Knee-tagging - a new marking technique for anurans

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Abstract. From 1979 to 1987 637 common frogs *Rana temporaria* have been marked by knee-tagging in a population in east-central Sweden. A small coloured and numbered plastic tag is tied to the knee with a stretchable thread allowing for limb growth. The loss rate of the tags after one year was estimated to be less than 10%. Properly applied tags have lasted for at least four years.

Introduction

Much data of great interest to behavioural ecology have emanated from studies of anurans (Wells, 1977a, b). The use of marking techniques allowing the recognition of individuals or cohorts has been crucial (see Ferner, 1979, for a review). The most widely used techniques so far are probably toe-clipping and waist bands (George, 1940; Martof, 1953; Emlen, 1968). Marking techniques less frequently used include skin branding and recording of individual colouring patterns (Clark, 1971; Hagström, 1973; Daugherty, 1976; Arak, 1983). Toe-clipping frequently causes blood loss, and finger tips as well as skin heal or even regenerate (Noble, 1954; Clark, 1971; personal observations). Further, toe-clipping is likely to lower the survival of the frogs marked (Clarke, 1972). Waist bands may increase conspicuousness to predators.

Here, I present a new marking technique for anurans. When correctly used, it may be superior to those mentioned above. Its main advantages are simplicity, long life, lack of injurious effects and inconspicuousness to predators. The method has been used with excellent results for eight years in a study of the common frog *Rana temporaria* in Sweden.

Material and methods

Knee-tagging may be used on any anuran whose knee region is distinctly narrower than its upper and lower leg. I tag frogs with FTF-69 Fingerling and FTSL-73 Streamer tags (Floy-Tag & Manufacturing Inc., P.O. Box 5357, 4616 Union Bay Place N.E., Seattle, Wa., 98105, U.S.A.). The former is a 5 mm oblong plastic plate. The
latter is of thin soft plastic, shortened in length to show the last three digits only. Both
tags were originally designed for fish. Any other small, inconspicuous and durable tag
that will not rip from its attaching thread will of course do. I used a vinyl thread
(diameter 0.5 mm) for attachment. The thread must be a fabric that will stretch as the
limb grows. The only other equipment required is a pair of scissors for cutting the ends
of the thread after application.

For convenient field use, I put each tag on an adjustable loop, and secure the ends of
the thread with an overhand knot. I then slide the loop over the foot of the frog and up
along the leg, and apply the tag closely below the knee as tightly as possible without
causing constriction to the joint or the vessels (fig. 1). The free ends of the thread are
tied to fix the diameter of the loop. A tightness of the thread which barely allows
the tag to be moved around the knee is appropriate for *Rana temporaria*. If the tag and
the thread can be slid down more than one third of the length of the tibia, it needs
tightening. The optimal degree of tightness varies between species, depending on skin
softness and muscle width of the lower leg. I recommend users to practice this in the
laboratory before any large-scale tagging is undertaken in the field. Tying is easier and
faster with a needle at one end of the thread. After tying, cut the free ends of the thread
2-4 mm from the knot. With a little practice the marking of one frog is a one-minute
operation for one person.

It is important to the long-term performance of knee-tags that durable knots are
used. Care must also be taken not to over-stretch vinyl threads while tying. Otherwise,
they may break more easily and cause tag loss.

The size of tags used normally does not permit individual recognition of frogs at long
distances. In breeding congregations, however, the use of different tag colours and
right/left leg application give a fair number of combinations for long-distance iden-
tification.

**Results and discussion**

From 1979 to 1987, I marked a total of 637 adult *Rana temporaria* by knee-tagging in a
breeding pond in Umeå in east-central Sweden (63°50′N, 20°15′E).

To estimate tag loss, a total of 303 frogs tagged in 1979, 1986 and 1987 were also
marked by toe-clipping. Loss rate of tags during the first month was generally low
(3-8%); it was somewhat higher during the following eleven months (13-14%) (table
1). Total loss rate after one year decreased from 15% in frogs marked in 1979 to 10%
in those marked in 1986.

Tag loss is caused mainly by imperfect application. As my tying and tightening
techniques have improved, loss rate has decreased during the time of the study. With
proper application, less than 10% of the knee-tagged frogs should lose their tags during
the first year.

The long-term performance of the knee tag also depends on the quality of the at-
taching thread. If exposed to sunlight for prolonged periods, vinyl fabrics may become
brittle and eventually break. However, the vinyl thread to which the tags were attached at delivery was in excellent condition in the 120 frogs which were recaptured after one year. This was also true for the 40 frogs recaptured after two years. However, I observed colour change and brittleness of the vinyl in three of the frogs recaptured after three (n = 8) and four (n = 2) years. Students of diurnal species should thus consider the durability of the thread very carefully.

The frogs appear to be unaffected by the knee tags. I observed no change in behaviour; the frogs resumed their migration or breeding activities as soon as they were released after tagging. In the first study season, tightly applied threads cut and abraded frog skin. Such injuries were virtually eliminated in the following years as I came to know the proper degree of tightening. In knee-tagging, caution must be taken to avoid rough thread fabrics that cut or abrade the soft amphibian skin.

The ideal marking method must not increase the risk of predation in marked animals. For knee-tagging, no rigorous test of this has been made. The size and the position of fresh knee-tags, however, make them relatively inconspicuous; to the predator’s eye they are definitely less conspicuous than waist bands. After the first hibernation the tags are not visible at a distance because of mud and algae adhering to them. Hence, I feel confident to say that knee-tagging is a marking method which does not affect the survival of the frogs markedly.

I wish to stress that only adult frogs have been marked in this study. First-year and second-year frogs whose knee widths will increase considerably with general body growth may pose a special problem. For these, a very stretchable and durable thread must be used.

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References


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Figure 1. One of 637 knee-tagged common frogs Rana temporaria. The FTF-69 Fingerling tag is applied below the knee joint by simple tying. A stretchable vinyl thread allows for limb growth. Tags last for up to four years with a loss rate of less than 10% during the first twelve months.