

## THE EFFECTS OF FLOOD ON AN ISOLATED POPULATION OF SAND LIZARDS (*LACERTA AGILIS* L.) IN WROCLAW (SW POLAND)

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**S**OUTHWESTERN Poland was flooded by the river Odra and its tributaries in July of 1997. Extensive areas were inundated for 3-4 weeks, with flood waters reaching 4-5 metres in depth. The flood resulted in changes within plant communities and the accumulation of lead and some other elements in plant tissues (Karczewska et al., 2000).

Ogielska et al. (1998) and Ogielska & Konieczny (1999) noted that some amphibians decreased in numbers and the tree frog (*Hyla arborea*) disappeared from one part of the city after the flood, but the reptilian populations remained at the same level. However, their observations are from non-isolated habitats, which allowed the animals to escape and return, and other observations suggest that a few reptilian species may have in fact vanished from some habitats. Maślak (1999) observed a decrease in the numbers of Common Lizards (*Lacerta vivipara*) from one almost completely isolated habitat in Wrocław (Wojnów, located near the present study area). Najbar (1998) reported an increase in the density of some amphibians, but a significant decrease in the numbers of Slow-worms (*Anguis fragilis*), Sand Lizards (*Lacerta agilis*), Common Lizards, and Smooth Snakes (*Coronella austriaca*) (listed in the order from the most to the least affected species).

The island Wyspa Opatowicka is situated in the eastern part of Wrocław and for about a century isolated from the mainland by the Odra River and one of its channels (Fig 1). It is covered by deciduous forest (in the northern part) and meadow, bordered by an embankment with a tree belt. The only possible migration route for the lizards is a bridge on the Odra river. However, the bridge is unlikely to be crossed by the lizards

because of its considerable length of 250 m and heavy pedestrian traffic in warm weather. In addition, the potential immigrants would have to cross the forest on their way to the meadow and no lizard has ever been observed on the opposite (mainland) bank. Thus the bridge may possibly serve as an emigration rather than an immigration route for the lizards. The footbridge over the channel, built on a sluice, does not seem to be passable for a lizard as its board has a 20 cm wide gap in the middle and its ends overhang the ground at a height of 15 cm.

The present study was conducted for four years (1997-2000). The lizards were captured along zigzag transects at least twice a week from May through September on warm, sunny days, at different times of day. The individuals were marked by toe-clipping (Ferner, 1979; Borczyk, 2000) and every capture was plotted on a map.

The lizards were common in the meadow and on the embankment before the flood. In 1996 it was possible to catch 20 individuals along a 100 metre stretch of the embankment (Robert Maślak, pers. comm.) and for some ten years I occasionally observed a dozen to twenty adult lizards within half an hour. Unfortunately, no precise data on the population density before the flood are available, but it seems nevertheless to have been high.

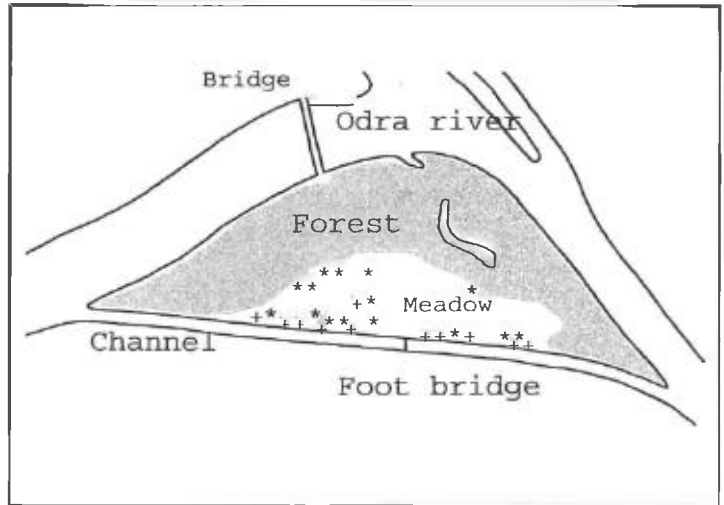
A significant decrease in the numbers of lizards on the island was observed after the flood. Only two yearling individuals were found and marked there in 1998. Six more lizards, one hatchling, one after first hibernation, three adult males, and one adult female, were marked in 1999. Eighteen new individuals, 11 hatchlings, four males, and three females were in marked in 2000. Altogether, 26 lizards were recorded after the flood.

Nearly all lizards (25) were captured either near the forest or on the embankment. Only one male, which had its hole near an isolated tree, was caught in the middle of the meadow. The distribution of animals after the flood (Fig. 1) suggests that those which survived could only have done so by climbing trees. Young individuals apparently stood the greatest chance of survival, probably because small lizards may be more difficult for predators to find, or are capable of hiding more effectively in bark crevices and climbing trees than adults. I observed young lizards

escape into trees more often and also climb higher than the adults. In the western part of the island the lizards are much more common than in the eastern, since the flood wave pushed the escaping animals westwards; the animals in the western and northern parts of the island were driven towards the trees where they could survive, while in the eastern part they were driven away from the trees.

Atypically coloured lizards were more common on the island after the flood than in other populations from Poland (Maślak, 2000; Borczyk unpublished). The most common colour anomaly was the erythronotus. In 1999 this form constituted 20% of the population. In other populations from Poland the percentages of erythronotus amounted to 2.2% (Kurczewski, 1999), 6.2% (Maślak, 2000), 14% (Pietrzak et al., 1999). Also, two very light-coloured females were captured after the flood. Colour mutants are common in isolated populations (Strijbosch & Verhoeven, 1997; Strijbosch, 1998; Barret, 1999; Maslak, 1999, 2000).

A significant decrease in the numbers of lizards after the flood suggests that both genetic drift and founder effect may have affected the island population. Because the drowning of lizards was probably random, the rare mutants could (1) decrease their frequencies or disappear, (2) maintain their frequencies, or (3) increase their frequencies (Grant, 1991). The high proportion of



**Figure 1.**

\* Captures and sightings of the lizards after the flood.  
+ Single trees.

atypically coloured animals in the island population speaks in favour of the third scenario, which exemplifies a typical bottleneck effect. Secondly, the very low number of lizards that survived the flood, and the apparent effectiveness of rivers as barriers preventing gene flow between lizard populations (Pounds & Jackson, 1981), are both conducive to the founder effect.

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