

Status and causes of decline in heterochronic newts from Europe

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Although amphibian declines are well documented, almost nothing is known on the status of intraspecific variation such as polyphenisms. Facultative paedomorphosis is an obvious example of alternative developmental pathway in caudates with paedomorphs that retain gills at the adult stage and metamorphs that undergo metamorphosis from the larval or paedomorphic stage. Our aim was to compare past and present data of dimorphic populations of four newt species (*Mesotriton alpestris*, *Lissotriton vulgaris*, *L. helveticus*, and *Triturus macedonicus*) in the two main European hotspots for this process: Larzac (France) and Montenegrin karst region, but also to determine the possible causes of declines. Paedomorphs of the three most common species were extirpated after fish introduction. *T. macedonicus* in which the heterochronic pattern is rare, disappeared in one of the sites. Fish appears as the main determinant of paedomorph absence and extirpation when considering alternative possible environmental factors. The introductions occurred mainly in the largest water bodies, which used to be inhabited by the most important populations. This is the case for high altitudinal lakes originally occupied by paedomorphs of *M. alpestris*, including possible differentiated populations. In some sites, metamorphs remained present or reappeared after fish extirpation, but not paedomorphs. A second cause of the decline is habitat destruction or alteration. It was mainly documented in Larzac where some ponds were destroyed for urban projects or were not repaired, then unable to retain water. If urgent measures are not taken soon, an important kind of diversity will become anecdotic or even disappear. We strongly recommend the integration of polyphenisms into the legislation to help the conservation of rare morphotypes within common species.

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A large, detailed illustration of a frog with bright yellow spots and patterns on a black background. The frog is shown in profile, facing left, with its red-tipped toes visible.

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