

duct but is absent from the epithelium of the main venom gland. The large number of capillaries associated with the underlying supporting tissue of the fang sheath epithelium, suggests that there is some mechanism for the reabsorption of fluid, thereby concentrating the venom before it is ejected by the fang. The fang sheath probably functions as a cuff surrounding the base of the fang thus allowing for a closed pressure system for the ejection of the venom by means of the fang. This pressure is developed by the *crotaphyte* muscle which is continuous with the venom apparatus connective tissue sheath. The connective tissue sheath in the neck region and the supporting septa have smooth muscle slips which could act in conjunction with the *crotaphyte* muscle. These findings agree with those of Gans & Kochva (1965), Rosenberg (1967) and De Lucca *et al.* (1974).

Kochva & Gans (1970) showed a uniformity in glandular structure in the venom apparatus of more than 20 viperid species, except for the mole vipers which do not have a differentiated accessory gland. The venom glands have four distinct regions, the main gland which occupies the posterior two-thirds of the gland, the primary duct, the accessory gland and the terminal duct that leads to the fang sheath. These findings are similar to those found in *Bitis arietans* except that the accessory gland is separated from the main gland by a distance of approximately one centimetre. Similarly, the accessory glands show two distinct regions, the anterior part lined with a typical mucous epithelium containing goblet cells, and the posterior part lined with a flat to cuboidal epithelium, the shape of which appears to correlate with the secretory activity (Gennaro, Callahan & Loring 1963; Gans & Kochva 1965; Odor 1965). Rosenberg (1967) showed that elapid snakes also have an accessory gland. These accessory glands, however, did not have an anterior and posterior region since the morphology of the gland showed no variation.

The function of the accessory glands remains to be fully investigated. Gennaro *et al.* (1963) have shown that an extract of the accessory gland enhances the toxicity of the main venom gland, but subsequent mixing experiments of the main venom gland product and the accessory gland secretion failed to show any inhibition or activation of enzymes in the venom of viperid snakes (BDolah 1979). In addition, the rods and cocci chains seen by us (King & Hattingh 1979) in the venom by aseptically culturing this product indicate that the venom produced by the main gland is not cytotoxic to all cell types and that it may subsequently be activated by additional secretion which is added to the venom or by some other mechanism not yet understood. The mechanisms involved in the production of venom in these snakes are clearly not yet fully understood.

Acknowledgements

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Range extensions of blennioid fishes on the southern African west coast

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The intertidal zone of the south and west coasts of southern Africa is notable for the complete dominance of blennioid fishes. Clinids of the subfamily Clininae are the most numerous fishes in the south and south-west, and blennies of the subfamily Blenniinae dominate in the northern portion of the west coast.

The distribution and ranges of clinids have been recorded by Penrith (1969, 1970) and those of blennies by Penrith & Penrith (1972). Subsequently Winterbottom (1976) recorded a number of clinid range extensions from the Cape Peninsula eastwards, but no additional information on blennioid fish distribution on the coast west of the Cape Peninsula has been published.

During December 1981 a number of localities were sampled in the company of Dr P.J. Miller (Bristol University) during an unsuccessful search for gobioid fishes. Some unexpected new records of clinid fishes were obtained, and in view of these results it was decided to rework some of the localities to the north of Toscanini (Figure 1).

Localities where collections were made, and where blennioid fishes were collected outside their recorded range were:

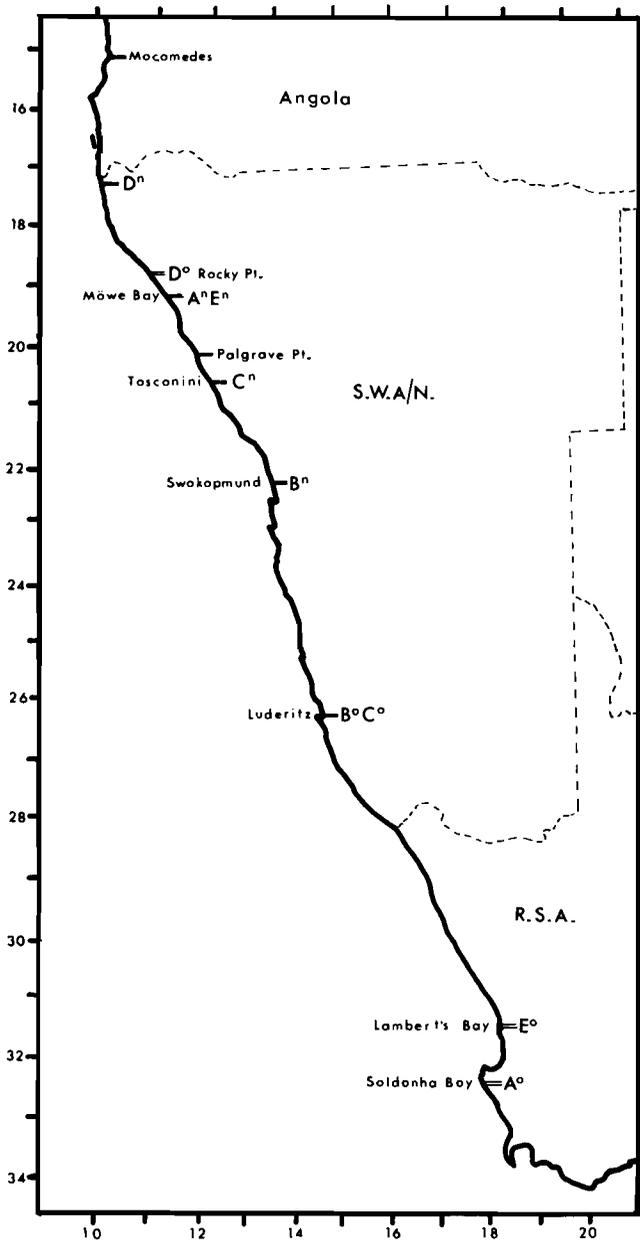


Figure 1 West coast of southern Africa. Localities shown are previous northern-most west coast records and the new localities recorded in the text. A = *Chalaroderma capito*, B = *Clinus anguillaris*, C = *Clinus agilis*, D = *Clinus superciliosus*, E = *Clinus taurus*. Suffix O = old locality, suffix N = new locality record.

Swakopmund: Badewanne	Dec. 1981	22°42,1'S/14°31,3'E.
Toscanini	Dec. 1981	20°49,2'S/13°23,7'E.
Palgrave Point	March 1982	20°26'S/13°13,5'E.
Rocks north of Mowe Point	March 1982	19°20'S/12°42'E.
Rocks 5 km south of Kunene R. mouth	Jan. 1982	17°17,2'S/11°45,3'E.

These last rocks are the group described by Kensley & Penrith (1980).

Unless noted to the contrary, the meristic and morphometric data of the fish recorded fall within the ranges recorded by Penrith (1969) and Penrith & Penrith (1972). Where possible, the material was compared directly with material from within the previously recorded distribution range. Figure 1 shows the previous northern records on the west coast for each of the species and the new localities recorded here.

Blenniidae

Chalaroderma capito (Valenciennes in Cuvier & Valenciennes), 1836

Localities collected: Palgrave Point, 1 example,
Ls 158 mm
Möwe Bay, 1 example,
Ls 184 mm

Meristic and morphometric data were within the range for the species as given by Penrith & Penrith (1972), with the exception of the eye of the Möwe Bay example (5,6 in head; previous range 3,0 – 5,1). This specimen is the largest yet recorded, and eye size shows negative allometric growth relative to the head in the species (Penrith & Penrith 1972).

The range is extended from Saldanha Bay (33°00'S/17°56'E) to Möwe Bay, a distance of approximately 1 600 km.

Clinidae

Clinus (Blennophis) anguillaris Valenciennes in Cuvier & Valenciennes, 1836

Localities collected: Swakopmund.

Five fish collected, size range 30,5 – 149,5 mm standard length.

Three of the present specimens are considerably smaller than any available to M.-L. Penrith for her (1969) revision of the southern African Clinidae. At a standard length of less than 60 mm, the scales on the head, clearly visible in larger fish, are not visible under normal magnification. Small juvenile *C. anguillaris* will therefore not 'key out' to the subgenus *Blennophis* using the key to subgenera of Penrith (1969: 20). Small fish can, however, be identified by the following unique combination of characters: A slender body, depth more than 6 in standard length; a tentacle over the eye; no barbels on chin or snout; and more than one soft dorsal ray. The living colour of these small juveniles is markedly different from the adult and subadult fish, being a plain dark purple-black with a white caudal fin.

The range is extended from Lüderitz (26°38'S/15°10'E) to Swakopmund, a distance of about 450 km.

Clinus (Clinus) agilis Smith, 1931

Localities collected: Swakopmund 15 examples
Toscanini 1 example

Size range: 22,1 – 70,9 mm standard length

Although the sample is small, there is a suggestion that the Swakopmund fish have a lower modal dorsal spine count than samples from other west coast localities (Figure 2). The mode is, however, still higher than in the Knysna population. It is possible that this is related to water temperature; the average inshore temperature in the Swakopmund area is low (14 – 16 °C), but still higher than further south on the west coast.

The range is extended from Lüderitz to Toscanini, a distance of approximately 700 km.

Clinus (Clinus) superciliosus Linnaeus, 1758

Localities collected: All stations listed.

At all localities except the rocks 5 km south of the Kunene River, large numbers of *C. superciliosus* were collected. On-

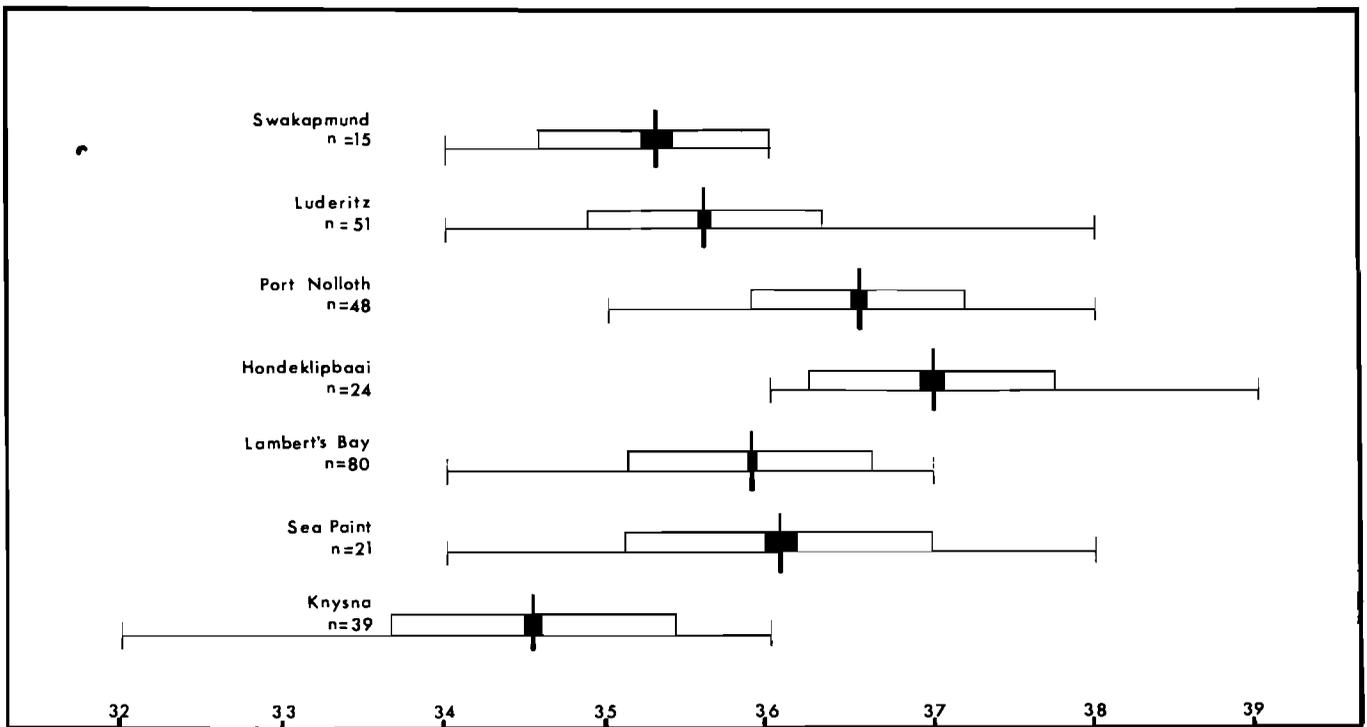


Figure 2 Dorsal spine counts of *Clinus agilis*. Horizontal base line represents range, vertical line mean, open rectangle represents the standard deviation and the solid rectangle two standard errors on either side of the mean.

ly one example of 49,5 mm standard length was collected at the rocks just south of the Kunene River mouth, the only collecting locality worked that was outside the recorded range of *C. superciliosus*. The fish is a male, and meristic and morphometric data fall within the range for the species. It has the typical crest on the dorsal fin of *C. superciliosus*. Colour in alcohol is a pale yellow mottled with brown. The characteristic dark spots on the dorsal crest and operculum (Penrith 1969) are present.

Clinus superciliosus has previously been recorded from Rocky Point (18°59'S/12°29'E). The present record extends the range a further 200 km northward. This means that the tropical subfamily Labrisominae, with its southern limit at Mosamedes, is separated from the temperate Clininae by a maximum of only 250 km.

George & Springer have recently (1980) suggested that the Labrisominae is in fact a separate family.

Clinus (Clinus) taurus Gilchrist & Thompson, 1908

Localities collected: Swakopmund 2 examples
 Toscanini 3 examples
 Palgrave Point 19 examples
 Möwe Bay 8 examples

Size range: 62,2 – 173,0 mm standard length.

The relatively large sample from Palgrave Point consisted of 8 females and 11 males. There was an indication that the adult male fish are larger than the females: Male mean size 157 mm Ls (range 131 – 173), female mean size 145 mm Ls (range 128 – 162).

The distribution range on the west coast is extended from Lambert's Bay (32°04'S/18°20'E) to the rocks north of Möwe Point, a distance of 1 520 km.

Discussion

All the localities listed where new distribution records were established have previously been sampled by us. The Badewanne rocks at Swakopmund were intensively collected in 1964 and 1966, and the other localities have all had rotenone collections made at least once previously.

The finding of these species well outside their previously recorded ranges can, we believe, be ascribed almost entirely to the use of an improved and much more rapidly acting ichthyocide. The collecting stations had previously been worked using either powdered derris root or liquid rotenone. The current series of stations were worked using crystalline rotenone (Penick Corporation) dissolved in acetone, with either Atlox 3335 or domestic dishwashing detergent added as an emulsifier. The greater rapidity with which this ichthyocide acted on fish in cold water, combined with unusually calm sea conditions, allowed successful collecting at the lowest limits of the intertidal zone.

It was noted that *Clinus taurus* was always affected well after all other intertidal fish, including very large *C. superciliosus*, had been collected, and it is thought that with the slower-working ichthyocides used previously, pools were flushed by the rising tide before this species was affected sufficiently to be collected.

Winterbottom (1976) recorded several extended range records of subtidal clinids from the Cape Peninsula eastward and remarked that this highlighted 'the lack of knowledge of subtidal fish fauna around South Africa', but added that high winds and heavy surf in the area made SCUBA collecting difficult. On the west coast these problems are compounded by an almost total lack of visibility in both the subtidal and intertidal zones.

Christensen & Winterbottom (1981) summarized the

quantitative errors present when using ichthyocides in population studies. The records given here indicate a further possible source of error, especially relevant in long-term studies. This factor is the obvious marked difference in the susceptibility of fish to different types of ichthyocides, or even possibly different production batches of the same product.

Acknowledgements

The initial impetus to resample these localities was provided by Dr P.J. Miller (University of Bristol), and the southern localities were sampled in his company. For help in collecting we are also grateful to John Irish and Viv Wallis (State Museum), Peter and Marilyn Bridgeford and Chris Moor (Directorate of Nature Conservation). Dr R. Winterbottom first drew our attention to the use of rotenone resin and provided information regarding sources.

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A new species of *Afrolernaea* (Copepoda:Lernaeidae), a gill parasite of mormyrid fishes

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Fryer (1956) described a new crustacean copepod genus and species parasitic on the gills of the mormyrid *Mormyrus longirostris* Peters from Lake Nyasa, which he named *Afrolernaea longicollis* Fryer. At that stage this was the only species assigned to the genus. During 1959 afrolernaeid

parasites were found in Lake Bangweulu on the gills of *Marcusenius macrolepidotus* (Peters) (Fryer 1959). These specimens differed from the *A. longicollis* from Lake Nyasa in having a neck which is both relatively and absolutely shorter, a longer posterior sac and transparent cephalic hooks as compared to bright green hooks in the case of the *A. longicollis* types. The three body regions, cephalothorax, neck and posterior sac of the type specimens of *A. longicollis* comprised 4; 78 and 18% of the total body length respectively (Fryer 1956). The respective lengths expressed as percentages of the body regions of three specimens found on *M. macrolepidotus* in Lake Bangweulu are 4; 59; 37; 4; 60; 36 and 4; 56; 40% (Fryer 1959).

On the basis of this information Fryer decided to provisionally assign all specimens studied by him to *A. longicollis* although distinct differences did exist in the body dimensions of the specimens of these localities. However, he recognized the possibility that subsequent findings may necessitate specific differentiation (Fryer 1959). Dollfus (1960), apparently unaware of the work of Fryer (1956, 1959) described a new genus and species which he named *Delamarina nigeriensis* Dollfus. This parasite, found on the fins of *Mormyrus rume* Cuvier in the Niger system, is now known to be a species of the genus *Afrolernaea*. It is closely related to *A. longicollis* and is recognized as *Afrolernaea nigeriensis* (Dollfus) (Fryer 1982). The two specimens described by Dollfus (1960) are 14 and 17 mm long, the percentage lengths of body regions, head plus neck and posterior sac of these specimens are 67; 32 and 37; 26% respectively.

Recently Fryer (1982) described a third afrolernaeid species, *A. brevicollis* Fryer. This species is very small (2.5 mm total length) and has, relative to the other species of *Afrolernaea*, a short neck. It was found on the fins of the mormyrid *Stomatorhinus corneti* Boulenger in the Ogowa system in Gabon, West Central Africa. According to Fryer (1982) it is the most primitive of the three known species and with its short neck, it is adapted to life as a fin parasite.

During a recent investigation on fish ectoparasites in Luphephe Dam, an irrigation reservoir in the Luphephe River, a tributary of the Limpopo River in Venda, northern Transvaal, afrolernaeid parasites were found on the gills of the mormyrid *Marcusenius macrolepidotus*. These parasites do not conform to the description of any of the three known species of *Afrolernaea*. They do, however, correspond to the afrolernaeid which Fryer (1959) found in Lake Bangweulu on the same host and which was provisionally placed under *A. longicollis*. The new information now available from Luphephe Dam necessitates the description of this parasite as a new species closely related to *A. longicollis* but which is even more specialized and, on the available evidence, specifically adapted to mormyrid fish hosts with short gill filaments.

Description

Afrolernaea mormyroides sp. n.

This description is based on 15 egg-bearing adult females collected from the gills of *Marcusenius macrolepidotus* from Luphephe Dam, Venda, northern Transvaal.