ELEVEN YEARS OF MONITORING: AMPHIBIAN POPULATIONS IN AN AGRICULTURAL LANDSCAPE NEAR BONN (GERMANY)

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Keywords: Amphibians, monitoring, long-term study, population dynamics, *Bufo bufo*, *Rana dalmatina*, *Triturus alpestris*.

INTRODUCTION

Within the project "development of amphibian habitats in an agricultural landscape" population dynamics of seven amphibian species in an agricultural landscape near Bonn (Northrhine-Westphalia, Germany) have been surveyed during eleven years (1989 – 1995, 2000 – 2003). Here, we present preliminary results on the population dynamics of three species at two ponds from 1989 till 2003, including and continuing the results of Schäfer (1993) and Kneitz (1998).

Central aims of the project are:

- Monitoring of the amphibian fauna in a typical middle-European landscape;
- Knowledge on population ecology and population genetics of native amphibian species (population sizes and dynamics including sex ratios and reproductive output, return rates, long-term captures and migration based on genetic data);
- Scientific contributions for species and nature conservation in Germany.

Major questions are:

- What do the long-term population dynamics look like?
- Which conditions have to be met for persisting and self-maintaining populations?
- Are there clear differences between natural and artificial ponds?

STUDY SITE AND METHODS

The study area is located 20 km south of Bonn (Germany). It represents a typical middle-European agricultural area with acres, meadows, small forests and villages. In this landscape five breeding ponds were examined, which were situated in distances between 300 and 1800 m. Two of them have a natural origin, three waterbodies (with waterproofing foil) have been build artificially to support the amphibian populations in this cultural influenced area. These five breeding ponds were enclosed by permanent drift fences with pitfall traps in order to record abundance and migration of all occurring amphibians throughout the whole year.

To mark the specimen, we used two different methods: Either toe-clipping or implantation of passive integrated transponders (PIT) for the anurans and only toe-clipping for newts.

RESULTS

Triturus alpestris colonized the new ponds within a few years and was present in all five study ponds up to the last study year 2003. In the beginning, the number of adult individuals in the whole pond system ranged 455 specimens (1989), increased till 1995 up to 3706 individuals and stagnated in the last three years between 2755 and 4625 animals. In the artificial ponds the population developed from 14 specimens more or less continuously to 3326 specimens till the year 2001, but stagnated as well in 2002 (1866 individuals) and 2003 (1656 individuals). Figure 1 for example shows the dynamics in pond 1. In the same

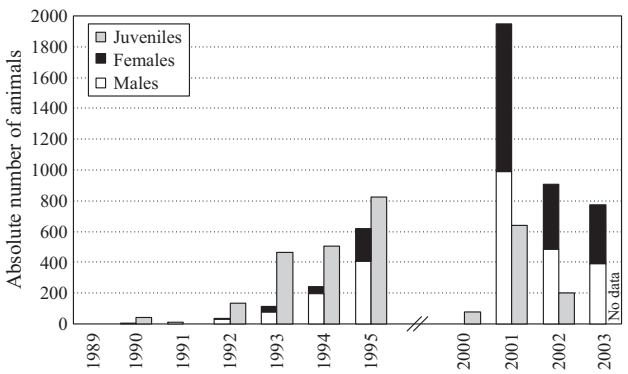

Fig. 1. Development of breeding population of *Triturus alpestris* at pond 1.

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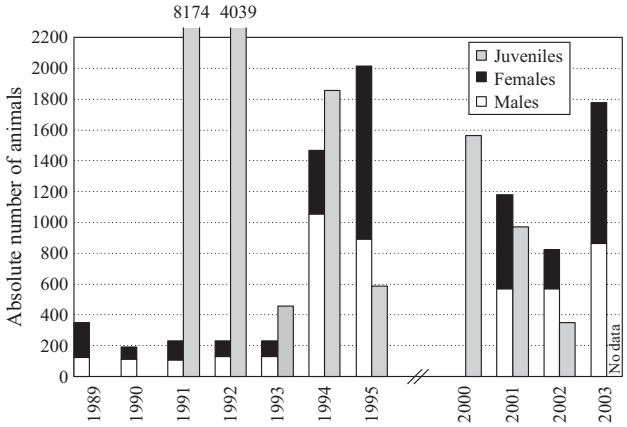

Fig. 2. Development of breeding population of *Triturus alpestris* at pond 3.

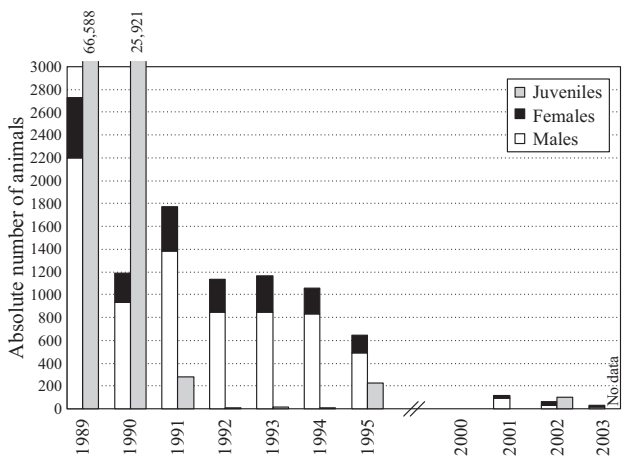

Fig. 3. Development of breeding population of *Bufo bufo* at pond 3.

period annual reproductive success ranged from 0 up to 8174 (year 1991 in pond 3, see Fig. 2).

Bufo bufo in contrast settled only temporarily in all waterbodies; in our study area it showed the most irregular dynamics of all species under concern. The breeding population at pond 3 consisted of 2200 males and 530 females in 1989 (Fig. 3). Reproduction in that year was very successful with 66,000 juveniles. Due to changes in habitat conditions (pond drying, strong decrease of fish population, increasing populations of newts and other potential predators) there were heavy losses in population size of the common toad. Currently, also the artificial pond 4 was regularly used as spawning site with remarkable reproduction, however its success was irregular (Fig. 4). Meanwhile pond 3, representing the former main breeding site, had lost importance. Adult numbers decreased extremely to 15 males and 19 females in 2003. Even in the whole

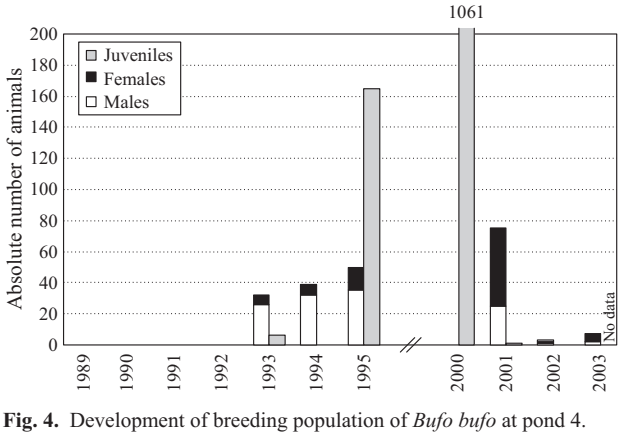

Fig. 4. Development of breeding population of *Bufo bufo* at pond 4.

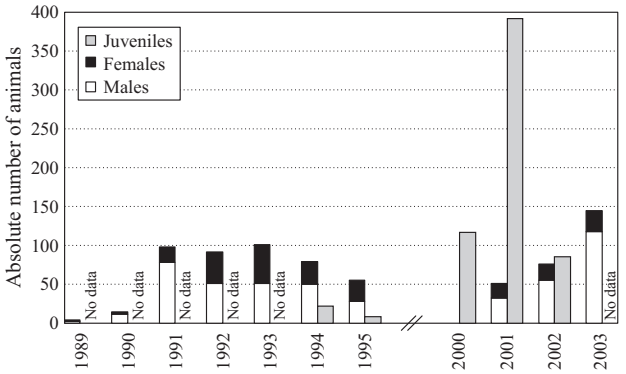

Fig. 5. Development of breeding population of *Rana dalmatina* at pond 2.

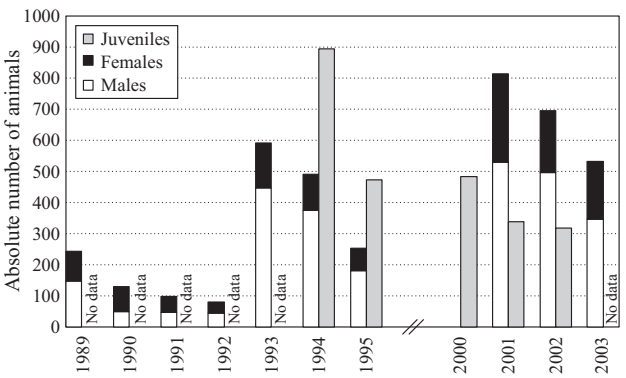

Fig. 6. Development of breeding population of *Rana dalmatina* at pond 3.

study area population size of adults during breeding period in 2003 did not exceed 37 males and 32 females.

Rana dalmatina occurred in all ponds but showed remarkable fluctuations. After colonization of the artificial ponds the spawning populations increased within four

years from 4 up to 138 adults in these waterbodies (for example pond 2 in Fig. 5). Nevertheless, since the year 2000 only two ponds (pond 2 at the edge of the wood and pond 3 situated in arable land; see Fig. 6) showed higher numbers of adults (i.e., far more than ten specimens per sex) and regular reproductive output. In three ponds only single individuals (25 or less per year) could be observed in the last three years, but in some years high reproductive output took place anyway.

In all species no positive correlation between number of adults and juveniles could be observed.

CONCLUSIONS

Especially for newts the population size in the pond system grew according to the creation of additional ponds. In contrast, for *Bufo bufo* the water system seemed to be only temporary convenient whereas concurrence between species (especially newts) and/or predation may be important negative factors. Even though *Rana dalmatina* adopted only some of the new ponds, its population was strengthened and enlarged by their creation.

General conclusions for amphibian populations are:

- Species composition, population size and reproductive output can change within a few years.
- Reproductive success and size of the spawning population are not correlated; a phenomenon, which is characteristic for animal species with large numbers of eggs.
- Population dynamics differ between species. Given the total time of 14 years in our study, the patterns rather look like an irregular developmental process than periodical dynamics which can not yet be recognized.
- There are no obvious differences between natural and artificial ponds with respect to species composition and reproduction rates.
- Artificial ponds in an agricultural landscape can be inhabited by amphibians for long time spans. They are useful to strengthen and interconnect amphibian populations even throughout intensive arable landscapes.

Acknowledgments. This project is financially supported as a "testing and development project" by the Federal Agency for Nature Conservation (BfN) and the Federal Environment Ministry (BMU). Many thanks we would like to say to all people, who helped recording masses of data in the field for all the years. Especially we thank our colleagues Gregor Bosbach, Regine Damaschek, Anja Dissanayake, Ruth Rottscheidt, Anja Sampels, Dr. David Tarkhnishvili, and Meike Thomas. Also we thank Dr. Stephan Kneitz for giving us data from 1991 till 1995.

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