

Road traffic impact on *Salamandra salamandra*: rescue of larvae after the death of the mother

Raoul Manenti^{1*}, Gentile Francesco Ficetola^{1,2}, Fiorenza De Bernardi¹

Abstract. Several studies showed that traffic mortality has a negative impact on the abundance of many amphibian populations. The fire salamander (*Salamandra salamandra*) shows important breeding migrations. We investigated the traffic impact on *S. salamandra* in an area with increasing anthropic development, and we tested an unusual way of rescue: if we found killed females on roads, we collected the larvae found both on the road and inside the mother's body, and we put them in small aquariums. Nineteen percent of the larvae were still alive; after feeding them, 11.4% survived even 3 days after the injury. Larvae were released in creeks nearby the collection area or kept until metamorphosis and were then released. Overall, 14 larvae and 6 metamorphs were released in the wild. These observations suggest that larvae of *S. salamandra* can be rescued from inside the females as well as from the streets even after several hours after the death of their mothers.

Keywords. Amphibians, road, ecology, decline.

In the last years several studies showed that traffic mortality has significant negative impact on amphibian populations. The worldwide traffic increase is for sure a major cause of declines in amphibian populations, especially in areas with high human density (Fahrig et al., 1995). Several conservation actions are therefore used for the mitigation of the negative impact of roads, such as building structures facilitating safe passage (Woltz et al., 2008), and the periodical action of volunteers facilitating the crossing (Aresco, 2005). In this note we present and test an unusual way of rescue from traffic impact of the fire salamander *Salamandra salamandra*. The fire salamander is widespread Europe, and is quite abundant in several parts of its range. Adults inhabit wooded areas and breed in a variety of damp habitats, including streams, small ponds and springs (Griffiths, 1995; Manenti et al., 2009). When breeding occurs in running waters, larvae are associated to heterogeneous

and shallow streams, with rich macrobenthos communities characteristic of oligotrophic water, and surrounded by woodlands (Manenti et al., 2009). *Salamandra salamandra* shows high migratory activity that affects survival and demographic processes (Schmidt et al., 2007). Migratory movements often have a limited extent, nevertheless, in adults migration distances up to 500 are not uncommon (Glandt, 1986; Schulte et al., 2007). Road traffic can be therefore an important cause of mortality of adult salamanders. The mortality of pregnant females can have important consequences for recruitment and population persistence.

From 2007 to 2009, we surveyed adjacent roads of known *S. salamandra* breeding sites in an area with increasing anthropic development in Lombardy (Italy). Because of the conformation of road borders and because of the lack of volunteers, it was difficult to detect crossing salamanders. We rescued salamanders from crossing roads, or we found them killed by cars in 15 localities. Due to low detection probability, we rescued only 14 adults; we found several dead specimens, including 10 killed pregnant females.

In the case of pregnant females, all the larvae found both on the road around females, or inside their bodies were collected and maintained in small aquariums. Overall, we collected 184 larvae after their mother's killing. Nineteen percent of the larvae were alive, while

1 Dipartimento di Biologia, Università degli Studi di Milano.
Via Celoria 26, 20133 Milano Italy;
e-mail: raoul.manenti@unimi.it

2 Dipartimento di Scienze dell'Ambiente e del Territorio, Università degli Studi di Milano-Bicocca. Piazza della Scienza 1,
20126 Milano Italy

*Corresponding author

11.4 % still survived after three days. Larvae were then released in creeks nearby the collection area, or kept till metamorphosis and then released. Overall, 14 larvae and 6 metamorphs were released into the wild.

Our observations suggest that even after the death of the mother larvae found on the streets and within the oviduct of the mothers are still alive and can survive for several hours if surrounding humidity (e.g. due to rain) of the asphalt is high enough. By keeping rescued larvae for a short time (up to three days) in an aquarium or in other appropriate conditions they will be able to recover and to fulfil a “normal” metamorphosis. The rescue of such larvae can partially mitigate road impact where detecting and rescuing of adults is difficult. It can also be integrated with already existing activities of amphibians rescuing by traffic, when dead females of *S. salamandra* are found.

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