



**Molecular identification, study of  
biology and stock structure of three  
common neritic tuna species found in  
Sri Lankan waters**

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## Abstract

Neritic tunas are very important in the Sri Lankan fishery industry. This research was carried out to study the growth condition indices, feeding habits, reproduction and stock structure of the three neritic tuna species *Euthynnus affinis*, *Auxis thazard* and *Auxis rochei*, commonly found in the Sri Lankan fishery catches. Samples were collected from the Northwestern, Western, Southwestern, Southern and Northeastern Provinces from October 2015 to September 2017. The samples were identified using morphological features and molecular characteristics and each sample was used for morphometric, biological and molecular analysis.

For each species, the computed length-weight relationships, length-length relationships and the condition factor showed that these species were living in good conditions and that their growth patterns were favourable. All the power coefficients were higher than 3 for all three species, showing positive allometric growth patterns. The relationships between the length parameters were all highly significant ( $p < 0.001$ ). Feeding studies on stomach fullness revealed that for *E. affinis* and *A. thazard*, the highest percentage of stomachs were full (37.17% and 24.25% respectively) and for *A. rochei*, the highest percentage of stomachs were one quarter full (31.41%). *E. affinis* and *A. rochei* stomachs revealed they were feeding mainly on small finfish such as herrings (*Amblygaster sirm*), sardines (*Sardinella* spp.), bigeye scad (*Selar crumenophthalmus*) and lizard fish (58.28% and 38.46% respectively). For *A. thazard*, the highest prey percentage was shown to be crustaceans (77%). Furthermore, the analysis showed that they had ingested a combination of prey items, indicating that these neritic tuna species are opportunistic feeders, feeding on any abundantly available prey item in the surrounding waters.

Reproductive studies on these species revealed that the male:female ratio for all three species was approximately 1. The spawning season for *E. affinis* was seen to be March to June and August to October for females and June to July and in November for males. For *A. thazard* the GSI values have peaked during May to July and in October for females and in May to August and in February for males. The length at first maturity ( $L_{50}$ ) values for female and male *E. affinis* were 40.8 cm and 35.1 cm respectively, for female and male *A. thazard* were 33.0 cm and 32.1 cm respectively and for female and male *A. rochei* were 27.5 cm and 27.7 cm respectively. Whenever management measures need to be implemented for any of these fishery resources, the spawning period could be used in declaring closed seasons for the fishery and the  $L_{50}$  values could be helpful in implementing mesh size regulations.

The species identification accomplished by mitochondrial COI sequencing, identified the individual samples to species level with more than 99% similarity. This also showed 7 samples had been misidentified using morphological features. This highlights the importance of molecular identification of species, when morphological features are unavailable. The stock structure analysis was carried out for the three species by using the 2 molecular markers, mitochondrial COI and mitochondrial D-loop region sequencing. The comparison of the individual marker sequences with the combined sequences revealed that the combined sequences were more informative for stock structure determination. This analysis revealed that the populations of *E. affinis* of the different fishery provinces considered, consist of one single stock. Similarly, the populations of *A. thazard* and the populations of *A. rochei* were shown to consist of single stocks. Furthermore, the population analysis also revealed that for all 3 species, other published Indian Ocean region sequences included in the analysis, share a common ancestor with the Sri Lankan populations considered in this study.



The morphometric analysis of the variables of the different morphometric features that the stocks of the different provinces showed all the provinces clustering together for all 3 species, confirming the results of the molecular analysis that the stocks of *E. affinis* of the different provinces studies are of one common origin. Similar results are seen for the other 2 species *A. thazard* and *A. rochei* as well.

The analysis of data of this study revealed novel information on the feeding, reproduction and on the stock structures of the neritic tuna species *E. affinis*, *A. thazard* and *A. rochei*. This information will be important when management plans for these species are being developed and implemented. The knowledge on whether the stocks are of a single origin or of different origins will help to decide whether a common management plan could be implemented or whether individual management plans need to be prepared and implemented for each province.