

THE GROWTH RINGS ON THE OTOLITHS OF THE OIL
SARDINE, *SARDINELLA LONGICEPS* CUV. AND VAL.

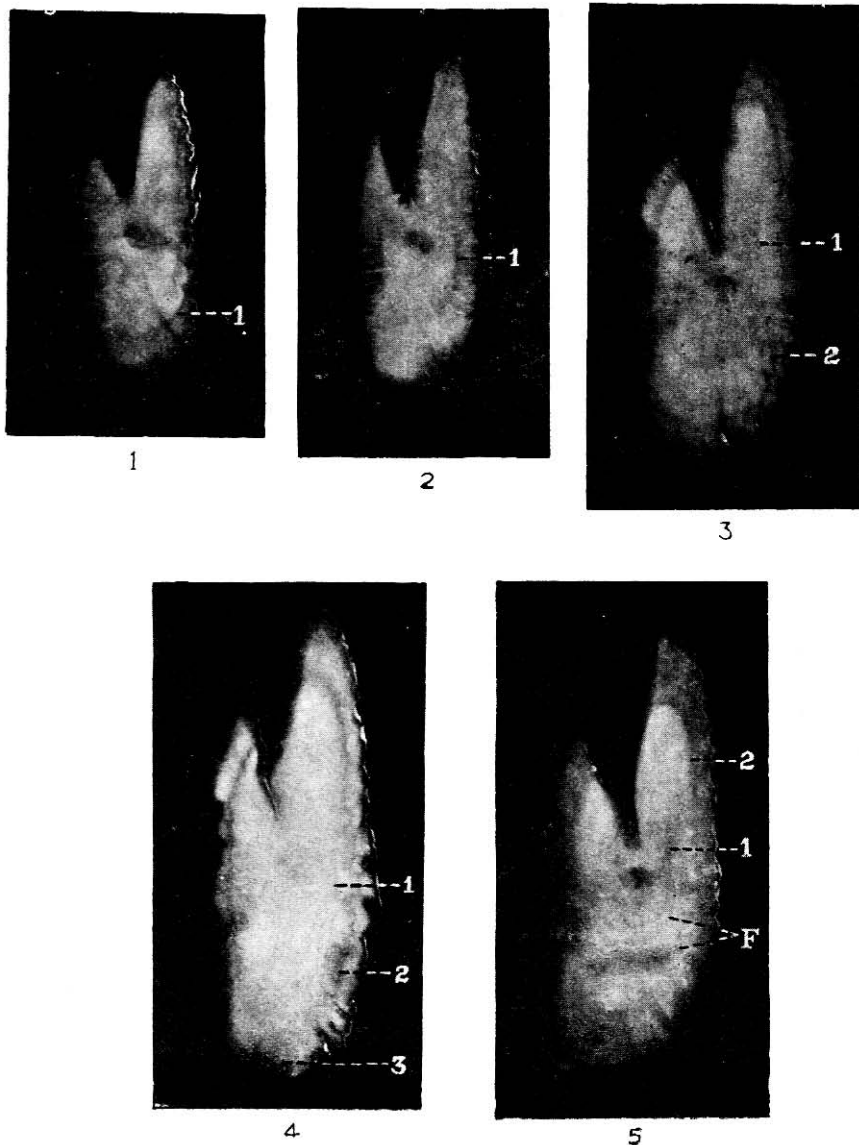
BY
R. VELAPPAN NAIR.

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THE GROWTH RINGS ON THE OTOLITHS OF THE OIL SARDINE, *SARDINELLA LONGICEPS* CUV. AND VAL.*

THE importance of the study of growth rings on the otoliths and scales of fishes for age determination, by which alone the passage of year classes of commercially important fishes

can be followed through the fishery, appears to have been well realised in European countries where intensive investigations on these structures have been made for several years.



Photomicrographs 1-5

1. Right otolith of *Sardinella longiceps* showing one growth ring. $\times 16$. (128 mm., gonads undeveloped, 25th November 1948.) 2. Right otolith of *Sardinella longiceps* showing one growth ring and a wide second growth zone. $\times 16$. (150 mm., immature male, 29th November 1948.) 3. Right otolith of *Sardinella longiceps* showing two growth rings. $\times 16$. (195 mm., female, 31st July 1948.) 4. Right otolith of *Sardinella longiceps* showing three growth rings. $\times 16$. (203 mm., male, 19th October 1948.) 5. Right otolith of *Sardinella longiceps* showing two growth rings and false rings (F). $\times 16$. (195 mm., female, 19th October 1948.)

In India, however, judging by the paucity of investigations in this field, very little attention appears to have been devoted to the determination of age of even the economically more important fishes. The observations of Rao (1935) and Sastry (1936) on the otoliths of *Psettodes erumei*, of Hornell and Nayudu (1923) and Devanesan (1943) on the growth rings on the scales of *Sardinella longiceps*, and of Chacko, Zobairi and Krishnamurthi (1948) on the radii (circuli ?) of the scales of *Hilsa ilisha* may be mentioned in this connection.

Hornell and Nayudu were the first in India to detect the presence of growth rings on the scales of the oil sardine and to conclude that they are formed when growth ceases with the scarcity of planktonic food, and that its longevity is limited to two and a half years. According to them the oil sardine attains sexual maturity and adult size of 15 cm. at the end of one year, the growth becoming extremely slow thereafter. In the course of a detailed study of the scales, Devanesan has noted the first growth ring on the scales of young oil sardines of 6.5 cm. in length and six of them in fish of 8.7 cm. and suggested that nine and fourteen growth rings may be expected to be present in fishes of 15 and 18 cm. size groups respectively. It appears probable that he has included the false rings also in his counts, which could be distinguished from the true rings by the characteristics given by Walford and Mosher (1943) for the Californian sardine, *Sardinops caerulea*. The conclusions of these authors, therefore, are so widely different that the span of life of the oil sardine, which ranks as the best known commercial fish of this country has been in doubt.

In view of the prevailing contradictory opinions on the age of the oil sardine, as judged by the study of the scales, special attention was given to the study of otoliths and scales, particularly to the former to determine their value in age determination. Contrary to the statement made by Hornell and Nayudu that "no definite lines of growth can be made out even when the otoliths are ground to thin flakes," the presence of distinct periodical growth rings has now been detected on the otoliths of the oil sardine. These rings can be made out faintly even in wet otoliths immediately after removal from the fish, but they become more pronounced after treatment in the following manner. They are subjected to upgrading in different strengths of alcohol, drying, treating with xylol and mounting in canada balsam on slides, provided with a circular piece of bristol board having two punched circular holes, in each of which an otolith is placed. It may be mentioned here

that when the otoliths are in alcohol and xylol, the white opacity of the growth zones and the translucency of the growth rings respectively become more pronounced. The degree of opacity of the growth zones can be easily controlled by varying the period for which the otoliths remain in alcohol. Such preparations, when viewed under the low power of the binocular microscope with reflected light, show the growth rings as translucent dark zones concentric with the margin of the otolith, while the intervening growth zones appear opaque white. The photomicrographs of otoliths reproduced here are taken with reflected light and show clearly the first, the second and the third growth rings. Sometimes false rings also appear, but these could be easily distinguished by their line-like appearance and tendency to join a growth ring. Occasionally otoliths fail to show the growth rings for reasons not at present known. In the majority of the otolith preparations only the first and the second growth rings are seen and in a few preparations the third ring is also seen at the posterior broad end of the otolith. My study of the otoliths of the oil sardine inclines me to the view that these rings are formed annually, probably during December to April when scarcity of planktonic food has been noted by Hornell and Nayudu, and that the average life of the fish is about three years. Judging from the size of the fish, the number of growth rings and the width of the last growth zone on the otoliths, it can be stated that the size at maturity, of 15 cm., is reached when the oil sardines are about two years old.

A detailed account of these investigations will be published elsewhere.

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Central Marine Fisheries R. VELAPPAN NAIR.
Research Station,
West Hill, Calicut,
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