

Long term monitoring of yellow-bellied toad populations in Italy

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Long-term studies of population dynamics are of great interest for life history theory, population ecology, wildlife management and conservation biology. The yellow-bellied toad (*Bombina variegata*) is reported to be a long-living and a long-breeder amphibian species, which uses temporary ponds or low-flow river pools as spawning sites. The reproductive success strongly depends on the availability and duration of suitable ponds, and therefore on climatic and environmental conditions.

In Italy, the distribution of the species is limited to the northern regions with the western side of its range falling in Lombardy. In that region yellow-bellied toad populations are highly fragmented and relatively smaller than in other parts of its geographic range. Two monitoring programs started in Lombard Prealps on two populations living in temporary ponds (Parco dei Colli di Bergamo, PBC) and in low-flow river pools (Albino, ALB), since 1988 and 1994 respectively.

During monitoring activity, the yellow-bellied toads have been captured, photographed, sexed and measured. Photos of the ventral pattern have been used for individual identification during recaptures. On the first occurrence, newly metamorphosed and young individuals have been aged (0-1 years old), while a minimum estimated age of 2 years has been assigned, at the first capture, to the sexually matured toads (SVL > 30 mm) by considering our observations and literature.

Life tables, survival rates and the age-specific estimation of the minimum life expectancy of the populations have been calculated.

A total of 94 yellow bellied toads (46 males, 34 females, 14 immature) were identified at the site PCB during the period 1988-2009 and 102 yellow-bellied toads (38 males, 46 females, 18 young toads) were recorded at site ALB between 1994 and 2011. In both sites, 79.8% and 67.7% of the toads, respectively, have been recaptured at least once to a maximum of 18 years (2 males in PBC, 1 male and 1 female in ALB). Therefore these four toads were at least 20 years old at the last capture, but we can suppose they were even more aged (SVL > 40 mm on the first occurrence).

The estimated population size were 98 (95-108, PCB) and 112 (104-136, ALB), while the mean survival rates of adults were 82% (74-90%, PCB) and 83% (77-89%, ALB).

Habitat selection, reproductive ecology and body condition index (BCI) of *B. variegata* have been also evaluated. From the quite complete overlapping results of these long term studies, we can derive that longevity, high survival rates, high site fidelity together with other physiological adaptations, like the possibility for females to lay small clutches or skip the season, are the most important factors for the survival of these small and isolated populations. BCI is almost constant during adult life, supporting the idea that longevity is associated to good health and reproductive power. Coherently to this view, the estimated residual life expectancy only tends to decrease after the 15th year.

These long term studies can give important support information to the specific conservation action plans in Italy.