

Food availability and pollutant effects on population dynamics of the midge *Chironomus riparius*

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Chironomus riparius (Diptera: Chironomidae) is a non-biting midge that is widely distributed in the northern hemisphere at temperate latitudes. The larvae, which are collector-gatherer, feed on sediment-deposited detritus. Considered as bio-indicators, Chironomidae are of clear interest in ecology and in ecotoxicology [1].

By including the effects of food availability and pollutants in the environment, an extended Leslie matrix model was developed for a laboratory population of *Chironomus riparius*. Primary non-linear models were used to relate demographic parameters to the daily food input or to the pollutant concentration, but also to estimate input parameters of the population matrix model. Due to the food amount dependence of the fourth larval stage duration, we dealt with a Leslie matrix of variable dimension. The Leslie matrix could become irreducible but imprimitive, depending on the daily food input, thus leading to a cyclic dynamic [2]. We first characterized the Chironomidae population dynamics, under non-limiting food conditions without pollutant, in terms of the asymptotic growth rate,

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stable stage distribution and reproductive values. Then, we studied the effects of food availability and pollutant concentration on model outputs.

In particular, we underlined the role of the fourth larval stage duration. We demonstrate the efficacy of a Leslie modeling approach to adapt input parameters according to experimental data. We conclude with the robustness of Chironomidae to limiting food conditions: the population is still growing even when the daily food input falls in a drastic way. We advocate a posteriori the pertinence of such a modeling approach to predict the future of Chironomidae field populations.

References

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