During recent years it has become apparent that the Netherlands host a considerable number of introduced populations of reptiles and amphibians (Creemers and van Delft, 2009). The distribution of several native species has been enlarged through deliberate introductions outside of historical species ranges, which were often found to originate from foreign source populations and represent alien subspecies. Expanding and reproducing populations of species which form no part of the country’s native herpetofauna are however also present, including (but not limited to) *Triturus carnifex* (Laurenti, 1768), *Elaphe schrenckii* Strauch 1873, *Rana dalmatina* Fitzinger in Bonaparte 1838 and several South-European *Pelophylax* taxa (Creemers and van Delft, 2009; Felix et al., 2012; Van de Koppel et al., 2012; van Delft et al., 2012). Hybridisation of *T. carnifex* with native *Triturus cristatus* (Laurenti, 1768) across an expanding area in the central Netherlands has led to an unfortunate case of genetic pollution, as the former successfully invades, hybridizes and eventually displaces populations of the latter (Meilink et al., 2015).

*Triturus marmoratus* (Latreille, 1800), a salamandrid species which is native to France and the Iberian Peninsula (Wielstra et al., 2014a), has hitherto not been listed among the introduced species in the Netherlands. A recent record of this species from the Dutch province of Drenthe motivated the authors to survey two ponds located in the municipality of Westerveld (Fig. 1A) on the 24th and 25th of May 2015. Taking into account the dangers associated with ecotourism in combination with the recent rise of several invasive pathogens (Kik et al., 2011; Martel et al., 2014) we refrain from providing exact locality data here, which is however available upon request. The concerning area consists of mixed forest fragments interspersed by small heathlands and several well-vegetated ponds, which were partially dried-out at the time of the visit. Most of the surrounding land is agricultural. Randomised walks along the edge of the ponds were performed at night, during which newts were located using flashlights. In both of the surveyed ponds we encountered newts, phenotypically attributable to the following species: adult *T. marmoratus* (total n = 5), as well as native *T. cristatus* (total n = 2) and *Lissotriton vulgaris* (Linnaeus 1758; total n = 7). Additionally, one pond yielded a single male *Ichthyosaura alpestris* (Laurenti 1768), a species of which natural occurrence in the province of Drenthe remains disputed (Creemers and van Delft, 2009). Based on their enlarged tail fins and the presence of dorsal crests and swollen cloacae in males, all encountered newts appeared to be in breeding condition. Several larvae of *T. marmoratus* were observed which were well-recognizable by their greenish dorsal colour and/or greenish blotches. In addition, one female newt (TL > 15 cm) was caught which was identified as a hybrid between *T. cristatus* and *T. marmoratus* based on the combination of vague green marbling on the dorsal side and restricted orange colouration interspersed by tiny white dots on the underside (e.g. Vallée, 1959; Arntzen and Wallis, 1991; Fig. 1B). Based on the above, we conclude that...
*T. marmoratus* has successfully established itself in the Netherlands and hybridises with native *T. cristatus* in its presumed area of introduction. Due to the limited time spent during the survey, the presence of other ponds nearby, and extensive aquatic vegetation which covered most of the ponds during our visit, it is likely that only a fraction of the actual newt population was observed.

In Central France, *T. cristatus* and *T. marmoratus* are well known to have formed a relatively broad, natural contact zone in which they locally hybridise if environmental conditions are suitable for both species (e.g. Arntzen and Wallis, 1991; Arntzen et al., 2009). In the Netherlands, a similar situation might exist, concluding from the enduring presence of both parental species and at least one large-sized, adult hybrid in the same water body. In contrast to the situation in France, the Dutch co-occurrence is not a natural result of limited niche overlap as evolutionarily established. Hybridisation between *T. cristatus* and invasive *T. marmoratus* in the Netherlands is undesirable, as the former is a threatened species which is listed as vulnerable on the Dutch Red List (Creemers and van Delft, 2009). It however has to be noted that only 3-4% of the individuals in French syntopic *T. cristatus* – *T. marmoratus* populations comprise F1 hybrids, while introgression is basically non-existent (Arntzen and Wallis, 1991). Significant genetic pollution of the local *T. cristatus* gene pool by *T. marmoratus* can therefore be considered as unlikely, which sets this case clearly apart from the introgression and displacement of local *T. cristatus* populations on the Dutch Veluwe by invasive *T. carnifex* (Meilink et al., 2015). Nevertheless, future surveys should aim at discovering to what extent introduced populations of *T. marmoratus* are currently present in the Dutch province of Drenthe and what impact the species may have on local ecosystems. The development of a recent framework in which a great number of markers specifically designed for the genus *Triturus* can be sequenced on a large scale using next-generation sequencing methods (Wielstra et al., 2014b) might be a particularly helpful tool to assess the effects of ongoing hybridisation.

**Figure 1.** A: Distribution of *Triturus cristatus* (red) and *Triturus marmoratus* (green) in north-western Europe. Both species occur together in the hatched area. The green dot signifies the Dutch invasive population of *T. marmoratus* in the municipality of Westerveld, of which the habitat is displayed on the inset (photo by Laura Tiemann). B: Ventral view of *T. marmoratus* (top, middle) and a hybrid *T. cristatus*-*T. marmoratus* (bottom) from the Netherlands (photos by Wouter Beukema).
Acknowledgements. Ben Wielstra pre-reviewed the manuscript. We thank Reptile, Amphibian & Fish Conservation Netherlands (RAVON) for supplying permits to handle amphibians in the field.

References


Figure 2. *Triturus marmoratus* (A, B, photos by Laura Tiemann) and a hybrid between *T. marmoratus* and *T. cristatus* (C, photo by Bobby Bok) from the municipality of Westerveld, Netherlands.


Mémoires de la Société zoologique de France 31: 1–95.


Accepted by Iris Starnberger