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A STUDY OF NEWTS IN THE NEW FOREST

By

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INTRODUCTION.

There are three species of British newt and their appearance and size has often been described (see Smith, 1954, for descriptions and references). They are *Triturus cristatus* (Laurenti) 1768, (the great crested or warty newt), which may reach a total length of 150 mm., *Triturus vulgaris* (Linnaeus) 1758, (the common or smooth newt) and *Triturus helveticus* (Razoumowski) 1788, (the palmate newt). The females of the two latter species are very similar in colour and in size, but the males are easily distinguished by their nuptial dress in the breeding season. Less is known about the distinguishing characteristics of the larvae of these three species, and the present work is largely a study of these larvae from the egg stage to metamorphosis in a series of fresh water ponds in one tract of country.

The 10 ponds or groups of ponds studied are scattered over an area of about 70 sq. miles of the New Forest, Hampshire, in the South of England. A small group of biologists from Cambridge University visited them in April, June and September, 1960, and in June, 1961. The other members of the group studied the invertebrate fauna, the flora and the physical properties (temperature and pH). The ponds are listed in Table 1 together with the abbreviations used for them in this paper, the National Grid references given in the Ordnance Survey maps, and any special points about each pond. I am grateful to my colleagues for letting me use this latter information. My own task was to study the newt population of the ponds.

The newts were caught by sweeping the ponds with a net with a mesh of about 15 strands to the inch. The sweeps were generally random but in many ponds it was impossible to reach the centre, because of the depth of water or the uncertain bottom. The newts and larvae when caught were measured in the field and notes made of their physical characteristics such as sex, eye colour and crest development, including the presence or absence of a tail crest.

FIELD STUDIES.

In April, 1960, all the ponds contained at least one species of newt. The smaller newts, *T. vulgaris* and *T. helveticus,* usually occurred together. The numbers captured of each species are given in Table II; these numbers can be taken to indicate the relative concentrations of newts in each pond. All these individuals were adult and in full breeding condition.

The markings of male adult newts are very characteristic for each species, especially in the breeding season. But among the females it is often difficult at first to distinguish *T. vulgaris* and *T. helveticus.* On close study, however, slight differences become apparent and a sufficient number of points characteristic of each species emerge, thus making identification possible. In *T. vulgaris* the throat is normally speckled with dark brown, while in *T. helveticus* this is very rarely the case; the general body colour tends to be more olive in *T. vulgaris,* though it is dependent on the background and light intensity; the belly is often a more vivid orange than that

of *T. helveticus*; the body of *T. vulgaris* may be broader in the region of the front legs; the shape of the head is smoother with rounded corners at the base of the skull and the head markings are more diffuse. The eye and body markings are of no use for identification, for both species show a line across the iris of the eye (Fig. 1 d-f) and the body markings are very variable, ranging from being uniformly speckled to two definite dark lines (Fig. 1 b-c). There was no evidence of greater gland development of the back in either species.

All the females captured were distended with eggs, and, in all three species, individuals were seen laying eggs. The eggs were laid individually on leaves of *Ranunculus flaririula* (Water Crowfoot), *Myosotis palustris* (Forget-me-not) and other aquatic plants. When freshly laid they are spherical and uniformly fawn in colour. All the eggs seen in April were in this condition and were therefore recently laid.

In June, 1960, ten weeks later, the same ponds were swept again. Many larvae were caught, but there were usually very few adults. Since no larvae had been found in April it is assumed that all the larvae found in June were recently hatched, and that no larvae had survived as such over the preceding winter.

The exact time before hatching takes place in ponds is unknown. Eggs of *T. vulgaris* and of *T. helveticus* kept in jars hatched in 20-23 days (see later), the time probably depending on physical conditions. There was no direct information on the eggs of *T. cristatus.*

In one pond (R) there were a large number of adult *T. helveticus* in June and courtship was seen to occur several times. The females were probably still laying eggs. In another pond (BH) there were several *T. cristatus* adults present, but the sexes were indistinguishable and breeding activity had almost certainly ceased.

All the larvae captured in June were studied to observe their state of development and to assess the changes which preceded metamorphosis. Further observations were made in September, 1960, and in June, 1961, in an attempt to distinguish the characteristics of the larvae of each species. The larvae of *T. cristatus* were easily identified, but this was not the case with those of the other two species. Attention was paid in particular to ponds (BuII), (R) and (B), where in April, 1960, the adult population was largely confined to either *T. vulgaris* or *T. helveticus,* and distinguishing characteristics of the larvae of the two species were looked for.

Larvae of T. cristatus. (Fig. 2 e-f)

The size of the larvae of *T. cristatus* on hatching is not known; the smallest animals caught were 18 mm. long but these were fairly well developed. Their maximum size, reached at metamorphosis, was between 45 and 60 mm. depending probably on the external habitat, since there was a constant size at metamorphosis for all the larvae in a particular pond.

Since the larvae were not seen hatching out, their markings were not observed at this stage. The tail markings of young larvae are shown in Fig. 3 (a-d). They are characterised by dark splotches on the outer margins of the tail crest (b) but variations such as a or c also occur, especially in less well developed animals. The larger animals have rather more spots (d) before the crest is finally lost at metamorphosis. The variations in the eye are shown in Fig. 4. The commonest type is type (a) with no central annulus and is therefore not unlike that of the adult, Fig. 1 (h), which is yellow with diffuse black markings. Types f, d and c may also occur. The

crest of the larvae extends to halfway along the back, where it ends abruptly. In the adult male, however, the main crest extends only over the tail with an additional crest along the back.

Larvae of T. vulgaris and T. helveticus.

Early development. *T. vulgaris* and *T. helveticus* larvae are smaller and more cylindrical in shape than *T. cristatus* (Fig.2a-d). On hatching (*in vitro*) both the former species were found to be 6 mm. long. In the field the smallest larvae caught were 7.5 mm. and the largest were 41 mm. long, but in most ponds metamorphosis took place at a length of 25-35 mm. in the two species. As with *T. cristatus,* for each particular pond, one size corresponded to a particular pattern of pigmentation but this size differed in different ponds. The graph (Fig. 5) shows that temperature may have some influence on size at metamorphosis.

The larvae undergo a series of changes during development which are for the most part similar in the two species, at least in the early stages. When the larvae first hatch they are transparent except for dark lines along the dorsal and ventral surfaces (Fig. 2a, b). After about two weeks, by which time the fore-limbs have grown, the larvae become fawn but are still comparatively transparent. At this stage the iris of the eye is uniformly dark with a pale annulus round the pupil (Fig. 4b), while the tail has a single dark line down the side (Fig. 3e). The iris then becomes uniformly paler (Fig. 4c) or paler in the centre only (Fig. 4d). Just before metamorphosis a bar generally forms across the iris (4 e, f). This slowly becomes more pronounced (4 g, h) until the time when the larvae finally leave the water. The tail, meanwhile, also undergoes a number of changes (Fig. 3). It becomes uniformly speckled (f) at about one month then develops two dark lines (h) or becomes type (i) with unpigmented marks. Other variations such as (j) and (k) may occur at this stage. The unpigmented marks appear originally on the body and only in some animals spread to the tail. These marks may each develop a white spot in the centre, especially on the body.

Changes at Metamorphosis. In addition to the changes described above, other changes take place before metamorphosis. First the belly becomes opaque and greyish before turning pink, orange or pale brown. The animal then grows a little, the eye develops its bar and the limbs become stronger. Soon the gills become reduced and the body takes on the fawn colour of the adult with two dark lines along the dorsal surface. Before the tail crest and gills are finally lost the animal comes to the surface periodically for air and then leaves the water. About this time the skin becomes coarser and drier, and forms folds beneath the eyes. The whole process takes anything from two days to a week but the final stages are usually rapid.

From the time the belly becomes opaque to the adoption of pulmonary respiration the larvae usually grow 4-5 mm. At this stage the general proportions of the body change. The legs become sturdier and relatively longer, and the crests are reduced. Up to this time the tail has been increasing in length relative to the body, but on metamorphosis the ratio $\frac{\text{body length}}{\text{total length}} \times 100$ becomes more or less constant at 51%. In the mature adults this figure varies with the species, sex and season, but is normally between 50-56%.

Comparison of the two species.

T. vulgaris and *T. helveticus* larvae tend to develop certain differences at metamorphosis. Earlier than this one species may show a higher incidence of a particular character, but the overlap is so great that they cannot be used to separate the two species. Such characters include pigmentation of the tail and the body, with presence or absence of unpigmented marks, the colour and texture of the eyes, markings on the head and possibly the shape of the head. For instance the unpigmented marks are more often found in *T. vulgaris* larvae than in *T. helveticus* and occur earlier in the former species.

Just before metamorphosis the belly of *T. vulgaris* becomes yellow or orange. In *T. helveticus,* however, the belly is pink or brown. In both species the throat may be pale brown and in neither species is it spotted, although the main distinguishing feature of the adult females is the spotted throat of *T. vulgaris.* The body of *T. helveticus* larvae tends to become brown while that of *T. vulgaris* is rather more olive. This difference is slight however, and can only be appreciated if the two larvae are held side by side. Both species develop two dark lines along the back but this tends to be more pronounced in *T. helveticus.* *T. vulgaris* larvae probably metamorphose when slightly larger than *T. helveticus,* but as there is much variation between different ponds this is of little value in the field.

Egg development in the laboratory.

In order to supplement the field work some eggs and larvae were kept in the laboratory. In April, 1960, freshly laid eggs of *T. vulgaris* and of *T. helveticus* were collected from ponds which contained a single species of adult. Also some older larvae were collected. In April and May the following year captive newts of both species laid eggs. All captive animals were originally kept in water from their own ponds, but this was later replaced by water from the Rivers Cam in Cambridge, and Cherwell in Oxford, as this became necessary. The eggs laid in captivity were isolated in small groups and kept in jars covered with algae. These stood in the open air so that they were subjected to normal light changes as far as possible. In all cases the eggs took about 21 days (20-23) to hatch. The larvae only survived for about four weeks, however, and the full sequence of changes could not be followed. The larvae were found to be vegetarian on first hatching and only survived in jars that contained much green algal growth. The older larvae, however, are carnivorous and were fed on earthworms. There was no indication at what age the transition takes place but dissection of the larvae in the field revealed the remains of animal food in the guts of larvae presumably only a few weeks old.

During the four weeks the larvae grew from 6 mm. at hatching (Fig. 2 a - b) to about 12 mm., and the body became less transparent (Fig. 2 c). The eye was type (b) (Fig. 4) throughout but the dark line of pigmentation on the tail became less pronounced, finally becoming uniformly speckled (f) (Fig. 3). The fore limbs appeared after about one week, while the hind limbs never grew beyond small protuberances from the body.

When the larvae first hatched they remained stationary for long periods projecting perpendicularly from plant stems or the side of the jar. If disturbed they moved with quick jerky movements to another position. After the legs had grown, however, they moved around more smoothly, using undulations of the tail, as well as the limbs. They then sat parallel to the surface on which they were resting.

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We much regret that in the last number of the Journal (December 1964) the text of page 173 was repeated on page 174. The correct text for page 174 is printed below.

The effect of light on the pigmentation.

Adult newts in the field show a marked response to light intensity and background colour by altering their general body colour to blend with the background. Changes usually take place within a few hours. To test the possible effect of light on the distribution of pigment in the larvae, several animals of all three species were studied and their markings carefully noted. Some were then put into total darkness, while others were subjected to a continuous bright light. The experiment was repeated several times, using different backgrounds. It was found that the general body colour became deeper after a period of darkness but that distribution of the more dense pigment spots and general markings was not altered, even after a week in darkness. Similarly, bright light had no effect.

Notes on the adults.

The adult newts were found to be entirely carnivorous. Several animals were seen snapping at invertebrates in the ponds, while in captivity they were fed on worms for many months. A number of adults were also dissected to discover the contents of the gut. In all cases it was found to contain only animal remains. These were similar to the invertebrate fauna of the pond. Animals from one pond, for instance, had lived almost exclusively on *Daphnia* spp. and those from another on coryxids. Each pond showed a high incidence of the particular species.

DISCUSSION.

All three species of newt are believed to be indigenous to this country, although *T. helveticus* was not recognised as a separate species until 1843 (Bell, 1849), 60 years after it was first described in Switzerland. *T. vulgaris* and *T. helveticus* are very closely related and although the males are strikingly different, the females and the larval forms remain almost identical. The two species are often found in the same pond, though *T. vulgaris* is more widely distributed on the Continent, while in England it tends to be more abundant in low-lying areas. *T. helveticus* may be the only species found on higher ground; in Scotland and Wales it is more common than either *T. vulgaris* or *T. cristatus*. Breeding takes place at the same time in the two smaller species, but interbreeding is not known to take place in nature in this country. In captivity, *T. helveticus* breeds freely with those forms of *T. vulgaris* from Southern Europe where *T. helveticus* is not found. Obviously some barrier exists which prevents cross-fertilisation in Britain. This may be physiological but the slight differences in the breeding display and nuptial dress of the male may be sufficient to prevent the completion of the behaviour pattern, which finally leads to the release of the spermatophore by the male. The similarity of the larvae in the two species, however, would make recognition of hybrids impossible, although there was never any doubt of the species with the males, and very seldom with the female adults.

According to Smith (1954) *T. cristatus* larvae metamorphose at a length of more than 80 mm., while *T. helveticus* larvae do so at 28-35 mm. and *T. vulgaris* at over 35 mm. These figures are somewhat higher than those found for the New Forest animals: i.e. 55 mm. for *T. cristatus,* 25-35 mm. for *T. helveticus* and *T. vulgaris*. Also, Smith states that metamorphosis takes place at 5 months in *T. cristatus* and 3½-4 months in the two smaller species. In the New Forest, however, it was found that three months is sufficient for all species, and the smaller species probably develop

in less time (although the exact time is not known). In the New Forest the ponds contained considerably less water in June than in the previous April and local inhabitants informed us that many of them dry out completely in summer. This would mean that if the larvae are to survive, they must be capable of living on land probably by July at the latest. Larvae in the New Forest were already leaving the water in June, 1960 and 1961. Gislèn and Kauri (1959) in Sweden, and Smith, mostly S.E. England, however, say that metamorphosis first occurs in mid-July. This would therefore suggest that metamorphosis occurs earlier in the New Forest than in certain other places studied and that the larvae are smaller at that time. Since no larvae were present in April in the New Forest ponds, there is no question of them over-wintering as occurs in some parts of Britain (Evans, 1894, in Edinburgh; Smith, 1954). The breeding season of the New Forest newts coincides with that in other areas, occurring from early April to early June.

It was found that details of size, density and larval development varied considerably in different ponds. In Sweden a larger proportion of larvae have metamorphosed in August in the South-East of the country than elsewhere, and this is claimed to be due to the warmer, drier climate (Gislèn and Kauri, 1959). In the New Forest the climate probably also effects the populations, but the position is rather more complex. There is variation in temperature and in pH (both of which will effect respiratory and metabolic processes), but in addition the nature of the soil shows much variation. Some ponds have soft bottoms while others are fairly firm. Also the amount of decaying vegetation and leaf mould varies. This will influence the newts directly by determining the amount and nature of the cover and the negotiability of the bottom, and also indirectly by way of the flora and the invertebrate fauna, which did in fact show a wide variation from one pond to another. The food of the newts (which are partly vegetarian as young larvae but carnivorous as adults), predators and other factors effecting the survival at different stages will therefore vary in different ponds. The gut contents of individuals from different ponds has already been shown to vary. All these factors are closely inter-related and a detailed analysis of the ponds would be necessary to assess the significance of any separate factor.

Twitty (1959) suggests that with *Taricha rivularis* (a species closely related to *Triturus*) the precise chemical nature of the ponds may play an important part in the homing of individuals and the return to a particular breeding area in spring. He believes that the affinity for a particular area is imprinted on the immature larva and the adult will only breed when subjected to this same olfactory stimulation. Although such behaviour is learnt, it would indicate that chemical stimuli could play an important part in the behaviour of the newt. This theory, however, does not explain the invasion of new ponds by breeding individuals, which has been shown to take place in the New Forest and elsewhere. I have also found no difficulty in producing young in different water in captivity, although other workers have reported failure to produce eggs after a year in captivity.

SUMMARY.

The three species of British newts were studied in a group of ponds in the New Forest in the south of England.

The adult males of all species and the adult females of *Triturus cristatus* are easily identified in the breeding season. The adult females

of *T. vulgaris* and *T. helveticus* are almost alike, but a number of differing small details make identification possible.

The larvae of *T. cristatus* are always identifiable. The larvae of *T. vulgaris* and *T. helveticus* are alike and the species cannot be identified until metamorphosis is about to take place.

The investigations of the larvae of *T. vulgaris* and *T. helveticus* were supplemented by studies in the laboratory.

There was some evidence that metamorphosis in all species takes place earlier and when the larvae are smaller than is usually accepted. This is discussed in relation to the climate and the soil conditions.

ACKNOWLEDGMENTS.

This work was carried out at the suggestion of Dr. J. F. D. Frazer, of the Nature Conservancy, and I am most grateful to him for his help and guidance throughout. I would also like to thank Mr. Oliver Hooke, of Lyndhurst, who gave us much valuable local information, and the other members of the group, particularly Robert Bürk, Philip Lloyd and Sheila Megaw.

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TABLE I

Abbreviation of pond name	Pond name Map reference	pH	°F. June Temp. bottom	Remarks
H	Hatchet (4 ponds) SU/36650171	6.5–7.0	65–70	
P	Pilley SZ/33429857	>8.0	69	Large pond with deep centre
S	Setley (2 ponds) SZ/30409958	7.0	c. 65	
B	Balmer Lawn—claypits SU/31300367	>8.0	61	Many Coleoptera—clay bottom
BH	Balmer Lawn—hotel SU/30450327	7.0–8.0	69	Deep pond containing much rubbish
T	Balmer Lawn—tadpole SU/30580350	>8.0 Apr 7.0 Sept	—	Very muddy and shallow
L	New Park SU/30140463	6.5 Apr 7.5 June 5.5 Sept	66	*Notonecta*—much decaying vegetation
R	Rhinefield Way SU/27800242	5.5–6.5	c. 67	Many *Aeschnea* nymphs—few other invert. spp. Many *Th.* throughout year
BuI	Burley—clay hill SU/23310238	8.0	74	Many coryxids
BuII	Burley—Bistone Close SU/22830242	7.0–7.5	—	Large—much moss—many *Asellus*
BuIII	Burley—Holmesley SU/20340124	5.0–6.0	63	Large and deep—gravelly

TABLE II

Abbreviation	April, 1960 Adults T.c.	T.v.	T.h	June, 1960 Larvae T.c.	T.v/T.h	Size at metamorphosis T.v/T.h
H	0	7	5		+	–
P	1	14	0	+	+	40
S	0	2	2		+	25–28
B	7	1	150	+	+	21–26
BH	9	32	8	+	+	38–40
T	1	10	7	–	–	–
L	0	15	36	+	+	–
R	0	0	30		+	34–38
BuI	0	14	1		+	32–34
BuII	0	123	1		+	30–33
BuIII	–	–	–		+	32

Occurrence of larvae and adults in ponds with the average size of the two smaller species at metamorphosis

(T.c = *Triturus cristatus*, T.v = *T. vulgaris*, T.h = *T. helveticus*)

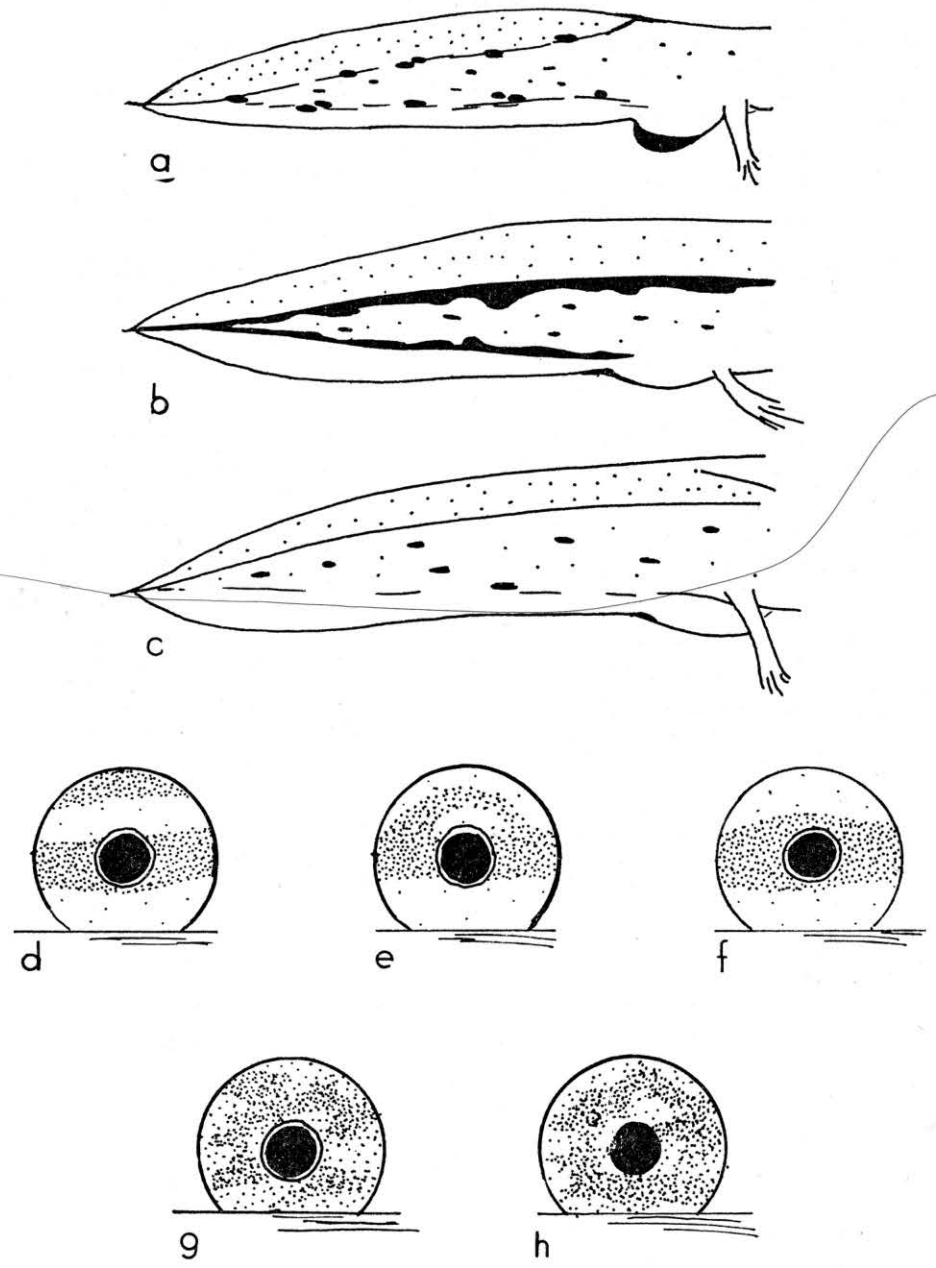


Fig. 1 Typical eyes and tails of adult newts.
a-c lateral view of tail of *T. helveticus*.
(a) male with filament.
(b), (c) extreme types in female.

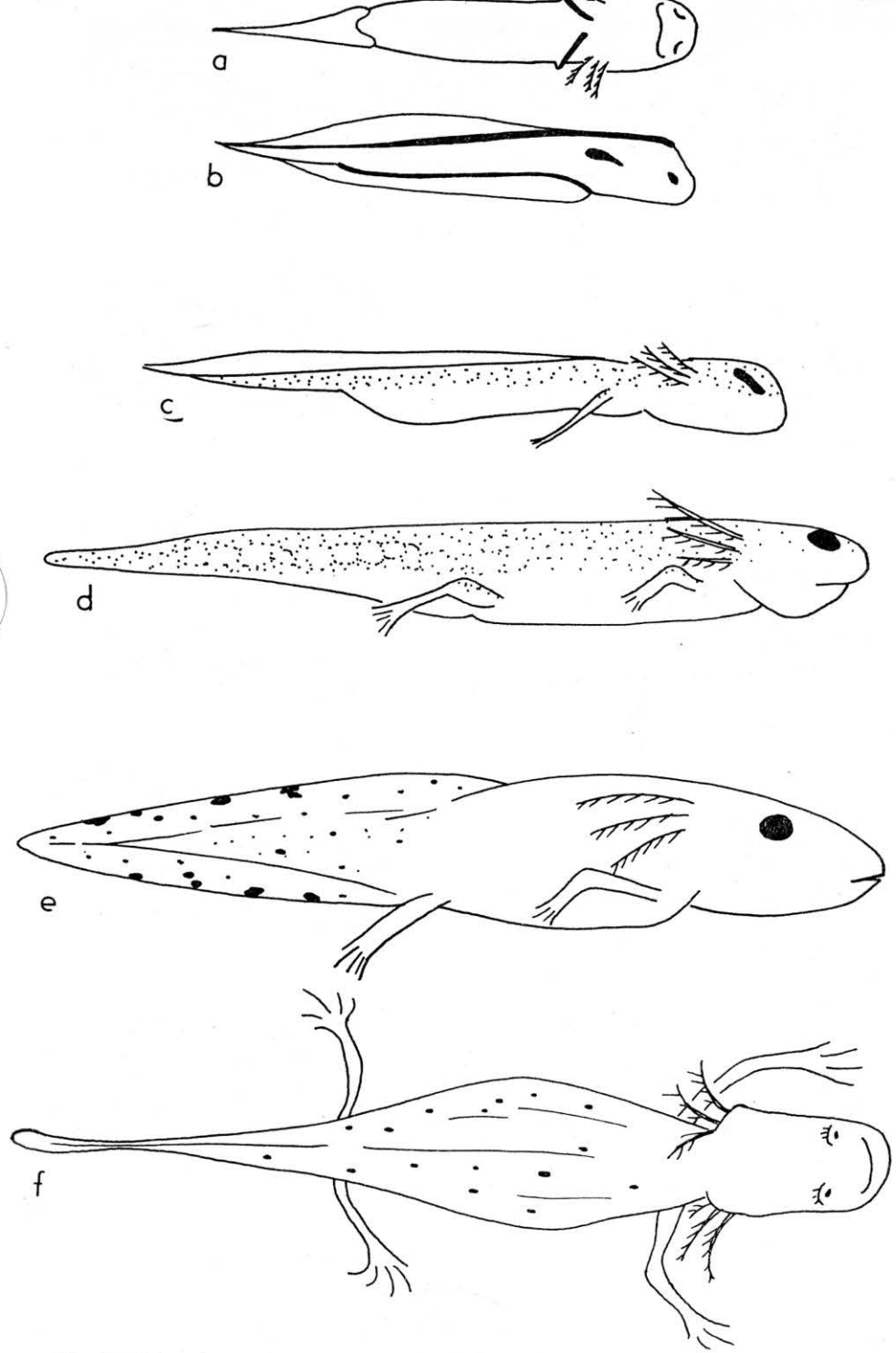


Fig. 2 Newt larvae.
a-d larvae of *T. vulgaris/T. helveticus*.
(a) dorsal view, (b) lateral view on hatching. (× 11·5)
(c) about 10 days later, after growth of front legs. (× 10·5)
(d) shortly before metamorphosis. (× 4·5)

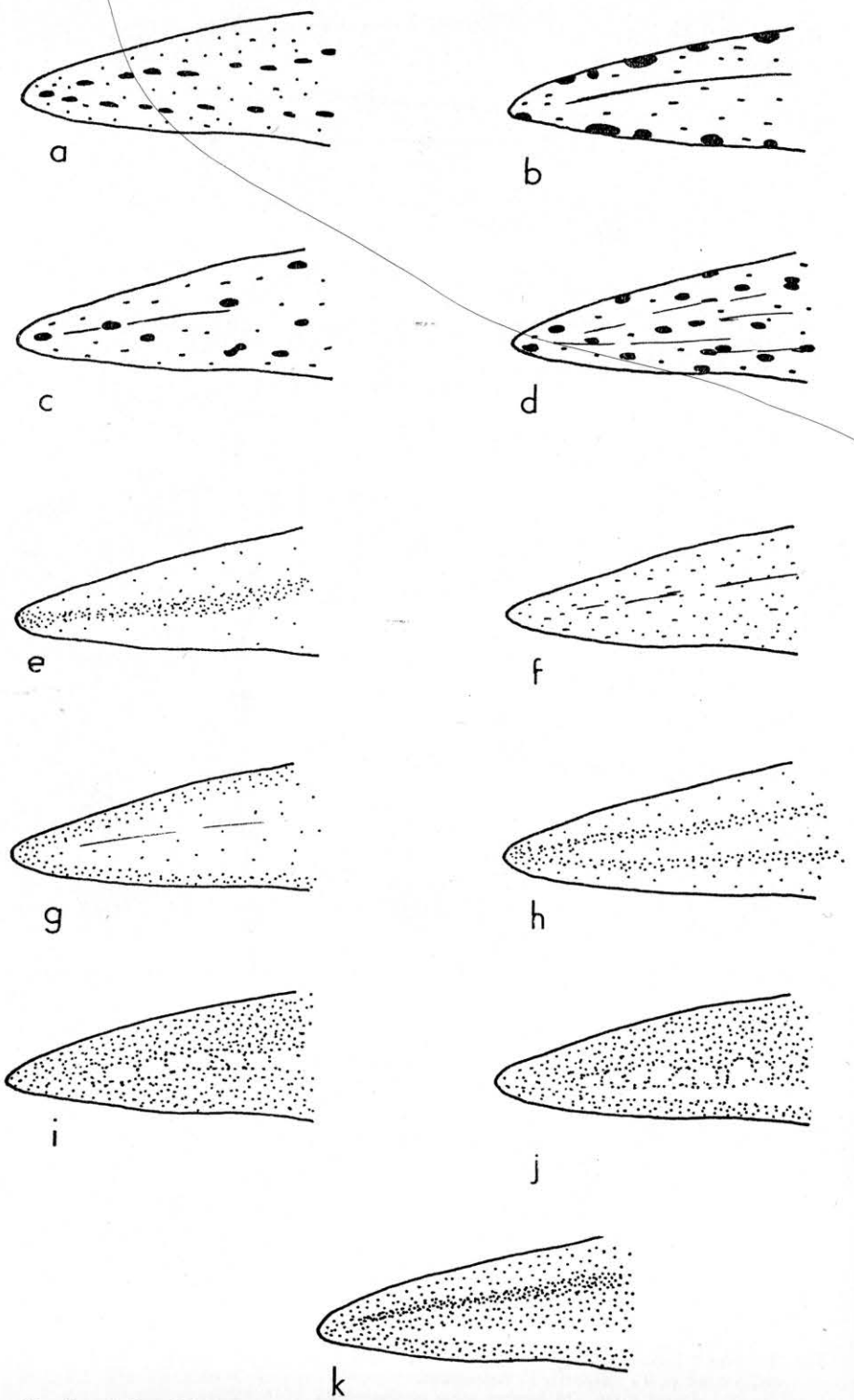


Fig. 3 Tails of larval newts.
a-d *T. cristatus.* (b) is most common type with (a) and (c) as variations, (d) is

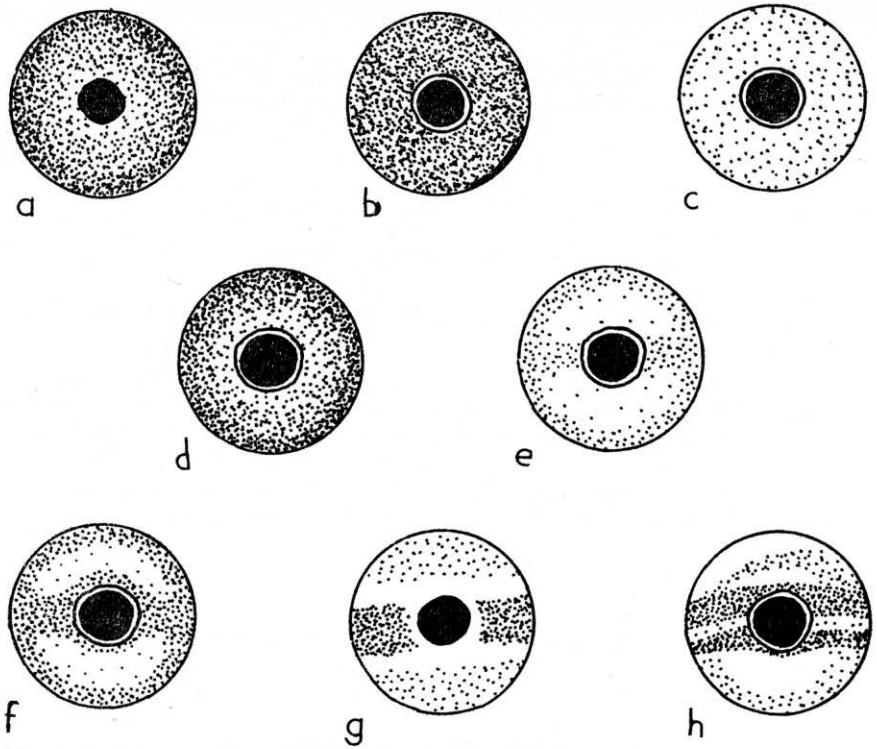
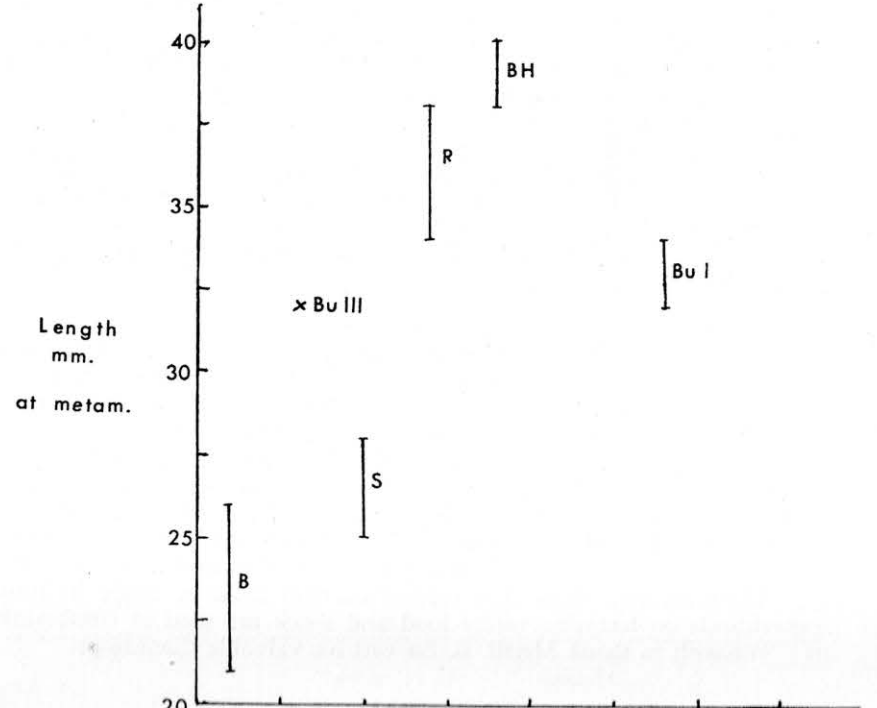


Fig. 4 (top) Eyes of larval newts.
(a) is the common type in *T. cristatus.* (f), (c) and (d) also occur.
(b) early type in *T. vulgaris/T. helveticus* leading to types (c) and (d). Later a bar forms (e), (f), which becomes more pronounced just before metamorphosis (g), (h).



ELECTRIC SHOCK AND REDUCED WEIGHT GAIN IN THE TERRAPIN

Pseudemys ornata callirostris

By

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The great variation in growth of chelonians has often been commented on, e.g. Cagle (1946). Some periods of slow growth are related to seasonal cycles (Hildebrand, 1932) but others, in wild animals, may extend over several years (Nichols, 1939). In captivity the conditions of housing and climate are important factors (Townsend, 1931). However even in standard conditions in this laboratory wide variations in growth of terrapins (as determined by their body weights) have been noted. The present results show how electric shock may affect the growth of terrapins.

EXPERIMENTAL PROCEDURE AND RESULTS

Terrapins, *Pseudemys ornata callirostris* (Gray) were kept in the laboratory in conditions similar to those described by Boycott and Robins (1961) except that very little ultra violet light was given. On arrival from North America in June the animals weighed 4-8 grams and the umbilical scars were not completely healed. About 5 months later they were used in a training experiment. During this some of them received electric shock over a period of several weeks. Control animals had the same number of trials over the same period but not shocks.

It is difficult to evaluate the strengths of shocks received by animals under water (Mrosovsky, 1964). However the shocks were always sufficient to cause retraction of the head; at times there were also transient tremors of the limbs when the shock ended. The duration of the shocks was 2 seconds and the mean number received each week was 8.8. The animals were fed in the morning; the training took place in the afternoons. Weights were recorded weekly.

Six of the shocked animals showed almost complete cessation of growth (e.g. No. 6R, Fig. 1) : three had reduced growth rates (e.g. No. 10B, Fig. 1): three appeared unaffected. The five control animals continued to grow as before (e.g. No. 2B, Fig. 1). The shocked animals appeared to eat less during this period.

DISCUSSION

Although the terrapins in the present experiment were gaining weight before the shock period there is no reason to suppose they were as healthy as those in the wild. The diet used by Boycott and Robins is probably not ideal. Livers of animals kept on this regime tend to be pale. The present data show that in these conditions electric shock, which can be thought of as an additional stress, may affect the growth of terrapins. This suggests the possibility that some of the individual differences in growth under standard conditions (compare No. 6B and No. 12B in Fig. 1) might be attributed to differences in reaction to captivity and new conditions.

These findings show that careful controls must be made in training experiments on terrapins where food and shock are used in combination.

We wish to thank Mr. B. B. Boycott for valuable discussions.

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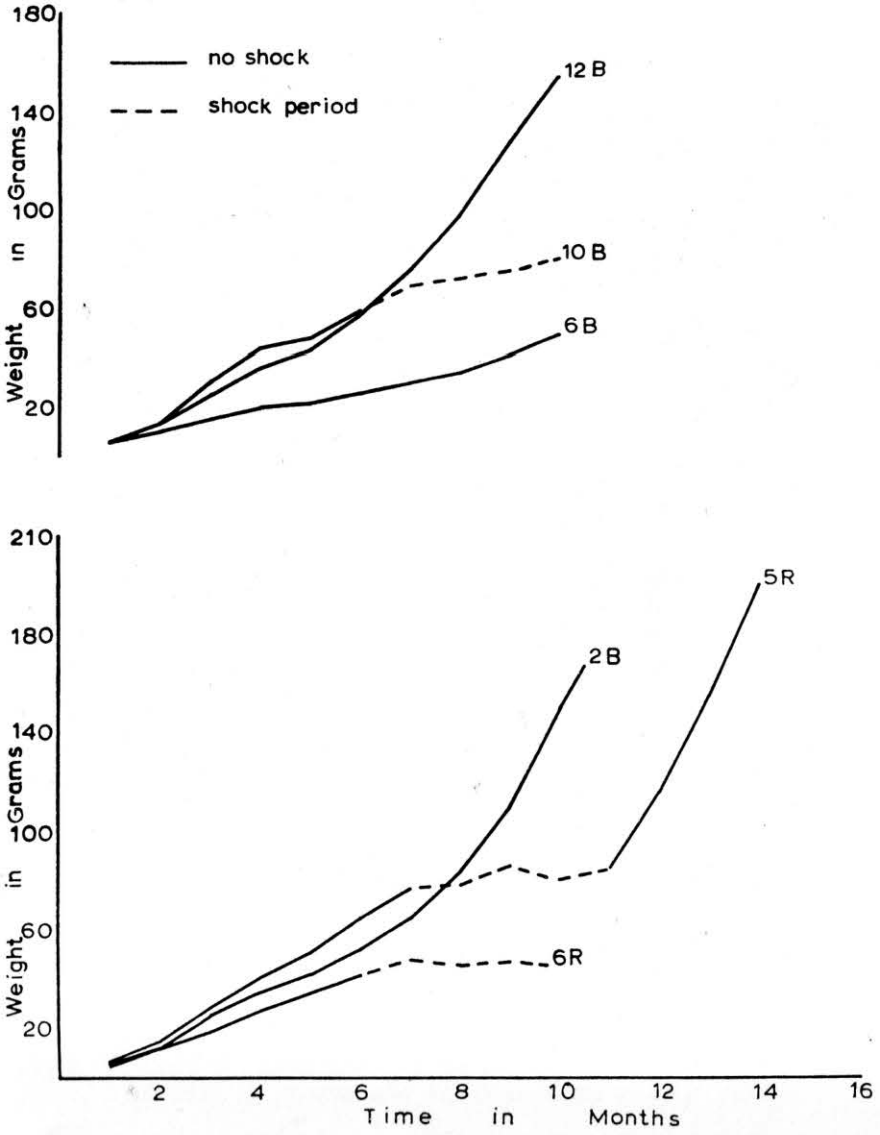


Fig. 1

POLYDACTYLY IN THE SMOOTH NEWT

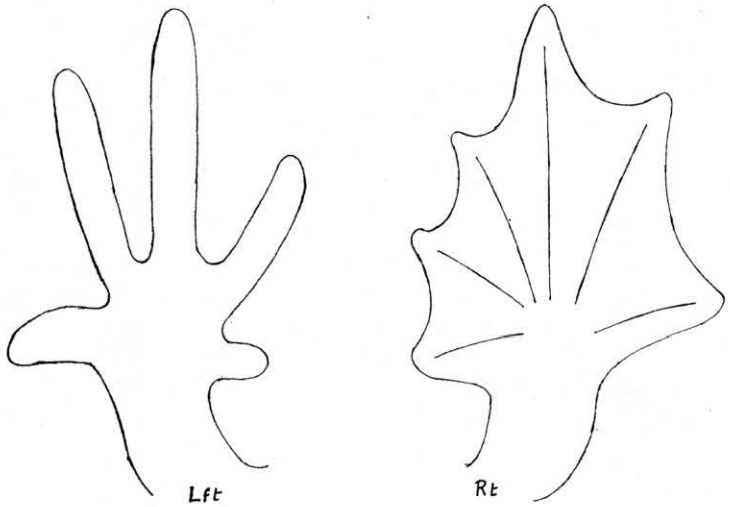
(Triturus vulgaris)

By

A. WOOLLACOTT

(Brooklands, Crosshill, Codnor, Derbyshire.)

A specimen of this newt was captured at Codnor, Derbyshire, in 1963 with an abnormal right hind foot. The drawing below shows the condition of polydactyly. No other abnormality was observed.



FROM OTHER JOURNALS

By

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In this column we hope to publish from time to time information on herpetological subjects, published here or abroad. The journals mentioned will be available, on loan, from the librarian.

AQUARIEN, TERRARIEN. A monthly journal, in German, for those interested in aquaria and vivaria. It is sponsored by "Deutscher Kulturbund" and issued by a committee of experts in East Berlin. The editor's address is: Berlin C2; Littenstrasse 79 a.

The following issues have been received: 1962, Nos. 1-5, 8, 10; 1963, Nos. 2, 4, 6, 8, 12; 1964, Nos. 1-3.

The erection of the Iron Curtain has not, apparently, diminished the widespread interest the Germans have always taken in the maintenance of well stocked aquaria and vivaria. Furthermore this interest seems to be shared with equal intensity by the Czechs and to some degree by the Russians. The East Germans have thus a large number of readers and a wide circle of distinguished contributors to rely on. Their journal, though unfortunately printed on indifferent paper, is extremely well produced. It has colour photographs on the front and the back page and the printers manage to do astonishingly well also with the many black and white illustrations inserted in the text. Considering that the public, for which this journal is issued, is not famous for its purchasing power, it seems only too likely that the paper is subsidised by funds from the "Kulturbund" or some other government agency. Even so, the guiding finger of the sponsoring power does not feature too prominently. Only occasionally as on p. 3 of No. 1/1962 where the defection to the West of the president of the organisation is deplored, is one made to see that, in the East, even herpetology has been drawn into the political vortex. Each issue of the journal has about 70 closely printed pages with expert papers on fish, amphibia and reptiles, a questions and answers column, news from abroad and from "the organisation" (it is not quite clear which), and, most important perhaps, some pages on recent books and papers published anywhere in the world. The moderate price of each issue is D.M.1.20 (= 2/1).

Neglecting the many papers published on fish, the following is a selective list of articles on amphibians and reptiles contained in the issues received. The figures give the number of the journal and the year. Many of the contributors are curators of reptile collections in zoological gardens with world-wide reputations. Others, equally authoritative, come from members with perhaps only one terrarium in the back garden. The balance between science and popular appeal is well maintained by the editor.

1/1962 KRONBERGER, H. On Terrapins from Vietnam.
2/1962 OLEXA, A. On the variegated dwarf chamaeleon *Microsaurus pumilus* Daud.
VOGEL, Z. On the biology of the adder.
3/1962 VOGEL, Z. On the biology of the large snakes.
KLUGE, K. The Hydrography of Nigeria.
4/1962 PENZES, B. Breeding *Boa occidentalis*.
PETZOLD, H. Reptiles and amphibians in the towns of Vietnam.

5/1962 DOBERSBERG, K. On keeping marine algae.
FREYTAG, E. On *Linguaelapsus cingulatus* Cope, an American salamander.
GRAMBOW, A. On Baltic algae.
8/1962 FROMMHOLD, E. On *Coronella austriaca.*
HALES, J., & ROTTER, J. Experiences with *Agkistrodon.*
WEBER, W. On *Phelsuma lineata,* a gecko from Madagascar.
10/1962 HELMERT, H. Hints for the aquarist-photographer.
GRAMBOW, A. On *Noctiluca miliaris.*
BRENNER, W. On *Anolis roquet extremus,* a lizard from Barbados.
IRTZ, P. On *Amblyrhynchus cristatus,* a marine saurian.
2/1963 DATHE, H. On *Candoia bibroni,* the pacific boa.
FREYTAG, G. On *Paramesotriton chinensis,* a Chinese newt.
PRIVORA, M. On *Paramesotriton deloustali* from Vietnam.
GILLE, H. On *Limnodynastes marmoratus,* an Australian frog.
4/1964 OLEXA, A., & KRAL, J. On the catching and management of *Triturus vittatus.*
6/1963 DAREWSKI, I. On the habitat of the Komodo dragon.
LULING, K. On *Podocnemis unifilis* and *P. expansa* from Peru.
8/1963 VIVAT, H., & MATUS, P. On the reproduction of *Proteus anguineus.*
SUHR, E. On sand boas.
10/1963 HERBER, FR. On the biology of *Agama sanguinolenta* (=*A. aralensis*).
FREYTAG, E. On *Plethodon longicrus* from N. Carolina.
12/1963 FREYTAG, E., & PETZOLD, H. On *Amphiuma means.*
WEHNER, W. School and Vivarium.
1/1964 KNORR, FR. Reptiles and Amphibians on stamps.
LULING, K. On the act of feeding in boas.
2/1964 OPITZ, J. On the Chinese terrapin, *Chinemys reevesii.*
BOSSELMANN, W. On the annual microbiology of a village pond.
3/1964 MACHLIN, M. D. On *Eumeces schneideri,* a caucasian skink.
WANKE, L. On *Malayemys subtrijuga,* a terrapin from Cambodia.
LIERSCH, P. On the breeding of *Salamandra salamandra.*

REVIEW

SNAKES OF AFRICA: SOUTHERN, CENTRAL AND EAST: by R. M. Isemonger. Nelson, 1962. 236 pp., 16 photographs (10 in colour), and various drawings. Price 21s.

This is the nearest approach so far to a "field-guide" of the snakes of this section of Africa, and as such is of considerable value. The author has put a wealth of personal experience into the book, and knows his local snakes very well. The bulk of the work is taken up by individual descriptions of the main species, together with notes on distribution, habitats, food and habits, all cross-referenced to a series of basic-colour identification charts of obvious practical value in identifying species in the field.

All this adds up to the fact that anyone interested in snakes, who lives in or visits any part of the area covered by the book, would do well to keep a copy in his pocket. From this point of view, some of the other chapters constitute rather a "mixed bag". Those on myths and superstitions, observations in the veld, snake-catching and keeping, and venom and its effects, are interesting and contain a lot of useful information, but are probably more suited to the library shelf than to the pocket. The chapter entitled "Some of the best" is amusing to read once but is otherwise superfluous to the main value of the book as a field guide.

It is unfortunately necessary to criticize the author at times when he steps outside his particular field of local herpetology. For example, a reference to the Smooth Snake of Europe is rather misleading, and a sequence of five lines under the heading "Evolution", stating that birds are the direct descendants of snakes and that snakes in their earliest form were flying reptiles rather like winged lizards or bats, is an absolute classic of concentrated misstatement.

Nevertheless, the book is good value for the money and a useful contribution to the herpetological literature of Africa.

J. W. Steward.

ANNOUNCEMENTS

The Ohio Herpetological Society has reprinted a number of harder-to-get herpetological papers dealing, in general, with the reptiles and amphibians of the mid-western United States. These facsimile reprints are distributed as part of the Society's *Reprint Series* and may be obtained postpaid from the Publications Secretary, Steve G. Tilley, 1115 Broadview Avenue, Columbus 12, Ohio, 43212, U.S.A. Cheques should be made payable to "Ohio Herp. Soc.". Available reprints and their prices are as follows :

KIRTLAND, J. P. 1838 (reprint 1961). *Zoology of Ohio* (herpetological sections), 5 pages.....$.35

LINNAEUS, C. 1766-1771 (reprint 1963). *Systema Naturae* (12th edition) and *Mantissa Plantarum* (herpetological sections), 56 pages.....$1.00

RAFINESQUE, C. S. 1820 (reprint 1962). *Annals of Nature* (herpetological and ichthyological portions), 4 pages.....$.25

——. 1822 (reprint 1963). *On two new salamanders of Kentucky* (reprinted from the *Kentucky Gazette*), 2 pages.....$.25

——. 1832 (reprint 1962). Five herpetological papers from the *Atlantic Journal,* 4 pages.....$.25

WILCOX, E. V. 1891 (reprint 1961). *Notes on Ohio batrachians* (reprinted from the *Otterbein Aegis*), 3 pages.....$.35

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Lt.-Col. R. H. R. Taylor (The Studio, Belchamp St. Paul, Sudbury, Suffolk) would be grateful for futher distribution records of the British amphibians and reptiles.

* * *

Volume 98, Section 16 of the Zoological Record dealing with Amphibia for the year 1961 is now available from the Zoological Society of London, price twenty shillings.