The quality of what can be called the "heel test" for the identification of the Common Frog *Rana temporaria* (LINNAEUS, 1758)

Between March 10 and August 29, 2013, 30 specimens of the Common Frog *Rana temporaria* (LINNAEUS, 1758), were measured and examined with regard to what one may call the "heel test" (there is no such term in English). The data was recorded on a fact sheet (Table 1). The specimens originated from three areas to the north and south of the town of Hall in Tirol (Tyrol, Austria). Confusion with other brown frog species from Austria such as *Rana arvalis* (NILSSON, 1842) and *Rana dalmatina* (BONAPARTE, 1840) can be excluded, since both have never been recorded in this particular area or even the Tyrol on the whole (LANDMANN & FISCHLER 2000; CABELA & GRILLITSCH 2001). The specimens were collected by hand and photo-documented. To avoid multiple measuring of one and the same individual, the dorsal color patterns were compared to those of previously studied and photographed frogs. Snout-vent length (SVL) and the lengths of right and left hindlimbs (HLL) were measured with a measuring tape. Hind limb length was defined as the length of the stretched limb from its insertion to the heel. Finally, the specimens were examined in applying the above-mentioned "heel-test": On each side, the stretched out hindlimbs were folded along the lateral contour of the trunk, moving the heel towards the snout. This procedure puts SVL in a clear and well visible relation to HLL. All tested specimens were treated carefully and released unharmed instantly after measuring.

In the literature, this "heel-test" is seen as a reliable differentiation between *R. temporaria* and *R. dalmatina* but also the long-legged southeastern form of the Moor Frog, *Rana arvalis wolterstorffi* FEJÉRVÁRY, 1919. There is a broad consensus that the heel in Common Frogs subjected to this test, reaches "meist nur bis auf Augenhöhe, selten bis zur Schnauzenspitze" [in most cases only as far as to the eye, rarely the tip of the snout] (GOLLMANN et al. 2014) or "zumeist bis zum Augenbereich, nie zur Schnauzenspitze oder darüber hinaus" [mostly as far as the eye region, never the tip of the snout or beyond] (NÖLLERT & NÖLLERT 1992). The verification of these statements is a subject in this paper.

Snout-vent length of the individuals tested was between 17 and 92 mm (N = 30, mean = 46,6 mm, SD = 26,7 mm). The sex of the frogs was determined by observing the presence (for male) or absence (for female) of nuptial pads; 6 females, 11 males and 13 juveniles were examined. Ten of the juveniles were in their final stage of metamorphosis, a few days before they would have left their hatching pond (specimens 12-21 on Table 1). In this size class (SVL = 17-20 mm) the "heel test" mirrored without exception the ratio SVL/HLL ≥ 1 as predicted by NÖLLERT & NÖLLERT (1992) and GOLLMANN et al. (2014).

In the present sample, SVL/HLL values ranged from 0.94 - 1.12 (N = 30; mean = 1.019; SD = 0.05). A value > 1 in the proportion SVL/HLL indicates that the length of the hindlimb from its insertion to the heel is shorter than the distance from the snout to the posterior end of the trunk, a result that is to be expected for the Common Frog. Values < 1, however, characterize hindlimbs longer than SVL. After excluding the above mentioned 10 juveniles from the analysis, the result of the "heel test" in grown individuals was not characteristic of *R. temporaria* in 13 of 20 (65 %) cases, in which the heel projected beyond the snout.

In all specimens measured (apart from two outliers - see nos. 11 and 30 in Table 1), the "heel-test" results paralleled the ratio SVL/HLL. Over all, the measured SVL exceeded the measured HLL a little bit, even in the specimens misclassified by the "heel-test". This is explained by the fact that HLL was measured from the heel to the hip joint, which is a few mm anterior to the posterior tip of the pelvic girdle which marks the posterior end of the frog's trunk and determines the SVL.

ARNTZEN & WALLIS (1999) examined crested newts (Superspecies *Triturus cristatus*) of 100 different populations in Europe regarding the proportion (forelimb length x 100)/(distance between insertion of fore- and

Table 1: Collecting data, snout-vent-length (SVL), sex, hind limb length (HLL) on right (r) and left (l) side and “heel test” results of 30 individuals of *Rana temporaria* LINNAEUS, 1758, from the region of Absam, the Tyrol, Austria. *) Position of the heel: < E – posterior to eye; ~ E - close to eye; > E - between eye and tip of snout; ~ S – close to tip of snout; > S - anterior to tip of snout.

No.	Date	Location	Sex	SVL [mm]	HLL (r) [mm]	SVL/HLL (r)	Right side “heel test“*)	HLL (l) [mm]	SVL/HLL (l)	Left side “heel test“ *)
1	27.03.2013	47°19‘04“N, 11°32‘24“E - Absam	M	63	67	0,940	> S	67	0,940	> S
2	27.03.2013	47°19‘04“N, 11°32‘24“E - Absam	F	92	85	1,082	> E	85	1,082	> E
3	01.04.2013	47°19‘04“N, 11°32‘24“E - Absam	M	62	64	0,969	> S	64	0,969	> S
4	19.04.2013	47°19‘04“N, 11°32‘24“E - Absam	F	80	78	1,026	~ S	78	1,026	~ S
5	29.04.2013	47°15‘03“N, 11°33‘05“E - Tulfes	M	82	83	0,988	> S	83	0,988	> S
6	29.04.2013	47°15‘03“N, 11°33‘05“E - Tulfes	M	70	72	0,972	> S	72	0,972	> S
7	29.04.2013	47°15‘03“N, 11°33‘05“E - Tulfes	M	80	80	1,000	> S	80	1,000	> S
8	20.05.2013	47°19‘04“N, 11°32‘24“E - Absam	F	34	32	1,063	~ S	32	1,063	~ S
9	09.06.2013	47°18‘52“N, 11°32‘40“E - Absam	F	70	70	1,000	> S	70	1,000	> S
10	09.06.2013	47°18‘50“N, 11°32‘36“E - Absam	F	68	65	1,046	~ S	65	1,046	~ S
11	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	M	75	73	1,027	> S	73	1,027	> S
12	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	18	17	1,059	> E	17	1,059	> E
13	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	17	16	1,063	~ S	16	1,063	~ S
14	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	19	18	1,056	> E	18	1,056	> E
15	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	17	16	1,063	> E	16	1,063	> E
16	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	18	17	1,059	> E	17	1,059	> E
17	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	19	17	1,118	~ E	17	1,118	~ E
18	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	20	19	1,053	> E	19	1,053	> E
19	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	19	18	1,056	~ S	18	1,056	~ S
20	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	19	18	1,056	> E	18	1,056	> E
21	16.06.2013	47°18‘49“N, 11°32‘38“E - Absam	J	18	18	1,000	~ S	18	1,000	~ S
22	01.07.2013	47°18‘52“N, 11°32‘29“E - Absam	J	23	21	1,095	> E	21	1,095	> E
23	17.08.2013	47°18‘49“N, 11°32‘38“E - Absam	F	77	80	0,963	> S	78	0,987	> E
24	18.08.2013	47°18‘44“N, 11°32‘41“E - Absam	M	65	67	0,970	> S	67	0,970	> S
25	18.08.2013	47°18‘39“N, 11°32‘21“E - Absam	M	55	58	0,948	> S	58	0,948	> S
26	23.08.2013	47°18‘49“N, 11°32‘34“E - Absam	J	22	23	0,957	> S	23	0,957	> S
27	23.08.2013	47°18‘49“N, 11°32‘34“E - Absam	M	40	42	0,952	> S	42	0,952	> S
28	23.08.2013	47°18‘48“N, 11°32‘36“E - Absam	M	60	63	0,952	> S	63	0,952	> S
29	27.08.2013	47°18‘47“N, 11°32‘47“E - Absam	J	21	20	1,050	> E	20	1,050	> E
30	29.08.2013	47°17‘57“N, 11°30‘36“E - Absam	M	75	76	0,987	> E	76	0,987	> E

hindlimb), which is known as "Wolterstorff Index" (cf. WOLTERSTORFF 1923). This approach, which is comparable to the "heel-test", yielded a maximum error rate of 31 % (ARNTZEN & WALLIS 1999: 185). Compared to the error rate of the "heel test", which was 65 % in the grown Common Frogs tested, it must be concluded that the "heel test" threshold values cannot be valid, at least for the populations studied where it turned out to be an unreliable method for the identification of *Rana temporaria*.

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