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Urban development and the natterjack toad (*Bufo calamita*) - implementation of the Habitats Directive in The Netherlands

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Abstract. *Bufo calamita* is fairly common in The Netherlands and listed on Annex IV of the Habitats Directive. The species and its habitat are strictly protected in The Netherlands. Urban development regularly conflicts with the presence of the species. The implementation of compensation measures in a large-scale project is discussed. For small-scale projects within urban areas the strict interpretation of the Habitats Directive is a bottleneck. This led to the general practice of preventing the species to benefit from temporal situations. A set of practical measures for handling local urban populations is proposed. The set aims to protect the natterjack toad in its most critical stages when construction works are carried out. The potential for a local population sink should be taken into account when deciding to accept or to prevent animals using temporal habitats.

Introduction

The natterjack toad (*Bufo calamita*) is listed at Annex IV of the European Habitats Directive (HD). It is a strictly protected species under the European and national legislation. *Bufo calamita* is rather common in The Netherlands (Bergmans and Zuiderwijk, 1986; Hom et al., 1996). Its natural habitats are found in the coastal dunes, riparian areas and heath land. In The Netherlands it also occurs in polder areas with grassland, arable land or glasshouses and in urban areas. The presence of local populations in urban areas is known, but is mainly documented for Amsterdam (Boomsma and Arntzen, 1985; Melchers and Timmermans, 1991). In The Netherlands urban development areas in general have large surfaces of bare sand as a foundation for constructing buildings. *Bufo calamita*, as a pioneer species, can quickly colonize urban development areas. It benefits from new created ditches and temporal waters that, after rainy periods, remain in local terrain depressions.

Urban development projects often conflict with the strict prohibitions of the HD due to the presence of *B. calamita*. The problems can occur at the planning phase when the species is known to be present in the plan area. But also the colonisation of a project area, after the construction work started, has caused procedural problems and project delays. The latter situations raise the question how to deal with protected species in temporal habitats as a result of land development? Taking measures to prevent colonisation is common practice. But preventing colonisation might not be preferable for species that benefit from temporal situations though it offers better procedural prospects for the project executants. Accepting the colonisation of protected species involves the risk of project delay due to legal procedures, the need for establishing mitigation or compensation plans and the need for field surveys. This results in the dilemma that nature legislation discourages the potential for temporal habitat (Woldendorp and Backes, 2005).

The presence in urban area involves mortality risks of individuals due to local traffic and construction activities. This can cause temporal breeding sites that lack connectivity to suitable terrestrial habitat to act as population sinks. Especially high mortality of juveniles during emigration can be a bottleneck (Rothermel, 2004).

This paper presents the result of a compensation project for *Bufo calamita* and proposes a list of practical measures for urban development areas.

Legislation

Species listed on Annex IV of the HD are strict protected in their natural range. It is prohibited to undertake actions that have a negative effect for their populations. The prohibitions defined in Article 12 of the HD are: all forms of deliberate capture or killing; deliberate disturbance, particularly during the reproduction season, hibernation and migration; deliberate destruction or taking of eggs from the wild; deterioration or destruction of breeding sites or resting places.

For development projects derogation of Article 12 is accepted: (1) provided that there is no satisfactory alternative; (2) not detrimental to the favourable conservation status in their natural range; (3) in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment.

The HD has a strict implementation in the Dutch legislation. In addition the principle of 'careful handling' is defined; anyone does, within reasonable limits, what is necessary to prevent damage to protected species. For *Bufo calamita* reproduction and hibernation

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sites are protected. In case of damage to reproduction waters, hibernation sites or killing of individual animals the derogation criteria should be applied. There are several examples of large-scale projects were the three criteria are valid. From criteria 2 follows that within those projects possible negative effects are mitigated and compensated. For small-scale projects the third criteria is often not valid and derogation is not accepted.

Development of business area Boekelermeer

Boekelermeer is a polder area in the western part of The Netherlands. The polder is assigned for business development to increase the regional employment. The polder area is 200 hectare and shared by three communities. The city of Alkmaar has the largest interest in the development of the polder. Historical data from the seventies showed that *Bufo calamita* occurred in the polder in low densities (RAVON unpublished data). A field survey in 2001 confirmed that *B. calamita* was still present in the polder. This implied that development of the polder leads to violation of the prohibitions defined in the HD. Because criteria 1 and 3 can be applied a project and compensation plan has been drawn up for the local Municipality (Adrichem, 2005; Van Eekelen and Smit, 2001) to maintain the Favourable Conservation Status of *B. calamita.* This plan includes other (protected) species that are present in the polder as flowers, common amphibian species, small mammals and fish. The Ministry of Agriculture, Nature and Food Quality provided dispensation in 2002 under the condition that all proposed measures in the plan would be put into practice and the results are monitored for a five-years period. The same year the construction work started. The total project period is expected to cover 10 years.

Compensation is done within the plan area and should be realised before the population in the polder is affected. The available surface for nature reduces from 200 hectare of agricultural land to 45 hectare of 'green infrastructure'. Therefore the compensation aims to improve the quality of the remaining habitat.

The project will be developed in phases. The area where most activity of calling males of *B. calamita* were observed, remains undisturbed until the compensation area is realised. This allows for spontaneous colonisation of the new created area. Colonisation is preferred to translocation of individuals, which is often unsuccessful (Sinsch, 1998).

When planning compensation for Boekelermeer there was little known about the ecology of *B. calamita* in polder areas. The bare land after harvest and fresh cleaned ditches can be understood as equivalents of pioneer habitat. But *B. calamita* also occurs in grassland polders where pioneer stages are lacking. Because of this knowledge gap the habitat of coastal dunes, where the species is abundant, was used as a reference for *B. calamita* habitat rather than the original polder habitat. In general the original habitat can be expected to give the best reference. But because the future business area would alter the landscape completely, the artificial 'dune like' habitat is considered as acceptable. The green infrastructure is designed with a 'dry' *B. calamita* core area situated in the business area and a 'wet' zone optimised for species of grassland. The 'wet' zone is situated along the polder edge where it is in compliance with the adjacent landscape. A pilot of 1,5 ha of dry area is created in 2002. The soil was topped with sand deposits and 3 concrete ponds are created as proposed by Beebee and Denton (2001). Each pond is accompanied by a 20 meter long and 1 meter high wall of bricks covered with sand to provides shelter for vulnerable juveniles within short distance of the breeding site. Though *B. calamita* is expected to be able to colonise the pilot area within a few years (Sinsch, 1998), in October 2003 20 juveniles were collected outside the pilot area and translocated to the shelter walls. Translocation in October was expected to stimulate hibernation in the pilot area. In 2004 no activity of the species was observed in the pilot area. The first calling males were observed in 2005. That year we counted in 1 pond 5 egg strings, the larvae developed successfully (Smit, 2006). In spring 2006, about 300 subadults were counted under stones of the shelter walls. An additional area of 12 ha is created in 2004 and colonised by *B. calamita* in 2005.

Faunatunnels (ACO Pro) with guiding walls to prevent road access are realised where roads dissect the green infrastructure. The separate elements of the green

Figure 1. Artificial pond at Boekelermeer; habitat of *Bufo calamita.*

infrastructure are interconnected and connect with the landscape surrounding Boekelermeer.

Future prospects: Successful reproduction and hibernation indicates that the new created 'core' area is accepted by *B. calamita*. The area is used by a variety of birds, small mammals and plants. The present community is typical for pioneer habitat. The next years will show if the population of *B. calamita* will be sustainable. When construction starts in the old core area, translocation of the remaining local individuals will become inevitable (Marsh and Trenham, 2004). We expect translocation to new shelter sites short before hibernation to be the best approach.

Colonisation in urban area

There are several examples in The Netherlands of *Bufo calamita* colonising urban development area. It recently invaded Maasvlakte, the extensive expansion area of the Port of Rotterdam, from the coastal dunes. It invades sandy project areas of Amsterdam Harbour. At the city of Culemborg, near the river Lek, *B. calamita* is present for several years in the expanding western district. Its natural habitat is the floodplains along the river. *Bufo calamita* did not occur in these project areas before the construction activities started.

The continuing development of Maasvlakte will result in loss of recently colonised reproduction sites which conflicts with the legal prohibitions. A compensation plan has been drawn to facilitate legal procedures. This includes the creation of sustainable reproduction sites (core breeding sites) near terrestrial habitat and a set of guidelines for handling temporal waters and potential shelter sites.

Since the start of developing the western district in Culemborg no conservation measures are undertaken for flora either fauna. In the agricultural land that is used for urbanisation *B. calamita* is not present. It appears in new plots short after the first earthwork has been carried out en new drains are constructed. In the years after finishing construction activities it disappears again. The overall result is a population that shifts with the border of the expanding district. In April 2005, *B. calamita* became active in the river floodplain at 500 meter distance of the western district. In May 15, calling males where observed in a new plot in 1 of 4 ditches that were created in 2004. In May the number grew to a maximum of 25 males and moved to the other ditches and to puddles of rainwater on bare plots. Egg strings were found at two ditches next to bare plots were no construction work was yet carried out. In May and June these ditches contained thousands of larvae. The plots are bare with little debris and do not provide cover for fresh metamorphs. *B. calamita* metamorphs can leave patches used for breeding sites within a few weeks after emergence. Even small toadlets can migrate distances of several hundred of meters within a short time (Sinsch, 1997; Stevens et al., 2004). The bare soil and lack of cover was expected tot facilitate quick movements of toadlets (Stevens et al., 2004). The toadlets were considered to be most vulnerable the first weeks after emergence. When construction work starts in summertime, this could affect the fresh metamorphosed juveniles. But the work was not expected to start before the end of 2005. Therefore, it was recommended to postpone the common practise of mechanical removal of debris from the ditches before the summer holiday, to the end of August when most larvae will be metamorphosed. In August, juveniles were considered to be enough mobile to find suitable land habitat in adjacent areas and were expected to have left the direct vicinity of the water. Thus, no recommendations were given considering metamorphs or juveniles. In August, first juveniles were reported from the gardens of surrounding buildings.

Discussion

Metapopulation theory is an important concept for amphibian conservation. Marsh and Trenham (2000) emphasize the balance between metapopulation considerations and local habitat quality. Habitat connectivity is considered to play a key role in regional viability of amphibian populations. The connectivity is predominantly effected through juvenile dispersal (Cushman, 2006). Breeding sites that lack connectivity to suitable terrestrial habitat may be population sinks due to high mortality of juveniles (Rothermel, 2004). Therefore the design of compensation areas should take into account the quality of breeding sites, the location of these sites close to terrestrial habitat and measures to prevent fragmentation from surrounding populations.

The population size of *B. calamita* in the Boekelermeer was unknown. Estimations in 2001 varied from 100 to 400 individuals. Also knowledge of the effective size of habitat used by the population was lacking. An additional survey carried out in 2003 revealed a core population in the centre of the polder at an area of 6 hectare of a pot flower company. In 2005, a total number of 165 adults were counted during one night in a ditch close to the pot flower company. This was the highest number of individuals observed in the polder. This six hectare area, a glass house for horticulture and a high density of shelter sites, seems to serve as (artificial) habitat for the major part of the polder population. Therefore, the 45 hectare for compensation in Boekelermeer can be considered to be sufficient for a sustaining *B. calamita* population, taking into account that not all the area is optimal habitat and special consideration is given to prevent isolation of the Boekelermeer population.

The compensation area is a popular strolling area for business people in lunchtime. This shows that compensation measures do not necessarily conflict with the public function of green infrastructure in urban areas.

When sink populations can be avoided the common practice of preventing *B. calamita* to benefit from temporal situations in urban development is not desirable and unnecessary. The history of *B. calamita* in the urban development area of Culemborg, shows that it can survive in an area with ongoing construction activities. It appears to benefit from temporal situations, even when no conservation measures are considered. The species seems well adapted to the dynamic situations in urban development areas.

Temporal habitat can support local core populations, but the close distance to natural breeding sites deserves attention. In compliance with the legal principle of 'careful handling' a set of recommendations can be given to protect *B. calamita* in its most critical stages. Natural development of larvae and save migration of juveniles to terrestrial habitat is important to prevent temporal habitat to become population sinks. When natural development and save migration cannot be guaranteed the principle of 'careful handling' requires preventing individuals to access temporal habitat. The following recommendations are proposed: (1) if no work is planned next to water with reproduction of *B. calamita* the water remains undisturbed. Removing of debris is postponed until there are no more larvae or metamorphs present in the water. In general there are no actions necessary when no construction activity is planned between April and August; (2) if work is carried out next to water with egg strings or larvae the water is fenced in, combined with pitfalls for collecting fresh juveniles. The juveniles are translocated to a safer place outside the work area; (3) before construction work starts, debris is manually removed and checked for sheltering animals. Individuals are moved outside the work area; (4) piles of debris or construction material, as potential hibernation sites, are not cleared between October – March. Piles with stock material, which is regular manipulated, are preferably kept on beams. This way they are less suitable as sheltering sites.

It is noted that for translocation of egg strings, larvae, juveniles and adults formal dispensation from the prohibitions of the legislation is required.

The proposed recommendations are intended for handling local urban populations. The strict interpretation of the HD requires that anyone should request for formal dispensation for all actions that violate the prohibitions of the directive. This includes the removal of animals from a construction site or the removal of temporal shelters or breeding sites. The need for formal dispensation often result in project delays. Woldendorp and Backes (2005) therefore propose a definition of 'temporal nature' and a dispensation or an exempt from the prohibitions for affecting temporal habitat. In case of *B. calamita*, the proposed recommendations combined with an exempt from the prohibitions for 'temporal nature' in development projects serve the conservation goal. If habitat with viable *B. calamita* populations is affected, dispensation will be required and implementing compensation in the new urban landscape is a realistic option. We can allow the natterjack toad to survive in urban areas.

References

Adrichem, M. (2005): Rugstreeppadden gered in de Boekelermeer. Groen **61**: 11-17.

Beebee, T., Denton, J. (2001): The Natterjack Toad Conservation Handbook. English Nature, Countryside Counsil For Wales.

Bergmans, W., Zuiderwijk, A. (1986): Atlas van de Nederlandse Amfibieën en Reptielen en hun bedreiging. KNNV, Hoogwoud.

Boomsma, J.J., Arntzen, J.W. (1985): Abundance, growth and feeding of natterjack toads (*Bufo calamita*) in a 4-year-old artificial habitat. Journal of Applied Ecology **22**: 395-405.

Cushman, S. A. (2006): Effects of habitat loss and fragmentation on amphibians: A review and prospectus. Biological Conservation **128**: 231–240.

Hom, C.C., Lina, P.H.C., Ommering, G. Van, Creemers, R.C.M., Lenders, H.J.R. (1996): Bedreigde en kwetsbare reptielen en amfibieën in Nederland. Toelichting op de Rode Lijst. IKC Natuurbeheer, Wageningen.

Marsh, D.M., and Trenham, P.C. (2000): Metapopulation dynamics and amphibian conservation. Conservation Biolologie **15**: 40-49.

Melchers, M., Timmermans, G. (1991): Haring in 't IJ. De verborgen dierenwereld van Amsterdam. Stadsdrukkerij Amsterdam, Amsterdam.

Rothermel, B.B. (2004): Migratory success of juveniles: a potential constraint on connectivity for pond-breeding amphibians. Ecological Applications **14**: 1535–1546.

Sinsch, U. (1997): Postmetamorphic dispersal and recruitment of first breeders in a Bufo calamita-metapopulation. Oecologia **112**: 42-47.

Sinsch, U. (1998): Biologie und Ökologie der Kreuzkröte (*Bufo calamita*). Laurenti Verlag, Bochum.

Smit, G. (2006): Succes voor de rugstreeppad in Boekelermeer Zuid. Groen **62**: 18–23.

Stevens, V. M., Polus, E., Wesselingh, R. A., Schtickzelle, N., Baguette, M. (2004): Quantifying functional connectivity: experimental evidence for patch-specific resistance in the Natterjack toad (*Bufo calamita*). Landscape Ecology **19**: 829–842.

Van Eekelen, R., Smit, G.F.J. (2001): Compensatie natuurwaarden Boekelermeer Zuid. Compensatie - en projectplan in het kader van de ontwikkeling van een bedrijventerrein. Rapport 01-108. Bureau Waardenburg bv, Culemborg / Municipality of Alkmaar.

Woldendorp, H.E., Backes, C. (2005): Natuurontwikkeling door tijdelijke natuur? Journaal Flora en fauna **7**: 117–175.