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To bait or not to bait: it depends on the context

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Passive methods for sampling amphibians have been a well-established routine for long (Willson & Gibbons 2009). Bottle traps, funnel traps, and fish traps have proven to be effective, cheap and non-invasive methods for sampling amphibians under various environmental conditions (Griffiths 1985, Heyer et al. 1994, Dervo et al. 2014). Traps are usually not baited and rely on the spontaneity of newts to enter them. In one study, traps furnished with a light source yielded more captures than control traps without it (Grayson & Roe 2007), but another study found no difference between light-baited and unlit traps (Kröpfli et al. 2010). In a recent paper, Baker (2013) tested the hypothesis that traps baited with small cubes of stewing steak captured more individuals of *Lissotriton vulgaris* (Linnaeus, 1758) and *Triturus cristatus* (Laurenti, 1768) than bare traps. The author found clear support for this hypothesis, thus suggesting that baited traps are useful when sampling newts.

Even though the study by Baker (2013) tested 125 pairs of traps (baited and not baited) in seven ponds over seven years, not one single bycatch was reported. We define bycatch as all animals that could be casually trapped but are not the target species of a study (Hall 1996). It is reasonable to assume that syntopic small animals that rely upon chemical cues for foraging, may be lured to, and trapped in, baited traps. For example, the grass snake *Natrix natrix* (Linnaeus, 1758), a species that is widespread across Europe and predates upon amphibians and from which scavenging behaviour has been reported in the literature for this species (Ayres 2012), might be lured to traps containing possible prey items. Some invertebrates also predate upon amphibians, like water beetles (Lanza et al. 2007), and they rely on chemical and visual cues to find prey (Hodgson 1953, and references herein). If amphibian predators are present in the study area, as it is often the case (authors' unpubl. obs.), traps baited with small pieces of steak may attract scavengers, like some snakes and beetles (Ayres 2012). In such a case, the presence of bait could lead to unexpected results. We actually expect that the presence of predators inside traps may discourage amphibians from entering them. Moreover, if a predator enters the trap when some amphibians are already trapped, it could attempt to predate upon them. In such cases, the study results would likely be distorted, and therefore great caution should be exercised when planning a sampling protocol.

We tested the hypothesis that in a habitat with both amphibians, especially newts, and their predators, baited traps do not yield more captures because they will also attract predators like snakes and water beetles.

We selected a pond in the Groane Regional Park (Lombardy, northern Italy, 45°38' N, 9°6' E), in an area with partial anthropogenic disturbance. The pond has a surface area of approximately 400 m², but it is subject to seasonal fluctuations. The pond contains no fish and represents the most important site for amphibian reproduction in the area (Gatti & Sannolo 2014). Two newt species, *Lissotriton vulgaris* and *Triturus carnifex* and the anurans *Rana dalmatina* (Fitzinger in Bonaparte, 1839) *Rana latastei* Boulenger, 1879, *Pelophylax* kl. *esculentus* (Linnaeus, 1758), and *Hyla intermedia* Boulenger, 1882 reproduce in this pond.

We selected a period during which the two newts species are present in the pond, although *L. vulgaris* was already leaving it. By surveying the area in the same period the previous year, we verified that *N. natrix* and several species of Dytiscidae (Insecta: Coleoptera) were also present at the time of the study. On 10 May 2014, we set up six cylindrical funnel traps in the water along the shore of the pond. Traps were hand-made from PVC netting (50 × 21 cm; 3 mm mesh size; 175 g total weight), fitted with six funnels (10 cm external Ø, 3 cm internal Ø; Fig. 1). Three traps were baited with a small piece of ground beef (~5 g)

each, and the other three were not baited. We placed the traps at least 5 m from each other and alternated the baited traps with the not baited traps in the manner of Baker (2013). The traps were placed two hours before sunset and retrieved two hours after dawn. For each trap, we recorded the species, the number of specimens, and the sex of every trapped animal. Specimens were afterwards released in the exact place of capture.

The results of the test are summarized in Table 1. The two experimental conditions yielded different numbers of captures ($\chi^2 = 15.13$, $P < 0.05$, $df = 4$). In particular, the baitless traps yielded more than double the number of individuals of *T. carnifex* than baited traps. Moreover, every baited trap contained an individual of *N. natrix*. Water beetles and tadpoles were captured more often in the baited traps than in the baitless traps. One of the baited traps held two dead newts bearing signs of consumption attempts by the snake found with them. Before releasing the snakes, we gently squeezed them to force them to regurgitate their stomach contents. Each of the three grass snakes had ingested a newt. This means that five casualties occurred in the baited traps, while none of the newts from the baitless traps showed any signs of stress or was dead. Statistical analyses were performed with R (R Development Core Team 2014).

Table 1. Summary of the animals that were trapped in the three baited traps and the three baitless traps. Note that the 14 *Triturus carnifex* reported from baited traps do not include the three that were found dead in the stomachs of *Natrix natrix* individuals.

Species	Baited	Not baited
Triturus carnifex	14	32
Natrix natrix	3	0
Dytiscidae sp.	3	1
Pelophylax kl. *esculentus* tadpoles	14	5
Pelophylax kl. *esculentus*	1	1
Total	35	39

We found clear evidence that baited traps and not baited traps set up in the same pond at the same time yield different numbers of individuals of the same species. In particular, baited traps collected fewer newts and more amphibian

Figure 1. Construction phases of each trap used in this study: (a) six funnels were sewn to along the diagonal; (b) detail of a single funnel; (c) each trap was bent over and the edges were sewn together with iron wire; (d) three of the traps in the field. The trap can be placed either horizontally or vertically.

predators than baitless traps. Scavenging behaviour may explain the presence of both *N. natrix* and water beetles in baited traps (Hodgson 1953, Ayres 2012) likely assisted by chemical cues that might be especially efficient under low-light conditions. The high number of tadpoles sampled in the baited traps was unexpected, since they are herbivorous and would likely avoid traps containing water beetles. This outcome could perhaps be based on an unexpected luring effectof chemical stimuli exuded by the steak on tadpoles.

Our results are in striking contrast with those of Baker (2013) who did not report any bycatches in baited or baitless traps. The long period of sampling, combined with the high number of traps and ponds tested make the difference between these two studies even more striking. In our view, this difference could be explained in at least three ways. First, since the two studies were conducted in very different areas (eastern England versus northern Italy), there could be no predators like *N. natrix,* water beetles, or any others in the ponds sampled by Baker (2013). Second, if such species were present in those areas, they could have avoided the traps altogether for unknown reasons. Finally, the author might have failed to report bycatches. Indeed, the latter is probably the correct interpretation (J. Baker pers. comm.), even though it seems that the absence of *N. natrix* in the study by Baker (2013) is due to his methodology. Baker (2013) placed his traps on the bottom of the sampled ponds while we positioned ours near the surface, where it is more likely that grass snakes hunt (authors' unpubl. obs.).

Our study is based on a single observation with only 6 traps that was not replicated (for ethical considerations) and its results have to be considered preliminary. Furthermore, variation in sampling efficiency, bias and replicability have been found to be dependent on the kind of trap used (Kronshage & Glandt 2014, Kronshage et al. 2014). Finally, experimental differences between the present study and that of Baker (2013) exist. Nonetheless, it is clear that a great deal of caution has to be exercised when planning amphibian sampling sessions with funnel traps. In particular, the use of steak baits has to be evaluated in an overall habitat context. If the investigated area is home to amphibian predators that likely exploit chemical cues to locate their prey, the use of such baits should probably be avoided.

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