**Highlights**

* We decompose variation in growth among individuals into persistent (faster throughout their lifetime) or transient (faster in one year) components.
* We apply the model to a wild marine population of Antarctic toothfish and validate using a simulation study.
* Transient variation accounts for up to half of the total variability in Antarctic toothfish.
* The simulation study suggests that these models are approximately unbiased given the available sample sizes.
* The code is made publically available as an R package *TagGrowth*.