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## Letter to the Editor

# A Sight for Sore Eyes: *Diplostomum* and *Tylodelphys* in the Eyes of Fish

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## Dear Editor in Chief

*Tylodelphys* Diesing, 1850 and *Diplostomum* von Nordmann, 1832 are trematode parasites of Order Strigeatida, Family Diplostomidae, which co-populate the eyes of teleost fish in the metacerarial stage. Fish, infested by these species, develop impaired vision and morbidity of the eye eventually developing a condition known as 'pop-eye'. Fish with heavy infestation, called diplostomiasis, lose weight and experience anterior traumas due to impaired vision - failing to locate food and striking rocks or other objects. Field and Irwin (1) cite a number of authors who suggest "infection with *Diplostomum* spp. metacercariae results in increased predation by birds and fish, and an altered feeding behaviour in heavily infected fish populations". The effects are more pronounced in farmed fish than wild populations. A broad world spread of records is provided (2). Field and Irwin (1) point to the vast body of published information on *Diplostomum* spp., up to 1994, and since then, publications concerning *Diplostomum* spp. have not abated. Researchers go some way to providing worldwide records of occurrence of diplostomids, but mostly in the northern hemisphere (3). They did distinguish 19 newly delineated species out of a previous count of 33 species; however as is commonly the case, sampling effort appeared to play a role in species delineation.

This study concerns only the metacercariae of two species, and the only species of *Tylodelphys* recorded was *T. clavata*. *Diplostomum* and *Tylodelphys* inhabit the eyes of freshwater fish throughout the world. However, the phylogenetics of two genera remains problematic, and the role of morphometrics is re-asserted. Incidence of *Diplostomum* ssp. and *Tylodelphys clavata* in *Perca fluviatilis* in Ireland was recorded with age of the fish hosting the parasites. A generalized linear model, GLZ, was applied to



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the data, following the failure of other statistical methods to confirm any relationship between the genera. The data was collected from n = 59 individuals of *P. fluviatilis* and we can learn very little from it without further analysis, or at least a model to help formulate the problem. For example, in the plot of mean abundances of *Diplostomum* and *Tylodelphys* against Host Age, the graph appears to show that as *Tylodelphys* increases in abundance, the abundance of *Diplostomum* falls until yr 4, after which the abundance of *Diplostomum* increases and the abundance of *Tyldelphis* subsequently "crashes" after yr 5. A modeling program would be required to make sense of the data.

Taking each genus in turn as the dependent variable and setting the other species of diplostomid as 'predictor' or 'factor', I aimed to determine if there was some kind of interaction. The model type in each case was set up as linear model and although Host Age was included as a factor, the reader is asked to bear in mind that the age of host was related but not equivalent to size and some undetermined immunological effect such as "tolerance". I also included the cross-wise Host Age*GENUS interaction effect. In all cases, significant results were obtained at the 95% confidence level, $P<.05$; however, the result for *Diplostomum* as dependent variable was even more pronounced when the Gamma distribution model was used. Whereas a linear model was used within the GLZ and the results were significant, the use of a Gamma distribution in *Diplostomum* pointed to the nature of the actual distribution of *Diplostomum*.

*Diplostomum* formed some kind of relationship with age of fish host, but *Tylodelphys* did not, as it is an annually re-infecting parasite, but that both genera exerted an influence on each other, based on cross-wise interactions.

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