

(3) *Minor crustacea*: (a) *Isopoda* (0.41%), Isopods (parasitic forms) presumably taken in along with the host. (b) *Stomatopoda* (0.4 per cent.), *Squilla* sp. (c) *Miscellaneous crustacean remains* (12.15 per cent.) (4) *Molluscan shells on coconut tree roots* (0.01 per cent.). (5) *Insecta* (0.36 per cent.): Insects, young stages of dragon fly and unidentified insect remains. (6) *Vegetable Matter* (0.64 per cent.) These consist of water weeds, bits of grass, cladodes of casuarina and occasionally leaves of land flora. (7) *Digested Matter* (3.9 per cent.): Animal matter digested and mixed with mucus, and (8) *Mud and Sand Grains* (0.85 per cent.): Fine mud mixed with mucus and particles of sand grains.

In four instances the stomach was found to have been pierced by the pectoral spines of the cat fish *Mystus gulio*.

Seasonal observations are continued with a view to making a detailed, comparative study of the food and feeding habits of the fish in the different seasons and stages of growth.

Observations so far carried out show that *Lates calcarifer* feeds actively in the cold season. It is a column feeder, preying mainly on Teleosteans and Decapod crustaceans. Mud and sand in the guts of a few specimens examined were obviously brought in by the mullets which were consumed. The fragments of vegetable matter included in the diet are probably accidental. The 'Bekti' takes a considerable toll of valuable food fishes, like mullets, clupeids, cat fishes and prawns, but the large variety of specimens consumed show that as long as adequate animal food is provided in the environment, 'Bekti' may not destroy the major food fishes exclusively. By providing sufficient quantities of forage fish it should, therefore, be possible to maintain Bekti farms successfully.

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I. Mookerjee, H. K., Ganguly, D. N., and Majumdar, T. C., *Science and Culture*. 1946. **11**, 564.

THE ROLE OF MAWA, AN INDIGENOUS MILK PRODUCT, IN THE NUTRITION AND EPIDEMIOLOGY

MAWA, a crudely manufactured form of condensed milk, is a widely consumed nutritious diet; although the milk is concentrated enough to facilitate transportation, this product still has enough moisture to favour the growth of micro-organisms of which the moulds give visible growth on its surface within about six days of storage at room temperature. It was of considerable practical interest to determine if mawa plays any part in the dissemination of the intestinal pathogenic bacteria.

The chemical composition of several samples (collected on different occasions) revealed that, on an average, mawa contains 10.81 per cent. moisture, 26.71 per cent. proteins, 29.67 per cent. fat, 19.98 per cent. lactose, 3.81 per cent. ash, 1.46 per cent. calcium, 0.66 per cent. phosphorus and trace of iron. The above composition suggests the possibility of mawa serving

as an excellent material for the nutrition of both man and micro-organisms.

Bacteriological studies conducted on mawa with *E. typhosa*, *S. schottmuelleri*, *E. coli communis*, *S. dysenteriae* (Shiga), *S. paradysenteriae* (Flexner), and *V. cholerae* have yielded remarkably clear-cut results on repeated experimentations. Mawa was used in the state obtained and in a slightly more moist state and was experimented upon in both its native (non-sterilized) and steam-sterilized states. Incubation was done both at the room (28°-29° C.) and the body (37° C.) temperatures. The results obtained clearly show that growth of all the tested species does take place and that the survival period may vary from 14 to 34 days depending upon the species, the moisture and sterility status of mawa and also on the incubation temperature. A detailed report on this work will be published elsewhere.

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ACCLIMATISATION OF THE MILLIONS *LEBISTES RETICULATUS* (PETERS) IN MADRAS*

It is widely believed that the Millions, *Lebistes reticulatus* (Peters), are incapable of withstanding the climatic conditions in the hotter tracts of this country.¹ The species is now considered as not being found in India,² but only in Ceylon where it is used for larvicidal purposes.³ It was, however, found thriving in the tanks of the Rameswaram temple situated in Ramnad district in February 1946 during an investigation of the distribution and local densities of the larvicidal fishes indigenous to the provincial waters. It is possible that it has been introduced from Ceylon, but exact details are not available.

In October 1946 a consignment of about 1,000 fish was taken to Madras with a casualty of only 9 en route, and stocked in a concrete garden cistern, in which they bred for the first time in December 1946 and several times thereafter. The stock was then distributed to other waters in the City and to departmental farms and certain private waters in the districts of Tanjore, Cuddappah, Kurnool, Malabar and Salem, where they soon got acclimatised and multiplied. Through gradual adaptation the fish has also been acclimatised to brackish waters. The maximum size to which the fish has grown is 1.5 inches in the case of the female and 1 inch in the male. The two sexes occur in equal proportions. The females are dull grey in colour; and the males are iridescent. Details of sexual dimorphism concerning colour, pattern, body form and size, and of the factors influencing sex recognition in the species have already been recorded by Breder and Coates.⁴

Lebistes reticulatus is a surface feeder, and moves about in small groups of 10 to 15. Its food in Madras provincial waters was found to be the following:—

(1) Diatoms and desmids (30 per cent.) *Cosmarium*, *Closterium*, *Fragilaria*, *Melosira*, *Navi-cula*, *Nitzschia*, *Pinnularia*, *Suriella*, and *Syne-dra*. (2) Insect life, including mosquito lar-væ (25 per cent.). (3) Crustaceans (20 per cent.) *Copepods*, *Daphnids* and *Cypris*. (4) Al-gæ (15 per cent.) (*Anabæna*, *Cladophora*, *Os-cillatoria*, *Pediastrum* and *Spirogyra*). (5) Roti-fers (5 per cent.) Larval forms (3 per cent.). (7) Miscellaneous matter such as sand parti-cles (2 per cent.).

Under artificial conditions it feeds on prawn pulp, oil-cake, mosquito larvæ, cooked rice and egg-yolk.

The breeding habits and development of the species have been detailed by Stoye⁵ and Pur-ser.⁶ The variations from their observations are indicated below. Maturity is attained when 0.7 inch in size by the male and when 1 inch by the female. The ovarian egg is 1.0 to 1.66 mm. in diameter, whereas the fertilised egg is full of oil-globules and measures 2.0 mm. in diameter. The embryo lies curved over the yolk-sac when 4 mm. in size, showing 8 somites, black eyes and the fin buds. Pig-mentat.ion commences when 5 mm. in length, and the mouth cleft appears when 6 mm. in size. The young are released in broods of 5 to 7 at intervals of 3 weeks. At the time of birth the young is 10 mm. long. The yolk-sac is completely absorbed by the third day. Can-nibalism is not observed in the Millions; and it lives in harmony with *Gambusia affinis* (B. & G.), *Oryzias melastigma* (McCl.) and *Aplocheilus blochii* (Arnold). While its ene-mies in its native waters are the fishes, *Creni-cichla saxatilis* and *Rivulus harti*, the common frog, *Rana hexadactyla*, is found to feed on it in Madras.

The Millions are successfully used for anti-malarial purpose in other parts of the world. In Madras it is observed to be only of moderate utility, the rate of larval consumption being only 20 to 80 per day. The species may, how-ever, become a useful addition to the indige-nous larvicides.

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In *Hilsa ilisha* (Hamilton) occurring in the del-taic area of the Godavari, the radii are arrang-ed transversely. A study of these radii of the scales of the pectoral region of 1,110 specimens has revealed that the number of radii repre-sent the body length of the fish in inches.

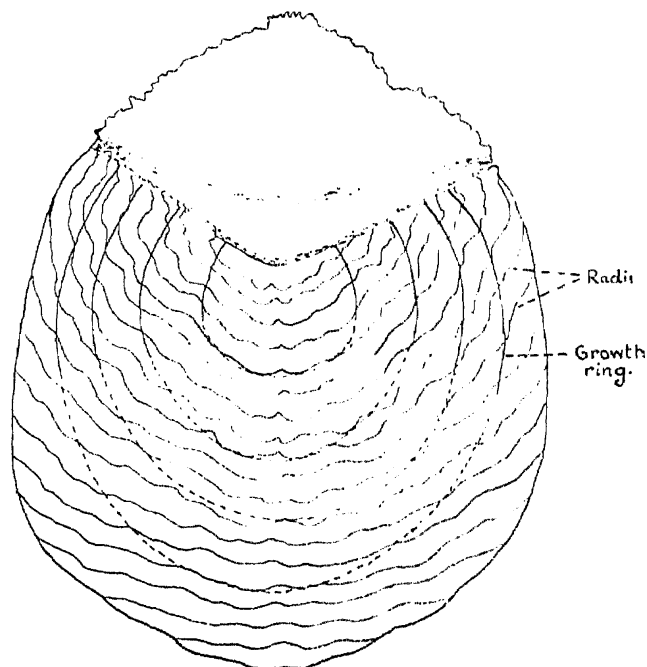


FIG. 1. Diagram of scale of Hilsa, 18.2" in body length

According to Hora² and Raj,³ the maximum length attained by Hilsa during the first year of its life is 9 inches. And according to Job⁴ Hilsa grows at the rate of one inch per month and attains a marketable size and about a foot at the end of the first year. Basing on these observations, the age of the fish can also be roughly determined by counting the number of radii.

The following table indicates the relation-ship between the body length, number of radii and probable age of *Hilsa ilisha*.

No. of specimens examined	Length of body in inches	No. of radii on scale	Probable age in months
87	9.8-10.5	10	10
114	10.7-11.4	11	11
112	11.5-12.4	12	12
121	12.5-13.4	13	13
127	13.5-14.5	14	14
114	14.6-15.5	15	15
98	15.6-16.4	16	16
117	16.5-17.5	17	17
79	17.6-18.4	18	18
88	18.4-19.4	19	19
39	19.5-20.4	20	20
14	20.5-20.8	21	21

It, however, remains to be ascertained if the fish continues to grow in length and to add to the number of the radii until its natural death. The largest Hilsa so far recorded by the authors is a female spawner, 20.8 inches in body length. It is likely that the fish does not escape the fisherman who comb the river

THE RADII OF SCALES OF HILSA ILISHA (HAMILTON) AS AN INDEX OF GROWTH AND AGE*

SEVERAL explanations on the function and sig-nificance of the radii of fish scales have been given by various workers including Raj,¹ on the basis of the mode of disposition of the radii.