Abstract: Features of the sagitta, lapillus and asteriscus of laboratory-hatched and -reared Labeo mesops juveniles (56 days after hatching, 16.30-26.05 mm TL) were investigated. The sagittae were arrowhead-shaped with obvious cores and fragile two rostra. Increments in the sagittae were observable until bases of rostra but were hardly visible in outer rostra. The lapilli were fan-shaped with obvious cores. Increments in the lapilli were well observable from the core to the margin. Increment counts in the lapilli did not significantly differ from actual age in days, indicating the lapillus being applicable for daily increments analysis until 56 days after hatching. The asterisci were oval-shaped with ambiguous cores. Increment counts in the asteriscus were fewer than actual age, showing the asteriscus being unsuitable for aging.

Key words: Labeo mesops juveniles; Otolith; Lapillus; Daily increments

Ntchila Labeo mesops (Günther) is the cyprinid fish inhabiting in Lake Malawi and its tributaries. This species grows to 40 cm in total length, and has been an important target of commercial fishing in Malawi. Decline in its stock level has been reported out since 1960s, this decline leading to necessity in aquaculture promotion and stock management of the species. However, the fundamental biology of this species has scarcely been known so far. In research on the early life history of fish, analyses of daily growth increments in otoliths have been broadly applied since Pannella and growth analyses in larvae and juveniles with daily increments has been thereafter developed. On L. mesops, however, such analyses have never been done, while otolith research have been previously made in other cyprinids and elucidated the utility of the lapillus.

In this study, micro-structural features of otoliths (sagitta, lapillus and asteriscus) were described in order to identify the suitable otolith for age determination in days, and validation of increment formation pattern in otoliths was attempted.

Fig. 1. Otoliths of Labeo mesops juvenile (21.75 mm TL). Left: sagitta, center: lapillus, right: asteriscus. Left and right arrowheads indicate anterior- and posterior-rostra, respectively. Oblique dotted lines show bases of rostra. Bars indicate 100 μm.
unsuitable for reading increments and agreed with observations in ostariophysans fish as well as in other cyprinid fishes, e.g. Delistites luxatus and Chasmistes brevirostris, Opsaridium microlepis, Opsaridium microcephalum and Engraulicypris sardella.

The lapillus was fan-shaped and had an obvious core (Figs. 1 and 3). Around the core, a distinctive check was observed in most specimens (27 of 29), the diameter of that check being 8.57 ± 1.55 μm (mean ± SD, n = 27). This was considered a “hatch check” formed at hatching inside which distinctive increments were rarely observed (Fig. 3). Maximum radii of the lapilli ranged from 216.25 to 357.50 μm (mean ± SD: 296.93 ± 36.37 μm, n=27). Relationship between the maximum radius and TL was expressed by the following allometric regression; TL = 0.24 · R^{0.79} (r=0.92, n=29) (Fig. 2). Width of increments near the hatch check was less than 4 μm. It once increased to more than 7 μm at 20th-30th increments deposition and decreased thereafter to about 5 μm (Fig. 3). Increments were deposited clearly from the core to the edge in most cases although subdaily increments often occurred when increment width was wider (20th-40th increments). Mean number of increments was 55.87 ± 0.78 (n = 29), and did not significantly differ from the actual age in days, 56 days (t-test, P>0.05) (Table 1). This elucidated that increments in the lapillus were formed on a daily basis after hatching as reported in earlier studies on cyprinids until 56 days after hatching.

The asteriscus was oval-shaped with irregular notches on the margin (Fig. 1). It had an ambiguous core (Fig. 1). The maximum radii of asterisci ranged from 171.25 to 300.00 μm (mean ± SD: 243.06 ± 33.91 μm, n=29). Relationship between the maximum radius and TL was expressed by the following allometric regression; TL = 0.58 · R^{0.66} (r=0.88, n = 29) (Fig. 2). In the asterisci, mean number of increments was 45.82 ± 4.29 (n=28), being significantly fewer than the actual age in days (t-test, P<0.01) (Table 1).

Table 1. Mean of lapillus and asteriscus increment counts of Labeo mesops juveniles (56 days after hatching), and results of comparison (t-test) between actual age in days and their increment counts

<table>
<thead>
<tr>
<th>Otoliths</th>
<th>Mean</th>
<th>SD</th>
<th>Results of t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lapillus (n = 29)</td>
<td>55.87</td>
<td>0.78</td>
<td>Not significantly different (P&gt;0.05)</td>
</tr>
<tr>
<td>Asteriscus (n = 28)</td>
<td>45.82</td>
<td>4.29</td>
<td>Significantly different (P&lt;0.01)</td>
</tr>
</tbody>
</table>

Consequently, the lapillus was found as the most appropriate otolith for daily increments analysis in L. mesops until 56 days after hatching, while the sagitta and asteriscus were not, as previously shown in various cyprinids. Considering occasional difficulties in observing increments of the sagitta and better utility of the lapillus than the sagitta in other fish taxa, the lapillus needs further investigations not only in cyprinids but in others for usage in micro-increments analysis.

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References