LARVAL DEVELOPMENT OF THE CONGRID EEL *GNATHOPHIS CAPENSIS* (KAUP), OFF SOUTHERN AFRICA, WITH NOTES ON THE IDENTITY OF *CONGERMURAENA AUSTRALIS* BARNARD

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INTRODUCTION

More than 100 species of marine eels are now known from the rich waters of the western Indian Ocean and southern Africa. Many of these, particularly those of the tropical north, are widespread throughout whole or part of the warm Indo-Pacific. The influence of the latter area on the marine fauna of southern Africa is indeed a considerable one and is demonstrated clearly in the eels. The Atlantic influence on Cape waters is much weaker. This might be expected in view of the close association between eel distribution and the hydrological conditions which provide opportunities for oceanic movement of their pelagic larvae (leptocephali). The westward flowing currents of the central Indian Ocean favour the spread of a multitude of Indo-Pacific species (mainly as larvae, but also as adults) into the western Indian Ocean and ultimately northwards and southwards along the east coast of Africa. On the other hand, because of the presence of cold water masses off the west coast of southern Africa the southwards movement of central Atlantic species into South African waters is by no means so well favoured. Certain cosmopolitan deep-water eels are also known from off the Cape.

Although the composition of the eel fauna of the western Indian Ocean is now fairly well established, very little is known of the early life histories of these eels. Eel-larvae (leptocephali) are not uncommon in these waters but few have been recorded, and still fewer have been reliably correlated with their adult species. The difficulties involved in identifying leptocephali stem mainly from our insufficient knowledge of the important criteria which link larvae with their adults. Even so, Barnard (1925) was able to identify nearly all of the eight different types of eel-larvae which he described from southern Africa. Della Croce and Castle (1966) recently described 13 species from the warmer waters of the Mozambique Channel, further to the north.

Amongst Barnard's larvae (collected mainly by the research vessel S.S. *Pieter Faure* in the early 1900's) were nine specimens which he identified as leptocephali of *Congermuraena australis* Barnard, 1923, the "Cape lesser conger". Barnard believed that *Leptocephalus capensis* Kaup, 1856, also from off the Cape, was identical, but he did not apply the prior larval name to his material.

The larvae on which Barnard based his account (and which have been re-examined by the present author in the collection of the South African Museum) were half- to full-grown and included also three metamorphic specimens. The original description contained some information on the characters of these larvae but there is little information on the earlier development of the Cape lesser conger. The location of its spawning area(s) is wholly unknown.

Since this first account was written many leptocephali of this species have been added to the collection of the South African Museum (particularly by recent trawling off the Cape). More importantly, the Division of Sea Fisheries has collected abundant gnathophid leptocephali during its systematic examination of the hydrology and biology of Cape waters over the past few years. Although a variety of gear was used in this programme eel-larvae were more frequently collected by oblique hauls through the upper 150m. by 100 cm. diameter Nansen nets. This material, ranging from recently hatched larvae (10 mm. length) to full-grown (150 mm.), was collected in all months over a wide area off the Cape (32°S—38°S x 15°E—22°E). The continental shelf varies in width along this part of the coast. In the Cape Point area it is narrow and within a few miles of the coast the bottom slopes away rapidly into 2,500 fathoms or more. Off Cape Agulhas the shelf is much wider (in the order of 100 miles). As could be expected, the hydrological conditions off the Cape are relatively complex and vary considerably from month to month, with depth and with distance from the coast. The hydrological complexity of the area is due to the existence of two vastly different current systems along the west and east coasts and the resultant intrusion into the area of water masses of varying origin. The essential characters of Cape hydrology have been recently reported on by Shannon (1966).

The extensive larval material of Barnard's *Congermuraena australis* now available from the above collections, has enabled a reasonably complete picture of the development and at least the larval distribution of this species to be constructed. This is made the more complete by the availability of the particular hydrological data (temperature and salinity) which are the two major physical factors influencing the spawning and development of eels. Because adults of the species are probably fossorial and elusive fishes which no doubt escape easily from all except the finest-mesh trawls, little adult material has been to hand for studies on gonad development to add information on spawning of this species. In fact, few adult specimens have been added to Barnard's original material, although the species is probably not rare in Cape waters.

Congermuraena australis Barnard is consequently a rather poorly known species whose precise systematic position within the Congridae is in need of clarification. A later paper will deal with this matter as well as the systematics of other congrid eels of the western Indian Ocean and southern Africa. For the purpose of the present study the details regarding *C. australis* are summarised below.

In his original description of *C. australis*, Barnard (1923) noted the similarity of his new species to *Muraena balearica* De La Roche, 1809 and *M. mystax* De La Roche, 1809 from the north Atlantic. However, these two species are not congeneric and are now known to belong to the congrid genera *Ariosoma* Swainson, 1838 and *Gnathophis* Kaup, 1860 respectively. *Congermuraena* has been frequently used in the past as a convenient catch-all for a number of congrid species of doubtful relationships but it has no standing as it is a synonym of *Ariosoma*.

Smith (1953) combined *C. australis* and *C. albescens* Barnard, 1923 under the name *Ariosoma balearica* but at least part of his material was shown to be referable to *Pseudoxenomystax* Breder, 1927 by Castle (1960). Penrith (1967) recently reviewed the position of these two species and although he showed conclusively that Barnard's two species are not conspecific he retained them as distinct species of *Ariosoma*.

The essential features of *C. australis*, as observed in the type series by the present author, show that it is a *Gnathophis* and not an *Ariosoma*. Larvae of this species also conform in generic characters with known gnathophid leptocephali. Furthermore, as Barnard himself fully recognised, the earlier described *Leptocephalus capensis* Kaup, 1856 (a species described from a leptocephalus collected off the Cape) is the young of *C. australis*. The prior larval name must stand and the "Cape lesser conger" should now be known as *Gnathophis capensis* (Kaup, 1856). Other species of *Gnathophis* occur in Australasian waters and in the north and east Pacific.

The spawning, development and distribution of the larvae of the Australasian species have been dealt with elsewhere (Castle 1963). South African gnathophid larvae seem to be remarkably similar in these respects. Spawning of adults probably takes place in the mixed and subtropical waters over the continental slope, the larval life being about 10 months to a year. However, undoubtedly as a result of similar hydrological conditions occurring at different times of the year, spawning and early development of the South African species occurs in mid- to late-summer, while these processes may occur in midwinter in Australasian waters.

SYSTEMATIC ACCOUNT

Eel-larvae are so remarkably diverse and at the same time so unlike their adults that it is often not an easy task to identify them. However, the essential larval features of most eel families are now well established, allowing the recognition of larvae of these families. In general, the body form, features of the cranium, the presence or absence of fins, the form of the intestine, the structure of the caudal and pigmentation serve to distinguish larvae of different families of eels.

Although structural characters are also used in the recognition of genera, the general abundance and distribution of melanophores appear to distinguish larvae of genera in the same family. This pigmentation is often laid down at an early stage in development and continues through metamorphosis, but in some genera it may be lost before the onset of this process. As is well known the full number of myomeres is established early in larval development and also characterises the adult, thus providing a major clue to the definitive identification of larval species.

Congrid leptocephali are usually elongate-oval to moderately elongate in body form but never filamentous. The vent is usually near the end of the body throughout the major part of larval growth, the caudal fin is not reduced in length and the pectoral fin is present at all stages of development. The intestine is straight without any modifications and melanophores always occur ventrally and sometimes also laterally on the body wall. Larvae of this family may reach 200-300 mm. at full growth but are usually much smaller.

The Congridae is one of the larger families of eels and contains many genera. Only a few of these, however, are definitely known in their larval form. Two major groups of congrid larvae have been recognised, conforming with the broad division of the family into two groups of genera established on adult characters. Larvae of the *Conger* — *Gnathophis* — *Uroconger* group have an oval eye with a crescentic patch of black pigment below it and a paired series of somatic melanophores at the level of the intestine from the throat to the vent. There are scattered melanophores on the bases of the median fin-rays, and somatic melanophores sometimes present in a longitudinal series midlaterally. The vent is usually somewhat in advance of the caudal tip until the beginning of metamorphosis, and the dorsal origin is in advance of the level of the vent throughout development. They are thus readily distinguished from larvae of the *Ariosoma* group of genera. The latter have a round eye without subocular pigment with ventral pigment on the body as a series of minute somatic melanophores from the throat to the level of the gall bladder and then as a splanchnic series above the intestine to the vent. Lateral pigment is laid down as an oblique series of minute melanophores on each myoseptum below the lateral line. There is usually a series of melanophores on the dorsal midline and melanophores are present on the bases of the median fin-rays. The vent is subterminal until metamorphosis, and dorsal and anal fins are restricted during early larval life to the posterior tip of the body.

Gnathophis larvae may be distinguished from those of *Conger* and *Uroconger* in having no midlateral pigment. (Some species of *Conger* also show no lateral pigment but have the ventral series of melanophores continuing on to the body wall above the base of the anal fin, and a short, rounded snout at later stages of development). The larvae of *Gnathophis capensis* conform well with this pattern, as established from larvae of other species of the genus, and their general features are illustrated here in Text-figure 1 and Plate 1.

Although gnathophid larvae have been described in detail before (Castle, 1963), a brief summary of the important features of larval *G. capensis* is given below in order that they may be more readily distinguished from other eel-larvae occurring in the waters of southern Africa. Reference may be made to the above paper for detailed descriptions and illustrations of gnathophid leptocephali, together with a discussion on the systematics, development and distribution of the group.

Gnathophis capensis (Kaup, 1856) (Text figures 1-3, Plate 1).

MATERIAL EXAMINED: 165 specimens, as listed in Table III.

DESCRIPTION: 165 specimens: total lengths 10 mm.-150 mm., myomeres 132-140, first major vertical blood vessel to intestine at myomere 12-14, last at myomere 47-50, anterior margin of gall bladder at myomere 36-39, teeth increasing with age ($\frac{1+\mathrm{VIII}+15}{1+\mathrm{VIII}+7}$ in a 135 mm. specimen), dorsal rays 164-222, anal rays 137-163, caudal rays 5+4, dorsal origin to anal origin separated by 13 to 29 myomeres (i.e a—d=+13 to+29).

This brief description sets out the important characters which may be used to distinguish the leptocephali of *G. capensis* from those of other species of the genus. Body proportions of larvae of the same species may vary considerably resultant from the often remarkable changes which take place during growth and with the approach of metamorphosis. Proportional measurements are therefore of little use in distinguishing larvae of different species. The general pattern of distribution and abundance of melanophores is constant in larvae of the same genus but varies in detail from specimen to specimen. Few of the external characters which might be used to distinguish adults of different species e.g. the nature of the external nostrils, the configuration of cephalic pores, the pattern of definitive teeth, are sufficiently developed to enable them to be used as distinguishing features of the larvae. Meristic characters, which are often readily available in larvae (e.g. number of myomeres, fin-rays, etc.) are recognised to be of greatest value in the correlation of larvae with their adult species.

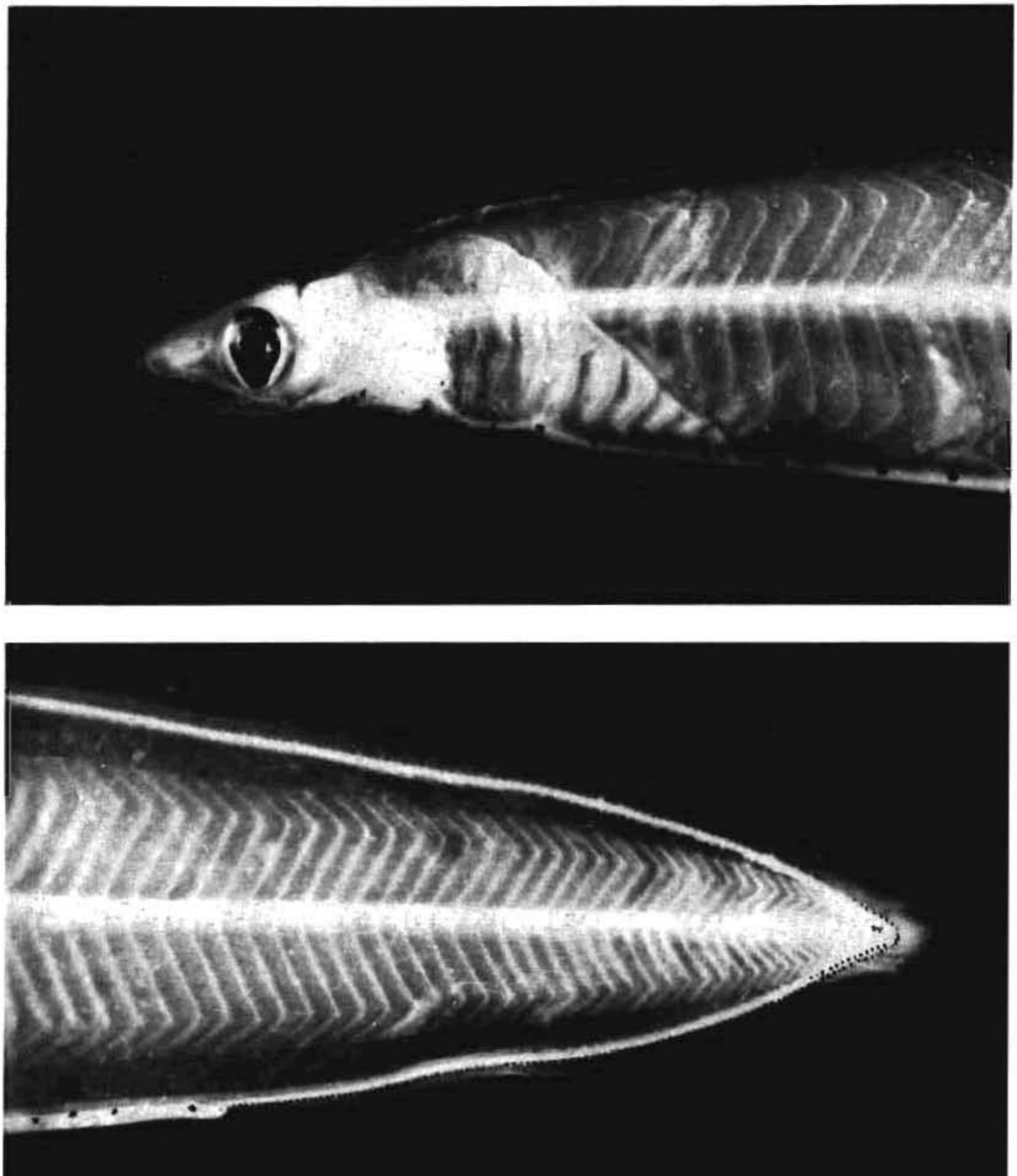

Plate 1. *Gnathophis capensis* (Kaup, 1856), leptocephalus, 113mm total length, Table Bay, 20/7/6. ×6

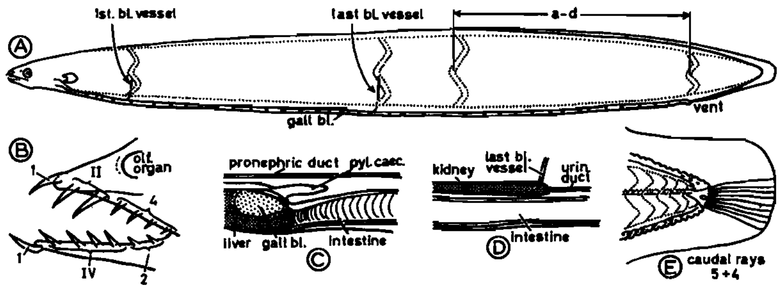

Figure 1. *Gnathophis capensis* (Kaup, 1856), leptocephalus, showing important structures mentioned in the text. Fig. A: lateral view; Fig. B: larval teeth, dental formula $\frac{1+\text{II}+4}{1+\text{IV}+2}$; Fig. C.: lateral view at level of gall bladder; Fig. D: lateral view at level of last vertical blood vessel to viscera; Fig. E: caudal fin.

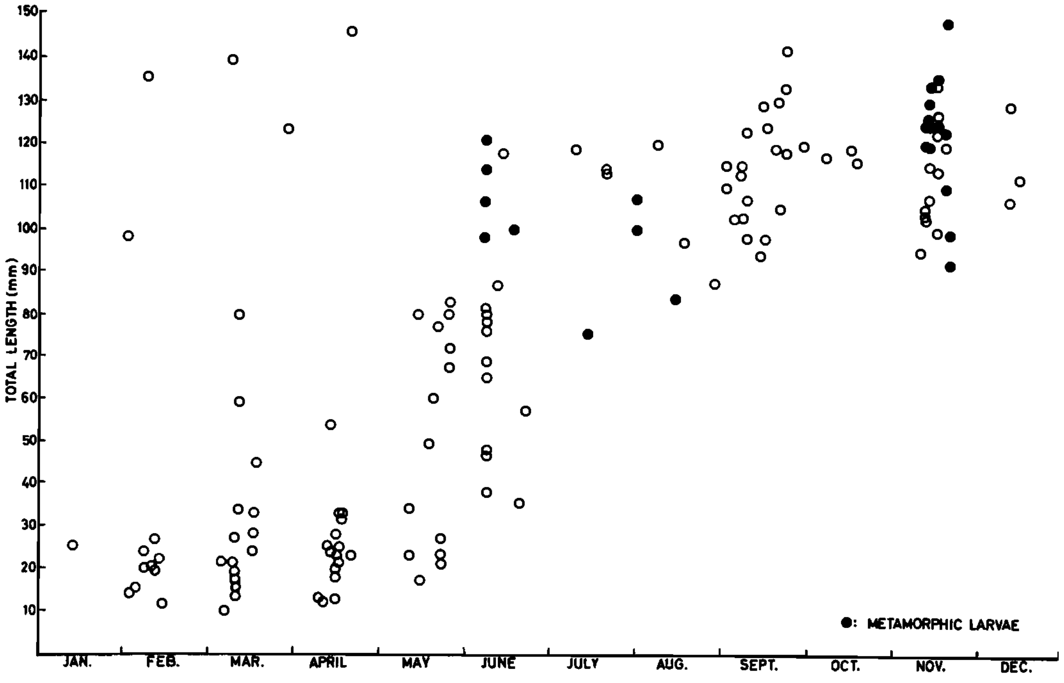

Figure 2. Size distribution during the year of larvae of *Gnathophis capensis* (Kaup, 1856). Various years included.

Leptocephali of *Gnathophis capensis* may be distinguished from those of the Atlantic *G. mystax*, to which they bear close resemblance, in having the anterior margin of the gall bladder placed further back in segmental position, slightly more numerous anal rays and perhaps most conspicuously, the last major intestinal vessel placed more posteriorly. Although the positions of the vertical vessels appears to be an insignificant character, they are related to the positions of important visceral structures in the adult. The last vertical vessel is associated with the larval opisthonephros, which becomes the adult kidney. The segmental position of the last vertical blood vessel very closely delimits the division between precaudal and caudal vertebrae in the adult. The major distinguishing features of some of the known gnathophid species, based on larval structures, are set out in Table I. Unfortunately, only a single specimen of *Gnathophis mystax* was available from which to count fin-rays, etc.; the number of myomeres in this species has been taken from Lea (1913).

TABLE I

CHARACTERS OF VARIOUS SPECIES OF LARVAL *Gnathophis*

Species	*G. mystax* (De La Roche, 1809)	*G. capensis* (Kaup, 1856)	*G. habenatus* (Richardson, 1848)	*G. incognitus* (Castle, 1963)
No. of specimens examined	1	25	191	68
Locality	East Atlantic	South Africa	S'west Pacific	S'west Pacific
Myomeres	132–147	132–140	116–131	134–150
Dorsal rays	176	164–222	121–215	170–269
Anal rays	133	137–163	96–173	130–184
		Segmental Positions		
Gall bladder	34	36–39	37–39	37–40
1st blood vessel	11	12–14	12–14	11–13
Last blood vessel	45	47-50	41	46

Excluding *G. habenatus* which seems distinct in its myomere number and forward position of the last vertical blood vessel, the remainder seem to be separable on different combinations of these characters. The fin-ray count in *G. incognitus* and *G. capensis* was made from a wide size-range while the single specimen of *G. mystax* was full grown and the latter is likely therefore to have a lower count than in the other two species. It remains to examine a series of adults to determine what other characters might prove useful in separating the species. Larvae of north and east Pacific species of *Gnathophis* have yet to be described in detail so that no comparable information is available.

GROWTH AND METAMORPHOSIS

The larvae of *G. capensis* studied here range greatly in size and all stadia in larval growth are probably represented, with the exception of prelarvae (less than 10 mm.). The considerable number of specimens between 10 mm. and 20 mm. in the collection suggests that eggs of this species would doubtlessly also have been present in the hauls of the Division of Sea Fisheries. These have yet to be identified in plankton hauls off southern Africa and samples have not been examined in the present study for eggs of this species. The size-frequency of the larvae can be extracted from Text-figure 2. The hauls from which the larvae were taken were not all standard and little can therefore be said about the relative abundance of larvae of various sizes haul to haul. Clearly though, they should be greatest in number at the smallest size and the efficiency of the gear used for retaining such small organisms must enter into any considerations of the size of larvae collected.

During growth of the larvae the structural and pigmentary changes which take place follow very closely those in *Gnathophis habenatus* (see Castle, 1963). Briefly, the vent reaches its most posterior position along the body very rapidly so that most larvae have the vent placed at about myomere 110-115 (compared with 95-105 in *G. habenatus* and 110-115 in *G. incognitus*). The vent remains in this position until the onset of metamorphosis (which begins at 130 mm.-140 mm. total length). During subsequent metamorphosis the vent moves forward to the level of segment 45-50 in elvers, but in the adult the vent lies at segments 35-40. The origin of the dorsal fin in full-grown larvae lies about 20 segments in advance of the level of the vent. During metamorphosis a very rapid movement forwards of the dorsal origin takes place so that in the young, fully metamorphosed eel it is placed about level with the midpoint of the pectoral. This is the position which it occupies in the adult.

There is a gradual increase in the number of dorsal rays, but the full complement of anal rays is laid down early in development. Teeth increase in number, especially those of the posterior series. The nostrils separate early and the organ elongates forwards to take up finally almost the whole length of the snout. The conspicuous melanophores of the ventral series increase in number and minute pigment spots appear on the bases of the anal rays as well as on the terminal dorsal rays. Pigment spots also develop deep on the spinal cord. Full grown and metamorphic larvae are much less diaphanous than younger individuals, probably due to the increase in thickness of the lateral muscle of the body wall.

GEOGRAPHICAL AND SEASONAL DISTRIBUTION OF LARVAE

Many oceanographic stations have been occupied over a wide area off the Cape during the investigations of these waters by the Division of Sea Fisheries. Larvae of *Gnathophis capensis*, however, occurred most abundantly in the area indicated in Text-figure 3, that is, in the area most intensively studied in the above investigations. The limits of larval distribution of this species are presently unknown but they are probably not much beyond the area indicated by the figure. The possibility that larvae move into deeper waters, outside the limits of the hauls, cannot be entirely discounted. However, evidence from similar investigations in the Australasian region suggests that gnathophid larvae do not normally move much below 300 m. Occasional specimens (like the Port St. John's metamorphic larva in the South African Museum collection) must occasionally reach further afield, no doubt due to the action of local coastal currents.

The considerable number of specimens of less than 25 mm. total length in the collection immediately suggested that spawning of *G. capensis* takes place close to, if not coincident

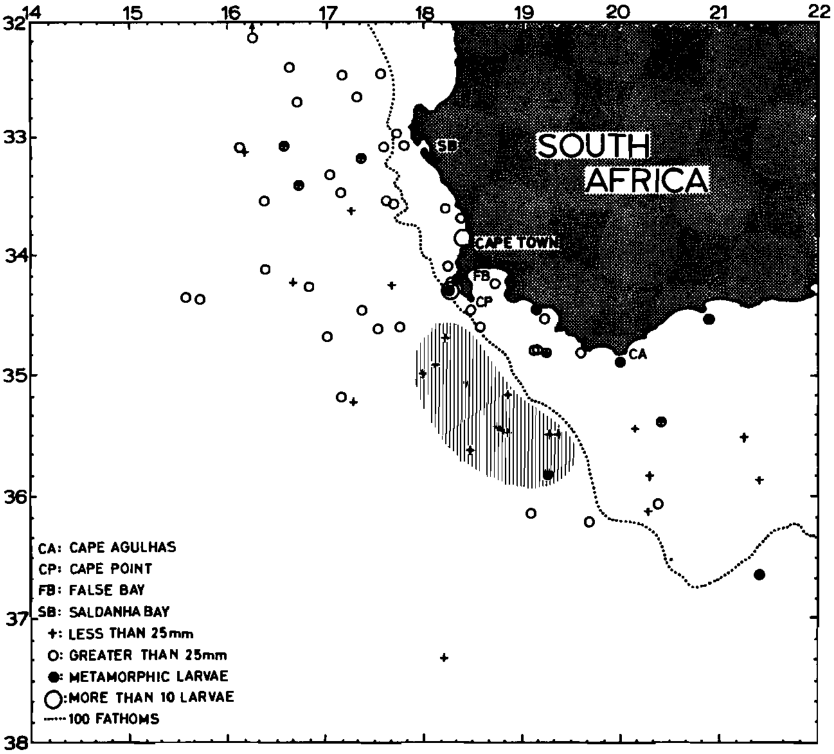

Figure 3. The distribution of larvae of *Gnathophis capensis* (Kaup, 1856) off southern Africa. Shaded portion indicates suggested spawning area of adults.

with, the area in which these small larvae were collected. The common occurrence of full-grown to metamorphic larvae within the same area shows that the whole larval growth normally also occurs here.

To illustrate this more clearly the size distribution of larvae is plotted in Text-figure 3. Very young specimens are distinguished arbitrarily from the remainder as those of 25 mm. or less. Although little is known about growth rates of eel-larvae, it seems likely that such larvae could not be much more than a few weeks old. Metamorphic larvae, in which the vent is in the process of forward movement and the body is contracting in length (i.e. regressive metamorphosis) are also distinguished from the remainder in Text-figure 3. Smallest specimens occur most abundantly in waters south of Cape Point just beyond the 100 fathom contour. However, similar small specimens may occur to the north and east, but in smaller numbers. The shaded portion of the figure represents the area of greatest abundance of small larvae (a cross (+) in the figure may represent more than one specimen). There is no regular pattern of increasing size (age?) toward the periphery although all larvae taken coastwards of the 100 fathom contour from off Saldanha Bay (north of Cape Town) to Cape Point are 50 mm. or more, mostly greater than 100 mm.

From these observations, therefore, it is suggested that spawning of adult *Gnathophis capensis* takes place some miles offshore over the continental slope, probably centred on 35°S/18°E although the spawning area is undoubtedly a broader one. Larvae move outwards and shorewards as growth proceeds and metamorphosis probably takes place close inshore. These observations accord remarkably well with the spawning and development of *G. habenatus* and *G. incognitus* off eastern and western Australia (Castle 1963). The latter species also spawn over the continental slope some miles offshore and almost certainly beyond the range of the benthic distribution of the adults.

Furthermore, if the lengths of larvae are plotted against time-of-year at which they were collected (as in Text-figure 2) it becomes quite clear that spawning must take place in midsummer to early autumn (January to March). Half-grown larvae are abundant in the area in winter months and maximum growth seems to be attained in October-November. There are wide variations within this broad pattern which might be accounted for by the fact that the figure is a composite plot of larvae collected in the same months of different years. Spawning probably takes place over several weeks, dependent on suitable physical conditions which undoubtedly vary in the time and place at which they occur from year to year. It is significant that very small larvae are completely absent from June to December. The larger larvae occurring from January to May are probably larvae of the preceding year-class. Larval life of *G. capensis* is thus about 10 months to a year, although the occurrence of large larvae in small numbers early in the year suggests that this may occasionally be somewhat prolonged. Metamorphosis clearly takes place in November as a normal procedure of growth from a spawning in the early months of the same year (Text-figure 2). Where larval life is prolonged (if such a condition does occur) metamorphosis apparently takes place in June-August of the year following spawning.

Unfortunately, only a small number of adult *G. capensis* have been available from which to determine the development of the gonads throughout the year. As an adult the species appears to be rather rare. This apparent rarity is no doubt associated with its fossorial habit — *G. habenatus*, a related species, is known to spend much of its life buried in offshore mud in New Zealand waters. In addition, specimens of *G. capensis* would not be easily retained in large-mesh commercial trawls. However, a midsummer to early autumn spawning as suggested by larvae is confirmed by the record of Penrith (1967) of a 280 mm. gravid female (S.A.M. No. 18097) taken in Kalk Bay (False Bay) in February, 1931.

THE RELATIONSHIP OF HYDROLOGICAL FEATURES TO THE DISTRIBUTION OF LARVAE

The southern tip of Africa lies in a unique position in relation to the two major oceans which surround it. On one side is the western limit of the Indo-Pacific which has a considerable tropical influence on the marine fauna of South Africa by way of the south-flowing Mozambique Current — Agulhas Current system. On the other side is the South Atlantic, the faunal influence of which extends essentially only as far as Cape Point. It is greatly modified by the very cool upwelled water mass which flows northwards along the west coast as the Benguela Current. Antarctic water masses have little influence on the fauna. This unique situation, which has no equivalent elsewhere (the southern tip of South America extends too far into the Southern Ocean for it to be influenced in a similar manner), makes for rather complex and extraordinarily variable hydrological conditions off the Cape.

These conditions have been investigated in detail over recent years by the Division of

Sea Fisheries in connection with research on the biology of the South African pilchard *Sardinops ocellata* Jenyns. Regular and detailed sampling of the area around the Cape has enabled the essential characteristics of these waters to be elucidated and Shannon (1966) has set out the main results of this survey in relation to hydrological conditions occurring over recent years. The eel-larvae discussed here were collected concurrently with the hydrological data which form the basis of Shannon's results.

The vertical section diagrams of hydrological features shown by Shannon (1966) indicate clearly that temperature in particular, but also salinity, vary markedly with depth, especially over the continental shelf where there is an uplift of the colder, less saline, lower water layers. As most of the present larvae were taken by oblique hauls through the upper 150 m. it is therefore impossible to establish the precise physical environment of *G. capensis* larvae. However, a number of surface tows yielded eel-larvae and in these cases the temperature and salinity, therefore, can be stated more accurately. Tows with closing nets might yield more precise information on the depths at which larval *G. capensis* live.

Table II sets out the temperature and salinity data for 17 of the surface tows in which larvae were collected.

The number of specimens listed above is not sufficient to yield definite conclusions about the hydrological conditions related to larvae. The figures suggest, nevertheless, that young specimens (i.e. those of Stations F 2378, F 4038 and A 4589) are more characteristic of waters of high temperatures (18C — 19C) than are later stadia. Lower temperatures (in the order of

TABLE II

DATA FOR SURFACE TOWS IN WHICH LARVAE OF *Gnathophis capensis* WERE COLLECTED

D.S.F. Station	*Date*	*Temperature* (°*C*)	*Salinity* (°/oo)	*Length of larva* (*mm.*)
R	18/10/57	14·60	35·14	116
A 1280	17/8/61	14·71	35·18	96
F 2378	16/4/63	18·43	35·30	32
A 2406	8/6/63	17·94	35·41	38, 48, 65, 78
A 2407	8/6/63	15·12	35·06	47, 69, 80, 82
A 2408	8/6/63	14·12	34·92	76
D 529	20/7/63	13·20	34·83	113
A 2575	8/8/63	15·39	35·22	120
E 701	2/9/64	12·60	34·74	110, 115
A 3238	12/9/64	13·90	35·18	107
A 3881	23/9/65	14·89	35·32	118, 133, 142
E 801	29/9/65	12·92	35·03	120
A 3927	16/10/65	15·04	35·21	119
F 4038	11/5/66	18·84	34·98	34
F 4073	19/5/66	17·29	35·24	60
E 959	10/11/66	12·30	35·17	95
A 4589	13/4/67	19·87	35·32	24

12C — 15C) may favour the latter. If this were true it would explain why larger larvae are to be found more abundantly close to the west coast of the Cape, where temperatures are consistently low throughout the year, due to the upwelling of cooler waters.

These observations further suggest that spawning and very early growth of the larvae are associated with moderately high temperatures and salinities (i.e. greater than 15C and 35‰, respectively). Water having these characteristics occurs south of Cape Point (the suggested spawning area) and is mainly of mixed Atlantic and Indian Ocean (Agulhas) origin. Mixed Agulhas Water, as this has been termed, forms "pools" and intrusions off the Cape in mid- to late-summer (Shannon 1966). Spawning of the adults is possibly "triggered" by the intrusion of such water into the Cape area, that is, into the area where adults are reaching maturity at this time of the year.

Recently the author studied a large collection of eel-larvae from the eastern Indian Ocean collected along the 110°E. meridian during the Australian-French contribution to the International Indian Ocean Expedition (1962-1963). Larvae of the Australasian gnathophid species, *G. habenatus*, occur in considerable numbers in this area. It is clear from this study that spawning and early development of this species takes place west of Perth (32°S) over the continental slope (or over deeper waters further to the west) and at 18C-19C. Associated salinities seem to be rather higher (35.5‰) than in the comparable situation in South African waters. In the southeast Indian Ocean larval *G. habenatus* are associated with water designated as the South Indian Central High Salinity Water Mass by Rochford (1967, in press). This water intrudes into the area during midwinter rather than in mid- to late-summer. Spawning of *G. habenatus* and *G. incognitus* also occurs in the Tasman Sea off eastern Australia (34°S) over the continental slope during the summer and early autumn, that is, in a strikingly equivalent geographical area and at about the same time as in the South African species.

These are remarkable parallels which suggest that the location of spawning areas of gnathophids is closely dependent upon hydrological conditions. Young gnathophid larvae of other species are likely to be located in similar areas of the Atlantic and the north and east Pacific. Schmidt (1912) indicates that *G. mystax* spawns in the Mediterranean in late summer and autumn, but gives no details of associated hydrological conditions.

SUMMARY

1. The congrid eel *Congermuraena australis* Barnard, 1923 from shallow water off southern Africa, must now be known as *Gnathophis capensis* (Kaup, 1856). The adult shows generic features consistent with gnathophids from other parts of the world, while the larvae conform well with known larval gnathophids. There is strong evidence to show that *Leptocephalus capensis* Kaup, 1856 from the Cape of Good Hope can be identified with Barnard's species and Kaup's prior larval name should stand as the name of the "Cape lesser conger".
2. The adult of *G. capensis* probably spawns in mid- to late-summer over the continental slope south of Cape Point, under the influence of warm Agulhas water (of mixed Indian Ocean-Atlantic origin) which intrudes into the area at this time of the year. This spawning area coincides almost exactly with the Agulhas/Atlantic mixing area demarcated by Shannon (1966).

3. The young larvae develop in water of 18C-19C and salinity greater than 35‰ in these offshore waters, but older larvae and metamorphic forms may be found closer inshore in much cooler water, later in the year. Metamorphosis normally takes place in early summer of the spawning year.
4. Larval life, therefore, is about ten months to a year, occasionally longer. The larvae spend much of this time close to the spawning area.
5. This pattern of spawning and development very closely parallels that of gnathophid species off the western and eastern coasts of Australia. Here the hydrological conditions are similar at other times of the year, and spawning of Australasian gnathophids corresponds with the occurrence of these suitable conditions.

TABLE III

COLLECTION DATA FOR LARVAE OF *Gnathophis capensis* (KAUP, 1856)
A. Division of Sea Fisheries Collection (99 specimens)*

D.S.F. Station	*No. of Specimens*	*Total length (mm.)*	*Date*	*Position*		*Gear*	*Depth (m.)*
				Lat. S.	*Long E.*		
R	1	117	7/10/50	33°05′	17°47′	N100H	50
R (12)	1	98	2/2/51	34°23′	15°43′	N70V	200–0
2056	1	57	22/6/51			N100B	100–0
2104	1	34	11/3/52	33°29′	17°09′	N100B	150–0
2124	1	146	20/4/52	31°12′	16°15′	N100B	150–0
2647	2	113–115	7/9/54	34°07′	18°14′	N100B	125–0
R	1	116	18/10/57	33°05′	17°47′	N100B	20–0
3480	2	59–80	11/3/58	34°07′	16°23′	N70V	100–0
A	1	103	5/9/58	32°43′	16°42′	N100B	150–0
F5	1	39	8/1/59	34°21′	15°35′	N100B	150–0
A1085	1	134	9/2/61	33°05′	17°36′	N100B	150–0
A1280	1	96	17/8/61	33°34′	17°42′	N100H	0–5
A1406	1	129	15/9/61	34°50′	19°36′	N100B	70–0
A1415	2	124	16/9/61	35°25′	20°25′	N100B	120–0
—	2	107–129	12/12/62	Cape Town harbour		—	—
A2361	1	139	8/3/63	34°37′	18°34′	N100B	100–0
F2378	1	32	16/4/63	34°37′	17°44′	N100H	0–5
A2406	4	38–78	8/6/63	32°26′	16°38′	N100H	0–5
A2406	1	76	8/6/63	32°26′	16°38′	N100B	150–0
A2407	4	47–82	8/6/63	32°29′	17°10′	N100H	0–5
A2443	1	87	12/6/63	34°39′	17°32′	N100B	150–0
A2503	1	119	9/7/63	36°04′	20°22′	N100B	150–0
D529	2	113–114	20/7/63	33°54′	18°27′	BN40	Surface
A2575	1	120	8/8/63	34°49′	19°07′	N100H	0–5
A2888	2	18–27	12/2/64	34°50′	19°12′	N100B	150–0
F2954	1	13	9/4/64	34°17′	17°40′	N100B	150–0
F2965	1	25	12/4/64	33°39′	17°14′	N100B	150–0
A2995	1	20	15/4/64	35°30′	19°16′	N100B	150–0
A2996	4	13–28	15/4/64	35°50′	19°13′	N100B	150–0
A2998	1	24	16/4/64	37°20′	18°11′	N100B	150–0
F2984	2	32–33	17/4/64	32°40′	17°18′	N100B	150–0
A3013	1	23	20/4/64	34°43′	18°12′	N100B	150–0
F3026	1	23	11/5/64	35°28′	18°47′	N100B	150–0
F3044	1	80	14/5/64	35°12′	17°09′	N100B	150–0
A3060	1	118	14/6/64	34°13′	18°17′	N100B	90–0
E701	2	110–115	2/9/64	33°54′	18°27′	BN40	Surface
A3238	1	107	12/9/64	34°13′	18°43′	N100B	30–0
A3264	1	119	19/9/64	32°58′	17°43′	N100B	145–0
A3276	1	105	21/9/64	32°10′	17°42′	N100B	150–0

*This station list is incomplete; other specimens are present in the D.S.F. collection.

D.S.F. Station	*No. of specimens*	*Total length (mm)*	*Date*	*Position Lat. S.*	*Long. E.*	*Gear*	*Depth (m.)*
A3463	1	14	3/2/65	35°53′	21°25′	N100B	105–0
A3472	1	15	5/2/65	35°51′	20°18′	N100B	115–0
A3483	1	19	8/2/65	35°29′	18°50′	N100B	150–0
A3484	1	24	8/2/65	35°09′	18°51′	N100B	150–0
A3552	1	20	5/3/65	36°08′	20°17′	N100B	150–0
A3595	3	24–33	16/3/65	33°25′	16°43′	N100B	150–0
F3631	1	26	22/5/65	33°08′	16°32′	N100B	150–0
F3632	1	21	22/5/65	33°08′	16°10′	N100B	150–0
A3866	1	130	20/9/65	33°37′	18°12′	N100B	50–0
A3881	3	118–142	23/9/65	33°06′	16°08′	N100B	0–5
E801	1	120	29/9/65	33°54′	18°27′	BN40	Surface
A3927	1	119	16/10/65	34°32′	19°13′	N100H	0–5
A3998	1	112	15/12/65	33°33′	17°37′	N100B	150–0
A4126	1	21	9/3/66	35°30′	19°20′	N100B	150–0
A4130	3	12–26	10/3/66	35°27′	18°50′	N100B	150–0
F3952	2	15–18	13/4/66	35°33′	21°18′	N100B	84–0
F4038	1	34	11/5/66	36°13′	19°41′	N100H	0–5
F4059	1	16	15/5/66	35°01′	18°00′	N100B	150–0
F4072	1	49	18/5/66	34°42′	17°00′	N100B	150–0
F4073	1	60	19/5/66	34°18′	16°50′	N100H	0–5
F4083	1	77	21/5/66	33°33′	16°21′	N100B	150–0
F4091	1	23	22/5/66	33°05′	16°33′	N100B	150–0
F4152	2	35	20/6/66	34°28′	17°22′	N100B	150–0
A4340	1	94	14/9/66	36°09′	19°04′	N100B	150–0
E959	1	95	10/11/66	33°54′	18°27′	BN40	Surface
A4497	1	25	13/1/67	34°56′	18°05′	N100B	150–0
A4532	1	20	11/2/67	33°06′	16°33′	N100B	150–0
F4684	1	21	13/2/67	35°27′	18°46′	N100B	150–0
F4690	1	11	14/2/67	35°05′	18°25′	N100B	150–0
F4715	1	10	6/3/67	35°28′	20°09′	N100B	125–0
F4763	1	45	17/3/67	33°19′	17°01′	N100B	150–0
A4570	1	12	10/4/67	35°38′	18°27′	N100B	150–0
A4589	1	24	13/4/67	35°15′	17°16′	N100H	0–5
A4589	1	54	13/4/67	35°15′	17°16′	N100H	150–0
A4594	1	21	16/4/67	35°15′	16°40′	N100B	150–0

B. South African Museum Collection (62 specimens)

S.A.M. No.	*No. of specimens*	*Total length (mm.)*	*Date*	*Locality*	*Depth (m.)*
12813	1	103	8/9/02	Off Cape Point	156
12814	1	100	17/6/06	36°40′S., 21°26′E.	366
12815	1	123	28/3/00	Off Cape Point	240
12817	1	88	28/8/02	Off Cape Agulhas	77
12823	1	75	13/7/00	Off Cape Infanta	80
12824	1	84	14/8/01	Off Sandy Point	93
13091	1	133	—	Sea Point beach	—
14683	1	97	?/9/02	Off Cape Point	156
18229 18230	2	100–121	—	Kommetje, Milnerton	beach
18980	2	92–98	21/11/37	Hout Bay	beach
19008	4	98–121	7/6/38	Kommetje	beach
19548	1	80	?/10/41	Port St. Johns	beach
22496	2	93	—	Kommetje	beach
S.A.M.	IKMT	Stations (see Grindley & Penrith, 1967: 277-288)			
7	4	69–83	23/5/61	west of Slangkop	250
16	2	98–123	9/9/61	west of Slangkop	350
19	9	103–125	11–12/11/61	west of Slangkop	100
22	12	108–134	12–13/11/61	northwest of Slangkop	15
27	7	114–135	16/11/61	west of Slangkop	100
28	4	99–125	16/11/61	west of Slangkop	15
29	1	127	16/11/61	west of Slangkop	15
51	4	110–150	18–19/4/63	30°10′S., 17°20′E.	120

C. University of Cape Town Ecological Survey (2 specimens)

Station No.	*No. of specimens*	*Total length (mm.)*	*Date*	*Locality*	*Depth*
C.P.R. 76B	2	100–107	1/8/63	Hermanus estuary	—

D. University of Cape Town Oceanography Dept. Collection (1 specimen)

Station No.	*No. of specimens*	*Total length (mm.)*	*Date*	*Locality*	*Depth*
—	1	131	1965	Clifton beach	—

E. Rhodes University Dept. of Ichthyology Collection (1 specimen)

1 specimen 84 mm. total length, no data.

Abbreviations: N70: 70cm diameter Nansen net; N100: 100cm diameter Nansen net; V: vertical haul; H: horizontal haul; B: oblique haul; BN40: "Blanket net" used for young fish sampling, 40 ft. square, ¼″ mesh (used only in shallow water close inshore during dark nights of new moon periods).

ACKNOWLEDGEMENTS

I wish to express my gratitude to the Anglo-American Corporation of South Africa for an Advanced Research Fellowship at the Department of Ichthyology, Rhodes University, which enabled this investigation to be carried out. I am grateful to Professor J. L. B. Smith who read the manuscript. My thanks are also due to the Division of Sea Fisheries, the Trustees of the South African Museum and the University of Cape Town for the loan of material on which this paper is based. In particular I wish to thank Dr. A. H. B. de Decker, of the D.S.F., who supplied much relevant information.

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