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The common toad *Bufo bufo* population of Hitra island, Central Norway

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The summer habitat of the common toad *Bufo bufo* on Hitra island, well-known for its large toad population, is described: wet heath interrupted by pine woods and a number of ponds and lakes of good water quality. The ecological status of the species on Hitra seems satisfying. Biometrical measures from 34 individuals show that these toads are small or middle-sized, but with a defined sexual dimorphism. Mean snout-vent lengths are 63 cm for males and 73 cm for females. Body-length shows strong correlation with weight and also with tibia-length, in both sexes.

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INTRODUCTION

According to Corbett (1989), little is known about the distribution and ecology of many Norwegian herptiles, and the status and biology of common toad *Bufo bufo bufo* (L.) populations e.g. need further research (Dolmen 1986; Semb-Johansson 1989).

The status of this species in Norway is probably satisfying (Dolmen 1986), but Semb-Johansson (1992b) reports of a serious decline of the common toad on the Hvaler islands in southeastern Norway.

During two brief stays on Hitra island, situated 5—6 km off the mainland (Sør-Trøndelag, Norway), we found a considerable number of common toads along the road. Although situated 250 km south of the northernmost record of the species, Hitra represents the northernmost area in Norway where the common toad seems to be really common (Dolmen 1978a, b; cf. Semb-Johansson 1992a). A few remarks about the status and habitat as well as biometrical and sex-ratio data will be presented here.

AREA DESCRIPTION

Hitra island is situated on the Norwegian coast about 80 km WNW of Trondheim (Fig. 1). Geological substratum is mainly formed by plutonic rocks: granites, granodiorites, diorites and migmatitic gneisses (Sigmond et al. 1984). The climate is relatively mild (average temperature in January is approximately + 1.2°C; in August + 13°C), and rainfall is about 1000—2000 mm/year (NVE & Statens kartverk 1986; Sør-Trøndelag Fylkeskommune, pers.comm. 1992).

Hitra is mainly coastal lowland covered by heath and mire plant communities dominated by heather *Calluna vulgaris,* in the western

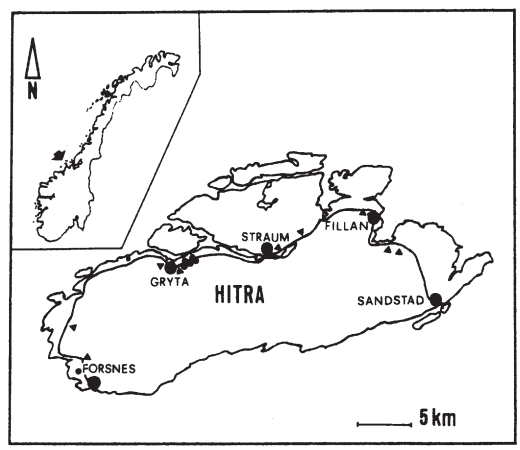

Figure 1. Hitra island and its geographic localization, in Sør-Trøndelag county, Norway. Circles: 1991 toad records, triangles: 1992 toad records.

Table 1. Temperatures and rainfall registered on Hitra island district before/on the sampling days. Data sources: «Regionalt samarbeid reiseliv Midtnorgeskysten» and Det Norske Meteorologiske Institutt.

Data	Min T (°C)	Max T (°C)	Rainfall (mm)
1991			
August 1	12.8	16.0	0
August 2	13.0	16.6	0
August 3	12.4	15.4	0
August 4	12.6	16.5	18
August 5	12.4	18.4	1
1992			
August 15	11.3	15.5	0
August 16	8.3	15.0	0
August 17	10.5	14.2	16.5
August 18	10.0	13.5	11.5
August 19	5.4	17.5	1.6

inland interspersed with copses of Scots pine *Pinus sylvestris* and birch *Betula pubescens* i.e. the Lowland- and Prealpine belts of coastal section (see Dahl et al. 1986). Coniferous forests rich in mires (Southern- and Middle boreal regions) are dominant in the eastern inland part, and an Alpine belt can be found on the highest elevations (above 300 m alt.), where forest is absent. A very high number of small lakes and ponds are distributed all over the island.

MATERIALS AND METHODS

On the first trip common toads were captured on and along the main road encircling Hitra (Forsnes - Straum - Sandstad) from 11.30 p.m. of 5 August to 2.30 a.m. of 6 August 1991. Both the air and the habitat were humid, as the weather had been overcast and drizzly (Table 1). The main capture site for toads, east of Gryta, is a wet heath, where hygrophilous herbaceous species are abundant, while birch and Scots pine are sparse and stunted. The probable toad breeding-site is a neighbouring pond, belted by *Phragmites australis, Juncus conglomeratus, Carex rostrata* and *Eriophorum vaginatum* among others. On the other side of the road is a sparse pinewood. Along the road some dead toads were also observed on the asphalt.

Toads were held venter up against a transparant plastic ruler, and body-length was measured from the snout to the posterior end of the cloaca (SVL), to the nearest millimeter; the right tibia was measured with vernier calipers to the nearest 0.1 millimeter. Each specimen was also weighted with a spring balance to the nearest 0.5 gram and immediately released.

On the second trip, during daytime 19 August 1992, the number of traffic-killed toads were counted on the same road. The weather had been rainy, but the day of recording was clear (Table 1). This registration was made in order to get a picture of the distribution of the common toad on the island.

Water samples were also taken in ponds and lakes, near the recording-sites, and analysed for pH, conductivity (K_{25}), hardness and chloride content (for methods see Dolmen 1981).

RESULTS

Toads were seen along the whole route; most records, however, were made in northern/-central parts of the island (Fig. 1). Most of the sample (n = 30), on the first trip, was captured in this area of the island, along a four kilometer section of the road eastwards from Gryta (see Fig. 1). Five or six dead toads were also observed there on the asphalt. A few toads, besides, were captured near Forsnes, and a male was found near Fillan village.

A total of 34 toads was measured; the sample consisted of 12 reproductive males, 17 adult females and 5 individuals which could not be sexed on the basis of their external characters. The sex ratio (male : female) of the sample was 0.71.

Table 2 gives the average snout-vent length, tibia-length and body-weight for male and female subsamples. Figure 2 shows the relationship existing between body-size and weight. For males the regression line was: Weight = 1.11 SVL - 45.07 ($r = 0.84$, $p<0.01$) and for females: Weight = 1.43 SVL - 63.50 ($r = 0.86$, $p<0.01$).

Body-length and tibia-length were also correlated, both in males and females; Spearman's rank correlation coefficients were: $r_s = 0.583$ ($n = 12$, $p<0.05$) and $r_s = 0.527$ ($n = 17$, $p<0.05$), respectively. Figure 3 shows the relationship between body-length and tibia-length of males and females.

On the second trip (n = 14) 2 toads were recorded at/north of Forsnes, 4 at Gryta, 6 east of Straum, and 2 between Fillan and

Table 2. Mean snout-vent length, mean right tibia length and mean body weight of Hitra male and female subsamples.

	Males (n = 12)		Females (n = 17)	
	mean ± S.D.	range	mean ± S. D.	range
Snout-vent length (mm)	63.50 ± 4.40	58 - 72	72.94 ± 4.41	64 - 80
Right tibia length (mm)	22.78 ± 1.54	20.0 - 25.4	24.66 ± 1.97	21.7 - 26.7
Body weight (g)	25.42 ±5.85	20.0 - 36.0	40.79 ± 6.88	31.5 - 51.0

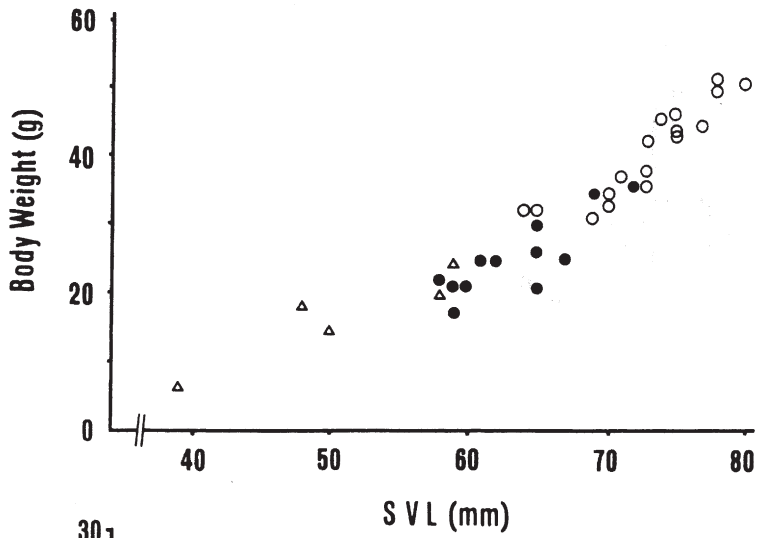

Figure 2. Relationship between snout-vent length (SVL) and body weight in common toads (*Bufo bufo*) from Hitra. Open circles: females; closed circles: males; triangles: unsexed specimens.

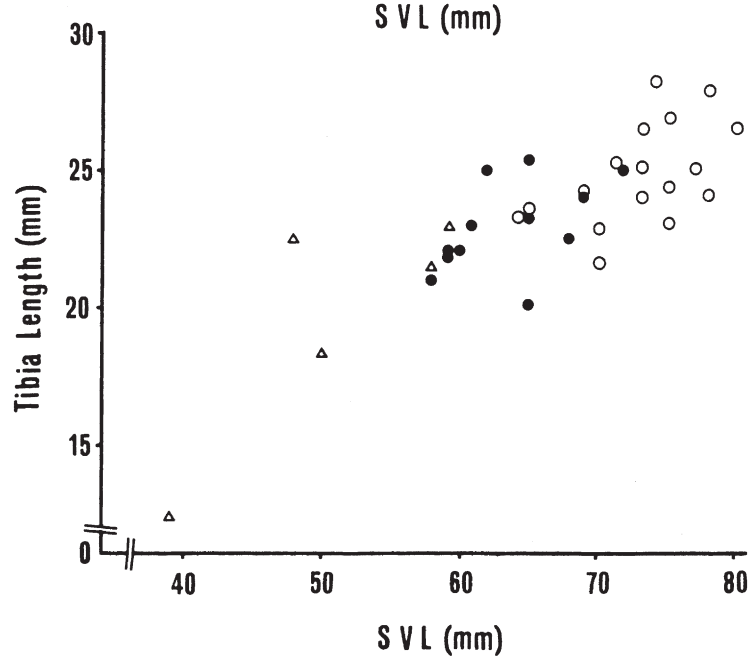

Figure 3. Relationship between snout-vent length (SVL) and right tibia length in common toads (*Bufo bufo*) from Hitra. Open circles: females; closed circles: males; triangles: unsexes specimens.

Table 3. Water quality of potential toad breeding-sites on Hitra island (n = 18); * = one locality was strongly influenced by tidal sea-water.

	pH	Colour Pt mg/l	Conduct. K_{25} µS/cm	Total hard. °dH	CaO-hard mg/l	Cl- mg/l
Min.	5.9	35	79.9	0.4	1.0	16.5
Max.	6.9	200	2130*	10.5*	13.5	592.5*
Median	6.4	40	104	0.7	3.0	25

Sandstad. Most records (11) were made in connection with small woods and most often (12) where (or near) the road crossed small valleys or brooks.

At this time of year no tadpoles were probably left in the water, none were observed, so it was not possible to tell exactly which ponds and lakes were actual breeding-sites. The water quality, in summary, of 18 potential breeding-sites, however, is given in Table 3. Most ponds and lakes had weakly acidic water, i.e. pH 6.0—6.6; one was (on the border of being) strongly acidic (Grytelva river system, draining the inner parts of the island: pH <6.0), and two were neutral (pH>6.7). All investigated localities were polyhumic and poor in calcium, but with high values for conductivity, total hardness (and therefore for manganese), and chloride; definitions follow Dolmen (1981).

DISCUSSION

The life and life cycle of Norwegian common toads *Bufo bufo* have been described by Dolmen (1978a), Hemelaar (1988) and Semb-Johansson (1989, 1992a, b). Usually common toads start their breeding migration in late April-May. In especially good sites in southeastern Norway, according to Semb-Johansson (1989), spawning may take place in mid April (late March—early May). The first observation of toads on Hitra in 1992, however, was as early as 7—8 March (Øystein Størkersen, pers. comm.). In inland Central Norway females spawn at the end of May, and tadpoles metamorphose during July or August. Hibernation starts in early September (cf. Hemelaar 1988). However, little is known about toad summer activity and habitat. Semb-Johansson (1989) states that the species is more common where hiding-places are abundant. On the basis of our observations, it can be suggested that common toads on Hitra are active during summer nights, at least till the end of August, in terrestrial habitats contiguous to mires in which they breed. Sometimes they are very active, especially after heavy rainfalls (cf. Semb-Johansson 1992a). On Hitra such biotopes are indifferently wet heaths, moorlands and pine-woods.

Water quality of ponds and lakes on Hitra island seems satisfying. The common toad is not very sensitive to moderately low pH values (Dolmen, unpublished). Inner parts of Hitra island have somewhat lower pH and buffer capacity than the more peripheral parts of the island: Grytelva river, draining the inner parts of Hitra, had the lowest values for pH, conductivity, hardness and chloride (see Table 3). The values were not alarming, however. These central parts of Hitra are also fitting for the toad. Otto Frengen (pers. comm.) 22 May 1974, near midnight, thus observed a number of toads (probably 20—30) in this area, on a stretch 2—4 km SSE of Gryta, i.e. at Skumfossøra and northwards. This Havmyran moor area is a partly protected area today.

It seems that terrestrial toads are common especially in connection with small woods and along creek valleys, which may offer humid conditions and good shelter for the animals. Such places may probably also act as landmarks in navigation and as migration routes.

Concerning the ecological status of the common toad in Norway, Semb-Johansson (1992b) points out the drastic decline of the species on the Hvaler islands in southeastern parts of the country. He ascribes this phenomenon to one or more subtle factors, probably including acid precipitation. On Hitra island the toad population still seems to be healthy. Among zoologists, the island has been well-known for many years for its large

toad population. Acid precipitation is not a problem. pH in precipitation is, according to Henriksen et al. (1988) above 4.9, which is the most favourable in Norway, compared to pH less than 4.3 for the Hvaler islands (see above).

Even though many toads are accidentally killed by cars on the roads, the island is so large and the inner parts of it so «untouched» by human interference that traffic is only a very small, local problem. The ecological status and the future of the common toad on Hitra seem therefore, so far, satisfying.

The biometrical study shows that in the study population, snout-vent length is positively correlated with body-weight and tibia-length both in females and males. Besides, females grow larger and heavier than males ($p<<0.001$; Student's t-test), probably because females normally mature one year later than males (Hemelaar 1988). Female average body size is similar to that reported by Hemelaar (1988) for females spawning near Lake Jonsvatnet, 10 km SE of Trondheim, i.e. approximately at the same latitude as Hitra. Mean SVL were 72.94 and 72.13 mm respectively for Hitra and Jonsvatnet. On the other hand, Hitra males appear to be larger (SVL = 63.50 versus 58.92). This difference is also highly significant ($p<0.001$; Student's t-test).

Body-length and tibia-length of Hitra toads seem to lie between those of two island populations studied by Semb-Johansson (1989) in southeastern Norway; toads from the islet of Tisler are very small, and the two sexes are about the same size, while on Søndre Sandøy island the animals are much larger, and females reach a still much larger length than males. The size of the Søndre Sandøy toads can be regarded as «normal» for Scandinavia (Semb-Johansson 1989). The Hitra toad population thus shows an intermediate, but distinctive pattern of variation: animals are relatively small, but still with an evident sexual dimorphism.

SAMMENDRAG

Sommerhabitatet til padda *Bufo bufo* på Hitra, kjent for sin store paddebestand, er beskrevet: fuktig lyngmark avbrutt av furuskog og et utall av dammer og sjøer med god vannkvalitet. Paddas økologiske status på Hitra synes tilfredsstillende. Biometriske mål fra 34 individer viser at disse paddene er små eller av middels størrelse, men med en klar kjønnsdimorfisme. Gjennomsnittslengde (snute - kloakk) er 63 mm hos hanner og 73 mm for hunner. Kroppslengden viser sterk korrelasjon med kroppsvekt og også med leggelengde, hos begge kjønn.

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