(Middle Europe), which were 3.6°C and 4.2°C respectively. The oxygen consumption was determined in May, July/August and in December (after two months of hibernation). The lowest Q_{10} values and the smallest oxygen uptake were measured in December, when the oxygen consumption at 35°C in *L. vivipara* and *L. agilis* was 44.8 and 39.3 cm^3/100g/hr respectively, against the 68.5 and 53.3 cm^3/100g/hr measured in July/August.

The mean preferred temperature and the oxygen consumption of the three species of *Lacerta* did not differ, when measured before and after acclimation to 16°C, 26°C and 32°C. In the critical thermal minimum, the 16°C acclimation caused a fall, while the 26°C and the 32°C acclimation caused a rise in all three species. These results are correlated with the ecology of the species studied.

GROWTH IN *RANA TEMPORARIA* AND *R. ARVALIS*

J. LOMAN, *Department of Animal Ecology, University of Lund, Sweden*

The growth in two frog species (*Rana temporaria* and *Rana arvalis*) was studied by means of: (1) The size distribution in the catch from pitfalls operated continuously for 2½ years. Due to individual variation in growth, a year-class could only be followed up to one year of age with this method. (2) Individual growth records from marked adult frogs recaptured during the same growth season. (3) Ditto, but recaptured during successive summers. All measurements are snout–urostyle. The study area is located in S Sweden (55°40′N, 13°30′E).

During the growth season, the mean growth in adult frogs was 0.03 mm per day (*Rana arvalis*, N = 19) and 0.08 mm per day (*R. temporaria*, N = 53). There was no difference between males and females. *R. temporaria* virtually ceased growing after 1st September. Too few captures made a similar analysis of *R. arvalis* impossible. In the catch from the pitfalls, the size-class of young-of-the-year was distinct. Young *R. arvalis* grew significantly from July to August but not from August to September (means of 17.2, 20.7 and 21.3 mm resp.). Young *R. temporaria* grew significantly from July through September but not from September to October (means of 14.3, 22.0, 23.6 and 24.0 mm resp.). When measured both intra- and inter-yearly, large frogs grew more slowly than smaller. When measured within one season, the linear regression of growth per day, g(mm), on the length at the middle of the growth period, l (mm), was $g = -0.0078\, l + 0.41$ ($r = -0.75$, $N = 15$) (*R. arvalis*) and $g = -0.0071\, l + 0.48$ ($r = -0.54$, $N = 35$) (*R. temporaria*). According to these equations, growth ceases completely at 52 and 67 mm resp. When measured on a yearly basis the linear regression of growth per year, G (mm), on the length of the frog in the first year, L (mm), is $G = -0.58\, L + 30.1$ ($r = -0.82$, $N = 17$) and $G = -0.73\, L + 47.5$ ($r = -0.73$, $N = 13$). According to these equations, growth ceases completely at 52 and 65 mm resp. The largest frogs measured in these populations were 56 mm (*R. arvalis*, 230 measured frogs) and 70 mm (*R. temporaria*, also 230 measured frogs).

The large spread in size of youngs (16–27 mm (*R. arvalis*) and 18–33 mm (*R. temporaria*) for frogs measured during the winter) shows that growth rate is individual. The data above show that the asymptotic growth limit (that I suggest exists for each individual frog if food availability is constant) also varies individually. For both growth rate and growth limit I suggest that genotypic and environmental factors influence the values for individual frogs.

If these data are used to construct growth curves for a 'mean frog', the following results are obtained: *R. arvalis* year 0: metamorphosis, I: 30 mm, II: 42 mm, III: 47 mm, IV: 50 mm, V: 51 mm. Fast growing and/or early maturing frogs might start breeding when not quite two years old, but most probably do not start breeding before they are three years old. *R. temporaria:* year 0: metamorphosis, I: 38 mm, II: 58 mm, III: 64 mm, IV: 65 mm, V: 65 mm. Fast growing and/or early maturing frogs might start breeding when not quite two years old, but most probably do not start breeding before they are three years old.

THE REPRODUCTIVE CYCLE OF *VIPERA BERUS* IN SW SWEDEN

G. NILSON, *Department of Zoology, University of Gothenburg, Sweden*

Investigations on the reproduction biology of *Vipera berus* from the west coast of Sweden have been in progr
The normal reproduction cy
V. berus spans over one yea
male is able to mate every sp
genesis is non-active during
with resting spermatogonia i
ous tubules. At the end of Ju
develop in the tubules and
spermatocytes continues duri
season. In January spermatid
the males have finished hi
middle of March several lay
line the lumen. Soon after
hibernation, spermatozoas c
end of March, about two we
activities start, full sperm
progress.

The mating period starts w
of the males; this seems to s
days in all the different
investigated. At this time s
diminishing, the germinal
generating and the bulk o
to be found in the vas
spermatogenesis regression
and tubuli with only resti
can be seen in the middle c
mating period.

The testis is largest dur
full spermatogenesis in th
then decreases in size and r
value in May, shortly aft
mating period. The interst
cur in highest number du
full spermatogenesis. After
very few can be seen. In th
a synchronization with s
V. berus from Denmark a

The fact that the femal
triennial reproduction cyc
of the range of the speci
by several authors. This
the Swedish west coast.
that even the male in son
the influence of certain e
yet fully analysed, can h
cycle that, as in the fem
of more than one year b
are gone through. One ex
delay in development of
the spermatogenetic cycle
the normal cycle observ
times of the year. The st
genesis in June coincide