

SOME OBSERVATIONS ON THE SIZE DISTRIBUTION AND THE OCCURRENCE OF GROWTH RINGS IN THE SCALES OF THREE SPECIES OF *CYNOGLOSSUS* AT CALICUT

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ABSTRACT

Observations have been made on the length-frequency trends in three of the less common species of *Cynoglossus* at Calicut during the years 1969-73, these species being *C. bilineatus* (Lacepede), *C. puncticeps* (Richardson) and *C. lida* (Bleeker). As these species occur only as occasional specimens in the fish catches, large samples were not available for studying the month-to-month variation patterns in the size distribution, and so the annual totals are considered here, and these give some idea of the sizelimits and the prevailing sizes during the different years. 204 individuals of *C. bilineatus* were measured during the period (5-5.9 to 33-33.9 cm); of *C. puncticeps*, 316 specimens were measured (5-5.9 to 20-20.9 cm groups); and of *C. lida*, 138 individuals were measured (14-14.9 cm to 21-21.9 cm).

In all the three species, the scales revealed growth rings comparable to those described in the case of the Malabar sole, *C. macrostomus* (Norman); the trend of occurrence of these growth rings in the three species is described and discussed.

INTRODUCTION

While some work has been done on the commercially important species of *Cynoglossus* such as the Malabar sole *C. macrostomus* (Seshappa and Bhimachar 1951, 1953 & 1955; and Seshappa 1964, 1968, 1970a & b, and 1974), the large scaled tongue-sole *C. macrolepidotus* (Kutty 1967, and Qasim and Kutty 1967), the large tongue-sole *C. dubius* (Seshappa 1976) and the long tongue-sole *C. lingua* (Kuthalingam 1958), almost no work has been published so far on any biological aspects of the less common species of *Cynoglossus*. A study of these species would however be of considerable value for comparative purposes and also in view of their potentialities for becoming commercially important in future. Hence a study of a few aspects of biology was undertaken at Calicut on such species of *Cynoglossus* as occurred along with the Malabar sole which was being regularly sampled and studied. The present paper deals with the length-frequency distribution and the occurrence of growth rings in the scales of three of these species namely, *C. bilineatus* (Lacepede), *C. puncticeps* (Richardson) and *C. lida* (Bleeker).

## MATERIAL AND METHODS

The samples were taken from the fish landings at Vellayil (Calicut) and all the three species included here occurred only as stray specimens mixed up with the large catches of *C. macrostomus*. The fishing units landing these soles during the period were mainly trawling units of mechanised boats, but occasionally the boatseine (*Paithuvala*) and very rarely the gillnet and castnet were also used. In addition, experimental departmental collections with the boatseine were also made regularly once a week for the greater part of the year during the period of this work and all the flatfishes occurring in these catches were also examined. Measurements of total length were taken as described by Seshappa and Bhimachar (1955). The scales used for studies of growth rings were taken from about the middle of the body on the eyed side near the lateral line.

## OBSERVATIONS

## (A). Length-frequency distribution

As already stated above, specimens of all the three species studied here were available only as rare and stray individuals; the totals measured during the period considered in this paper (January 1969 to May 1973) were 204 in the case of *C. bilineatus*, 316 in the case of *C. puncticeps* and 138 in the case of *C. lida*. No special search was made for these species generally and they were only picked up as and when they occurred in the larger random samples of the Malabar sole, no specimen in these samples being left out. A picture of the size-distribution in the annual totals of these species is presented in tables 1 to 3; these give an idea of the maximum and minimum sizes of these species in the different years and also of the more dominant size-groups. It is not possible to have a more refined picture of the size-distribution in such cases though very desirable.

(a) *C. bilineatus*: This species ranged from the 5-5.9cm group to the 33-33.9cm group during the period, the important groups being in the range of 16-29.9cm. The distribution is noticed to be at least bimodal from data of 1969 and 1971.

(b) *C. puncticeps*: The annual totals measured in the case of this species were 172 in 1969, 13 in 1970, 96 in 1971, 17 in 1972 and 18 in 1973; the size-range was 5-20.9cm. The distribution in 1969 is only unimodal with a peak frequency in the 9-9.9cm group. The numbers of specimens available in 1970, 1972 and 1973 were so small that no particular pattern of size-distribution could be made out from these except the range in the total lengths; in 1971 again, there is a unimodal picture in the size-distribution with a peak in the 10-10.9cm group.

(c) *C. lida*: Only 138 specimens of this species were available for the entire period, the size-range being 11-21.9cm; and the numbers measured in 1970, 1972 and 1973 were negligible. In 1969 the distribution was unimodal with the mode at 15-16.9cm; in 1971 also there was a single mode which was at 17-17.9cm.

TABLE 1. Length frequency distribution in *C. bilineatus* from January 1969 to May 1973.

| Size-groups (cm) | 1969 | 1970 | 1971 | 1972 | 1973 | Total |
|------------------|------|------|------|------|------|-------|
| 5-5.9            | —    | 3    | —    | —    | —    | 3     |
| 6-6.9            | —    | 1    | —    | —    | 1    | 2     |
| 7-7.9            | —    | 2    | —    | —    | —    | 2     |
| 8-8.9            | —    | —    | —    | —    | 1    | 1     |
| 9-9.9            | —    | —    | —    | —    | 1    | 1     |
| 10-10.9          | —    | —    | —    | —    | 2    | 2     |
| 11-11.9          | —    | —    | 1    | —    | 1    | 2     |
| 12-12.9          | —    | —    | —    | 1    | 4    | 5     |
| 13-13.9          | 1    | 2    | 1    | —    | 1    | 5     |
| 14-14.9          | 1    | 1    | —    | —    | —    | 3     |
| 15-15.9          | 3    | 1    | —    | —    | —    | 4     |
| 16-16.9          | 12   | 3    | 1    | —    | —    | 16    |
| 17-17.9          | 9    | 2    | —    | —    | 1    | 12    |
| 18-18.9          | 6    | —    | —    | —    | 1    | 7     |
| 19-19.9          | 13   | 1    | —    | —    | 2    | 16    |
| 20-20.9          | 6    | 3    | 4    | —    | 1    | 14    |
| 21-21.9          | 2    | 7    | 2    | —    | —    | 11    |
| 22-22.9          | 4    | 6    | 5    | —    | —    | 15    |
| 23-23.9          | 4    | 3    | 4    | —    | 1    | 12    |
| 24-24.9          | 1    | 2    | 5    | —    | 1    | 9     |
| 25-25.9          | 3    | 5    | 2    | —    | 1    | 11    |
| 26-26.9          | 3    | 2    | 1    | —    | 3    | 9     |
| 27-27.9          | 2    | 3    | 1    | —    | 3    | 9     |
| 28-28.9          | —    | 3    | 6    | —    | 4    | 13    |
| 29-29.9          | 2    | 8    | 1    | —    | —    | 11    |
| 30-30.9          | 2    | 2    | —    | —    | 1    | 5     |
| 31-31.9          | —    | 1    | 1    | —    | —    | 2     |
| 32-32.9          | —    | 1    | —    | —    | —    | 1     |
| 33-33.9          | —    | 1    | —    | —    | —    | 1     |
| Totals           | 75   | 63   | 35   | 1    | 30   | 204   |

**(B). Occurrence of growth rings in the scales**

(a) *C. bilineatus*: In keeping with the much larger size to which this species grows, more growth rings are found in the largest fish in this case than in the other two species. Here also the smaller sizes without scale-rings and below

TABLE 2. *Length-frequency distribution of C. puncticeps from January 1969 to May 1973.*

| Size-groups<br>(cm) | 1969 | 1970 | 1971 | 1972 | 1973 | Total |
|---------------------|------|------|------|------|------|-------|
| 5-5.9               | 2    | —    | —    | —    | —    | 2     |
| 6-6.9               | 6    | —    | 1    | —    | —    | 7     |
| 7-7.9               | 15   | —    | 1    | —    | —    | 16    |
| 8-8.9               | 22   | —    | 6    | —    | 1    | 29    |
| 9-9.9               | 44   | —    | 16   | 1    | —    | 61    |
| 10-10.9             | 35   | 1    | 18   | 3    | —    | 57    |
| 11-11.9             | 22   | 1    | 15   | 1    | 1    | 40    |
| 12-12.9             | 10   | —    | 13   | 4    | 3    | 30    |
| 13-13.9             | 5    | 1    | 3    | 4    | 5    | 18    |
| 14-14.9             | 2    | 2    | 5    | 0    | 5    | 14    |
| 15-15.9             | 6    | 3    | 5    | 1    | 1    | 16    |
| 16-16.9             | 2    | —    | 7    | 3    | 2    | 14    |
| 17-17.9             | 1    | 4    | 4    | —    | —    | 9     |
| 18-18.9             | —    | 1    | 1    | —    | —    | 2     |
| 19-19.9             | —    | —    | —    | —    | —    | 0     |
| 20-20.9             | —    | —    | 1    | —    | —    | 1     |
| Totals              | 172  | 13   | 96   | 17   | 18   | 316   |

TABLE 3. *Length-frequency distribution in C. lida from Jan. 1969 to May 1973.*

| Size-groups<br>(cm) | 1969 | 1970 | 1971 | 1972 | 1973 | Total |
|---------------------|------|------|------|------|------|-------|
| 11-11.9             | 1    | —    | —    | —    | —    | 1     |
| 12-12.9             | 1    | 1    | —    | —    | 1    | 3     |
| 13-13.9             | 2    | —    | 2    | —    | —    | 4     |
| 14-14.9             | 7    | —    | 3    | —    | 1    | 11    |
| 15-15.9             | 16   | —    | 7    | —    | —    | 23    |
| 16-16.9             | 16   | 1    | 12   | —    | 1    | 30    |
| 17-17.9             | 10   | 4    | 25   | —    | —    | 39    |
| 18-18.9             | 1    | 1    | 16   | —    | —    | 18    |
| 19-19.9             | 2    | —    | 5    | —    | —    | 7     |
| 20-20.9             | —    | —    | —    | —    | —    | 0     |
| 21-21.9             | —    | —    | 1    | 1    | —    | 2     |
| Totals              | 56   | 7    | 71   | 1    | 3    | 138   |

TABLE 4. *Distribution of growth rings in different size-groups of C. bilineatus.*

| Number of rings:<br>Fish length (cm.) | 1  | 2  | 3  | 4  | 5 | 6 | Total |
|---------------------------------------|----|----|----|----|---|---|-------|
| 16-16.9                               | 1  | —  | —  | —  | — | — | 1     |
| 17-17.9                               | 2  | —  | —  | —  | — | — | 2     |
| 18-18.9                               | 1  | 1  | —  | —  | — | — | 2     |
| 19-19.9                               | 11 | 3  | —  | —  | — | — | 14    |
| 20-20.9                               | 3  | 6  | —  | —  | — | — | 9     |
| 21-21.9                               | —  | 8  | —  | —  | — | — | 8     |
| 22-22.9                               | —  | 6  | 5  | —  | — | — | 11    |
| 23-23.9                               | —  | 2  | 6  | 1  | — | — | 9     |
| 24-24.9                               | —  | —  | 7  | 1  | — | — | 8     |
| 25-25.9                               | —  | —  | 7  | 2  | — | — | 9     |
| 26-26.9                               | —  | —  | 5  | 4  | — | — | 9     |
| 27-27.9                               | —  | —  | 2  | 6  | — | — | 8     |
| 28-28.9                               | —  | —  | 1  | 9  | — | — | 10    |
| 29-29.9                               | —  | —  | —  | 6  | 5 | — | 11    |
| 30-30.9                               | —  | —  | —  | 2  | 2 | — | 4     |
| 31-31.9                               | —  | —  | —  | —  | 1 | 1 | 2     |
| 32-32.9                               | —  | —  | —  | —  | — | 1 | 1     |
| 33-33.9                               | —  | —  | —  | —  | — | 1 | 1     |
| Totals                                | 18 | 26 | 33 | 31 | 8 | 3 | 119   |

16cm total length have been omitted in the reckoning though they were examined, table 4 showing the data on the occurrence of the growth rings in the fish of the size-groups in the range 16-33.9cm. As many as six rings have been noticed in the largest sizes of this species. The numbers of growth rings in fish of different size groups are given in the table; altogether, about 15%, 22%, 28%, 26%, 7% and 2% of the individuals showed 1, 2, 3, 4, 5 and 6 rings respectively in their scales. In all these categories, a small number of uncertain cases suspected to have an additional ring have been included, crediting them to the lower frequency group of growth rings; in many of the columns of table 4 for instance, the number of rings mentioned at the top of the column were clearly present but one more ring could also be seen in a few cases, these being however not clear enough to be positively counted as such. The result of this treatment is that the doubtful rings are actually omitted in the calculation.

Assuming the growth rings seen in the scales of *C. bilineatus* to be annual rings as in the case of *C. macrostomus* (Seshappa and Bhimachar 1951, 1953 and 1955) and *C. macrolepidotus* (Kutty 1967), some of the largest individuals noticed in the present work would be at least six years old. The most frequent

TABLE 5. *Distribution of growth rings in different size-groups of C. puncticeps.*  
(S) = Suspected; (Cl) = clear; \* = one more ring suspected.

| Size-groups<br>cm. | Numbers of growth rings |      |       |      |       |      |       | Total |
|--------------------|-------------------------|------|-------|------|-------|------|-------|-------|
|                    | 0                       | 1(S) | 1(Cl) | 2(S) | 2(Cl) | 3(S) | 3(Cl) |       |
| 10-10.9            | 3                       | —    | —     | —    | —     | —    | —     | 3     |
| 11-11.9            | 1                       | —    | 3     | —    | —     | —    | —     | 4     |
| 12-12.9            | 1                       | 2    | 9     | —    | —     | —    | —     | 12    |
| 13-13.9            | —                       | 1    | 12    | —    | —     | —    | —     | 13    |
| 14-14.9            | —                       | —    | 10    | 2    | —     | —    | —     | 12    |
| 15-15.9            | —                       | —    | 3     | 3    | 8     | —    | —     | 14    |
| 16-16.9            | —                       | —    | —     | 2    | 9     | —    | —     | 11    |
| 17-17.9            | —                       | —    | —     | 1    | —     | 2    | 7     | 10    |
| 18-18.9            | —                       | —    | —     | —    | —     | —    | 2     | 2     |
| 19-19.9            | —                       | —    | —     | —    | —     | —    | —     | 0     |
| 20-20.9            | —                       | —    | —     | —    | —     | —    | 1*    | 1     |
| Totals             | 5                       | 3    | 37    | 8    | 17    | 2    | 9+1*  | 82    |

size of the different ring-classes in *C. bilineatus* on the basis of the present data may be stated as follows:- one ring: 19-19.9cm; two rings: 21-21.9cm; three rings: 24-25.9cm; four rings: 28-28.9cm; five rings: 29-29.9cm; and six rings: above 30cm.

(b) *C. puncticeps*: About 45% of the fish examined had one clear ring in the scales (fish length: 12-14.9cm), 21% (15-16.9cm) had two clear rings, and 11% (17-20.9cm) had three clear rings; no growth rings were found in fish below 11 cm in total length. In addition to the above, however, one ring was suspected in 4% (fish length: 12-13.9cm), two rings in 10% (14-17.9cm), three rings in 4% (17-17.9cm), and above three rings in a single fish (20-20.9cm) among the specimens examined. Size-groups below 10cm have been omitted here but a considerable number of these were also examined and all were found to be *without* any growth rings in the scales.

The growth rings in the scales of *C. puncticeps* are normally clearly formed and are comparable to those of *C. macrostomus* in all respects; it may be concluded that at least three year classes and perhaps a fourth year class also occur in this fish, the longevity being thus perhaps four years. The one-ring class may be said to be mostly in the 13-14.9cm range, while the two-ring class is mostly in the 15-16.9cm range and the three-ring class mainly in the 17-17.9cm group. As fish above 18cm total length were few in the samples, the still older age-grounds are only of theoretical importance.

TABLE 6. *Distribution of growth rings in different size-groups of C. lida*  
(S) = Suspected; (Cl) = Clear

| Size-groups<br>cm. | Numbers of growth rings |       |      |       |            |       | Total |
|--------------------|-------------------------|-------|------|-------|------------|-------|-------|
|                    | 1(S)                    | 1(Cl) | 2(S) | 2(Cl) | 3(S)       | 3(Cl) |       |
| 14-14.9            | 1                       | 2     | —    | —     | —          | —     | 3     |
| 15-15.9            | —                       | 2     | —    | —     | —          | —     | 2     |
| 16-16.9            | —                       | —     | 2    | 5     | —          | —     | 7     |
| 17-17.9            | —                       | —     | 1    | 10    | —          | 1     | 12    |
| 18-18.9            | 2(?)                    | —     | —    | 9     | 1          | —     | 12    |
| 19-19.9            | —                       | —     | —    | 3     | —          | 1     | 4     |
| 20-20.9            | —                       | —     | —    | —     | —          | —     | 0     |
| 21-21.9            | —                       | —     | —    | —     | 1          | —     | 1     |
|                    |                         |       |      |       | (4 rings?) |       |       |
| Totals             | 1+2(?)                  | 4     | 3    | 27    | 2          | 2     | 41    |

(c) *C. lida*: Detailed examination of 41 specimens of this species for growth rings in the scales has revealed that about 10% have one clear ring (14-15.9cm range), 66% have two clear rings (18-19.9cm range) and 5% have three clear rings (length: 17-19.9cm). No rings were seen in the scales of this fish in sizes below 14cm total length. There were three specimens (7%) in the 16-17.9cm group suspected to have two rings, that is, one suspected additional ring over and above the one clear ring; there were two fish (5%) suspected to have three rings in the same way in the 17-18.9cm group; and there was a single specimen (2%) in the 21-21.9cm group suspected to have four rings in the same sense but more fish of this group were not available. The growth rings in this species are often less well marked than in *C. puncticeps* and *C. bilineatus* though the general nature of the rings in all the three species is the same as described in *C. macrostomus* (Seshappa and Bhimachar 1951 and 1955) and in *C. dubius* (Seshappa 1976). It would appear that in this species the one-ring class is in the 14-15.9cm group and the two-ring class mostly in the 16-18.9cm group.

#### DISCUSSION

Seshappa and Bhimachar (1951, 1953 and 1955) were the first to demonstrate the existence of growth rings in the scales of *Cynoglossus macrostomus* (*C. semifasciatus*) and to show that these rings were annual in their appearance in the scales, being thus useful in age and growth studies just as in the case of the winter rings of the scales in the temperate species of fishes. These rings were designated *monsoon rings* as their formation coincided with the south west monsoon season, and it was thought probable that similar growth rings

occur in the scales of other demersal species also along this coast; the three less common species of *Cynoglossus* studied and reported in the present work were collected from the same areas and were actually picked out from samples of that fish only, with which these species occurred as stray specimens. In general, all these species share the same environment along this coast, being all bottom-dwellers with the Malabar sole. The data presented here show clearly, not only the occurrence of growth rings in all the three species but also, (1) their absence in the scales of smaller sizes of fish, and (2) an increase in their numbers with an increase in fish size in all the three cases, specimens above a certain length invariably showing one or more clear growth rings in their scales. *C. bilineatus*, like *C. macrolepidotus* (vide kutty 1967) grows to a larger size than the other two species, lives for a longer number of years and shows more rings in the scales at larger fish sizes, as many as six rings being found in the largest individuals examined in this work. It is probable that *C. bilineatus* has a longevity of more than six years. *C. puncticeps* has a longevity of at least three years while *C. lida* probably four years. In species of limited numerical abundance as in the present instance, it is not possible to draw many far-reaching conclusions, but the present data do lead to the conclusion that the growth rings of all three species studied here are similar to those of *C. macrostomus* and can be used for age and growth studies as in the case of that form as well as *C. macrolepidotus* (Kutty 1967) and *C. dubius* (Seshappa 1976).

The present paper also gives an idea of the trends of size-distribution in the three species at Calicut in a gross and limited way for the different years of study, the totals of the entire period indicating the possible range of the lengths in the populations of the area, and the relative paucity of certain size-groups in different years as well as during the period as a whole.

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