

EXTENDED ABSTRACT

ICES CM 2006/J:31

Consequences of unreliable age determination in the management of the European eel, *Anguilla anguilla* (Linnaeus, 1758)

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Keywords: Age, interrupted summer growth, southern latitudes, brackish and freshwaters, eel management

The study of growth in fish usually requires the determination of age. Although in temperate waters age is often obtained by counting the year rings on the hard parts of fish, accurate estimation of age requires validation. Several attempts have been made to validate age determination. Nevertheless, due to temporal, spatial and individual changes it has become a complex task especially when it involves anguillid species. Age determination in these species is hampered by a complex life cycle, an extensive geographic range and the colonization of a wide variety of habitat types.

This study focuses on the discrepancies in age estimation for the European eel, *Anguilla anguilla*, throughout its distribution area considering both estuarine and freshwater habitats. Despite considerable effort, estimating age and growth of anguillids remains a difficult task mainly due to the recognized difficulty in interpreting otolith marks. As a consequence, big discrepancies in age estimation have been found not only among localities but also among readers. Although the inevitable influence of latitudinal differences, environmental conditions and individual variability cannot be underestimated, such discrepancies might reflect differences in the interpretation of ring periodicity as well as differences in absolute age. Due to many constraints, age validation methods have not been fully successful to clarify this situation.

In this study, the periodicity of growth increment formation was determined from the otoliths of eels sampled in the freshwater system of a southern river, the Mondego River. Marginal increments on sagitta, measured monthly, were used to validate that periodicity and revealed that in this type of habitat, growth band deposition reflects a bi-annual increment formation.

The first ring, corresponding to winter was laid down between December and March whereas a second ring was laid down in summer between July and August (Fig. 1).

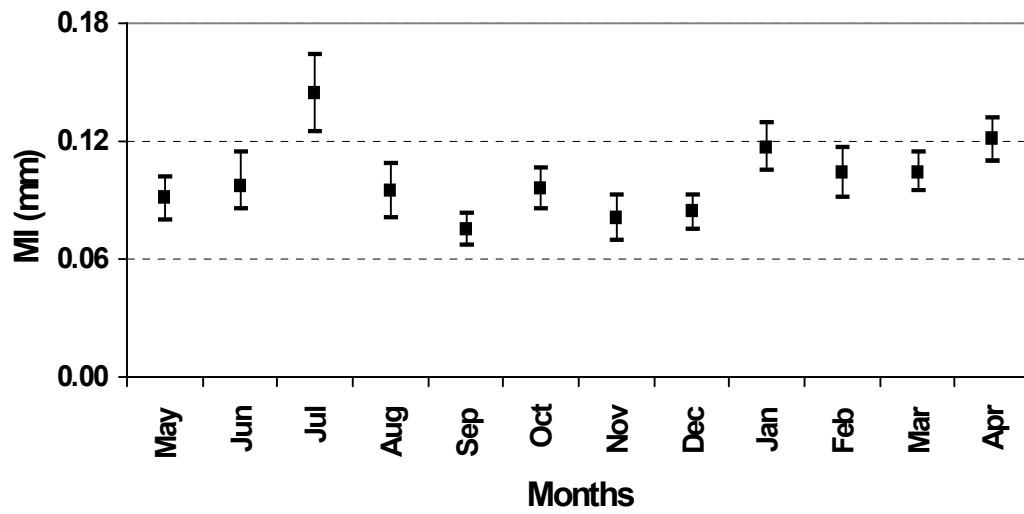


Figure 1. Monthly variation of the marginal increment (MI) of the otoliths from eels caught in the Mondego River.

Unfavourable conditions such as high summer temperatures (Fig. 2), typical of southern latitudes, can account for these results and affect growth similarly to what happens with low temperatures during winter.

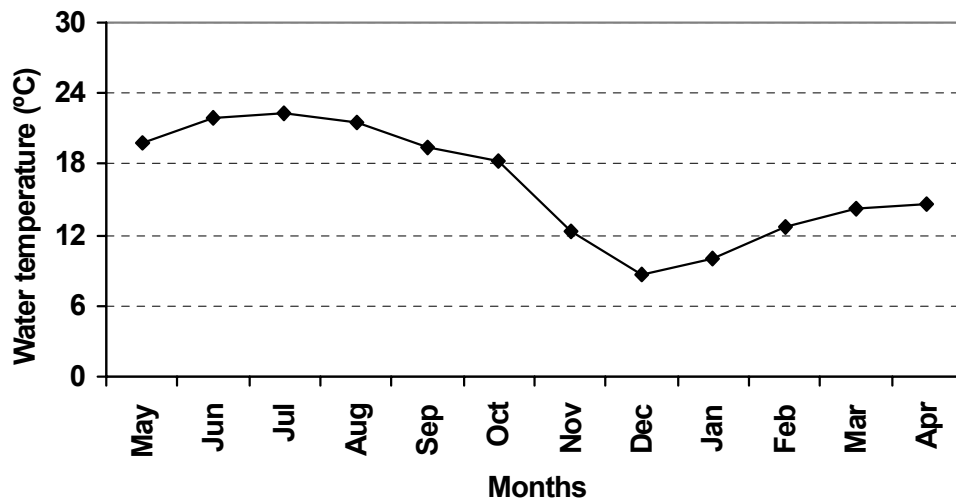


Figure 2. Monthly variation of water temperature (°C) in River Mondego.

The time of deposition of the summer ring is consistent with the results obtained for the condition (K) of individuals (Fig 3).

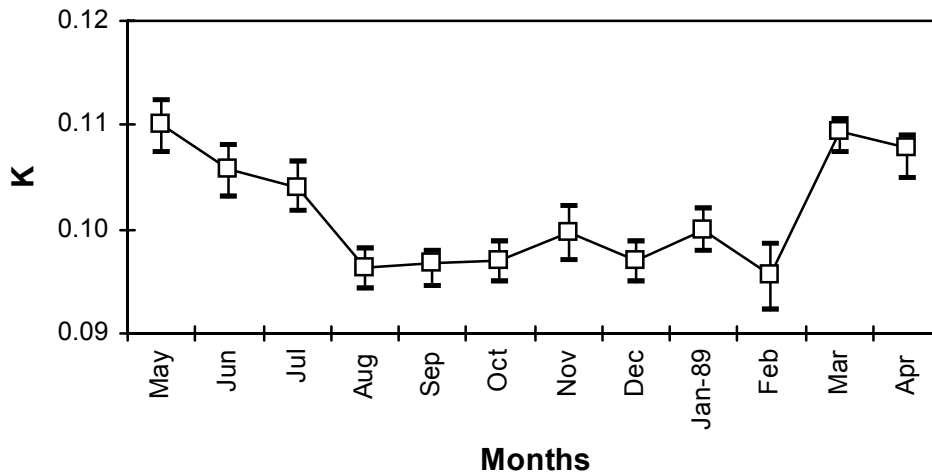


Figure 2. Monthly variation of the condition factor (K) of eels sampled in River Mondego.

Eels are usually described as slow growing fish, which according to Deelder (1981) is due to the supernumerary rings that are laid down during summer months as a result of high water temperatures. This interrupted summer growth was also described by other authors for the American eel (Oliveira, 1996) and the European eel (Tzeng *et al.*, 1994) which implies that age of eels may be largely overestimated.

The present findings indicate a bi-annual ring deposition. Unfortunately, most studies that were conducted in southern latitudes included only eels from brackish water systems (e.g. Rossi & Villani, 1980; Gordo & Jorge, 1990; Fernández-Delgado *et al.*, 1989), where environmental conditions are more stable than the ones which occur in freshwater systems. Therefore, further research to validate age of eels from other southern rivers is needed to draw conclusions that can be used for stock assessment and conservation measures.

The possible extension of these conclusions to eels from other systems and the implications on the population dynamics and management issues should be thoroughly analysed and reconsidered in future studies.

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