. Belly light brown to cream.

Material examined: 95 specimens, 22 - 68.5 mm. in standard length. 1 off Orange River Mouth, 10 fathoms, U.C.T.; 89 from Lambert's Bay, 28 - 30/3/1964, S.A.M. not catalogued; 5 from Lambert's Bay, R.U.C.

Distribution: The known range at present is Orange River Mouth (infratidal, dredged) to Lambert's Bay (in intertidal pools and gullies at lowest levels of shore). Burrows in very coarse shingle and broken mussel shells. Fairly common but patchily distributed.

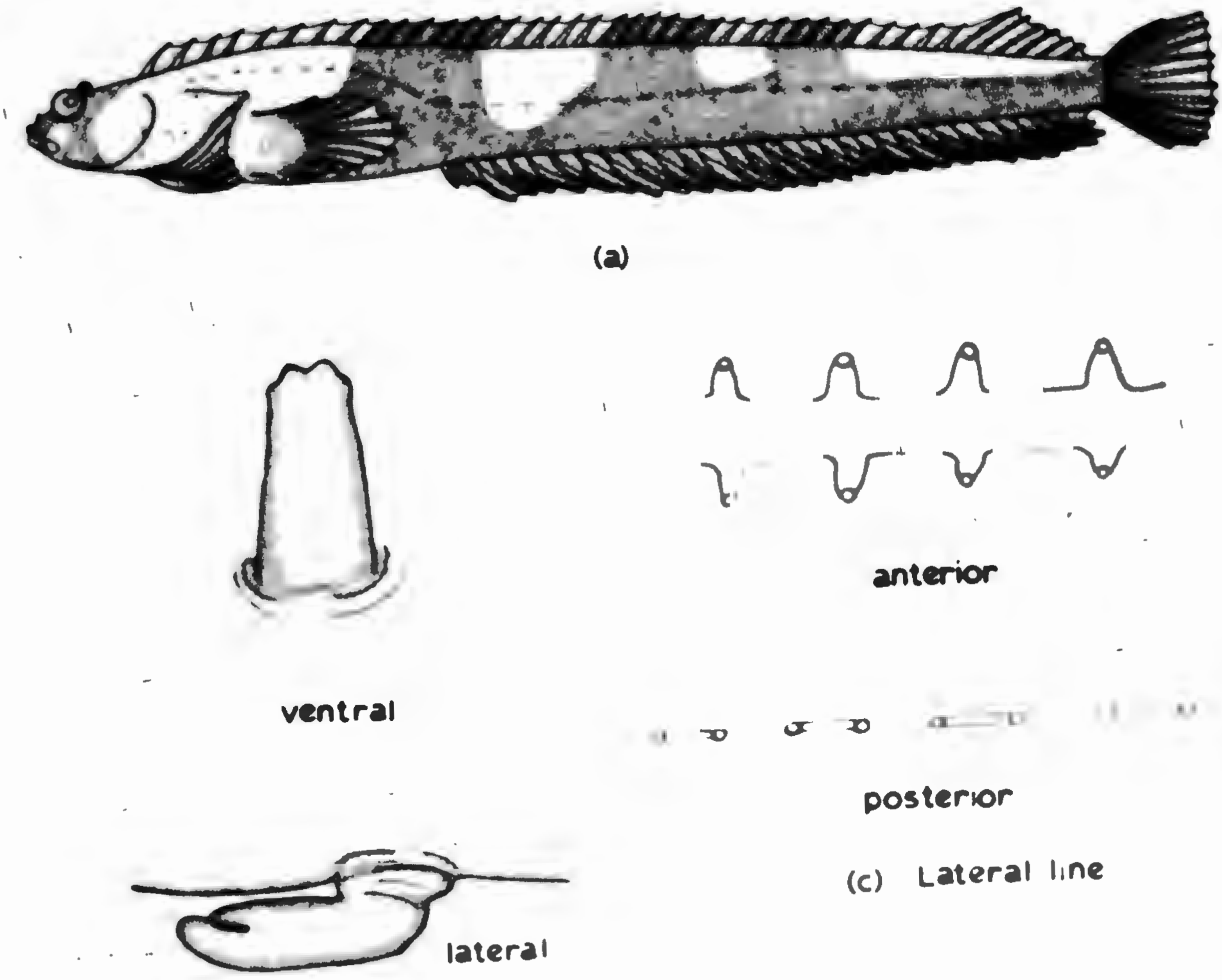


Fig 38 Xenopoclinus leprosus

Genus Cancelloxus Smith, 1961

Cancelloxus Smith, 1961 :355 (type species Cancelloxus burrelli Smith)

Diagnosis: No tentacle or papilla over eye. Body elongate, compressed, covered with minute embedded cycloid scales not extending on to median fin bases or head. Vomer edentate. Lateral line curves gradually to medial course behind pectoral fin.

Discussion

The single species for which this genus was erected has traces of a hook-like process on the anterior border of the pectoral girdle, which varies from a knob-like process in some specimens to a low inconspicuous ridge in others. It is more elongate than the other species of Xenopoclinini described, and appears to prefer a more open habitat with a fair amount of wave action.

<u>Cancelloxus</u> <u>burrelli</u> Smith, 1961

(fig. 39)

<u>Cancelloxus</u> <u>burrelli</u> Smith, 1961 :355

Description: D. XXXIV - XXXIX (XXXVI - XXXVIII) 10 - 14 (10 - 13); A. II 38 - 43 (41); P. 13 - 15 (13 - 14); V. I 3; C. 13. Dorsal fin low, even, anterior spines lowest, soft rays a little higher than spines. Spines soft. Pectoral fin with middle rays elongate, pointed, and upswept, lower rays thickened. Pelvic fin of three equal rays, joined from bases to tips by a membrane, resembling a webbed foot. Dorsal fin originates well behind head. Caudal peduncle short, length 23.5 - 31% of head length, depth 20 - 28.5% of head length. Caudal fin subtruncate.

Body elongate, compressed, covered sparsely with minute scales not extending on to dorsal, caudal, or anal fin bases, or head. Depth 8 - 11. Head depressed, 4.25 - 5.5 in standard length, snout pointed. Eyes oval, adjacent, 3.75 - 4.75 in head. No tentacle or papilla over eye. Anterior nostril tubular, cirrus a small simple flap. Upper jaw 26 - 29% of head length. Lips fairly thick. Lower lip produced at symphysis into an acute process. Vomer edentate. Few or no teeth at sides of jaw, a patch at each symphysis. Opercular membranes normal, not expanded or overlapping below.

Lateral line of single pores opening more or less medially in front, sloping gradually to mid-line behind pectoral fin, then of short separate horizontal tubes with a pore at either end (fig. 39 (c)). Intromittent organ of male extremely large. Basal portion long and stout, terminating anteriorly in a pair of horn-like lobes between which the tip protrudes. Tip conical, curving up towards belly. A flat fleshy lobe dorsally at base of tip. Belly of male deeply grooved. Intromittent organ illustrated in fig. 39 (b). Vent of female large and crescent-shaped, surrounded by a fleshy fold produced posteriorly into two lobes, one on either side of first anal spine. Each lobe with a thick fleshy dorsal portion overlain by a thin skinny lobe ventrally.

Colouring: Ground colour cream, semi-translucent. A bright silver broken stripe mid-laterally. Irregular olive patches above. Eleven olive saddles above, edged darker. Olive stripe from eye to posterior edge of opercle; below this stripe a broad silver stripe. Lips and underparts cream. Pectoral base silver. Fins hyaline. Pupils jet black, iris narrow and golden. In spirit the ground colour becomes opaque and the olive turns golden brown, later fades completely.

Material examined: 19 specimens, 75.5 - 107 mm. in standard length. 1 from off Orange River Mouth, 5 fathoms, S.A.M. 23272; 1 from Lambert's Bay, R.U.C. (holotype); 3 from Lambert's Bay, R.U.C. (paratypes); 14 from Lambert's Bay, 28 - 30/3/1964, S.A.M. not catalogued.

Distribution: The known range at present is Orange River Mouth (infratidal, 5 fathoms) to Lambert's Bay, mainly in gullies and inlets open to the sea at the base of the intertidal zone, in shingle. Not common.

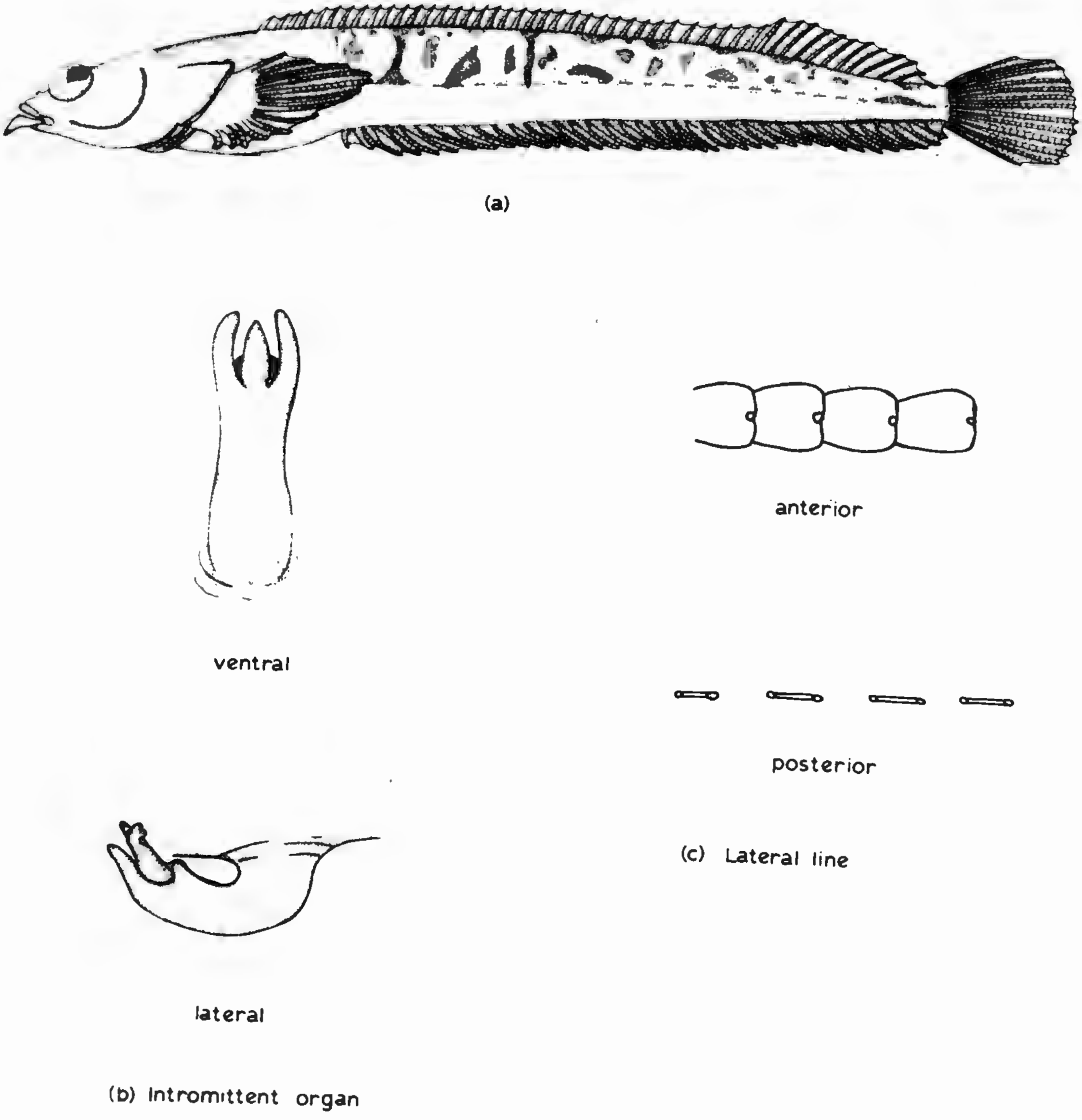


Fig. 39. Cancelloxus burrelli

THE ORIGIN OF THE SOUTH AFRICAN CLINIDAE

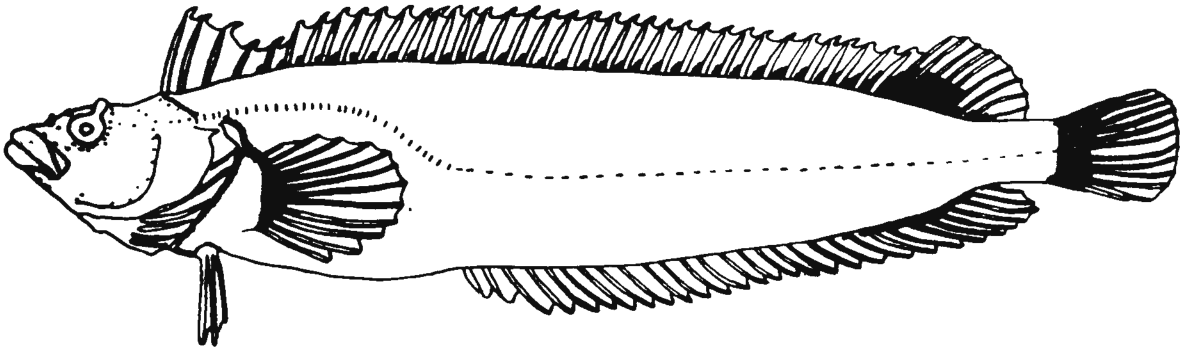
The presence in both the Myxodidi and the Clinidi of a hook-like projection on the anterior border of the cleithrum and the small scales with radii on all margins, as well as the very similar general appearance of the less specialized members of both groups, point to a common origin. Since the Myxodidi are more primitive than the Clinidi in that they are oviparous, fertilization is external, and there is no intromittent organ in the male, they are considered to be the ancestral group (Hubbs, 1952).

The derivation of the South African species from the most generalized of the American myxodids, the species of the genus Gibbonsia, is not difficult. If one of the American species such as Gibbonsia metzi C.L. Hubbs (fig. 40) were to develop viviparity, the result would be a clinid very close indeed to some of the more generalized South African clinids such as Clinus robustus. I was fortunate in being able to examine specimens of Gibbonsia elegans erroli Clark Hubbs and Gibbonsia elegans velifera Clark Hubbs in the collection of the Rhodes University Ichthyology Department, and, apart from the lack of an intromittent organ in the male, they are strikingly similar to the more generalized South African species, such as the species of Clinus (Clinus).

In a consideration of the origins of a group it is often

Fig. 40

<u>Gibbonsia</u> <u>metzi</u> <u>metzi</u> C.L. Hubbs (from Clark Hubbs, 1952, fig. 47, p. 123)



difficult to decide which characters are primitive and which are advanced. Table 14 gives the primitive condition for twenty characters which have been used in this study. In some cases the definition of the primitive condition is based on the statements of Hubbs (1953) regarding typically clinid characters, and in others on the conditions prevailing in the genus Gibbonsia.

Of the two subtribes of Clinidi represented in South Africa, the Clinini have by far the greatest representation, with five genera and thirty species in South African waters. The genera apparently represent two major lines of evolution and three minor ones. The hypothetical intergeneric relationships are shown in fig. 41. The method used for drawing up the figure is similar to that used by Stephens (1963). The lateral position is based purely on morphological resemblance and the horizontal distances are arbitrary, but the vertical position indicates the primitiveness of the genera. It is determined by the number of points awarded for each of the twenty characters listed in table 14, from no points for the primitive condition of a character up to ten points for an advanced condition. The thickness of the lines indicates the relative number of species.

The two major lines, leading to the genera Clinus and Pavoclinus, retain a fairly high number of primitive characters, but these are not the same in the two groups; for instance, the supra-orbital tentacle is retained in Clinus but lost in Pavoclinus,

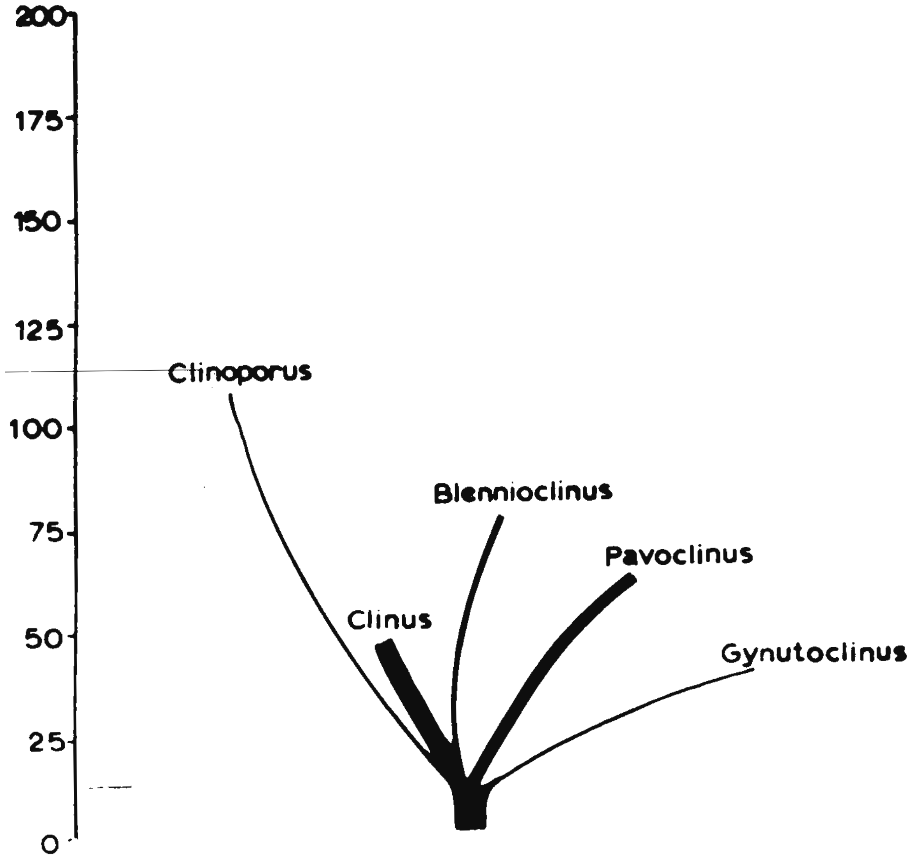


Fig. 41 Hypothetical interrelationships of the South African genera of Clinini (for explanation see text)

whereas the primitive arrangement of the anterior dorsal spines for this group is retained in several of the species of Pavoclinus, but in none of the species of Clinus. The species of Pavoclinus are more specialized for a particular habitat than are the species of Clinus.

In the genus Clinus there appears to have been a tendency to reduce the height of the anterior dorsal spines. This tendency is apparently paralleled in the Labrisomini (Hibbs, 1953). In those species in which the anterior dorsal spines are high the membrane, especially that between the third and fourth dorsal spines, is incised to a greater or lesser degree; this is also the case in two species in which the anterior spines are low. In three of the four subgenera (comprising, however, less than one third of the species in the genus) there is a tendency towards elongation of the body and an eel-like habit. These forms are thought to have diverged early from the main branch (see fig. 42, Clinus anguillaris, C. striatus, C. capensis, C. dorsalis, and C. navalis). All the species involved show considerable specialization which would have required a relatively long time, yet retain certain primitive characters such as the facial and supra-opercular scales in the subgenus Blennophis and the facial scales in the subgenus Cirrhibarbis; all the less specialized species of Clinus have the head region completely naked. The tendency to reduction of scaling in the head region has proceeded in all the genera of South African Clinini, most of which lack scales on the head, and the scaling of the fin bases has become reduced as well.

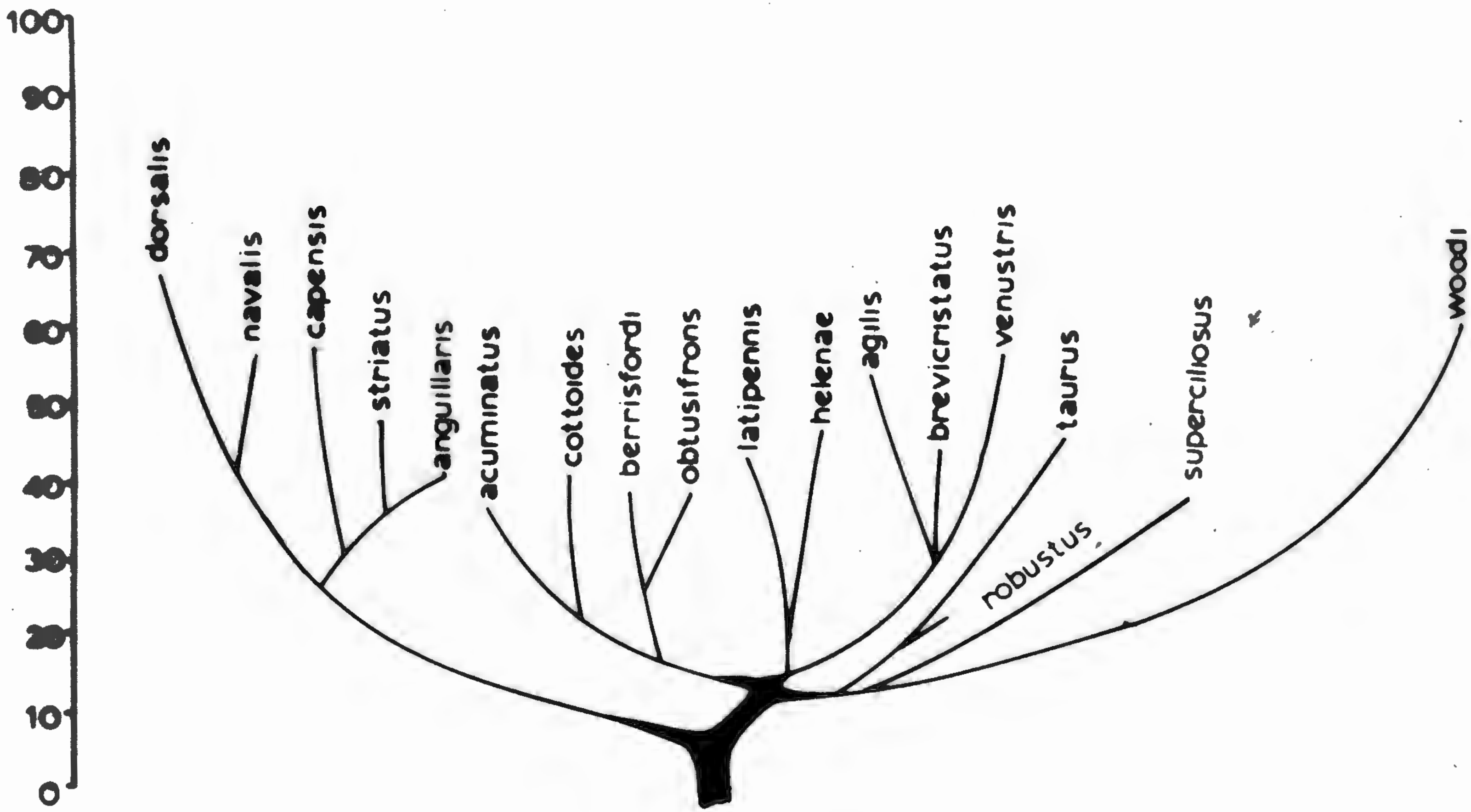


Fig. 42. Hypothetical interrelationships of the species of *Clinus* in South Africa

Fig. 42 shows the hypothetical interrelationships of the species of Clinus. The figure has been drawn up in the same way as figure 41, using the characters listed in table 14.

All the species of the genus Pavoclinus are modified for a weed-dwelling habit. The supra-orbital tentacle has been lost, and in this feature they are more advanced than the species of Clinus, but the arrangement of the dorsal fin in Pavoclinus heterodon, P. litorafontis, and P. pavo is very similar to that of the species of Gibbonsia, and is therefore considered to be primitive. As in the genus Clinus, there has been a reduction in the extent of the scaling, and in all the species of Pavoclinus the head region is entirely naked. The hypothetical relationships of the species are shown in fig. 43, which has been drawn up in the same way as fig. 41 and fig. 42.

The subgenus Labroclinus, containing one species (Pavoclinus mentalis) may have diverged fairly early. It retains several primitive features; the fin counts are higher than those in the other subgenera of Pavoclinus, being similar to those of the Clinus (Clinus) group of species; the dorsal and caudal fin bases are scaled; the vomer is toothed, and the caudal peduncle in only moderately elongate. On the other hand, it has specialized features such as the complete seperation of the dorsal crest and the skinny flap on the lower jaw symphysis. It presumably arose by specialization from a form such as Pavoclinus laurentii, which has

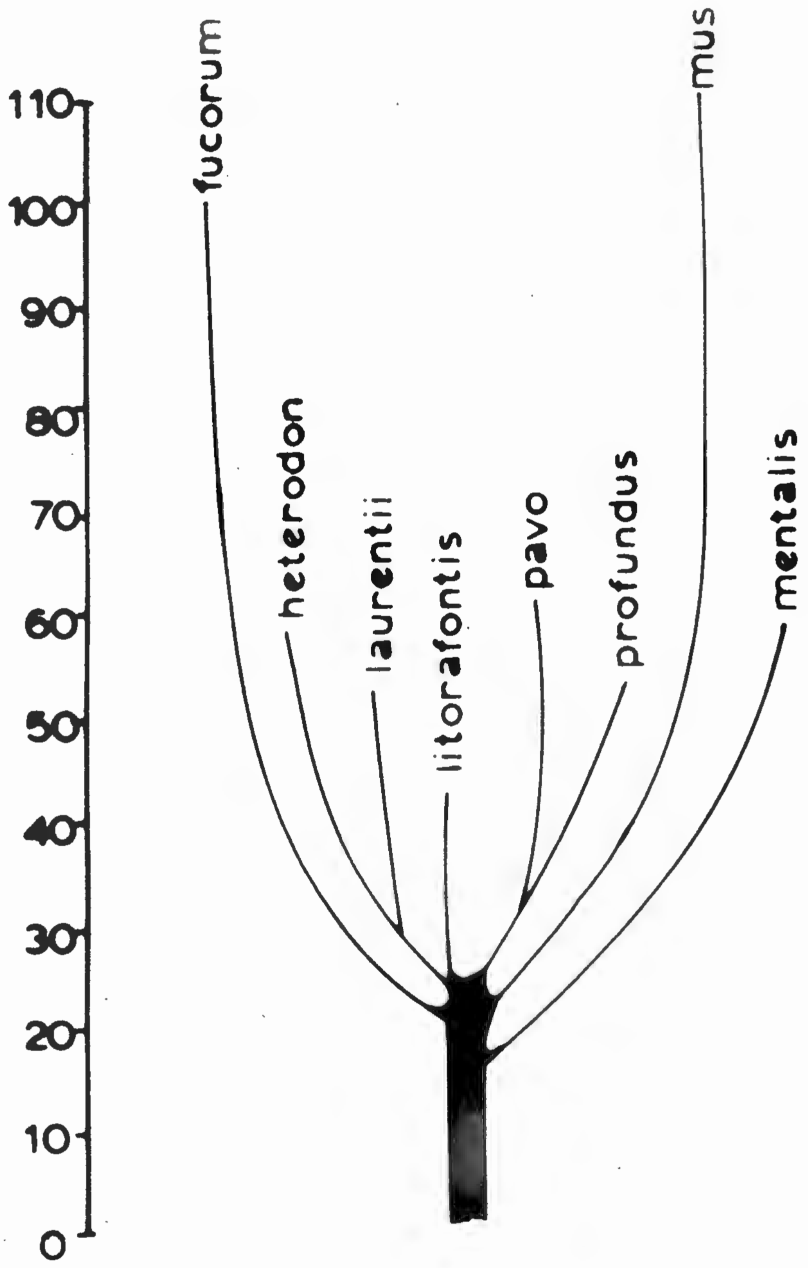


Fig. 43. Hypothetical interrelationships of the species of Pavoclinus

a separate dorsal crest.

The other two monospecific subgenera, _Fucomimus_ and _Smithichthys_, are highly specialized weed-dwellers and retain very few primitive characters. The fin counts are reduced, the scales are minute and do not extend to the median fin bases, the vomer is edentate, and the caudal peduncle is very long. _Pavoclinus_ (_Fucomimus_) _mus_ has a separate dorsal crest, and a low number of dorsal soft rays; the number of caudal rays is reduced to eleven. _Pavoclinus_ (_Smithichthys_) _fucorum_ has a peculiar form of crest with at least the first four dorsal spines involved, an upturned snout, and the jaw teeth reduced to one row. The loss of the vomerine teeth in the subgenera _Fucomimus_ and _Smithichthys_ is paralleled in the South American genus _Myxodes_, to which the species _Pavoclinus_ (_Smithichthys_) _fucorum_ was referred by Smith (1945).

The remaining species, constituting the subgenus _Pavoclinus_, form a relatively compact group; in one of the five species the fin membrane is incised between the third and fourth dorsal spines, and in one of the species, _Pavoclinus profundus_, the anterior dorsal spines are low.

The three remaining genera are minor groups and have undergone little or no speciation.

Blennioclinus is apparently not close to any of the other genera (see, however, appendix A), but in the character of the anterior part of the lateral line and in the body form and habit resembles Clinus rather than Pavoclinus. The notch in the profile of the dorsal fin before the dorsal soft rays in this genus is unique in the Clininae, although it commonly occurs in the labrisominid genera Labrisomus and Malacoctenus (Springer, 1958, pls. I - VII). However, as Blennioclinus clearly belongs to the Clininae, it is difficult to see how this character may have developed. In this connection it is interesting to note that there are various features which appear scattered throughout the clinids in not very closely related forms. Examples are the flap of skin on the lower jaw symphysis developed in some of the American tribe Paraclinidi, e.g. Paraclinus barbatus Springer (Springer, 1954, fig. 1), in Pavoclinus mentalis (fig. 28), in Cancelloxus burrelli (fig. 39), and in members of the related family Chaenopsidae, e.g. Chaenopsis alepidota alepidota (Gilbert) (Stephens, 1963, pl. 12); the reduction of the number of dorsal soft rays to one in the Paraclinidi (Hubbs, 1952) and the subgenus Climacoporus of the genus Clinus; and the development of the hook on the pectoral girdle, so characteristic of the Clininae, in the adults of two Labrisominae, Malacoctenus erdmani Smith and Malacoctenus aurolineatus Smith (Springer, 1958). It is felt that this is strong evidence for a monophyletic origin of the Clinidae as a whole.

Clinoporus, the most specialized of the five South African genera of Clinini, is apparently most closely related to the genus *Clinus* (see also appendix A), and may have been derived from the line leading to the eel-like species of *Clinus* by loss of the scales and modifications of the lateral line. Since the single species, *Clinoporus biporosus*, is the only species of the South African Clinini (other than the little-known *Pavoclinus profundus*) which is normally taken in relatively deep water beyond the limits of the infratidal fringe, it might be expected to differ markedly from the predominantly intertidal Clinidae.

Gynutoclinus retains the highest number of primitive characters, although the peculiar form of the head excludes it from the direct line of descent of any of the other genera. The rarity of its single species suggests that it has not proved as successful as at least three of the other four genera; *Clinoporus* is also represented by a single, apparently rare species, but the inaccessibility of the usual habitat of *Clinoporus* may contribute considerably to the impression of rarity.

Gynutoclinus has features in common with both *Pavoclinus* and *Clinus*, but it appears to have followed an independent pattern of evolution. The intromittent organ of the male is similar to the type found in the genus *Clinus*, and there is a vestigial supra-orbital tentacle; the characters shared with *Pavoclinus* are chiefly those associated with adaptation to a weed-dwelling existence.

The other subtribe, the Xenopoclinini, apparently have a common derivation with the Clinini from a myxodid-like ancestor, and the high degree of specialization of this group suggests that the divergence must have occurred early. It is possible to derive them from a form tending towards elongation of the body such as might have given rise to *Clinoporus* and the eel-like species of *Clinus*.

Table 14. Characters used in the consideration of specialization in South African Clinini

Characters	Primitive condition
Presence or absence of scales on body	Scales present
Degree of scaling on head	Scale patches on cheek and above opercle
Degree of scaling on median fin bases	Scales on dorsal, caudal, and anal fin bases
Arrangement of jaw teeth	A row of small teeth behind front row of jaw teeth
Presence or absence of teeth on vomer	Vomer toothed
Position of dorsal fin origin	Over hind margin of preopercle
Height of anterior dorsal spines	First three dorsal spines higher than succeeding spines
Presence or absence of a notch in membrane between third and fourth dorsal spines	Notch in membrane absent
Number of dorsal spines	30 – 40
Number of dorsal rays	5 – 10
Number of anal rays	20 – 30

Table 14 (continued)

Characters	Primitive condition
Development of third pelvic ray	Stout, equal to other two
Arrangement of posterior part of lateral line	Short separate horizontal tubes with a pore at either end
Arrangement of anterior part of lateral line	Single pores opening more or less medially
Presence or absence of supra-orbital tentacle	Supra-orbital tentacle present
Shape of head	Compressed, not inflated
Snout shape	Sloping to mouth, not upturned
Presence or absence of facial barbels	Facial barbels absent
Condition of jaw symphysis	Smooth, without projecting skinny flap
Length of caudal peduncle	Short to moderate, 20 - 40% of head length

NOTE ON THE GEOGRAPHICAL ORIGIN OF THE CLINIDAE

As can be seen from fig. 1, the Clinidae are a widespread family occurring mainly in the tropics and in the temperate regions of the southern hemisphere. Their greatest occurrence is in the tropics of Central America, and this region is therefore considered to be their centre of origin (Hubbs, 1952; Springer, 1958). The South African and Indo-Australian forms are all viviparous and belong to the less primitive of the two subfamilies, so are considered to have spread to those regions from America some time after the origin of the group. Most of the clinids of the Pacific coast of America and all the clinids of the Atlantic coast of America belong to the more primitive subfamily, the Labrisominae. The subtribe Calliclinini, which Hubbs (1952) considered to be the most primitive of the Labrisominae, is apparently confined to the Pacific coast of South America. The fauna of the Pacific coast of America is considered to be one with that of the Atlantic. There was a communication between the two regions until late in the Miocene period, and the fauna of the west coast of America has far more elements in common with the eastern American coast than with Polynesia and the Indo-Pacific region, with whose fauna its affinities are extremely weak (Ekman, 1953). The family is thus considered to have originated in the Central American region and to have spread from that region. The most intriguing problem arising from this assumption is the dispersal of small fishes with a short larval history and a tendency to viviparity.

Rosenblatt (1963) pointed out, in connection with the strong tendency to endemism of small fishes of the rocky littoral zone such as clinids, that the mobility of such fishes is usually low. Most small littoral fishes of rocky shores are not strong swimmers, since they rely on concealment rather than speed for both prey capture and avoidance of predators. Many (including the clinids) have lost their air-bladders and therefore have a tendency to sink if they are not moving, which precludes passive transport by currents at least in the adult stages. In addition, they are often territorial.

Rocky shores are of relatively low occurrence and usually occur between sandy stretches. Fishes of the rocky shore must ensure that their young will reach suitable habitats. One way of doing this might be to produce young with a long pelagic larval stage to ensure that some will reach rocky shores, but many young must be produced to compensate for those which will inevitably be swept out to sea or otherwise lost and destroyed. For small fish the production of sufficiently large quantities of young is not physically possible; wastage of young is avoided instead by the development of a very short pelagic larval stage so that the young remain in the vicinity of the parental habitat, or viviparity may be developed. Thus not only is mobility restricted in the adults, but also in the juvenile stages. Little work has been done on the reproduction and development of the Clinidae, but most of those which have been studied have attached eggs and very short pelagic larval stages, and the South African and Indo-Australian forms are viviparous. Nevertheless, the family is extremely widespread.

There are three major problems in the dispersal of the Clinidae. The first is the occurrence of two labrisominids in West Africa, the second is the species found in the Mediterranean, and the third is the occurrence of Clininae in South America, South Africa, and the Australasian region.

Labrisomus nuchipinnis (Quoy & Gaimard) occurs on the tropical Atlantic coast of America, in the West Indies, the Madeira Islands, the Canary Islands, the Cape Verde Islands, and the coast of tropical West Africa as far south as Annobon Island. _Malacoctenus africanus_ (Cadenat) has been recorded from Dakar, Senegal, in West Africa. Steinitz (1950, q. Hubbs, 1953) believed the occurrence of _Labrisomus nuchipinnis_ in West Africa to date from the time of the Tethys Sea. Hubbs (1953) disagreed with this view, because he considered that a species could not for so long remain undifferentiated on both sides of the Atlantic, and he suggested that the fact that _Labrisomus nuchipinnis_ apparently has a rather longer pelagic larval stage than is usual for clinids might account for its transport across the

Atlantic. However, the species of _Malacoctenus_ apparently have a particularly short larval stage (Springer, 1958), so that this would not account for the occurrence of _Malacoctenus africanus_ in Senegal, if it is logically assumed to be derived from the American species of _Malacoctenus_. Arambourg (1921, 1927, 1943) described a fossil species which he called _Labrisomus pronuchipinnis_ from the Miocene (Tethys) deposits of Algeria. He referred it to the relatively small category of Mediterranean fossil species having their main affinities with the fauna of the Atlantic (Arambourg, 1943). The occurrence in the Mediterranean Tethys deposits of this form suggests a Tethys crossing by a labrisominid. Springer (1958) pointed out that the method whereby labrisominids might cross open expanses of sea, whether during Tethys or present times, remains unexplained, as does the mechanism whereby _Labrisomus nuchipinnis_ has remained undifferentiated on both sides of the Atlantic, unless the crossing was very recent. Whether the crossing of the Atlantic took place in Tethys or in recent times, it is considered to have been an eastward crossing from America to Africa since, although present ocean current flow in that region would favour a crossing from Africa to America, the large clinid fauna of America favours that region as a centre of origin for the group (Hubbs, 1953; Springer, 1958), particularly as the Labrisomini, to which both African species belong, are considered to be the less primitive of the two subtribes of the Labrisomidi;

the more primitive subtribe, Calliclinini, is confined to the Pacific coast of South America (Hubbs, 1953).

The origin of the Mediterranean clinid, "Clinus" argentatus (Risso) must remain obscure until more is known of its affinities. At present it is not even possible to assign it to a subfamily; it appears to be one of the Clininae in spite of the lack of a hook-like projection on the pectoral girdle. If this is so, we must postulate a north Atlantic crossing for one of the Myxodidi.

The Clininae are more or less confined to temperate waters (fig. 1). Their wide distribution is remarkable, considering that none of them are thought to have long pelagic larval histories, and one of the two tribes is viviparous. Furthermore, the Myxodidi, which are clearly the most primitive group, are confined to the temperate waters of the western, or Pacific, American coast. The most specialized genus, Myxodes, occurs in the temperate waters of Chile and Peru, with one species reaching the Galapagos Islands in the tropics under the influence of the cold Peru current (Hubbs, 1952; Rosenblatt and Walker, 1963). The other two genera have their centre of distribution on the temperate coast of California. Hubbs (1952) considered that the American Myxodidi gave rise to the South African Clinini, which then spread to the Indo-Australian region. It might be suggested that the ancestral myxodids might equally have reached Australia first from the Pacific coast of America, but this is most unlikely, since the eastern Pacific is known to be amore effective barrier to the migration of species than the Atlantic (Ekman, 1953), and the absence of any clinids from localities such as Hawaii between the Galapagos Islands and the Australian region suggests that the Australian clinids arrived there from the west.

In order to make such a westerly migration today, the myxodids would have to round Cape Horn to reach the Atlantic, which would not only mean a rather long migration, but would involve entering water considerably colder than that in which clinids usually occur; the Clininae are essentially a warm-temperate group and are not found on the coasts of Patagonia, the islands of the southern ocean, or southern New Zealand. However, during the Miocene there was a gap in the Central American region which allowed free passage of fauna between the eastern and western American coasts, which accounts for the considerable affinities of the faunas of the two regions today. This communication finally closed at the end of the Miocene period. It seems probable, then, that the migration of the ancestors of the Clinini from America across the Atlantic took place during the Miocene period, through the Central American communication. The time which would presumably have been necessary for the great diversity of South

African and Australian genera and species to develop lends further support to this probability.

On the western American coast the extent of tropical conditions at present is 25° north and 5° south, as opposed to 35° north and 35° south on the east coast, owing mainly to the influence of the cold Peru current which flows up the west coast of South America (Rosenblatt & Walker, 1963). If conditions were similar at the time of the Miocene communication, the Myxodidi would have occurred on the west coast sufficiently close to the Central American gap to pass through it. On reaching the eastern side, they would have to the north and south a considerable stretch of tropical coast under the influence of warm currents to traverse before suitable temperate water could be reached. However, warm water apparently presents less of a barrier to the dispersal of Clininae than does very cold water, since in the Indo-Australian region none of the Clininae occur south of Tasmania, but two have become established in the tropical Philippines. It is probable that the myxodids spread along the eastern American coast and reached temperate waters south (and possibly north) of the tropics, but conditions may not have been suitable for their establishment there, since none are known to occur along the temperate east coast of America now. On reaching the temperate waters of eastern South America, the South Atlantic circulation would favour their dispersal across the Atlantic to the west coast of South Africa, which is influenced by the cold Benguela current in much the same way as the western South American coast is influenced by the Peru current. From South Africa they presumably spread to Australia, where a few species have entered the tropics in the Indo-Australian archipelago.

The mechanism of such dispersal of virtually sedentary forms is of course still unknown. Ekman (1953) stated that the only conceivable method of dispersal over long distances for forms with a short or no pelagic larval period is by attachment to or entanglement in sea-weed. He cited two cases of wide distribution of viviparous echinoderms which he considered could have occurred in no way other than by transport in sea-weed. One is the brittle star Amphipholis squamata (Della Chiaje), which occurs from the Red Sea to South Africa, Hawaii, the Society Islands, and the west coast of America; it also occurs at the southern tip of Patagonia, indicating that it was transported around Cape Horn; it is obviously far more eurythermic than any of the Clinidae. The other is the star-fish <u>Asterina</u> <u>exigua</u> (Lamarck), endemic to South Africa, which also occurs on the island of St. Helena, where it was apparently carried in drifting material from South Africa by a branch of the Benguela current.

The transport in sea-weed of the myxodid ancestor of the Clininae is not only possible, but highly likely, since all of the present-day Myxodidi occur in weedy pools or even in kelp-beds. If the habits of the South African weed-dwelling species are anything to judge from, it would be quite possible for such a fish, or several such fish, to live for quite a long period of time in a floating mass of weed, provided that the food supply lasted until land was reached, and to become established in a new area if conditions were suitable. If a large bunch of weed is removed from a pool locally it is usual to find at least one clinid firmly entrenched in it. It is thus far more likely that the spread of the Clininae was accomplished by chance transport in sea-weed rather than by transport of larval stages by currents, particularly as the ancestral Australian forms were probably already viviparous. The spread of the labrisominids to West Africa is not necessarily explicable in the same way, since the Labrisominae are usually found in coral reefs and stony areas rather than weed.

Finally it may be said that during present times there are at least two records of transport of clinids over a considerable distance by ships, although in neither case did the transported species become established in the new area. The South African species Clinus navalis (Barnard) was first described from a specimen recovered from amongst barnacles on a ship's bottom at Simonstown in False Bay, Cape Peninsula. The range of distribution of this species is Still Bay to Port St. John's, well east of Cape Town.

In 1932 Fraser-Brunner described a species of clinid, Parviclinus spinosus Fraser-Brunner, from a single specimen recovered from the stomach of a fish caught in the mouth of the Conway River, on the coast of North Wales. No clinids were previously or subsequently recorded from British waters. Wheeler (1958) identified the specimen as Stathmonotus stahli (Evermann & Marsh), which occurs in the West Indies. He suggested that the specimen must have been transported in the bilge-water of a ship from Bermuda to England. The specimen was presumably alive when discharged from the ship if it was still identifiable after being eaten by another fish. It is clear from these cases that it is possible for clinids to survive passive transport over long distances, although their chances of reaching a suitable area and becoming established there must be exceedingly small.

SUMMARY

In an introductory section, the classification of the order Blennioidea is briefly reviewed, and the position of the family Clinidae within the order is discussed. The classification of the family Clinidae by Hubbs (1952) is discussed, and, with modifications concerning the South African Clinidae, is accepted. The relationships of the different groups within the family are considered.

The family Xenopoclinidae (Smith, 1961) is included in the family Clinidae, and is considered to represent a subtribe of the tribe Clinidi, to which all the South African clinids belong. The relationships of the Xenopoclinini are considered in some detail, including the apparent parallelism of this group with an American fish family of similar burrowing habit, the Dactyloscopidae.

The major part of the systematic section is a revision of the South African genera of Clinidae. The proposed classification reduces the number of genera of the South African Clinini to five from sixteen, and does away with the artificial division of the group into two "subfamilies" (Smith, 1945) or subtribes (Hubbs, 1952). Two genera of Xenopoclinini are retained, but a subgeneric division of one of them is discarded. The thirty-three South African species contained in the tribe Clinidi are

redescribed according to a consistent method, and are figured, together with the intromittent organ of the male and portions of the lateral line.

The possible origin of the South African Clinidae is discussed, and the zoogeography of the family is briefly considered.

REFERENCES CITED

ARAMBOURG, C. 1921. Sur la faune ictyologique d'Oran. C.R. Acad. Sci. Paris 172 (20) :1232 - 1245.

ARAMBOURG, C. 1927. Les poissons fossiles d'Oran. Matériaux carte géol. d'Algérie Ser. 1, Paléont. No. 6 :1 - 298.

ARAMBOURG, C. 1943. Sur la distribution mésogéenne de quelques poissons actuels et fossiles. C.R. Acad. Sci. Paris 217 :462 - 464.

BARNARD, K.H. 1927. A monograph of the marine fishes of South Africa. Ann. S. Afr. Mus. 21 (2) :419 - 1065.

BARNARD, K.H. 1935. Notes on South African marine fishes. Ann. S. Afr. Mus. 30 :645 - 658.

BARNARD, K.H. 1937. Further notes on South African marine fishes. Ann. S. Afr. Mus. 32 (2) :41 - 67.

BARNARD, K.H. 1948. Further notes on South African marine fishes. Ann. S. Afr. Mus. 48 :341 - 404.

BEAUFORT, L.F. de, & CHAPMAN, W.M. 1951. The fishes of the Indo-Australian archipelago. IX. Percomorphi (concluded). Blennioidea. Leiden: E.J. Brill. :1 - 484.

BEEBE, W., & TEE-VAN, J. 1928. The fishes of Port-au-Prince Bay, Haiti. Zoologica 10 (1) :1 - 279.

BEEBE, W., & TEE-VAN, J. 1934. A new genus and species of scaleless blenny, Somersia furcata, from Bermuda. Amer. Mus. Novit. No. 730 :1 - 3.

BERG, L.S. 1940. Classification of fishes, both recent and fossil. Trav. Instit. Zool. Acad. Sci. URSS 5 :87 - 517. (Facsimile lithoprint, 1947. Ann Arbor).

BLEEKER, P. 1860. Over eenige vischsoorten van de Kaap de Goede Hoop. Nat. Tijdschr. Neder.-Indië 21 :49 - 80.

BLOCH, M.E., & SCHNEIDER, J.G. 1801. Systema ichthyologie iconibus ex illustratum. Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit Johann Gottlob Schneider. Berolini :1 - 584.

BÖHLKE, J.E.1957. A review of the blenny genus Chaenopsis and a description of a related genus from the Bahamas. Proc. Acad. nat. Sci. Philad. 109 :25 - 57.

BÖHLKE, J.E., & SPRINGER, V.G. 1961. A review of the Atlantic species of the clinid fish genus Starksia. Proc. Acad. nat. Sci. Philad. 113 :29 - 60

BORGMEIER, T. 1957. Basic questions of systematics. Syst. Zool. 6 :53 - 69.

BOULENGER, G.A. 1904. Fishes. (Systematic account of Teleostei). In Harmer, S.F., & Shipley, A.E. ed. The Cambridge Natural History 7 :1 - 760 (:541 - 727). London: MacMillan & Co.

CADENAT, J. 1950. Poissons de mer du Sénégal. Init. Afr. 3 :1 - 345.

CAIN, A.J. 1956. The genus in evolutionary taxonomy. Syst. Zool. 5 :97 - 109.

CALDWELL, D.K. 1954. Additions to the known fish fauna in the vicinity of Cedar Key, Florida. Quart. J. Fla. Acad. Sci. 17 :182 - 184.

CASTELNAU, F.L. 1860. Note sur les poissons de l'Afrique australe. C.R. Acad. Sci. Paris 50 :788 - 789.

CASTELNAU, F.L. 1861. Mémoire sur les poissons de l'Afrique australe. :1 - 78. Paris: J.-B. Baillière et fils.

COCKERELL, T.D.A. 1916. The scales of the brotulid fishes. Ann. Mag. nat. Hist. (8) 18 :317 - 325.

CUVIER, G.L.C.F.D. 1817. Le règne animal distribué d'après son organisation....... 2, Poissons. :1 - 532. Paris.

CUVIER, G.L.C.F.D., & VALENCIENNES, A. 1836. Histoire naturelle des poissons. 11 :1 - 506. Paris: F.G. Levrault.

DAWSON, C. 1960. Starksia ocellato, a new sponge inquiline from South Carolina. Copeia 1960 (1) :75.

DELFIN, F.T. 1898 - 1901. Catalogo de los peces de Chile. Rev. Chilena Hist. Nat. 3 (6) :95 - 99.

EHRLICH, P.R. 1958. Problems of higher classification. Syst. Zool. 7 :180 - 184.

EHRLICH, P.R. 1961(a). Systematics in 1970: some unpopular predictions. Syst. Zool. 10 :157 - 158.

EHRLICH, P.R. 1961(b). Has the biological species concept outlived its usefulness? Syst. Zool. 10 :167 - 176.

EHRLICH, P.R., & HOLM, R.W. 1962. Patterns and populations. Science 137 :652 - 657.

EIGENMANN, C.H. 1912. Freshwater fishes of British Guiana. Mem. Carnegie Mus. 5 :1 - 578.

EKMAN, S. 1953. Zoogeography of the sea. :1 - 417. London: Sidgwick & Jackson.

EVERMANN, B.W., & MARSH, M.C. 1900. Descriptions of new genera and species of fishes from Puerto Rico. Rep. U.S. Comm. Fish & Fish. 25 (for 1899) :351 - 362.

FORD, R.F. 1959. A study of the major classification of blennioid fishes based upon cranial nerve evidence. Thesis submitted for degree of M.A. (Dept. Biol. Sci. Stanford University).

FOWLER, H.W. 1931. Fishes obtained by the Barber Asphalt Company in Trinidad and Venezuela in 1930. Proc. Acad. nat. Sci. Philad. 83 :391 - 410.

FOWLER, H.W. 1934. Fishes obtained by Mr. H.W. Bell-Marley chiefly in Natal and Zululand in 1929 - 1932. Proc. Acad. nat. Sci. Philad. 86 :405 - 514.

FOWLER, H.W. 1942. A list of fishes known from the coast of Brazil. Arq. zool. S. Paulo 3 :115 - 184.

FOWLER, H.W. 1944. Results of the Fifth George Vanderbilt Expedition (1941) .... The fishes. Acad. nat. Sci. Philad. Monogr. 6 :57 - 529.

FOWLER, H.W. 1947. Notes on Bahama fishes obtained by Mr. Charles G. Chaplin in 1947, with descriptions of two new species. Notul. nat. Acad. Philad. 199 :1 - 14.

FOWLER, H.W. 1950. Results of the Catherwood-Chaplin West Indies expedition, 1948. Part III. The fishes. Proc. Acad. nat. Sci. Philad. 102 :69 - 93.

FOWLER, H.W. 1953. On a collection of fishes made by Dr. Marshall Laird at Norfolk Island. Trans. Roy. Soc. N.Z. 81 :257 - 267.

FRASER-BRUNNER, A. 1932. A new genus of blennioid fishes from the British coast. Proc. Zool. Soc. Lond. 1932 :827 - 828.

FREIHOFER, W.C. 1963. Patterns of the ramus lateralis accessorius and their systematic significance in teleostean fishes. Stanf. Ichthyol. Bull. 8 (2) :80 - 189.

FROST, G.A. 1929. A comparative study of the otoliths of the neopterygian fishes. Ann. Mag. nat. Hist. (10) 4 :120 - 130.

GARMAN, S. 1899. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands, in charge of Alexander Agassiz, by the U.S. Fish Commission steamer "Albatross", during 1891. XXVI. The fishes. Mem. Mus. Comp. Zool. Harvard Coll. 36 :1 - 528.

GILBERT, C.H. 1900. Results of the Branner-Agassiz expedition to Brazil. Proc. Washington Acad. Sci. 2 (3) :161 - 184.

GILCHRIST, J.D., & THOMPSON, W.W. 1908. The Blenniidae of South Africa. Ann. S. Afr. Mus. 6 :97 - 142.

GILL, T. 1860. Monograph of the genus Labrosomus Swainson. Proc. Acad. nat. Sci. Philad. :102 - 108.

GILL, T. 1872. Arrangement of the families of fishes, or classes Pisces, Marsipobranchii, and Leptocardii. Smithson. Misc. Coll. No. 247 :1 - 49.

GRAY, J.E.(ed.). 1854. Catalogue of fish collected and described by Laurence Theodore Gronow, now in the British Museum. :1 - 193. London: Woodfall & Kinder.

GRIFFIN, L.T. 1926. Descriptions of New Zealand fishes. Trans. Proc. N.Z. Inst. 56 :538 - 546.

GUITEL, F. 1893. Observations sur les moeurs de trois Blenniidés, Clinus argentatus, Blennius montagui, et Blennius sphynx. Archiv. Zool. Exp. nr. 3 1 :325 - 384.

GUNTHER, A. 1861. Catalogue of the acanthopterygian fishes in the British Museum. 3 :1 - 586. London.

HERRE, A.W. 1936. Notes on the fishes in the zoological museum of Stanford University, V. New or rare Philippine fishes from the Herre 1933 Philippine expedition. Philippine J. Sci. 59 :357 - 382.

HERRE, A.W. 1939. The Philippine blennies. Philippine J. Sci. 70 :315 - 372.

HILDEBRAND, S.F. 1946. A descriptive catalog of the shore fishes of Peru. Bull. U.S. Nat. Mus. 189 :1 - 530.

HUBBS, C. 1952. A contribution to the classification of the blennioid fishes of the family Clinidae, with a partial revision of the eastern Pacific forms. Stanf. Ichthyol. Bull. 4 :41 - 165.

HUBBS, C. 1953. Revision of the eastern Pacific fishes of the clinid genus Labrisomus. Zoologica 38 :113 - 136.

HUXLEY, J.S.(ed.). 1940. The new systematics. :1 - 583. Oxford.

INGER, R.F. 1958. Comments on the definition of genera. Evolution 12 :370 - 384.

INTERNATIONAL TRUST FOR ZOOLOGICAL NOMENCLATURE, 1961. International code of zoological nomenclature adopted by the XV international congress of zoology, London, July 1958. London: the Trust for the International Commission on zoological nomenclature. :1 - 76.

JACKSON, P.B.N. 1950. The fishes of the intertidal zone of the Cape Peninsula. Thesis for the degree of M.Sc.(Zoology Department, University of Cape Town).

JORDAN, D.S. 1905. A guide to the study of fishes. 1 :1 - 626. New York: Henry Holt & Co.

JORDAN, D.S. 1923. A classification of fishes, including families and genera as far as known. Stanf. Univ. Publ., biol. Sci., 3 (2) :7 - 243.

KLAUSEWITZ, W. 1958. Fische aus dem Atlantik und Pasifik. Senckenbergiana, biol. 39 :57 - 84.

KNER, R. 1865. Reise der österreichischen Fregatte "Novara" um die Erde in den Jahren 1857 - 1859, unter den Befehlen des Commodore B. von Wüllerstorf-Urbain. Zoologischer Theil, Fische. :1 - 433. Wien.

LACEPEDE, B.G.E. de. 1800. Histoire naturelles poissons 2 :1 - 642. Paris.

LICHTENSTEIN, M.H.C. 1823. Verzeichniss der Doubletten des zoologischen Museums der Königliche Universität zu Berlin, nebst Beschreibung vieler bisher unbekannter Arten von Säugethieren, Vögeln, Amphibien, und Fischen. :1 - 118. Berlin: T. Trautureln.

LINNAEUS, C. 1758. Systema naturae .... 1 :1 - 824. Holmiae. (10th edition, reformed).

MCCULLOCH, A.R. 1908. Studies on Australian fishes. I. Rec. Austr. Mus. 7 :36 - 43.

MCCULLOCH, A.R. 1915. Notes on, and descriptions of, Australian fishes. Proc. Linn. Soc. N.S.W. 40 (2) :259 - 277.

MCCULLOCH, A.R. 1922. Checklist of the fishes and fish-like animals of New South Wales. Austr. Zool. 2 (3) :86 - 130.

MCCULLOCH, A.R. 1929. A check-list of the fishes recorded from Australia. Mem. Austr. Mus. 5 :1 - 534.

MACFARLANE, J.M. 1923. The evolution and distribution of fishes. :1 - 564. New York: The MacMillan Company.

MCLEAY, W. 1882. Descriptive catalogue of the fishes of Australia, part 3. Proc. Linn. Soc. N.S.W. 6 (1) :1 - 138.

MARSHALL, T.C. 1957. Ichthyological notes. Ichthyol. Notes Qd. 1 (3) :117 - 137.

MAYR, E., LINSLEY, E.G., & USINGER, R.L. 1953. Methods and principles of systematic zoology. :1 - 336. New York: McGraw-Hill.

MEAD, G.W. 1958. A catalog of the type specimens of fishes formerly in the collections of the Department of Tropical Research, New York Zoology Society. Zoologica 43 :131 - 134.

METZELAAR, J. 1922. On a collection of marine fishes from the Lesser Antilles. Bijdrag. Dierk. Feest-nummer :133 - 141.

MICHENER, C.D. 1957. Some bases for higher categories in classification. Syst. Zool. 6 :160 - 173.

MICHENER, C.D., & SOKAL, R.R. 1957. A quantitative approach to a problem in classification. Evolution 11 :130 - 162.

MORROW, J.E. 1957. Shore and pelagic fishes from Peru, with new records and the description of a new species of Sphaeroides. Bull. Bingham Oceanogr. Coll. 16 (2) :5 - 55.

MYERS, G.S., & WADE, C.B. 1946. New fishes of the families Dactyloscopidae, Microdesmidae, and Antennariidae from the west coast of Mexico and the Galapagos Islands, with a brief account of the use of rotenone fish poisons in ecological collecting. Allan Hancock Pacif. Exp. 9 :151 - 178.

OGILBY, J.D. 1886. Descriptions of new fishes from Port Jackson. Proc. Linn. Soc. N.S.W. 10 :225 - 230.

OLSEN, A.M. 1958. New fish records and notes on some uncommon Tasmanian species. Pap. Proc. Roy. Soc. Tasm. 92 :155 - 159.

PAPPE, L. 1853. Synopsis of the edible fishes at the Cape of Good Hope. :1 - 34. Cape Town: van de Sandt de Villiers & Tier.

PARR, A.E. 1930. Teleostean shore and shallow-water fishes from the Bahamas & Turks Island. Bull. Bingham Oceanogr. Coll. 3 (4) :1 - 148.

PENRITH, M.-L. 1965. Studies on the South African Clinidae. I. Description of a new species of Pavoclinus, and redescription of Gynutoclinus rotundifrons (Barnard). Ann. S. Afr. Mus. 48 (10) :211 - 217.

PENRITH, M.-L. 1965. Studies on the South African Clinidae. II. Two new species of the genus Clinus. Ann. S. Afr. Mus. (In press).

REGAN, C.T. 1912. The classification of the blennioid fishes. Ann. Mag. nat. Hist. (8) 10 :265 - 280.

ROSENBLATT, R.H. 1963. Speciation in marine shore fishes. in Harding, J.P., & Tebble, N. ed. Speciation in the sea. :171 - 180. London: Systematic Association.

ROSENBLATT, R.H., & WALKER, B.W. 1963. The marine fishes of the Galapagos Islands. Occ. Pap. Calif. Acad. Sci. no. 44 :97 - 104.

SCHULTZ, L.P. 1949. A further contribution to the ichthyology of Venezuela. Proc. U.S. Nat. Mus. 99 :1 - 211.

SCOTT, E.O.G. 1935. Observations on some Tasmanian fishes. Part II. Pap. Proc. Roy. Soc. Tasm. 1934 :63 - 73.

SCOTT, E.O.G. 1939. Observations on some Tasmanian fishes. Part IV. Pap. Proc. Roy. Soc. Tasm. 1938(1939) :139 - 159.

SCOTT, E.O.G. 1955. Observations on some Tasmanian fishes. Part VII. Pap. Proc. Roy. Soc. Tasm. 89 :131 - 146.

SMITH, C.L. 1957. Two new clinid blennies (Malacoctenus) from Puerto Rico. Occ. Pap. Mus. Zool. Univ. Mich. no. 585 :1 - 15.

SMITH, J.L.B. 1931. New fishes from South Africa. Rec. Albany Mus. 4 :145 - 160.

SMITH, J.L.B. 1935. New and little known fishes from South Africa. Rec. Albany Mus. 4 :169 - 235.

SMITH, J.L.B. 1937. New records of South African fishes. Ann. Natal Mus. 8 :167 - 197.

SMITH, J.L.B. 1945. The fishes of the family Clinidae in South Africa. Ann. Mag. nat. Hist. (11) 12 :535 - 546.

SMITH, J.L.B. 1947. New clinid fishes from South Africa. Ann. Mag. nat. Hist. (11) 14 :732 - 736.

SMITH, J.L.B. 1949. The sea fishes of southern Africa. :1 - 550. Cape Town: Central News Agency Ltd.

SMITH, J.L.B. 1953. The sea fishes of southern Africa (revised enlarged edition). :1 - 580. Cape Town: Central News Agency Ltd.

SMITH, J.L.B. 1960. A new species of South African clinid fish. Ann. Mag. nat. Hist. (13) 3 :689 - 691.

SMITH, J.L.B. 1961. Fishes of the family Xenopoclinidae. Ichthyol. Bull. 20 :351 - 356.

SMITH, J.L.B. 1962. Fishes from the Cape described by Lichtenstein in 1823. S. Afr. J. Sci. 58 (2) :39 - 40.

SNEATH, P.H.A., & SOKAL, R.R. 1962. Numerical taxonomy. Nature 193 (4818) :885 - 890.

SOKAL, R.R., & MICHENER, C.D. 1958. A statistical method for evaluating systematic relationships. Univ. Kansas Sci. Bull. 38 :1409 - 1438.

SOKAL, R.R., & SNEATH, P.H.A. 1963. Principles of numerical taxonomy. :1 - 359. San Francisco: W.H. Freeman & Co.

SPRINGER, V.G. 1954. Western Atlantic fishes of the genus Paraclinus. Texas J. Sci. 6 :422 - 441.

SPRINGER, V.G. 1955. The taxonomic status of the fishes of the genus Stathmonotus, including a review of the Atlantic species. Bull. Mar. Sci. Gulf & Caribb. 5 :66 - 80.

SPRINGER, V.G. 1958. Systematics and zoogeography of the clinid fishes of the subtribe Labrisomini Hubbs. Publ. Inst. Mar. Sci. 5 :418 - 491.

STARKS, E.C. 1913. The fishes of the Stanford expedition to Brazil. Leland Stanf. Jr. Univ. Publ. Univ. ser. :1 - 77.

STARKS, E.C. 1923. The osteology and relationships of the uranoscopid fishes. Stanf. Univ. Publ. biol. Sci. 3 (3) :259 - 290.

STARKS, E.C. 1930. The primary shoulder girdle of bony fishes. Stanf. Univ. Publ. biol. Sci. 6 (2) :149 - 239.

STEINITZ, H. 1950. On the zoogeography of the teleostean genera Salarias, Ophioblennius, and Labrisomus. Arch. zool. (ital.) Napoli 35 :325 - 348.(not seen).

STEPHENS, J.S. Jr. 1963. A revised classification of the blennioid fishes of the American family Chaenopsidae. Univ. Calif. Publ. Zool. 68 :1 - 133.

SWAIN, J. 1882. A review of Swainson's genera of fishes. Proc. Acad. nat. Sci. Philad. 34 :272 - 284.

SWAINSON, W. 1839. The natural history and classification of fishes, amphibians, and reptiles, or monocardian animals. :1 - 452. In The Cabinet Encyclopedia 2. London: Longman, Orme, Brown, Green, & Longmans.

THOMPSON, W.W. 1918. Catalogue of the fishes of the Cape Province. Mar. Biol. Rep. 4 :75 - 177.

TROTTER, E.S. 1926. Brotulid fishes. Zoologica 8 (3) :107 - 125.

WHEELER, A.C. 1958. The identity of the British fish Parvicilnus spinosus. Proc. Zool. Soc. Lond. 130 :253 - 256.

WHITLEY, G.P. 1929. R.M. Johnston's memoranda relating to the fishes of Tasmania. Pap. Proc. Roy. Soc. Tasm. 1928 (1929) :44 - 68.

WHITLEY, G.P. 1945. New sharks and fishes from western Australia. Austr. Zool. 11 :1 - 42.

WHITLEY, G.P. 1956. Ichthyological notes. Austr. Zool. 12 :251 - 261.

WHITLEY, G.P. 1959. Ichthyological snippets. Austr. Zool. 12 :310 - 323.

Omission

GREGORY, W.K. 1933. Fish skulls: a study of the evolution of natural mechanisms. Trans. Amer. Philos. Soc. 23 :75 - 481.

APPENDIX A

A simple quantitative assessment of the similarities between the South African species of Clinidae, by the use of numerical taxonomy

In recent years a method of assessing quantitatively the degree of similarity between different organisms has become practicable owing to the increasing availability and efficiency of electronic computers. The ease of calculation and correlation of large quantities of data by means of a computer has made possible the use of larger numbers of characters in considerations of the characteristics of an organism. That such quantitative assessment of similarity between organisms can be of great importance in taxonomy is obvious, since most classifications are based on the similarities between the organisms concerned. The various methods devised for quantitative assessment of similarity between organisms and the application of such assessments to taxonomy have been very fully described by Sokal & Sneath (1963) (see also Cain, 1956; Borgmeier, 1957; Michener, 1957; Michener & Sokal, 1957; Sokal & Michener, 1958; Ehrlich, 1958, 1961 (a), (b); Ehrlich & Holm, 1962; Sneath & Sokal, 1962).

It was felt that it would be interesting to compare the systematic conclusions put forward in the present study with a quantitative assessment of the similarities in the group. Thirty-two of the thirty-three species were used in the quantitative assessment, as the type and only known specimen of the thirty-third species, Pavoclinus profundus Smith, was not available at the time when the assimilation of characters for the quantitative study was carried out. In order to carry out the test as simply as possible, seventy-five characters, each having two states, were used, none of which required any of the species to be scored as "non-comparable" (see Sokal & Sneath, 1963, p. 74), for ease of computation. Much of the data consisted of measurements, and as no method was available for computing a mixture of two-state characters and unclassed multi-state characters (e.g. measurements and fin counts), all the characters were reduced to two states. It was hoped that the large number of characters used would to some extent compensate for the loss of information resulting from the reduction of multi-state characters to two states. The characters used are listed in table A_i. The similarity coefficients between pairs of species were calculated by the formula for the Simple Matching Coefficient proposed by Sokal & Michener (1958). The arrangement of species into groups was done using the formula for Spearman's sums of variables (see Sokal & Sneath, p. 183). All the calculations were carried out using a desk calculator or logarithmic tables. The data matrices are not reproduced here but are available in the Marine Biology Department of the South African Museum. The results are shown in a dendrogram (fig. A_i).

The vertical scale represents the similarity coefficients; the lateral arrangement of the species is arbitrary.

Discussion

The agreement between the results of the quantitative test and the proposed systematic scheme is on the whole good. The lowest similarity coefficient was between the Clinini and the Xenopoclinini, which have been separated in the classification at the subtribal level. Above this level, the groups *Pavoclinus*, *Clinus*/*Clinoporus*/*Blennioclinus*, and *Gynutoclinus* had a relatively low similarity coefficient. The arrangement of the species of the *Pavoclinus* group is very similar in the proposed scheme of classification and in the quantitative assessment, as is the position of *Gynutoclinus rotundifrons*. However, the quantitative assessment shows a greater similarity between the two species placed in the genus *Blennioclinus* and the species of the subgenus *Clinus* (*Clinus*) than between *Clinus* (*Clinus*) and the other subgenera of the genus *Clinus*; and also a greater similarity between *Clinoporus* and the eel-like subgenera of the genus *Clinus* than between those subgenera and the subgenus *Clinus* (*Clinus*). To define either one genus to include *Clinoporus* and *Blennioclinus* with the forms at present placed in the genus *Clinus*, or to define two genera, one to contain the eel-like *Clinus* + *Clinoporus*, and the other to contain *Clinus* (*Clinus*) + *Blennioclinus*, would be difficult, since *Clinoporus* and *Blennioclinus* possess several specialized features. It is considered that the avoidance of non-comparable characters in this study tended to minimise the importance of the specialized features of Clinoporus and Blennioclinus, and for this reason the present classification has not been altered. However, the obvious similarity of these two genera to Clinus is interesting. It is strong evidence in favour of the opinion expressed in the discussion of the origins of the group that Blennioclinus and Clinoporus are derived from the Clinus group of species, the former probably from the line leading to the Clinus (Clinus) group, and the latter from the eel-like line.

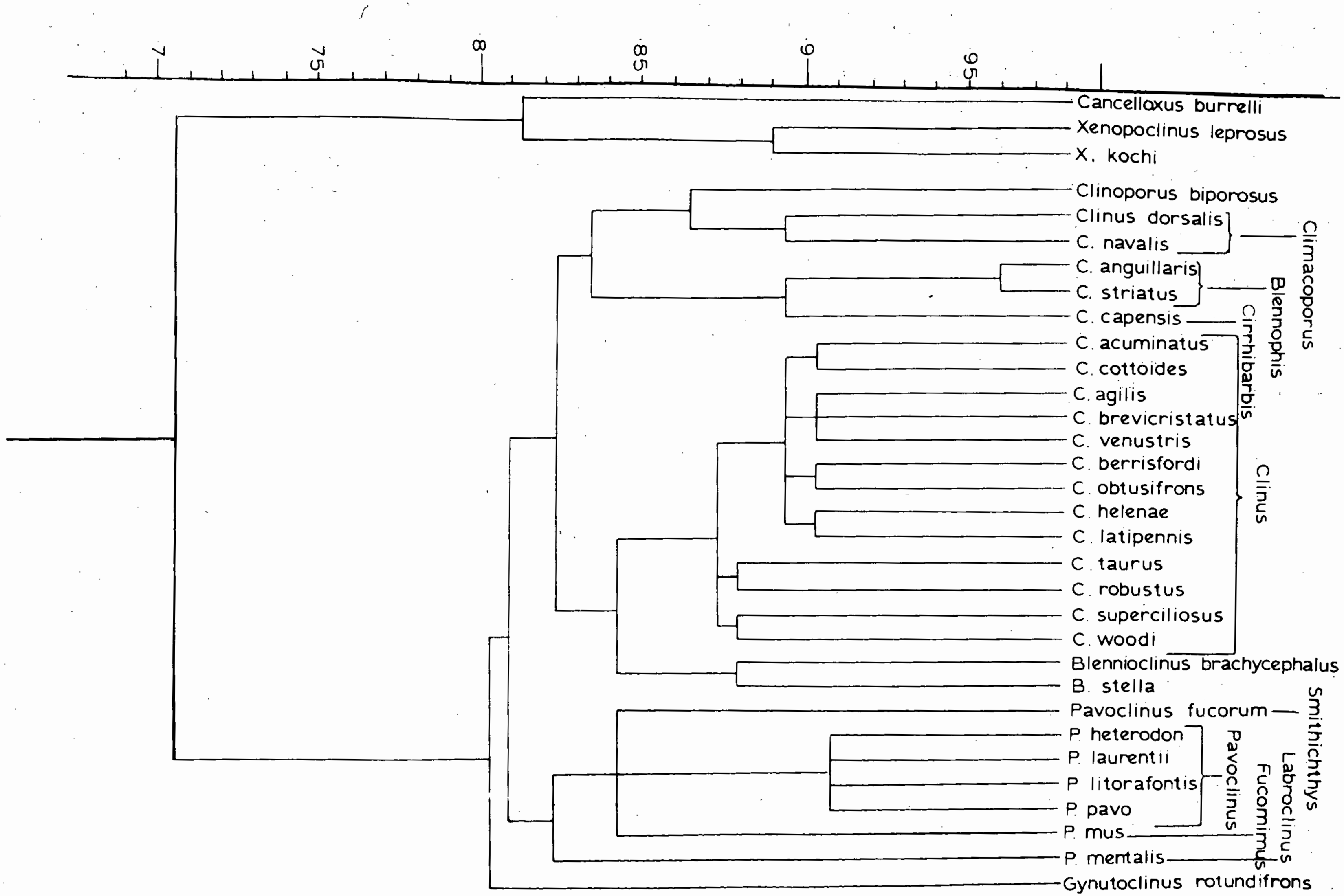


Fig. A1 Dendrogram showing similarities of South African species of Clinidae, based on 75 characters

Table A_1. Characters used in the quantitative assessment of similarity of South African species of Clinidae (the characters have not been listed in logical sequence but are listed in the order in which they were arranged in the matrix, for ease of comparison with the matrix)

1. Head length: less than 25% of standard length/ more than 25%
2. Snout - dorsal origin less/ more than 70% of head length
3. Orbit diameter less/ more than 25% of head length
4. Upper jaw length less/ more than 40% of head length
5. Horizontal distance from posterior margin of eye to dorsal origin less/ more than orbit diameter
6. Interorbital width less/ more than half eye diameter
7. First dorsal spine less/ more than eye diameter
8. Depth of body at anal origin less/ more than 17.5% of standard length
9. Least depth of caudal peduncle more/ less than or equal to caudal peduncle length
10. Length of caudal peduncle less/ more than 40% of head length
11. Length of dorsal fin base less/ more than 75% of standard length
12. Length of anal fin base less/ more than 60% of standard length
13. Average number of dorsal spines less/ more than 37.5
14. Average number of dorsal spines less/ more than 35

15. Last dorsal spine less/ more than half length of first dorsal ray
16. Total number of dorsal elements less/ more than 40
17. Notch in membrane between third and fourth dorsal spines present/ absent
18. Gap between third and fourth dorsal spines greater than/ equal to other gaps
19. Average number of dorsal spines less/ more than 30
20. Average number of dorsal soft rays less/ more than 5
21. Average number of anal rays less/ more than 25
22. Caudal rays 11/ 13
23. Average number of pectoral rays less/ more than 13
24. Inner pelvic ray well-developed/ reduced or absent
25. First dorsal spine longer than or equal to/ shorter than second
26. First dorsal spine longer than or equal to/ shorter than fourth
27. Second dorsal spine longer than or equal to/ shorter than third
28. Basic pattern or colour remains/ fades on preservation
29. Lateral line pores and head pores very large/ not very large
30. Tufts of cirri at tips of dorsal spines present/ absent
31. Outline of dorsal fin undulating/ not undulating
32. Pelvic fins with membranes extending between rays to tips/ not
33. Pectoral fin upswept/ not upswept
34. Scales on base of dorsal fin present/ absent
35. Scales on base of anal fin present/ absent
36. Scales on base of caudal fin present/ absent

37. Supra-orbital tentacle present/ absent

38. Supra-orbital ridges present/ absent

39. Occipital grooves present/ absent

40. Cheeks scaled/ naked

41. Eyes lateral/ dorsal

42. Facial barbels present/ absent

43. Opercular membranes expanded/ normal

44. Lips with vertical corrugations/ not

45. Pores on head on raised papillae/ flush

46. Skinny flap on lower jaw/ not

47. Vomer toothed/ edentate

48. Teeth in jaw in two rows/ one row

49. Dorsal origin behind opercle/ in front of opercle

50. Hook on pectoral girdle present, normal/ modified or absent

51. Width of body at anal origin less/ more than half depth

52. Basal part of intromittent organ less/ more than half total length of organ

53. Tip of intromittent organ completely ensheathed/ protruding

54. Lips of intromittent organ fused/ not

55. Lips of intromittent organ 4/ 2

56. Lobes at base of intromittent organ present/ absent

57. Tip of intromittent organ bifid/ single

58. Lips of intromittent organ frilled/ smooth

59. Tip of intromittent organ rounded/ pointed

60. Female opening modified/ not

61. Body scaled/ naked

62. Posterior part of lateral line normal/ modified

63. Anterior part of lateral line with double pores/ not

64. Anterior part of lateral line broad/ narrow

65. Cheeks normal/ inflated

66. Lateral line interrupted at curve/ not interrupted

67. Descent of lateral line to mid-line abrupt/ gradual

68. Sand-burrowing/ not

69. Weed-dwelling/ not

70. An anterior ocellate spot/ not

71. Head depressed/ normal

72. Maximum size attained less/ more than 140 mm.

73. Snout upturned/ not

74. 1 dorsal soft ray/ 2 or more dorsal soft rays

75. Body depth less/ more than 22.5% of standard length

FRANK HAMILTON TALBOT AND MARY-LOUISE PENRITH

CTENOGOBIUS CLOATUS SMITH, 1960 A SYNONYM OF *CTENOGOBIUS SALDANHA* (BARNARD, 1927)

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Barnard, K. H., 1927. A monograph of the marine fishes of South Africa Part II. *Ann. S. Afr. Mus.* **21**: 419–1065.

Böhlke, J. E., & Robins, C. R. 1960. A revision of the gobioid fish genus *Coryphopterus*. *Proc. Acad. nat. Sci. Philad.* **112**: 103–128.

Koumans, F. P. 1953. *The fishes of the Indo-Australian archipelago. X. Gobioidea.* Leiden: E. J. Brill.

Smith, J. L. B. 1959. Gobioid fishes of the families Gobiidae, Periophthalmidae, Trypauchenidae, Taenioididae, and Kraemeriidae of the Western Indian Ocean. *Ichthyol. Bull.* **13**: 185–225.

Smith, J. L. B. 1960. Fishes of the family Gobiidae in South Africa. *Ichthyol. Bull.* **18**: 299–314.

Ctenogobius saldanha (Barnard).

spots on preopercle, and usually four in a straight line along hind margin of opercle. Pectoral base dusky with several dark spots. Dorsal fins dusky with rows of black dots forming bands. A large black spot on the membrane between the fourth and fifth and the fifth and sixth dorsal spines. Pectoral, pelvic, anal and caudal fins dusky.

Head, nape, preopercle, and opercle naked; pectoral base, prepelvic, and belly with cycloid scales.

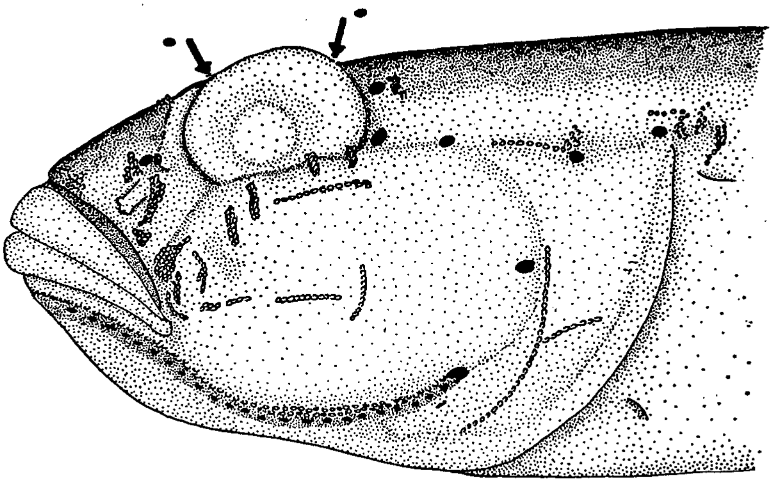

FIGURE 2.

Diagram of pores and papillae on head of *Ctenogobius saldanha* (Barnard).

DISCUSSION

A re-examination of the type of *saldanha* shows certain errors in the original description. The outer row of teeth in each jaw is clearly enlarged (not villiform throughout); there are 11 series of scales between the first anal spine and the dorsal fin base, not 10 as stated in Barnard's description; and the bases of the pectorals are scaled.

Smith's description of *cloatus* indicates the following differences from *saldanha*: strong development of the pelvic fraenum, absence of free upper pectoral rays in his specimens, enlargement of the outer row of teeth, number of transverse scale rows, shape of the tongue, and distribution.

The pelvic fraenum of *saldanha* shows no differences from that of the type of *cloatus* (fig. 1). In both cases the fraenum is well developed.

Smith's type has ragged fins with many rays broken off, and the fin membranes are damaged. Nevertheless, this specimen has the upper pectoral rays very similar to those of *saldanha* (fig. 1) (both the type of *saldanha* and fresh specimens from the type locality). In addition, South African Museum specimens from Port Elizabeth have the upper rays similar to those of the type of *saldanha*.

The apparent differences in teeth and in number of transverse scale rows fall away after re-examination of the type of *saldanha*.

The tongue in both *cloatus* and in specimens of *saldanha* from the type locality is truncate or feebly bilobed. It is not adnate, and Barnard (1927) seems to have been correct in his suggestion that the apparently adnate tongue of the type was due to the fact that the specimen was preserved with the mouth unusually widely opened. Dehydration may also have played a part in this, and in the shrinkage of the tongue, which has obscured its shape.

Böhlke & Robins (1960) have shown that the pore system of the head is important in the classification of gobies. This was found to be identical in all specimens examined, including Smith's type specimen of *Ctenogobius cloatus* (fig. 2).

As has been found in another intertidal group of fishes, the Clinidae, and in gobies such as *Psammogobius knysnaensis* Smith and *Coryphopterus nudiceps* (C. & V.), distribution around the Cape from at least as far west as Saldanha Bay to Algoa Bay or farther occurs commonly.

We can find no difference between east and west coast specimens, and conclude that *cloatus* and *saldanha* are synonymous.

The well-developed fraenum, presence of prepelvic scales, naked head and nape, scale and fin counts, narrow bony interorbital, enlarged outer teeth, tongue shape, and restricted gill openings, place this species within the genus *Ctenogobius* Gill, 1858, as defined by Koumans (1953).

Acknowledgements

Acknowledgement is made to Professor J. L. B. Smith of the Department of Ichthyology, Rhodes University, Grahamstown, for the loan of the type specimen of *cloatus*, and to Miss R. M. Tietz, of the Port Elizabeth Museum, and Mr. M. J. Penrith of the South African Museum, who assisted in the collection of fresh material.

The Trustees of the South African Museum are grateful to the Council for Scientific and Industrial Research for the award of a grant to publish this paper.

Summary

It is shown that *Ctenogobius cloatus* Smith is synonymous with *Ctenogobius saldanha* (Barnard) (Pisces: Gobiidae). *Ctenogobius saldanha* is redescribed.

CTENOGOBIUS CLOATUS SMITH, 1960, A SYNONYM OF *CTENOGOBIUS SALDANHA* (BARNARD, 1927)

By

FRANK HAMILTON TALBOT and MARY-LOUISE PENRITH

South African Museum, Cape Town

(With 2 figures in the text and 1 plate)

CONTENTS

INTRODUCTION

New material in the South African Museum fish collections from Port Elizabeth, False Bay, and Saldanha Bay, has shown clearly that *Ctenogobius cloatus* Smith, described from Knysna, and *Ctenogobius saldanha* (Barnard), described from Saldanha Bay, are synonymous.

The material examined is as follows:

S.A.M. 23277: 1 specimen, 79 mm., tidal swimming pool, St. James, False Bay;
S.A.M. 21488: 1 specimen, 33 mm., shallow water, Langebaan, Saldanha Bay;
S.A.M. 21489: 1 specimen, 30 mm., shallow water, Langebaan, Saldanha Bay;
S.A.M. 21490: 2 specimens, 34–37 mm., shallow water, Langebaan, Saldanha Bay;
S.A.M. 22034: 1 specimen, 40 mm., inter-tidal pool, Sea Point, Table Bay;
S.A.M. 17355: 1 specimen, 85 mm., Saldanha Bay (type of *saldanha* Barnard);
S.A.M. 23832: 6 specimens, 28–34 mm., dredged in 7 m. water, Saldanha Bay;
S.A.M. 23831: 4 specimens, 51–61 mm., inter-tidal pools, Port Elizabeth;
S.A.M. 24047: 4 specimens, 46·5–54 mm., tidal swimming pool, Port Elizabeth;
S.A.M. 24048: 3 specimens, 45·5–50 mm., inter-tidal pools, Port Elizabeth;
S.A.M. 23979: 3 specimens, 53–79 mm., inter-tidal pool, Strandfontein, False Bay;
S.A.M. 24049: 2 specimens, 67 mm., 70 mm., inter-tidal pool, Strandfontein, False Bay;
Rhodes Univ.: 1 specimen, 85 mm., lagoon, Knysna (type of *cloatus* Smith).

Ann. S. Afri. Mus. **48** (8), 1964, 189–193, 2 figs., 1 pl.

Ctenogobius saldanha (Barnard)
(pl. IV, figs. 1, 2)

Gobius saldanha Barnard, 1927, p. 823.
Bathygobius saldanha (Barnard), Smith, 1949, p. 331.
Monishia saldanha (Barnard), Smith, 1960, p. 304.
Ctenogobius cloatus Smith, 1960, p. 302.

Fin counts: D. VI + I 10–11; A. I 9–10; P. 19–23; C. 15 (branched rays only). Gill-rakers: 6–7 on lower arch, total 9. Scales 34–38, transverse 11. Depth 4·9–6·8. Head 3·0–3·6 in standard length. Teeth in jaw in several series; outer row markedly enlarged, inner rows viliform, no canines. Tongue truncate or feebly bilobed. Pectoral girdle without flaps, but with a low, indented ridge on the anterior border. Pectoral fin with upper 3–4 rays free, silk-like, markedly bifurcating (fig. 1). Pelvic fraenum (i.e. membrane connecting outer rays across base) strong and well developed (fig. 1). Eye 2·9–3·7 in head. Bony interorbital narrow, less than 5 in eye diameter, eyes adjacent. Pores and papillae of head shown in fig. 2.

Ground colour whitish, with three very broad, irregular, faintly dusky cross-bars on body. Sides irregularly spotted with black. Underparts white. Nape dusky with a lighter transverse bar. Head whitish grey. A few small dark

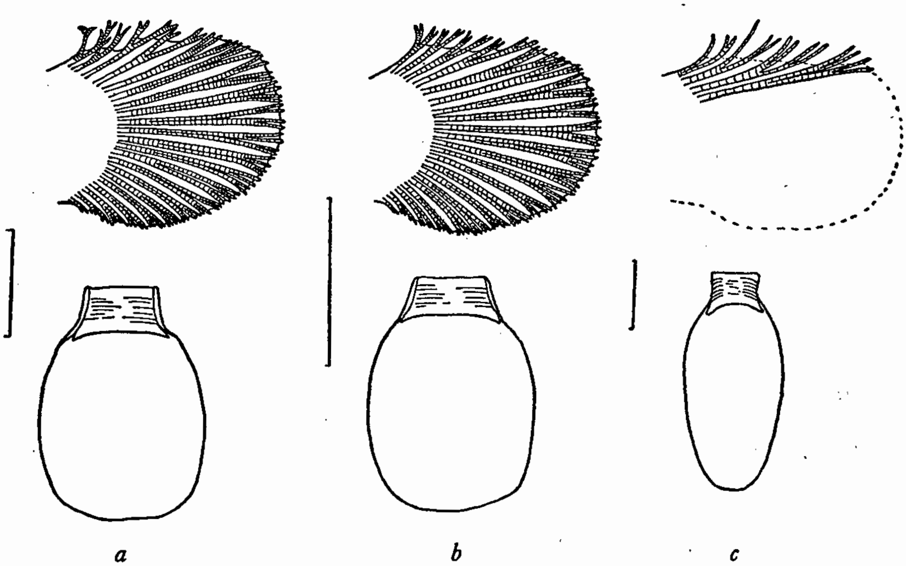

FIGURE 1.

Pectoral fin and pelvic fraenum of *Ctenogobius saldanha* (Barnard) from (*a*) Port Elizabeth; standard length 45.5 mm., (*b*) Saldanha Bay; standard length 35 mm., and (*c*) Knysna (type of *cloatus* Smith); standard length 85 mm. The fin is more contracted in (*c*) than in (*a*) and (*b*).

INSTRUCTIONS TO AUTHORS

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In duplicate (one set of illustrations), type-written, double spaced with good margins, including TABLE OF CONTENTS and SUMMARY. Position of text-figures and tables must be indicated.

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SMITH, C. D. 1954. South African Plonias. *In* Brown, X. Y. *Marine faunas*. 2nd ed. **3**: 63–95. London: Green.

SYNONYMY

Arranged according to chronology of names. Published scientific names by which a species has been previously designated (subsequent to 1758) are listed in chronological order, with abbreviated bibliographic references to descriptions or citations following in chronological order after each name. Full references must be given at the end of the paper. Articles and recommendations of the *International code of zoological nomenclature adopted by the XV International congress of zoology, London, July* 1958, are to be observed (particularly articles 22 and 51).

Examples: *Plonia capensis* Smith, 1954: 86, pl. 27, fig. 3. Green, 1955: 23, fig. 2.

When transferred to another genus:
Euplonia capensis (Smith) Brown, 1955: 259.
When misidentified as another species:
Plonia natalensis (*non* West), Jones, 1956: 18.
When another species has been called by the same name:
[*non*] *Plonia capensis*: Jones, 1957: 27 (= *natalensis* West).