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TORSTEN GISLÉN † AND HANS KAURI

ZOOGEOGRAPHY OF THE SWEDISH AMPHIBIANS AND REPTILES

WITH NOTES ON THEIR GROWTH AND ECOLOGY

Editors:

KAI CURRY-LINDAHL, STOCKHOLM
BERTIL HANSTRÖM, LUND
BERTIL KULLENBERG, UPPSALA

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PREFACE

Before his death in 1954, Professor TORSTEN GISLÉN had practically completed the manuscript of this work. After his decease I was asked by Professor BERTIL HANSTRÖM, who was then Head of the Institute of Zoology at the University of Lund, to edit and, where necessary, complete the work and prepare it for the press.

The fact that the author and I had collaborated for several years facilitated considerably the editing of the work. On reading through the manuscript I found that the maps showing distribution, and the illustrations were more or less complete. The text, however, was rather unevenly worked up, and in some cases still incomplete. This last-named applied especially to water-newts, and to a somewhat smaller degree to toads, frogs and reptiles.

In my opinion GISLÉN's text should be unchanged as far as possible and his views reproduced as they had been expressed. This principle has been adhered to. Only the necessary corrections, emendations and amplifications have been made, and a number of new portions have been added where it was considered necessary. New finds have been registered and worked into the text. Thus the chapter on the Smooth Newt, its new northern race and neoteny (pp. 209–242), has been entirely written by the present author. I have also arranged all the tables and diagrams, in fact all the diagrams in the book are my work.

The chapter on the Fire Toad was thoroughly elaborated by GISLÉN. In particular, climatic changes and their bearing on the reduction of the species in Sweden have been carefully investigated. ALLAN NILSSON's work (1954), which was carried out under GISLÉN's guidance, has made valuable contributions in this connection. I have only made some slight alterations.

In the chapter on the Tree Frog the views reached by Mrs. I. KJELLBERG in her observations of the development of the larvae (1951) have been utilized. This work was also carried out under GISLÉN's guidance. I have added, among other things, a number of new details on the distribution of the Tree Frog (pp. 273).

The chapter on the Common Toad has to some extent been augmented with new observations by, among others, KAI CURRY-LINDAHL. A diagram showing conditions of growth during the first year of life has been added (pp. 278).

The chapters on the Natterjack and the Variegated Toad have been subjected to a new revision and a section on salt tolerance and on mating conditions in brackish water has been added (pp. 288, 293–295).

The chapter on *Rana ridibunda* which appeared in the manuscript has been deleted. The salient information in this chapter is to be found in the chapter on *R. esculenta*. In my opinion *R. ridibunda* is not a separate species. To the chapter on *R. esculenta* a section has been added on mating conditions etc. which is based partly on STEN FORSELIUS' observations at the northern distributional limits of the species, and partly on my own observations (pp. 299–300).

In the chapter on *Rana arvalis*, although it may be queried whether several races exist in Sweden, the section dealing with the *issaitschikovi* race has been retained as it gives valuable details regarding the most northerly populations.

The chapter on the Common Frog has been extended somewhat (pp. 316–317).

To the chapter on the Sand Lizard has been added a short section on the species' ecology of development, which is in the main founded on an investigation by S. I. RÜDEBERG (1954). In addition the section on its general distribution has been scrutinized and expanded (pp. 329–330). The chapters on the Viviparous Lizard and the Slow-worm have been supplemented with new facts (pp. 331). The chapter on the Ringed Snake has been partly revised, and that on the Adder has been somewhat enlarged (pp. 360–362, 367, 370–372).

Much new material has been collected during recent years and a number of new observations have been reported. To all who in this way have assisted in the completion of the work the author wishes to extend his warmest thanks, especially to Mr. K. CURRY-LINDAHL, Mr. N.-G. KARVIK, Mr. H. WALDÉN, Professor B. HANSTRÖM, Professor O. NYBELIN, Dr. K. ANDER, Mr. L. HOLMBERG, Mr. H. STENRAM, and Mr. S. ANDERSSON.

The manuscript has been read by K. CURRY-LINDAHL, and some chapters have been read by A. NILSSON and N.-G. KARVIK. Past and present chiefs of the Institute of Zoology at the University of Lund, Professor B. HANSTRÖM, Professor C. H. LINDROTH and Professor E. DAHL, have placed technical assistance at my disposal and aided the work in every way. The chapter on the Smooth Newt was translated into English by Mrs. C. MEURLING, and a linguistic scrutiny has been carried out by Mrs. Ross ALMQUIST.

This work, which the author, TORSTEN GISLÉN, was himself unable to complete, and which has now been finally revised and completed by another author does not aim at dealing exhaustively with the zoogeography and ecology of Swedish amphibians and reptiles. But it does provide a foundation for future research work. How important it was to publish this work may be best illustrated by a quotation from MALCOLM SMITH's valuable book (1954) "The British Amphibians and Reptiles" where, on page 184, the author states: "The former (*L. agilis*) is rare in Sweden and is known only from two localities in the extreme south." In the present work more than a hundred localities in this country are mentioned.

HANS KAURI.

INTRODUCTION. ACKNOWLEDGEMENTS

It is not mere chance that close attention has been paid to the making of dot maps of plants, thus giving the distribution in the most detailed way. Plants are easily localized, as they are stationary during the vegetation period, and large collections can easily be made. Floral studies have therefore been favoured since the time of LINNAEUS, and since that time a vast amount of information has been collected concerning them.

Thanks to their flying abilities and nesting habits birds have been the easiest ones of the higher animals to identify and to map. Mammals and amphibians, on the other hand, are mostly nocturnal and difficult to observe. Many dig themselves down during the day or keep quiet under logs and stones. LINNAEUS saw only about 11 of the 18 species of our reptile and amphibian fauna. SVEN NILSSON made a considerable contribution to our knowledge in the faunistic literature of the 19th century. Otherwise most authors in that century only made completely irrelevant remarks on distribution—for example that a certain species was common or rare in the county. In that way no information concerning locally specific distribution, relictary occurrence etc. was gained. SVEN EKMAN's treatise in 1922 meant a very important increase in our knowledge, as he gathered together all records of faunistic information known earlier. The periodical Fauna och Flora since 1906 has proved of great importance in supplying rich information of local records.

In recent years dot maps of the reptiles and amphibians of Estonia have been given by KAURI (1946), of Denmark by PFAFF (1943) and of Rhine & Main district by MERTENS (1947). These countries are small, and moreover, densely populated, which has made information easy to obtain. Against the 43000 square kilometers of Denmark come 459000 square kilometers of Sweden, which marks a more than ten-fold problem, as the latter is to a great extent uninhabited country. Although far from being complete, I think that the present treatise gives fairly good information on the distribution of the Swedish reptiles and amphibians. We know now, for example, that there are some irregularities as to the distribution in the occurrence of frogs in Småland, which may be climatically explained. There are finds of sand-lizards in central Sweden and some isolated outposts of smooth snakes and salamanders in northern Sweden, probably of relictary nature. We may presume that in Norrland there are still many interesting finds to be made and we can suppose that in warmer districts the

distribution may extend northwards along the borders of the large Norrland rivers.

The present investigation was begun in the 1930's but comprised then only some few of the species treated in this publication. It was not until 1942 that a more systematic collection of records of our Amphibia and Reptilia was begun. About 600 questionnaires were then sent out to all biology teachers at higher schools and to other persons, chiefly trained zoologists, who were known to me as able observers. Later on, moreover, at least 200 questionnaires have been distributed. The response to these, however, was rather meagre—perhaps 10 % answers.

In addition to this I had a number of recurring appeals, some annual, regarding observations of amphibians and reptiles which were published in Swedish zoological periodicals. Some material also accumulated in that way. Every report was thoroughly checked, especially when the record involved an extension of the distribution area of a certain species. Many false records have been corrected in this way. When the record had been made by other than a professional zoologist, every extension had to be verified by the collection of control specimens. This was practically always necessary in the case of the species of *Rana* and *Lacerta* which, to an untrained eye, may present difficulties in identification. This procedure turned out to be a wise one, as several misinterpreted specimens were cleared up in such a way.

Thus, for instance, records of the common frog on Gotland (also, as misinterpreted, present in the Gothenburg Museum of Natural History) could be revealed as referring to tadpoles of *Bufo bufo*. Almost all "sand lizards" (*Lacerta agilis*) from Värmland were in fact mottled specimens of *L. vivipara*. On scrutinizing museum specimens also some "*Pelobates*" larvae turned out to be misinterpretations of *Rana esculenta*, or even, in one case, of *R. temporaria*.

By and by a very rich collection of specimens of amphibians and reptiles accumulated in the Lund zoological museum, which has now without doubt the richest collection of these animals in this country. Our museum specimens have been entered in a special slip catalogue in which therefore a large number of donors are also listed. Moreover, specimens in other museums and records only have been collocated in an additional catalogue. My thanks are due to all those who have aided me, sometimes over a period of years, with collecting observations and sending in material. Those who have contributed with observations are referred to by abbreviations given in the list below.

Abbreviations referring to those museums which have contributed by lending me their material are also given here.

Bibliographical notes are indicated by the name of the author followed by the year of publication. When giving a locality the parish is first listed, followed after a comma by the more detailed record of the locality.

Among recorders I wish specially to tender my thanks to three gentlemen. The late Mr. E. DAHL, formerly executive forester, generously placed at my disposal his maps and records from Dalarna, collected over a period of many years. Mr. S. SAHLIN, fisheries inspector, began during the 1920's an investigation of the amphibian and reptilian fauna of Scania. While later on he turned to other investigation, he kindly offered me his valuable dot maps and records to be worked into my treatise. And finally Mr. H. LOHMANDER, Director of the Entomological Department at the Gothenburg Natural History Museum, on his extensive journeys in southern Sweden, in addition to his studies on molluscs and arthropods of the soil and forest bottoms, has during the last decade also kindly paid great interest to recording and collecting the animals treated here. His preserved material is kept in the Gothenburg Natural History Museum. Moreover, a very large material and many records have been collocated during my yearly excursions by the accompanying officials and students of the Lund University.

All incoming material and records concerning occurrence have been revised and the records rearranged according to distribution in different counties. The rule has been to arrange the localities from south to north within each county. In this registering I had very valuable help from my three successive assistants Mrs. EVA MELANDER, Mr. ULF SCHELLER and Mr. ALLAN NILSSON. I wish to tender them my cordial thanks for their scrutinizing work and untiring interest during this investigation.

Though far from exhaustive, the present treatise has increased our knowledge of the distribution of the Swedish amphibians and reptiles very considerably. Thus, for instance *Rana dalmatina* was formerly known from 7 Swedish localities but is here reported from 48. *Lacerta agilis* was formerly recorded from 20 localities but is here given from 130. *Coronella austriaca* has previously been observed in about 40 localities, but is here listed from about 220. Still greater, perhaps, is the increase for the common species. Such forms considered by the layman to occur everywhere were formerly generally not recorded at all or, as in the case of species not easily correctly identified even by a zoologist, e.g. *Rana temporaria* and *R. arvalis*, the determination was previously often unreliable or erroneous. A careful sifting of the incoming reports was therefore essential. In fact, as a result of this scrutiny it was shown quite unexpectedly that, for example, the common frog is lacking in large parts of especially SE Sweden. Now there are more than 406 records for *R. arvalis*, about 670 localities for *R. temporaria*, and 720 for *Bufo bufo* given in my lists.

Figures have been given to elucidate the *vertical* distribution of each species, as such are considered to a certain degree to be of interest as regards the problems of horizontal distribution also.

On several occasions it has been possible to discuss racial problems and some interest has been paid to colour variations.

As far as possible the time of spawning, duration of different developmental stages, metamorphosis etc. have been given.

It has been evidenced that in several instances the species treated is under-

going regression, sometimes rapid, in Sweden. In connection with this, the influence of human cultivation and secular changes of the climate have been discussed.

After the treatment of the different species there is a general part which summarizes and further develops the discussion of general distributional problems concerning *Amphibia* and *Reptilia*, which are very important zoogeographically.

TORSTEN GISLÉN.

LIST OF CONTRIBUTORS

with abbreviations used in the lists of localities

O.F.A.	Aaröe, Olof F., Göteborg.
I.A-l.	Agrell, I., Lund.
A.A-n.	Ahlin, Anders, Mjöbäck.
T.A.	Allegård, Tage, Kölsillre.
G.A-m.	Alm, Gösta, Ven.
I.A.	Almgren, Ivar, Stockholm.
E.A.	Almquist, Erik, Eskilstuna.
T.A-t.	Almstedt, Tore, Lycksele.
N.A.	Alroth, Nils, Söderhamn.
K.A.	Ander, Kjell, Linköping.
E.A-g.	Anderberg, E.,
A.A.	Andersson, Annie, Södertälje.
E.A-n.	Andersson, Erik, Timmergata, Kolmården.
G.A.	Andersson, Georg, Värnamo.
G.A-n.	Andersson, Gösta, Svalöv.
H.A.	Andersson, H., Årnilt, Skavböke.
N.A.A.	Andersson, Nils Arvid, Simrishamn.
S.A-n.	Andersson, Sune, Västervik.
O.A.	Andersson, Olof, Karlshamn.
L.A.	Andersson, Louis, Malmö.
O.A-n.	Andersson, Onni, Södertälje.
S.A.	Arbman, Sven, Sunne.
P.A.	Ardö, P., Lund.
G.Ar-n.	Arvidsson, G., Uppsala.
I.A.	Arvidsson, I., Uppsala.
S.A-r.	Asker, S., Lund.
H.O.B.	Backlund, H.O., Karlstad.
E.B-n.	Bartler, E., Örnsköldsvik.
A.B-h.	Bech, Axel, Ystad.
L.B.-F.	Beck-Fries, Lave, Stockholm.
A.B.	Behm, A., †, Stockholm.
E.B.	Bengtsson, Erik, Lund.
S.B-n.	Bengtsson, Simon, Lund.
S.B-g.	Berg, Sven, Visby.
A.B-n.	Bergengren, A. Växjö.
E.B-n.	Bergengren, E., Hälsingborg.
E.B-n.	Bergman, Esbjörn, Rönninge.
H.B-t.	Bergquist, H., Göteborg.
U.B.	Bergström, Ulf, Stockholm.
G.B-n.	Bern, Gunhild, Karlskrona.
A.B-s.	Berndes, Agnes, Strömstad.
J.B.	Bernström, John, Tidö, Västerås.
G.B.	Bjurulf, Gunvor, Lund.
G.B-d.	Björklund, Gulli, Önnestad.
C.B.	Bliding, Carl, Borås.
S.B-t.	Blomquist, S., †, Sundsvall.
B.B-t.	Blomstedt, B., Huseby, Högsby.
H.B.	Bohman, Hans, Norrköping.
C.P.B.	Bonde, Ph. Carl-Philip, Bosjökloster.
S.B.	Boräng, Sven, Västervik.
H.B-m.	Brattström, H., Bergen.
P.B.	Brinck, P., Lund.
T.B.	Brodin, Torsten, †, Göteborg.
E-y B-n.	Brorsson, Evy, Jönköping.
N.B.	Bruce, N., Gårdby.
W.B.	Bülow, Waldemar, Lund.
C.A.C.	Cantell, C. A., Visby.
O.C-n.	Carlgren, O., †, Lund.
C.C.	Carlsson, Curt, Gotland.
D.C.	Carlström, Diego, Stockholm.
B.C.	Cederberg, Bert, Nacka.
H.C.	Christoffersson, H., Lund.
N.C.	Colliander, Nils, Göteborg.
K.C.-L.	Curry-Lindahl, Kai, Stockholm.
O.C.	Cyrén, Otto, †, Stockholm.
E.D.	Dahl, Eric, †, Stora Tuna.
E.D-l.	Dahl, Erik, Lund.
G.D-l.	Dahl, Georg, Colombia.
N.D.	Dahlbeck, Nils, Göteborg.
K.D.	Dahlén, Karin, Trälleborg.
P.D.	Dalenius, Per, Uppsala.
O.D.	Dahlin, Olof, Lidingö.
A.D.	Dahm, Anders, Lund.
G.D-s.	Degelius, Gunnar, Uppsala.
G.D.	Delje, Gustaf, Uppsala.
S.D.	Diding, Stig, Malmö.
K.F.D.	Dusén, K.-F., †, Kalmar.
Å.D.	Domeij, Åke, Mönsterås.
I.G.E.	Ebbersten, G:son, I., Ryssby.

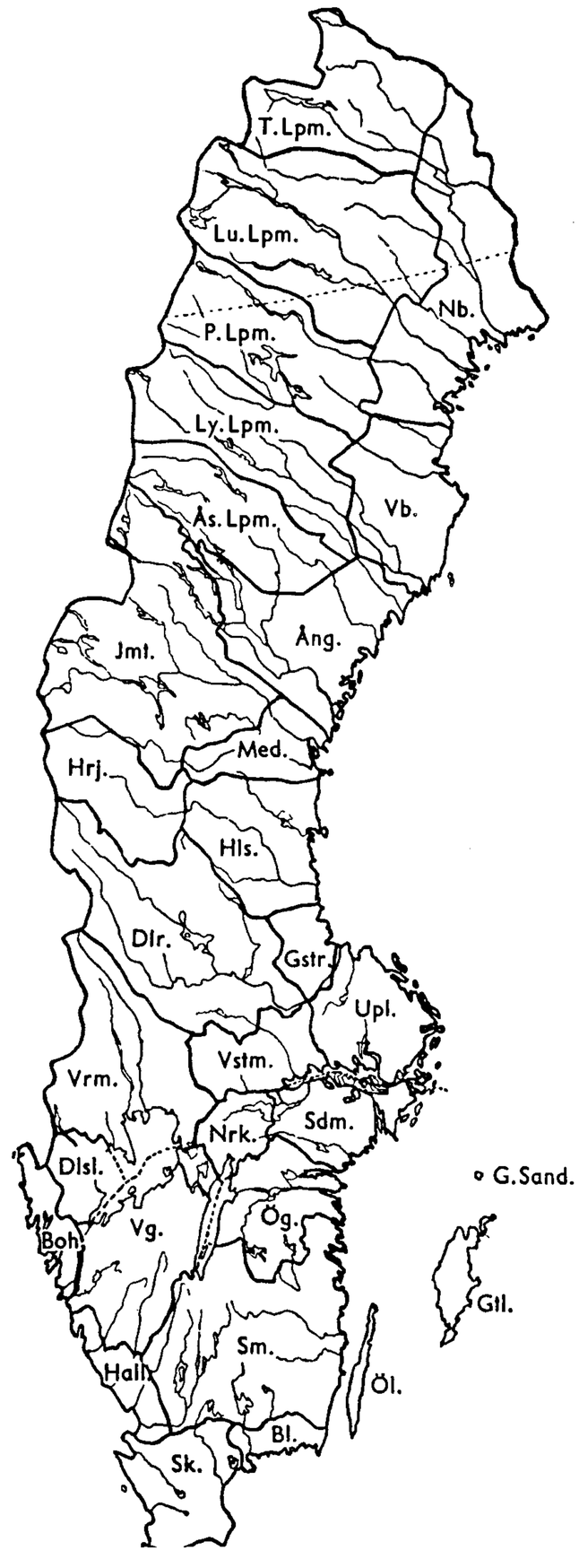
C.E. Edelstam, Carl, Stockholm.
S.Ed. Edin, Svea, Mönsterås.
K.E. Ehnbom, Kjell, Göteborg.
S.E. Ekman, Sven, Uppsala.
V.W.E. Ekman, V. W., Lund.
H.E. Eliasson, Hugo, Göteborg.
R.E. Enderlein, R., Lund.
H.E-n. Emanuelsson, Hadar, Lund.
A.E. Ernvik, Arvid, Grässjön, Arvika.
V.E. Ericson, Volmar, Lund.
K.E-n. Eriksson, Karin, Linköping.
S.E-n. Erlandsson, Stellan, Stockholm.
Exc. Excursions organized by the Zoological Institute of Lund University.
K.F. Fahlander, Kjell, Linköping.
A.F. Falk, Alma, Kalmar.
R.F. Fehrman, R., Hyltebruk.
V.F. Fontaine, Viking, Göteborg.
S.F-s. Forselius, Sten, Uppsala.
K.-H.F. Forsslund, Karl-Herman, Stockholm.
B.F. Forsman, B., Kalmar.
J.F. Forsman, J., Lund.
E.F. Fredriksson, Erik, Vetlanda.
O.F. Fredlin, O., Stockholm.
S.v.F. von Friesen, S., Lund.
E.F. Fries, Elias, Uppsala.
H.F. Frising, Hildur, Tomelilla.
R.F-e. Fänge, Ragnar, Lund.
C.B.G. Gaunitz, C. B., Österkorsberga.
S.G. Gaunitz, Sven, Stockholm.
N.G. Gisslen, Nils, Krångede.
T.G. Gislén, Torsten, †, Lund.
K.G. Grahn, K., Umeå.
L.G. Granholm, Lars, Härnösand.
G.G. Gullikson, Gullik, Sillre, Eriks-lund.
I.G. Göransson, Ivar, Malung.
A.H. Hage, Anders, Linköping.
Å.H-l. Hall, Åke, Göteborg.
Å.H. Hallander, Åke, Jönköping.
H.H. Hallander, Håkan, Jönköping.
C.E.H. Hallberg, C.E., Karlsborg.
T.H-g. Hallenborg, Torsten, Halmstad.
H.A.H. Hallström, H.A., Falköping.
P.H. Hallström, Per, Sundsvall.
D.H. Hannerz, Dag, Norrtälje.
E.H. Hannerz, E., Luleå.
E.H-M. Hansen-Melander, Eva, Lund.
S.H. Hanson, Sven, Kalmar.
B.H. Hanström, Bertil, Lund.
O.H-g. Hedberg, Olov, Västerås.
H-m. Hederstam, Å. J., Kalmar.
S.H-m. Hederström, S., Skellefteå.
L.-O.H. Hemming, Lars-Olof, Jönköping.
I.H-n. Hildén, Ilmari, Helsingfors, Finland.
C.A.H. Hill, Carl-Axel, Stockholm.
H.H. Hinricsson, H., Strängnäs.
O.H. Holm, O., †, Umeå.
Å.H-m. Holm, Åke, Uppsala.
P.H-A. Holm-Andersen, P., Köpenhamn.
I.H. Holmgren, Israel, Eckerö.
H.a.R. Horn af Rantzien, Henning, Stockholm.
E.H-n. Hultén, Eric, Stockholm.
K.H-a. Humbla, Kaj, Valdemarsvik.
T.H. Hylander, Tofte, Mönsterås.
B.H.-C. Hyltén-Cavallius, Björn, Lund.
G.H. Håkansson, Gösta, Visby.
L.H. Höglund, Lars, Uddevalla.
R.J-n. Jeppson, Ragnar, Fjelkestad.
A.J. Johansson, Aug., Hjorted.
B.J. Johansson, B., Vartofta.
K-E.J. Johansson, Karl-Erik, Blekinge.
R.J. Johansson, Ragnar, Jämshögsby.
O.J-n. Jonasson, Olof, Göteborg.
E.J. Julin, Erik, Haparanda.
L.A.J. Jägerskiöld, L. A., †, Göteborg.
V.J. Jääskeläinen, V.
H.K-g. Kalleberg, Harry, Uppsala.
M.K. Kangro, M. Lund.
S.K. Karlsson, Stig, Kalmar.
N.-G.K. Karvik, N.-G., Lidköping.
S.K-n. Karlsson, Stig, Linköping.
H.K. Kauri, Hans, Lund.
N.A.K. Kemner, N. A., †, Lund.
K.E.K. Kivirikko, K. E., Helsingfors.
R.K. Kjellström, Rolf, Kalmar.
E.K. Klefbeck, Einar, Falun.
A.K. Klementsson, A., Hästveda.
C.G.K. Klingberg, C. G., Vänersborg.
K.K.K. Kolthoff, K., †, Uppsala.
B.K. Kullenberg, Bertil, Uppsala.
G.K. Kvenne, Gösta, Gävle.
A.L-g. Lamberg, Aina, Malmö.
B.O.L. Landin, B. O., Lund.
K.L. Lang, Karl, Stockholm.
L-t. Langert, K., Göteborg.
O.L. Larsén, O., Lund.
N.L-n. Larsson, Nils, Borgviksbruk.
L.L-e. Lembke, Lennart, Sundsvall.
T.L. Leiler, T., Stockholm.
F.L. Lidström, Folke, Åkarp.
L.L.I. Limnologiska Institutionen, Lund.
A.L-u. Lindau, A., †, Lund.
L.L. Lindberg, Leif, Stockholm.
S.L. Linder, Stig, Hässleholm.
E.L-t. Lindquist, Erik, Experimentalfältet.
C.H.L. Lindroth, Carl H., Lund.
N.L. Linnman, Nils, Stockholm.
Y.L-e. Ljunge, Yngve, Karlshamn.
H.L. Lohmander, H., Göteborg.
St.L. Lohmander, Stella, Göteborg.
P.M.L. Lovén, P.M., Malmö.
S.E.L. Lundahl, Sven Erik,
H-s. L. Lundberg, Hans, Djursholm.
T.L-d. Lundblad, Torsten, Umeå.
O.L-d. Lundblad, O., Stockholm.
G.L. Lundequist, Gunnar, Stockholm.
C.F.L. Lundevall, C.-F., Norrköping.
B.L-n. Lundman, B. L., Uppsala.
A.L-t. Lundqvist, Arne, Lund.
A.L-m. Lundström, Allan, Sollefteå.
H.L-m. Lundström, Harald, Lund.
A.L-r. Luther, A., Helsingfors.
E.L. Lönnberg, E., †, Stockholm.
Y.L. Löwegren, Yngve, Lund.
E.L-n. Löwgren, Ester, Stocksund.
G.M-g. Malmborg, G., Karlskrona.
E.M-m. Malmström, E., Överum.
M.M. Malmö Museum, Malmö.
S.M. Mathiasson, Sven, Lund.
A.M-n. Mattisson, Artur, Lund.
Y.M. Melander, Yngve, Lund.
C.E.M. Mellgren, C. E., Veberöd.
A.M. Mellgren, Arne, Norrköping.
J.M. Molin, J., Luleå.
O.M. Mohlin, Olof, Lund.
E.M. Montén, Erik, Storängen.
C.M. Mossberg, Curt, Växjö.
H.M. Muchardt, Harald, Hälsingborg.
E.M-n. Mårtensson, E., Eriksdal.
E-s. M. Månsson, Elias, Bingsjö.
N.M. Månsson, Nils, Kurremölla.
G.N.M. Naturhistoriska Museet, Göteborg.
N.R.M. Naturhistoriska Riksmuseet, Stockholm.
E.N. Neander, E.
A.N-n. Nilsson, O. H. Allan, Malmö.
D.N. Nilsson, David, Skara.
S.N. Nilsson, Sixten, Väderum.
M.N. Nilsson, Martin, Nyköping.
C-B.N. Nordenberg, C.-B., Kalmar.
V.N. Nordquist, Vera, Lekvattnet.
N.N. Noréhn, Nils, Malmö.
O.N. Nybelin, Orvar, Göteborg.
K-G.N. Nyholm, K-G., Uppsala.
T.N. Nyholm, T., Stockholm.
A-J.O. Odeen, Axel-J., Årsjö.
B.O. Odeving, Bruno, Lund.
S.O. Olofsson, Sven, Olofsdal, Partille.
C.O. Olrog, C., Argentina
A.O. Olsson, A. Vallstena.
P.Å.O. Olsson, Per-Åke, Trälleborg.
V.O. Olsson, Viking, Valdemarsvik.
F.O. Ossiannilsson, Frej, Stockholm.
G.O. Otterlind, Gunnar, Lysekil.
F.P. Persson, Fritjof, Södåkra, Jonstorp.
H.E.P. Persson, H. E., Stockholm.
J.P. Persson, Julius, Skeppshult.
K.P. Persson, Kerstin, Lund.
P.P. Persson, Per, Lund.
O.P. Persson, Ove, Lund.
B.P. Pettersson, Bengt, Visby.
J.F.P. Pfaff, J. F., Köpenhamn.
E.P. Plahn, E., Bromma.
G.HvP. von Post, G. H., †, Stockholm.
O.M.R. Reuter, O. M., Helsingfors.
A.R. Rinde, Astrid, Lund.
O.R. Ringdahl, O., Hälsingborg.
G.A.R. Ringselle, G. E., Stockholm.
M.R. Roland, Margareta, Lund.
S.R. Roseen, S., Lindesberg.
E.R. Rosenberg, E., Örebro.
G.R. Rudebeck, G., Lund.
I.R. Rudebeck, Inga, Lund.
J.R. Rudner, J., Kapstaden.
O.R-g. Ryberg, O., Malmö.
F.R. Rösiö, Folke, Jönköping.
J.S-g. Sahlberg, J., †, Helsingfors.
S.S. Sahlin, Sven, Göteborg.
O.B.S. Santesson, O.B., Uppsala.
G.S. Samuelsson, G., †, Stockholm.
H.S. Samuelsson, Hj., Kalmar.
F.v.S. Schantz, F. von, Växjö.
U.S. Scheller, Ulf, Karlskrona.
E.H.S. Selander, E. Hj., Härnösand.
I.S. Segelberg, Ivar, Göteborg.
L.S. Silén, L., Stockholm.
R.S-s. Siewers, R., (Finland).

B.S.	Sjögren, Bengt, Tjörnarp
J.S.	Snellman, J., Stockholm.
P.A.S.	Stenberg, P. A., Linsäll.
H.S-m.	Stenram, Håkan, Lund.
R.S.	Sterner, Rikard, †, Göteborg.
B.S-z.	Stjernkrantz, Bengt, Slätafly.
O.S.	Sundin, O., Rätansbyn.
T.S.	Sundin, Torsten, Avesta.
H.S-n.	Svensén, H., Rosenfors, Lilla Sinnerstad.
P.O.S.	Swanberg, P. O., Skara.
E.S-n.	Svensson, Erik, Värnamo.
P.v.S.	Sydow, von P., Rödeby.
E.S.	Sylvén, Edvard, Lund.
Hj.S.	Sylvén, Hjalmar, Skara.
A.E.S.	Söderström, A. E., Tjurkö, Karlskrona.
A.S-g.	Söderberg, Arvid, Ilingetorp.
A.S.	Sönnermark, Anna, Åstorp.
N.T.-W.	Tarras-Wahlberg, N., Lund.
S.T-e.	Thore, Sven, Stockholm.
C.T.	Thorgren, Christina
S.T-n.	Thorgren, St.
K.T.	Thorleif, Karl, Göteborg.
T.T-t.	Thott, T., Skabersjö.
S.T-k.	Thunmark, Sven, Lund.
B.T.	Tjeder, Bo, Falun.
T.T.	Tjeder, Tord, Rättvik.
S.T.	Torgård, S., Linköping.
O.T.	Törngren, O., Karlskrona.
N.T.	Törnquist, N., Karlstad.
Å.U.	Uddling, Åke, Kristianstad.
B.W-n.	Wahlin, B., Linköping.
H.W.W.	Waldén, Henrik, W., Stockholm.
B-l.W.	Walldén, Bertil, Västerås.
J.G.W.	Wallén, J. G., Härnösand.
H.V.	Vallin, H., Hälsingborg.
B.W.	Welin, Bengt, Horndal.
C.W.	Weman, C., Kalmar.
G.W-g.	Wennberg, Gösta, Lund.
Å.W.	Wennström, Åke
H.W.	Westberg, H., Ronneby.
A.W-t.	Weylandt, A., Stockholm.
E.W-k.	Wibeck, Edvard, Tännö.
T.W.	Wickbom, Torsten, Katrineholm.
H.W-n.	Wigsten, Haldur, Huskvarna.
G.W.	Wigstrand, G., Åkeholm.
E.W.	Wiman, Erik, Kristinehamn.
K.G.W.	Wingstrand, K. G., Köpenhamn.
E.W-n.	Wirén, Einar, Lundsberg.
W-d.	Wistrand, C. G., Jönköping.
B.W-S.	Witt-Strömer, Bo, Ljusdal.
A.W.	Wollebæk, A., Oslo.
Th.W.	Wulff, Th., †, Lund.
L.Z.M.	Zoologiska Museet, Lund.
U.Z.M.	Zoologiska Museet, Uppsala.
G.Ö.	Ödquist, Gunnar, Stockholm.
G.Ö-t.	Ödquist, Gustaf, Stockholm.
Å.Ö.	Öhman, Åke, Luleå.
R.Ö.	Öhman, Richard, Sundsvall.

MAP OF SWEDEN

with division of counties and with definitions of other areas mentioned in the lists of localities.

Sk	Skåne, Scania
Bl	Blekinge
Hall	Halland
Sm	Småland
	Kalmar län — the coastal zone of Sm, not drawn on the map.
Öl	Öland
Gtl	Gotland
G. Sand.	Gotska Sandön, belonging to Gotland.
	Göteborg — the coastal area between Hall. and Boh., not drawn on the map.
Boh	Bohuslän
Vg	Västergötland
Ög	Östergötland
Vrm	Värmland
Nrk	Närke
Sdm	Södermanland
	Stockholm — the area between Sdm. and Upl., east of the lake Mälaren.
Vstm	Västmanland
Upl	Uppland
Dlr	Dalarna, Dalecarlia
Gstr	Gästrikland
Hls	Hälsingland
Hrj	Härjedalen
Med	Medelpad
Jmt	Jämtland
Ång	Ångermanland
Vb	Västerbotten
Nb	Norrbotten
	Lappland divided in Åsele-, Lycksele-, Pite-, Lule- and Torne Lappmark = Ås. Lpm., Ly. Lpm., P. Lpm., Lu. Lpm., and T. Lpm.



Triturus vulgaris (LAURENTI). **Smooth Newt. Mindre vattenödla**

Distribution: From Ireland, Scotland and England in the west, northern and central France, Belgium, Holland, Denmark, Germany and Switzerland. In Norway to Trondheim; in Finland in the southern and middle parts; in Russia (TERENTJEV & ČHERNOV, 1949) with northern border between 62° N (in the west) and 58° N (in the east) it reaches Abakansk Mnts in Siberia, 89° E, extending southwards to 50°–52° N. Isolated on the northern side of lakes Aral and Balhash. It occurs in the Balkans, in Italy and northern Asia Minor. Not existing in the Crimea, Corsica and Sardinia. In the south it forms several races: *Triturus vulgaris meridionalis* (BOULENGER) in southern Switzerland, northern and central Italy and northern Jugoslavia; *T. v. graecus* (WOLTERSTORFF) in Greece, southern Jugoslavia and Macedonia; *T. v. lantzi* (WOLTERSTORFF) in Caucasus. There are two races of smooth newt in Sweden: *T. v. vulgaris* L. and *T. v. borealis* nov. ssp.

Triturus vulgaris vulgaris (LAURENTI)

The common newt seems to occur in the whole of southern Sweden, including Öland and Gotland. In central Sweden it is distributed in central and northern Värmland, Dalecarlia, Gästrikland and Hälsingland, at least to Söderhamn, 61°30′. North of this occurs the northern race, here called ssp. *borealis*. (Fig. 1.)

The Smooth Newt begins its spawning in the middle of April, in the south of Sweden, but it can also be earlier or later according to weather conditions. In Scania, for instance, a warm early spring can encourage early mating, and spawning can then start at the beginning of the month; in the same way a period of inclement weather can lead to a delay. Hibernation begins in October.

The first metamorphosed specimens have been observed about July 15th. Most of the larvae are metamorphosed during the month of August, and the last ones at the beginning of September, when they leave the ponds. However, unmetamorphosed larvae have been found even later, for example, at the end of October. (Fig. 2.) This fact and the presence of large larvae (36 mm) as early in the spring as the first days of May indicates that the Smooth Newt can hibernate in Scania in the larval form. Clearly these larvae are the result of a late spawning, and have not had time to complete their metamorphosis during the first period of activity. If the larvae hibernate more or less regularly or only during favourable

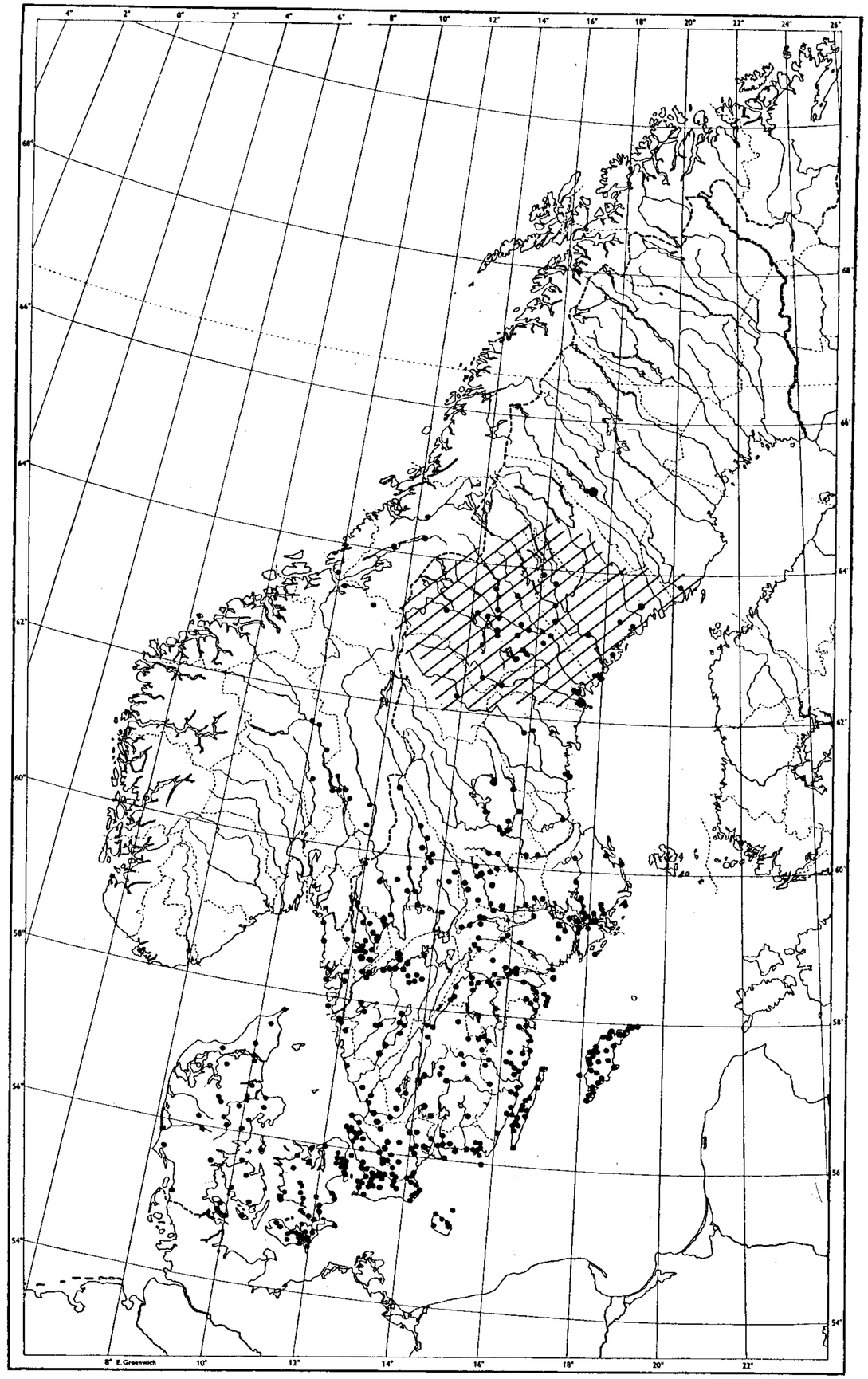


FIG. 1. Distribution in Scandinavia of *Triturus vulgaris vulgaris* (LINN.) (dots) and *T*

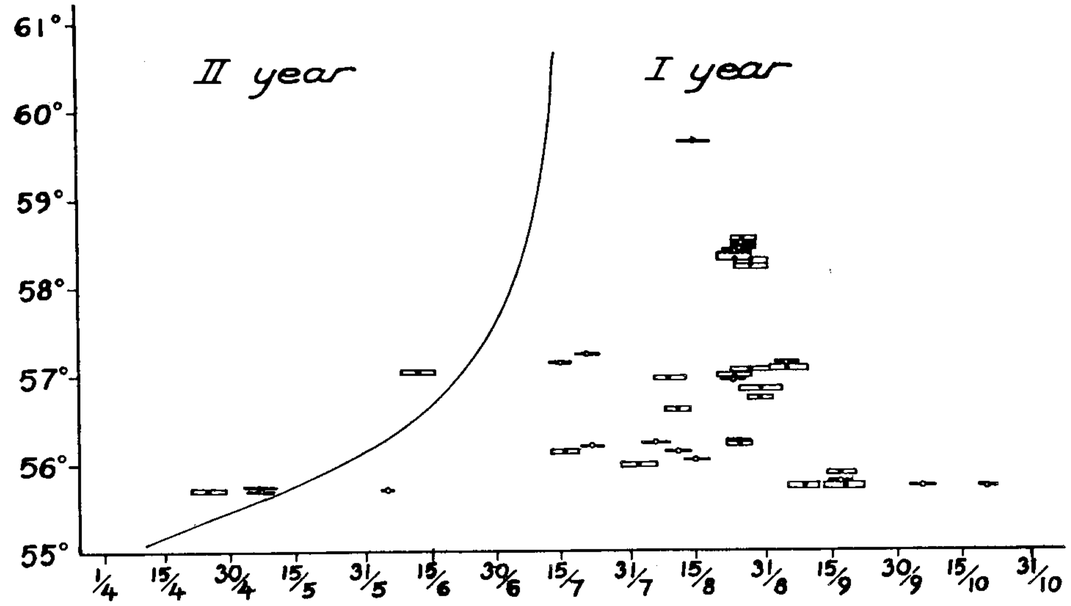


FIG. 2. Growth of larvae and metamorphosed specimens in the 1st year of life, transferred to geographic latitudes. Open rectangles = total length of metamorphosed specimens. Solid rectangles = total length of larvae. Scale 1:10.

winters, cannot be determined, owing to lack of sufficient observations. There are, however, observations from several years. The hibernation of *Triturus vulgaris* larvae has previously been reported by FISCHER-SIGWART (1896), BOETTGER & SCHWARZ (1928), and FREMERY, 1928. The hibernation of larvae also occurs in other European species (GILTAY, 1900; EGGERT, 1934; SELIŽKAR & PEHANI, 1935; MANGOLD & WAECHTER, 1953).

Fig. 2 also shows the size of the larvae and the conditions of metamorphosis during the first summer, at varying latitudes. The metamorphosis takes place when the larvae are 29.0–38.0 mm long. Both growth and metamorphosis are considerably influenced by the temperature. Phenological differences are also clear. In the southern counties the metamorphosis begins earlier than in the northern but there are also differences between the western and eastern parts of Sweden. Thus eastern Sweden, with a lower average humidity (KAURI, 1948), with less rain and more sun in the summer (AURÉN, 1939), and with a higher temperature in the ponds due to radiation (BRINCK, 1949, p. 147), shows a more rapid rate of development than the western counties with their damper maritime climate.

Specimens of larvae and of the year's young, collected at random during the last week of August, show, for instance, the following total lengths (in mm) (Table 1).

Of these collecting areas Västergötland and Östergötland have about the same latitude, but Öland is somewhat more than a degree further south. However, Västergötland's collecting areas lie between 12°20′–13°40′ easterly longitude, near the west coast and Lake Vänern, whereas the collecting area in Östergötland

TABLE 1. Total length of larvae and first year's young in the last week in August.

Västergötland (1954) 58°20′–58°38′	Östergötland (1952) 58°18′–58°32′	Öland 56°40′–57°20′
36.1 26.1	**42.5** **42.0**	26.0 29.0
18.5 28.1	31.8 **40.0**	**44.0** **45.0**
28.0 26.9	31.4 30.0	**40.0**
19.5 30.2	30.4 30.0	**45.0**
38.0 27.3	37.1 29.0	**45.0**
28.1 29.0	**44.0**	**40.0**
Average 27.98	Average 35.29	Average 39.26

(Metamorphosed forms are printed in thick type.)

TABLE 2. Average air temperatures in Skara (western area) and Västervik (eastern area) during May–August.

Average temp. in:	May	June	July	August
Skara, Västergötland 1954	11.9 (9.5)	14.1 (13.2)	14.5 (15.7)	14.3 (13.9)
Divergence from norm. temp.	+2.4	+0.9	−1.2	+0.4
Västervik Kalmar län 1952	8.4 (9.4)	13.8 (13.9)	16.1 (16.9)	15.1 (15.5)
Divergence from norm. temp.	−1.0	−0.1	−0.8	−0.4

(The figures in brackets give the normal for the period 1901–1930.)

is situated on the coast of the Baltic, between 16°–17° easterly longitude. Öland lies also on about the same longitude as the collecting area in Östergötland.

Of the twelve specimens collected in Västergötland only one was metamorphosed, and 4 larvae had begun their metamorphosis. In Östergötland at the same period 6 larvae of 11 were metamorphosed, and 4 were in a state of advanced metamorphosis; only one was still in the larval stage. The averages for the total length show the same tendency. Thus in Öland the metamorphosis is practically finished by the end of August, and in Östergötland it is being concluded. Västergötland's *T. vulgaris*, on the contrary, have only just begun their metamorphosis.

It is apparent from the above that the population of *T. vulgaris* in eastern Sweden at the beginning of their first hibernation has a more favourable position, with larger and stronger young than in Västergötland.

A comparison between the average temperatures during the months in question during the years when collecting took place, shows that it is not accidental local variations of climate which account for the differences in the numbers of the larval populations. (Table 2.)

As shown in table 2, the temperature of the summer 1954 was somewhat

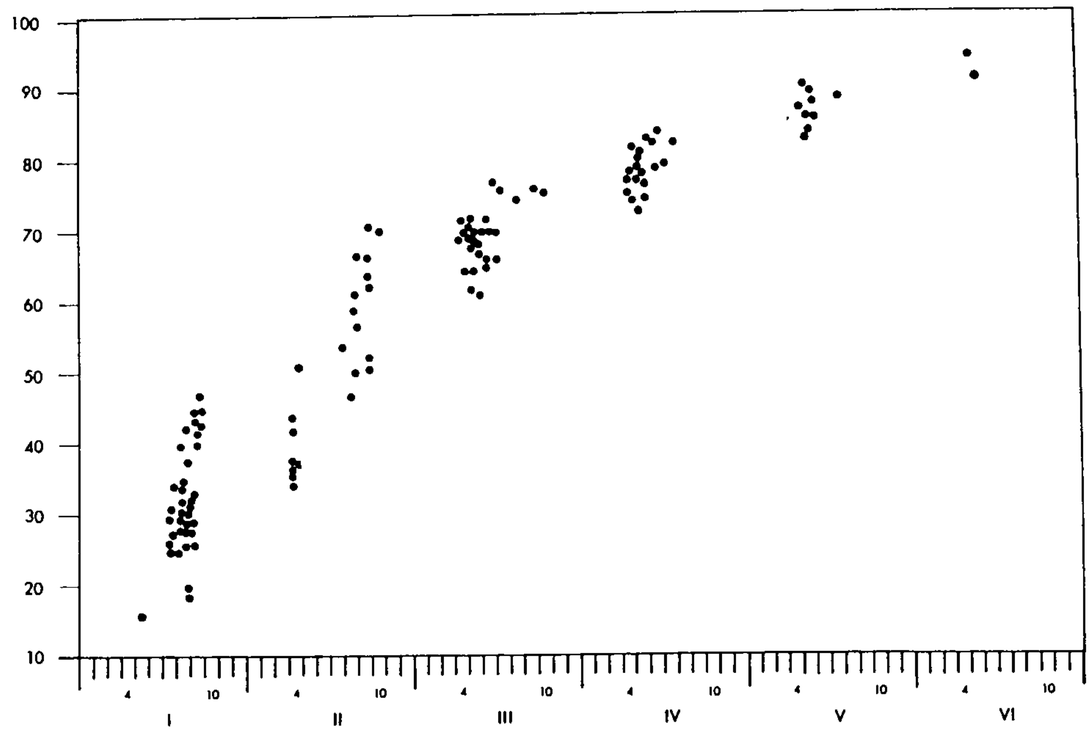


FIG. 3. Growth rate of Smooth Newt. Total length in mm transferred to age (months and years).

higher than normally and the summer 1952 was normal or even slightly cooler. Accordingly the different stages of the larval development and growth in the young Smooth Newt are depending on the normal climatic conditions in the areas in question. As established above, the eastern coast of Sweden has a higher summer temperature and a greater duration of insolation.

By the end of its first period of activity the transformed (metamorphosed) Smooth Newt in southern Sweden is 33–45 mm long, which corresponds to the measurements which have been reported for England (SMITH 1954).

After their first hibernation the young Smooth Newts stay on land. We have only a few specimens of this size, especially from the first half of the summer. The Smooth Newt, which is a nocturnal animal, hides itself well, and is difficult to find during its terrestrial period. The greater part of our material was collected on autumn excursions organized by the Zoological Institute of Lund University, and also during zoological field work in the summers. (Fig. 3.) According to our material the total length at the end of the second period of activity is 52–70 mm.

In the spring of the third year, that is, after the second hibernation, the Smooth Newt is sexually mature; and returns to the water for the mating period. The third summer period shows a maximum length of 76–77 mm and the fourth summer 83–84 mm. Higher age-groups are difficult to distinguish. The material at our disposal is too small, growth in the older animals is very slight, and dif-

TABLE 3. Total length in mature *Triturus vulgaris vulgaris*, calculated for the age-group.

Year-group		III		IV			V			Older	
	Number N	Total length	σ_M	N	Total length	σ_M	N	Total length	σ_M	N	Total length
♂♂	21	70.54	±0.79	23	79.17	±0.74	5	87.44	±0.64	1	95.0
♀♀	19	69.01	±0.96	13	78.71	±0.80	4	85.55	±0.93	1	92.0

Note: All figures in millimetres = mm. σ_M = standard error of the mean.

ferent age-groups may easily be confused. In Fig. 3 we have put in the 5th year's group with a maximum length of about 89–90 mm, but this group is quite probably mixed. The same applies to animals which are longer than the 90 mm total length. A 95 mm male is at least 6 years old, probably older. We can thus say (see also Fig. 3) that a size of 95 mm for males and 92 for females represents the probable limit of length in southern Sweden. Growth is slower each year, and in southern Sweden the Smooth Newt does not grow to any appreciable degree after the sixth or seventh year.

Differences in the total length of the sexes are clearly to be seen only in the older animals. In the table above the average value for the total length in mature animals has been calculated for the age-groups.

The females show a definite tendency to slower growth, and in all the age-groups dealt with here they are rather smaller than the males. Any exact mathematical difference in the size of the two sexes cannot, however, be proved, as the number of specimens in the higher age-groups is too small.

The number of specimens in the higher age-groups dwindles rapidly. Thus the third year group is represented by 40 specimens, the fourth has 36, the fifth 9, and of the oldest age-groups we have only 2 specimens. These conditions in the material which has been collected at random probably on the whole reflect the natural conditions.

The length of the extremities can, according to HUXLEY (1936), in the various age stages be considered as a function of the body growth (body growth = head + body). It is also known that in the *Salientia* and other animal groups an alteration occurs in the rate of growth of the extremities in relation to the body growth, on attaining puberty, especially among the females. (MARCH, 1937; KAURI, 1954). This tendency has not been observed in our material of the Smooth Newt. The regression line on our correlation diagram is straight and unbroken. This shows that the growth of the front extremities in all three stages—larva, immature and mature —is equally great, and differs in this respect from the growth of the extremities of the *Ranidae*. SCHUSTER (1950) writes regarding the *Salamandra salamandra* (L) "Das Längenverhältnis (Beine—Körper) ändert sich bei den Tieren aus Bayreuth und Traunstein im Lauf des Lebens nicht, während die Beine der

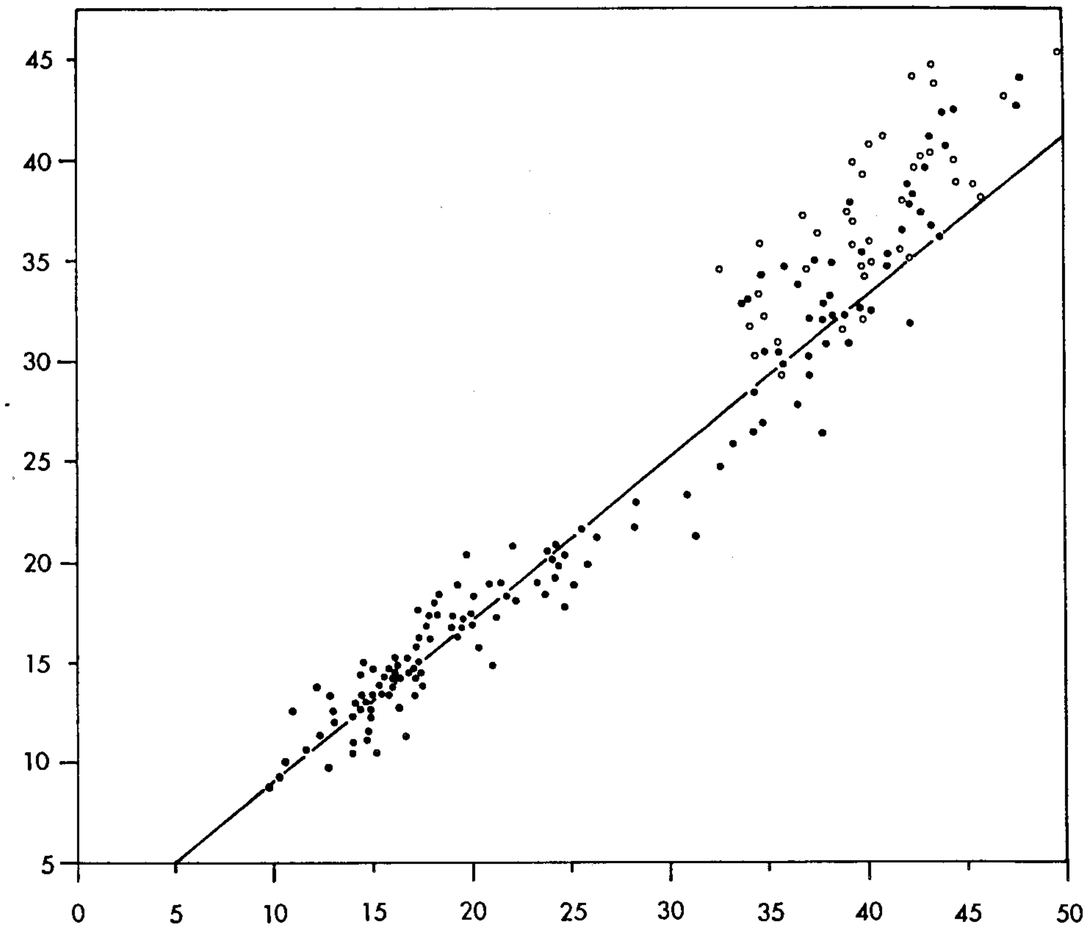


FIG. 4. Length of the tail (ordinate) plotted against the body (head + body) length (abscissa). Open dots = males. Solid dots = larvae, youngs and females.

Tiere aus dem Tessin im Alter relativ kürzer sind". SCHUSTER's material is 14 specimens from Bayreuth and 5 specimens from Traunstein, and there is nothing further known about the Tessin population. The statement requires to be checked up.

Our experience in this question as regards the *Urodela* is too small to allow of treating the problem in a large perspective. The reasons for the *Urodela*'s divergence as regards the allometric growth of the extremities can perhaps be found in the fact that the Smooth Newt's extremities are comparatively small in relation to the body, and, on the other hand, it would appear that the output of the sexual organs of the *Salamandridae* does not as strongly influence other bodily functions as, for instance, in the majority of the *Ranidae*.

The tail, on the contrary, shows a definite change in the intensity of growth as soon as maturity begins. The tail is always somewhat longer during the aquatic period than during the terrestrial period. During the metamorphosis the tail becomes shorter and is comparatively shorter during the whole of the second year's terrestrial period, as may be seen in Fig. 4. At the beginning of maturity

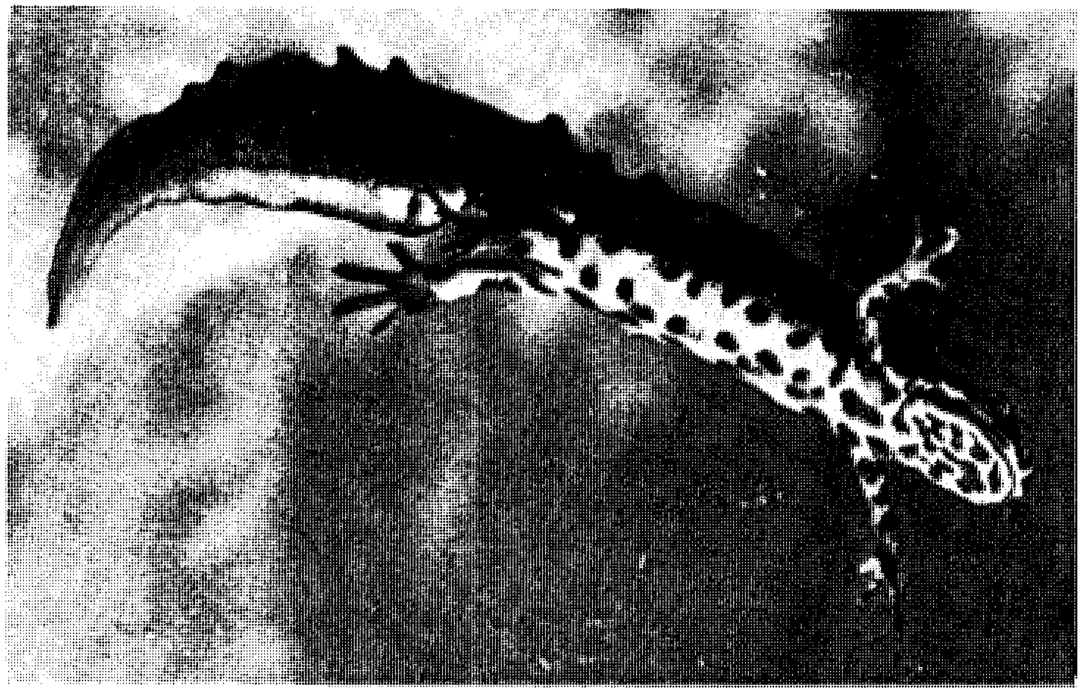


FIG. 5. Smooth Newt. Male. Photo by Lunds Lit. Lab. AB.

the tail becomes longer as the breeding dress is developed. Differences in the length of the tail between the aquatic and the terrestrial dress occur also in the mature newts.

A certain sexual dimorphism can be observed in regard to the extremities and the tail's relative length. The males have comparatively longer extremities and a longer tail (Tab. 6). The crest in the breeding dress of the male varies according to age. In the first breeding dress, in the spring of the third year, the crest is definitely lower than in older animals. (Table 4.)

The significance coefficient $t = \frac{M_2 - M_1}{\sqrt{\sigma^2_{M_1} + \sigma^2_{M_2}}} = 3.04$ is satisfactory. The crest does not attain its complete development until in the fourth or fifth year, that is, the second and third year after the onset of sexual maturity.

TABLE 4. Height of the crest in breeding dress of *Triturus vulgaris vulgaris*, calculated for the age-groups.

Year-groups	Height of the crest average				
	Number N	Mean value M	Standard error σ_M	Diff.	Crest × 100 / Total length
III	17	3.76	±0.36	1.59	5.33
IV–VI	15	5.35	±0.33		6.12

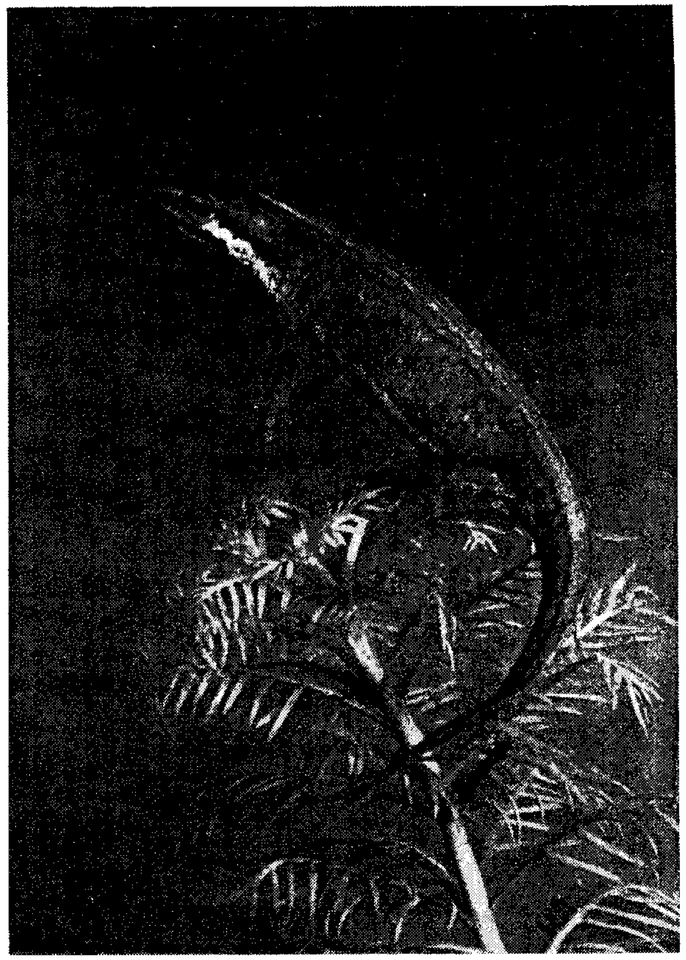


FIG. 6. Smooth Newt. Female. Photo by Lunds Lit. Lab. AB.

The above observations can be summarized as follows: the Smooth Newt grows rapidly during the first years, for instance during its first summer about 37 % of its maximum length. The intensity of growth becomes less each year and a limit is reached at about six or seven years of age. The maximum length in the south of Sweden is thus for males 95 mm, and for females 92 mm, or very slightly longer. In more southerly latitudes the total length is somewhat greater. MERTENS (1947) mentions a maximum length for males of 111 mm and for females 95 mm in the Rhine-Main district. In the south of England SMITH (1954) has noted the figures of 104 mm and 94 mm respectively.

Sexual maturity begins during the third year. It may be added that the male's secondary sexual characteristics are not fully developed to begin with, especially as far as the crest and the comparatively greater length of body are concerned.

The female's aquatic dress does not differ as much from the terrestrial dress as does that of the male. The skin undergoes a structural change and a low fin-like ridge is formed along the dorsal and ventral edges of the tail. As in the males a strong upper lip forms, which grows out over the lower jaw and covers

TABLE 5. Collecting and measuring data for *Triturus vulgaris vulgaris*.

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
	Skåne								
1	Ringsjön	♂	17.9.47	62.7	34.3	28.4	—	—	terrestr.
2	Ringsjön	juv	17.9.47	33.2	17.3	15.9	4.5	—	tadpole
3	Ringsjön	juv	17.9.47	31.3	16.7	?	3.0	—	
4	Reften	juv	13.9.75	26.3	14.8	11.5	4.8	—	
5	Reften	juv	13.9.75	26.0	14.7	11.3	3.6	—	
6	Reften	juv	13.9.75	29.1	15.8	13.3	4.7	—	
7	Källby	juv	21.10.45	22.5	12.9	9.6	—	—	
8	Lund	juv	6.10.49	30.5	16.1	14.4	5.2	—	
9	Lund	juv	5.6.14	7.3	—	—	—	—	
10	Lund	juv	5.6.14	6.5	4.0	2.5	1.1	—	
11	Lund	juv	7.9.57	39.7	20.8	18.9	—	—	metamorph.
12	Lund	juv	7.9.57	35.9	19.3	16.6	—	—	metamorph.
13	Lund	juv	7.9.57	30.9	16.2	14.7	—	—	metamorph.
14	Lund	juv	7.9.57	32.8	17.7	15.1	—	—	metamorph.
15	Lund	♂	June 27	70.4	38.9	31.5	11.2	3.7	
16	Lund	♂	June 27	66.1	35.5	30.6	11.4	2.5	
17	Lund	♂	June 27	66.3	35.5	30.8	11.0	1.7	
18	Lund	♂	June 27	66.0	34.2	31.8	11.3	2.6	
19	Ängelholm	—	Autumn 52	65.2	35.6	29.6	12.7	—	terrestr.
20	Ängelholm	—	Autumn 52	68.9	38.0	30.9	—	—	terrestr.
21	Lund	♂	Apr/May 33	87.4	43.5	43.9	14.1	3.2	
22	Lund	♀	Apr/May 33	74.0	42.2	31.8	13.0	—	
23	Lund	♀	Apr/May 33	76.2	41.0	35.2	13.2	—	
24	Lund	♂	Apr/May 33	72.0	39.8	32.2	13.6	—	
25	Lund	♀	Apr/May 33	70.4	38.3	32.1	11.6	—	
26	Lund	♀	Okt. 26	75.6	41.0	34.6	12.1	—	terrestr.
27	Lund	♀	Okt. 26	70.0	39.1	30.9	12.1	—	terrestr.
28	S. Sandby		18.9.53	64.2	37.8	26.4	11.3	—	terrestr.
29	S. Sandby		18.9.53	43.1	24.0	19.1	8.0	—	terrestr.
30	?	♂	—	90.3	47.0	43.3	15.3	5.1	
31	?	♀	—	80.9	42.0	38.9	13.2	—	
32	?	♀	—	70.6	37.8	32.8	12.4	—	
33	Lund	♂	18.6 ?	84.2	45.4	38.8	16.3	3.2	
34	Lund	♂	18.6 ?	83.5	43.3	40.2	15.2	2.8	
35	Ven	—	2.8.47	37.1	20.2	16.9	—	—	metamorph.
36	Ven	—	2.8.47	42.8	22.0	20.8	—	—	terrestr.
37	Höör	♀	11.4.48	69.0	37.0	34.7	—	—	
38	Lund	—	12.9.49	66.5	33.8	32.7	—	—	terrestr.
39	Lomma	juv	25.5.43	44.0	25.1	18.9	—	—	terrestr.
40	Lomma	juv	25.5.43	35.9	21.0	14.9	—	—	terrestr.
41	Lomma	juv	25.5.43	42.0	23.7	18.3	—	—	terrestr.
42	Lomma	juv	25.5.43	44.2	24.0	20.2	—	—	terrestr.

Table 5 (continued).

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
43	Lomma	juv	25.5.43	35.5	18.2	17.3	—	—	terrestr.
44	Lomma	juv	25.5.43	37.0	21.3	15.7	—	—	terrestr.
45	Lomma	juv	25.5.43	35.1	17.8	17.3	—	—	terrestr.
46	Lomma	juv	25.5.43	36.3	18.2	18.1	—	—	terrestr.
47	Lomma	juv	25.5.43	31.8	17.0	14.8	—	—	terrestr.
48	Lomma	juv	25.5.43	36.2	18.8	17.4	—	—	terrestr.
49	Äspinge	♂	30.4.52	74.7	40.0	34.7	13.6	5.2	
50	Äspinge	♂	30.4.52	74.3	39.8	34.5	12.8	2.3	
51	Äspinge	♀	30.4.52	77.9	41.8	36.1	12.9	—	
52	Fågelsång	♀	16.7.56	82.7	43.0	39.7	14.0	—	
53	Saxtorp	♂	17.4.52	82.0	40.8	41.2	13.3	5.7	
54	Saxtorp	♂	17.4.52	76.2	39.0	37.2	12.8	3.5	
	Blekinge								
55	Angerum		22.7.50	28.0	14.9	13.1	—	1.3	tadpole
56	Angerum		22.7.50	28.8	15.4	13.4	—	—	tadpole metamorph.
57	Angerum		22.7.50	27.1	14.4	12.7	—	0.8	tadpole
58	Angerum		22.7.50	23.5	11.0	12.5	—	1.0	tadpole
59	Buskelund		6.8.50	30.6	16.3	14.3	—	2.0	tadpole
60	Listerby		15.8.50	28.4	15.3	13.1	—	1.1	tadpole
61	Listerby		15.8.50	27.0	14.8	12.2	—	—	metamorph.
62	Mörrum		11.8.50	30.0	15.9	14.1	—	1.5	tadpole
63	Mörrum		11.8.50	25.6	15.2	10.4	—	1.4	tadpole
64	Mörrum		11.8.50	24.4	14.0	10.4	—	1.2	tadpole
65	Mörrum		11.8.50	25.0	14.1	10.9	—	1.2	tadpole
66	Bråkne	—	1.9.52	75.2	39.8	35.4	13.8	—	terrestr.
67	Ryssberget		16.7.49	31.3	16.8	14.5	—	—	metamorph.
68	Mörrum		15.7.50	26.0	12.2	13.8	—	1.3	tadpole
69	Mörrum		15.7.50	20.5	10.6	9.9	—	1.3	tadpole
70	Utklippan	♂	23.6.46	74.0	37.6	36.4	11.4	2.0	
71	Utklippan	♂	23.6.46	74.1	36.9	37.2	12.3	2.0	
72	Hanö	♂	24.7.50	88.0	43.3	44.7	16.2	7.8	
73	Hanö	♀	24.7.50	80.2	43.2	36.6	14.4	—	
74	Karlskrona	♂	10.7.36	83.6	39.0	44.6	—	3.8	
75	Karlskrona	♂	10.7.36	76.2	39.3	36.9	—	4.0	
76	Karlskrona	♀	10.7.36	80.2	43.0	37.2	—	—	
	Skåne								
77	Billebjer	♂	7.5.57	79.5	38.5	41.0	—	6.0	
78	Billebjer	♂	7.5.57	78.0	39.0	39.0	12.8	5.5	
79	Billebjer	♂	7.5.57	72.0	37.5	34.5	12.0	5.3	
80	Billebjer	♂	7.5.57	75.0	38.0	37.0	13.4	4.5	
81	Billebjer	♂	7.5.57	71.8	36.0	35.8	—	5.0	
82	Billebjer	♀	7.5.57	64.7	34.7	30.0	10.9	—	
83	Billebjer	♀	7.5.57	68.2	36.9	31.3	10.3	—	

Table 5 (continued).

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
84	Billebjer	♀	7.5.57	62.0	33.0	29.0	10.5	—	
85	Billebjer		7.5.57	32.0	—	—	—	—	tadpole
86	Billebjer		7.5.57	32.0	—	—	—	—	tadpole
87	Billebjer		7.5.57	36.5	—	—	—	—	tadpole
88	Billebjer		7.5.57	35.5	—	—	—	—	tadpole
	Halland								
89	Enslöv	—	24.9.49	71.0	38.8	32.2	12.2	—	terrestr.
90	Enslöv		6.5.48	37.0	19.8	17.2	—	—	terrestr.
91	Enslöv		6.5.48	35.6	19.2	16.4	—	—	terrestr.
	Småland								
92	Aneboda		21.7.35	31.2	16.1	15.1	—	0.3	tadpole
93	Aneboda		21.7.35	36.2	18.0	18.2	—	0.4	metamorph.
94	Aneboda		21.7.35	34.4	17.7	16.7	—	1.4	tadpole
95	Aneboda		21.7.35	30.1	16.0	14.1	—	1.8	tadpole
96	Aneboda		21.7.35	27.2	14.5	12.7	—	1.4	tadpole
97	Aneboda		21.7.35	27.0	14.0	13.0	—	1.2	tadpole
98	Aneboda		21.7.35	29.5	15.6	13.9	—	1.4	tadpole
99	Aneboda		21.7.35	23.8	12.4	11.4	—	1.2	tadpole
100	Aneboda		21.7.35	28.1	15.4	12.7	—	1.2	tadpole
101	Aneboda		21.7.35	25.0	13.0	12.0	—	1.4	tadpole
102	Flohult		31.8.52	28.0	17.7	10.3	—	2.0	tadpole (tail broken)
103	Toftaholm		24.8.50	38.2	20.0	18.2	—	—	terrestr.
104	Toftaholm		24.8.50	31.6	17.2	14.4	—	0.8	tadpole
105	Strömserum	—	30.8.47	61.7	34.8	26.9	—	—	terrestr.
106	Hästveda		25.8.48	35.0	17.4	17.6	—	—	metamorph.
107	Hästveda		25.8.48	29.5	14.5	15.0	—	—	tadpole
108	Hästveda		25.8.48	29.6	16.0	13.6	—	—	tadpole
109	Hästveda		25.8.48	25.5	13.0	12.5	—	—	tadpole
110	Hästveda		25.8.48	28.2	15.3	12.9	—	—	tadpole
111	Hästveda		25.8.48	22.3	11.6	10.7	—	—	tadpole
	Kalmar								
112	Påboda	♂	18.5.43	79.2	39.8	39.4	—	6.4	
113	Påboda	♀	18.5.43	64.0	35.9	34.7	—	—	
114	Årena	—	25.8.48	74.5	39.8	34.7	—	—	terrestr.
115	Ljungby		11.8.50	29.0	15.6	13.4	—	—	terrestr.
	Öland								
116	Halltorp		19.9.46	38.2	21.1	17.1	7.2	—	terrestr.
117	Halltorp	—	19.9.46	69.8	37.8	32.0	12.3	—	terrestr.
118	Halltorp	—	19.9.46	66.1	37.0	29.1	12.1	—	terrestr.
119	Halltorp	—	19.9.46	73.3	38.4	34.9	13.2	—	terrestr.
120	Resmo	—	6.9.51	52.5	31.3	21.2	11.1	—	terrestr.
121	Resmo	—	6.9.51	51.4	28.4	23.0	9.0	—	terrestr.

Table 5 (continued).

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
122	Resmo	—	6.9.51	47.3	26.2	21.1	9.0	—	terrestr.
123	Resmo	—	6.9.51	45.0	24.7	20.3	8.1	—	terrestr.
124	Persnäs	—	27.8.53	45.0	24.2	20.8	10.0	—	terrestr.
125	Byxelkrok	—	5.9.53	26.2	14.0	12.2	—	1.3	tadpole
126	Källa	—	29.8.53	45.6	25.8	19.8	9.7	—	terrestr.
127	Källa	—	29.8.53	40.0	19.7	20.3	7.7	—	terrestr.
128	Alböke	—	26.8.53	44.3	23.8	20.5	8.2	—	terrestr.
129	Alböke	—	26.8.53	40.4	21.5	18.9	7.9	—	terrestr.
130	Dystad	—	30.8.49	29.0	16.3	12.7	—	—	terrestr.
131	Persnäs	—	27.8.53	42.5	24.8	17.7	8.0	—	terrestr.
132	Ismantorp	—	30.8.49	47.1	25.5	21.6	—	—	terrestr.
	Gotland								
133	Stenkyrka	♂	28.4.49	74.2	35.0	39.2	—	5.3	
134	Stenkyrka	♂	28.4.49	77.0	39.2	37.8	—	5.2	
135	Stenkyrka	♂	28.4.49	64.7	34.5	30.2	—	5.6	
136	Lojsta	♂	25.4.49	75.0	39.3	35.7	—	5.2	
137	Lojsta	♂	25.4.49	71.7	37.0	34.7	—	5.3	
138	Stenkyrka	♀	28.4.49	71.0	38.0	33.0	—	—	
139	Öja	♀	28.4.49	70.6	35.9	34.7	—	—	
140	Fårön	—	9.9.47	57.3	32.6	24.7	—	—	terrestr.
141	Sundre		9.8.52	32.0	16.7	15.3	6.3	—	terrestr.
142	Eke	—	17.6.48	72.0	37.0	35.0	—	—	terrestr.
143	Burgsvik	—	12.6.48	40.0	21.8	18.2	—	—	terrestr.
	Bohuslän								
144	Solvik, Tanum	—	1949	54.3	31.0	23.3	—	—	terrestr.
	Västergötland								
145	Halleberg	♀	24.8.54	67.0	34.0	33.0	12.5	—	terrestr.
146	Halleberg	—	24.8.54	50.0	28.3	21.7	9.2	—	terrestr.
147	Halleberg		24.8.54	36.1	19.0	17.6	—	1.4	tadpole
148	Halleberg		24.8.54	18.5	9.8	8.7	—	0.9	tadpole
149	Halleberg		24.8.54	28.0	16.8	11.2	—	1.7	tadpole (broken tail)
150	Halleberg		24.8.54	19.5	10.2	9.3	—	1.4	tadpole
151	Hunneberg		25.8.54	38.1	19.2	18.9	7.0	—	terrestr.
152	Ö. Frölunda		May 53	67.7	34.4	33.3	12.8	2.5	neotenous
153	Ö. Frölunda	♂	May 53	70.5	34.6	35.9	12.0	3.2	
154	Ulricehamn	♂	3.5.51	76.0	40.1	35.9	14.5	2.6	
155	Ulricehamn	♂	3.5.51	67.4	—	—	13.2	—	terrestr.?
156	Ulricehamn	♂	3.5.51	75.0	41.5	33.5	13.1	—	terrestr.
157	Ulricehamn	♂	3.5.51	66.7	34.7	32.0	13.6	—	terrestr.
158	Ulricehamn	♀	3.5.51	60.6	34.2	26.4	11.0	—	
	Bohuslän								
159	Uddevalla	♀	27.5.48	86.7	44.2	42.5	—	—	
160	Uddevalla	♀	27.5.48	92.0	47.8	44.2	—	—	

Table 5 (continued).

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
161	Uddevalla	♀	27.5.48	86.6	44.1	42.5	—	—	
162	Uddevalla	♀	27.5.48	84.6	44.0	40.6	—	—	
163	Uddevalla	♀	27.5.48	84.3	43.1	41.2	—	—	
164	Uddevalla	♀	27.5.48	80.1	42.3	37.8	—	—	
165	Uddevalla	♀	27.5.48	80.6	42.4	38.2	—	—	
166	Uddevalla	♀	27.5.48	80.9	42.0	38.9	—	—	
167	Uddevalla	♀	27.5.48	70.3	36.6	33.7	—	—	
168	Uddevalla	♂	27.5.48	84.5	44.5	40.0	16.3	5.1	
169	Uddevalla	♂	27.5.48	86.6	42.4	44.2	14.2	4.3	
170	Uddevalla	♂	27.5.48	81.7	40.9	40.8	14.0	3.0	
171	Uddevalla	♂	27.5.48	67.0	34.5	32.5	—	—	
172	Uddevalla	♂	27.5.48	77.2	42.0	35.2	—	2.8	
173	Uddevalla	♂	27.5.48	95.0	49.6	45.4	16.4	5.2	
	Skåne								
174	Färingtofta	♂	22.4.53	78.4	43.8	34.6	15.1	6.1	
175	Färingtofta	♀	22.4.53	72.3	40.0	32.3	12.2	—	
176	Röstånga	♂	13.9.52	70.4	38.7	31.7	14.0	—	
	Småland								
177	Älmeboda	♂	25.4.53	82.2	42.5	39.7	15.8	5.0	
178	Älmeboda	♀	25.4.53	72.0	39.7	32.3	13.7	—	tadpole
	Västergötland								
179	Onsjön		26.8.54	28.1	15.0	13.1	—	1.2	tadpole
180	Onsjön		26.8.54	26.1	12.8	13.3	—	1.3	tadpole
181	Gillstad		26.8.54	28.6	14.3	14.3	—	—	metamorph.
182	Gillstad		26.8.54	26.9	14.4	12.5	—	—	metamorph.
183	Gillstad		26.8.54	30.2	15.8	14.4	—	—	tadpole
184	Gillstad		26.8.54	27.3	14.4	12.9	—	1.3	tadpole
185	Gillstad		26.8.54	29.0	15.2	13.8	—	—	metamorph.
186	Örsås	♂	14.5.53	68.9	34.7	34.2	—	2.5	
	Östergötland								
187	S:t Anna	—	30.8.52	42.1	23.2	18.9	—	—	terrestr.
188	S:t Anna		30.8.52	40.2	22.2	18.0	—	—	terrestr.
189	S:t Anna		30.8.52	30.0	15.6	14.4	—	—	metamorph.
190	S:t Anna		30.8.52	30.0	15.8	14.2	—	—	metamorph.
191	S:t Anna		30.8.52	29.6	15.0	14.6	—	—	metamorph.
192	S:t Anna		30.8.52	30.1	15.6	14.5	—	—	terrestr.
193	Gryt, Harstena		28.8.52	31.8	17.0	14.8	—	—	metamorph.
194	Gryt, Harstena		28.8.52	31.4	17.5	13.9	—	—	tadpole
195	Gryt, Harstena		28.8.52	30.4	17.1	13.3	—	—	metamorph.
196	Söderköping		26.8.52	59.1	33.3	25.8	11.0	—	terrestr.
197	S:t Anna		29.8.52	67.2	37.0	30.2	12.0	—	terrestr.
198	S:t Anna		29.8.52	44.1	24.3	19.8	8.1	—	terrestr.
199	Omberg		28.8.50	37.1	19.9	17.2	—	—	metamorph.

Table 5 (continued).

No.	District and locality	Sex	Date	Total length	Head + body length	Tail	Forelimb	Crest (dorsal)	
	Dalsland								
200	Kroppefjäll	♂	20.5.52	73.2	38.3	34.9	13.1	2.8	
	Värmland								
201	Trankil	♂	29.6.50	83.0	42.8	40.2	16.8	2.2	
202	Trankil	♂	29.6.50	77.2	41.7	35.5	15.3	2.0	
203	Trankil	♀	29.6.50	80.0	43.7	36.3	15.1	—	
204	Forsnor		Aug. 49	34.0	17.8	16.2	—	—	metamorph.
	Hälsingland								
205	Söderhamn	♂	June 47	84.0	45.9	38.1	15.9	5.3	
206	Söderhamn	♀	June 47	65.0	34.8	30.2	—	—	
207	Söderhamn	♂	7.6.47	65.0	35.6	29.4	11.4	1.8	
208	Norrala	♀	May 47	72.3	40.0	32.3	11.3	—	

the mouth from the sides, so that a sucker is formed. SMITH (op. cit.) has pointed out this development in *Triturus cristatus* as a characteristic of sexual maturity. As, however, MATTHES (1934) showed earlier, this characteristic can hardly be said to be connected with sexual maturity but is rather an adaption to aquatic life. A similar lip is found also in the larval state.

OCCURRENCE:

Skåne. Maglarp, B.S. — To the east of Stavsten, C.C. — Sandhammaren, T.G. — Borrby, to the east of the church, H.L. — Limhamn, LANG 1926. — Malmö, L.Z.M. — Tygelsjö, P.H.-A. — Fosie, E.H.-M. — Skabersjö, M.M. — Bökeberg, L.Z.M. — Bara hundred, LANG 1926. — Björkesåkrasjön, E.H.-M. — Between Sövdeborg and Sövdesjön, Exc. — Sövde, SAHLIN 1929. — Snogeholmssjön, L.Z.M. — Karups ängar, K.C.-L. — Bolshög, Stjärngården, H.L. —Rörum, Vik, H.L. — Between Simrishamn and Brantevik, H.B-m. — Simrishamn area, N.A.A. — Lomma, K.G.W., L.Z.M. — Dalby, L.Z.M. — Borgeby, B.S. — Lund: Källby, L.Z.M. — Lund, the garden of the Zoological Institute, Y.M.; Pålsjö, L.Z.M., A.N-n., B.S. — Lund, L.Z.M. — Staffanstorp, B.S. — Södra Sandby s:n: Reften; Linnebjär, L.Z.M., Skarnberga, P.H.-A. — Revingehed, B.S. — Between Revinge and Krankesjön, B.S. — Krankesjön, C.M. — Bjärsjölagård, Exc. — Tolånga, A.K. — Vollsjö, T.W. — Eljaröd, H.K. — Sankt Olof, H.B-m. — Ravlunda, to the west of the church, H.L. — Barsebäcksby, B.S. — Saxtorp s:n, Saxtorp, L.Z.M. — Kungshult, Exc. — Hörby, Allmarkaröd, O.P. — Maglehem, H.L. — Ven, Haken lighthouse, L.Z.M., O.P. — Stehag, L.Z. M., G.N.M. — Ringsjön, Exc. — Bosjökloster, Exc. — Höör, L.Z.M. — Äspinge s:n, Satserup, L.Z.M. — Hälsingborg, H.M. — Pilshult, N.N. — Kattarp, Tursköp, G.N.M. — Åstorp, A.S. — Ekeby, C.-E.H. — Röstånga, L.Z.M. — Tjörnarp, Sjöbergasjön, H.B-m. — Färingtofta, Djurröd, L.Z.M., T.G. — Perstorp, T.G. — Hässleholm, L.Z. M. — Bjärlöv, Exc. — Kristianstad area, Å.U. — Hanaskog, Exc. — Oppmanna, L.Z.M. — Kullaberg, near the lighthouse, G.N.M. — Mölle, Vattenmöllan, NILSSON 1954. — Mölle, G.N.M. — Arild, A.N-n. Hallands Väderö,

H.V. — Jonstorp s:n, K.C.-L.; Svanshall, A.N-n. — Välinge s:n, Rögle, A.N-n.; Vegeholm, A.N-n. — Ängelholm, L.Z.M. — Förslöv s:n, Ranarp, L.Z.M., A.N-n. — Hallands Väderö, VALLIN 1947, 1949. — Förslövsholm, B.O. — Skälderviken, K.C.-L. — Örkelljunga, Sonnarp, B.O. — Örkelljunga, V.T. — Hästveda, L.Z.M., T.G. — Glimåkra, T.G.

Blekinge. Utklippan, L.Z.M. — Hanö, L.Z.M., B.H. — Ryssberget, L.Z.M. — Bräkne-Hoby s:n: Spjutsö, L.Z.M. — Listerby s:n, Göholm, L.Z.M. — Mörrum s:n: Björkenäs, T.G.; Stensnäs, L.Z.M.; Buskelund, L.Z.M. — Mörrum, L.Z.M., T.G. — Hällaryd, Trensum, P.H.-A. — Förkärla, Tromtö, L.Z.M. — Karlskrona, Sturkö, G.N.M., L.Z.M., A.L.-m, Karlskrona, S.N.M. — Augerum, L.Z.M. — Fridlevstad, Björkeryd, G.M-g. — Rödeby, L.Z.M., G.M-g. — Jämshög s:n: Boafall, R.J.; Norra Röhult, R.J. — Åkeholm, G.W.

Halland. To the south of Våxtorp, T.G. — Laholm, T.G. — Laxvik, A.D., P.A. — Enslöv, L.Z.M. — Steninge, B.H. — Getinge s:n, A.K. — Varberg, Varberg Samrealskola. — Lindome, G.N.M.

Småland except Kalmar län. Mejenfors, B.H-k. — 3 km to the south of Hinneryd, T.G. — Stenbrohult, Rephult, H.L. — Virestad, Femlingen, H.L. — Älmeboda, L.Z.M., T.G. — Angelstad, H.L. — Odensjö, L.Z.M. — Toftaholm, L.Z.M. — Berg s:n, Vinninge, S.A-n. — Granhult s:n, Nottebäck, C.B.G. — Aneboda, Frännehåle, L.L.I. — Aneboda, L.Z.M., M.M. — Wåxtorp, Ed, H.L. — Hjälmseryd, O.C-n. — Österkorsberga, C.B.G. — Näsby s:n, on the northern side of Flögen, H.L. — Karlstorp, CYRÉN 1910. — Hult, H.L. — Ingatorp, H.L. — Månsarp s:n, Sjöhult, BJURULF 1944. — Ljungarum s:n, Sanna, BJURULF 1944. — Jönköping, Jära, BJURULF 1944. — Järstorp, Tranebo, BJURULF 1944. — Ralången, Måludden, LUNDBLAD 1918.

Kalmar län. Påboda, L.Z.M., T.G. — Ljungby s:n, Smedby, L.Z.M., U.S. — Kalmar, L.Z.M., HEINTZE 1909, C.W. — Stävlö, Exc. — Strömserum, L.Z.M., Exc. — Ålem, T.G. — Grönskåra, T.G. — Mönsterås, Herrstorp, T.H. — Mönsterås area, Å.D. — Forshultsjön, T.G. — Döderhult, Flinshult, G.N.M. — Oskarshamn, O.A. — Virserum, H.L. — Årena, L.Z.M. — Kristdala, Sandslätt, T.G. — Hummeln, T.G. — Kristdala, Sabeltorp, G.N.M. — Misterhult: Örö, G.N.M.; Grönhult, G.N.M.; Övrahammar, G.N.M. — Tuna s:n, Flohult, J.B., T.G. — Tuna s:n, Bredshult, T.G. — Pelarna, H.L. — Rumskulla, Hjorten, H.L.— Vestrum s:n, Horn, G.N.M. — Gamleby s:n, Heda, G.N.M. — Lofta s:n, Näset, G.N.M. — Tryserum, Ormö, G.N.M.

Öland. Ottenbylund, D.C. — Kastlösa, HEINTZE 1909. — Mörbylånga, G.N.M. — Resmo s:n, on the "alvar" about 400 m to the west of Möckle mire, L.Z.M. — Resmo, the "alvar", G.N.M. — Vickleby, Exc. — Färjestaden, HEINTZE 1909, S.H. — Runsten s:n, Dystad, L.Z.M. — Långlöt s:n, Ismantorp, L.Z.M., T.G. — Stora Rör, HEINTZE 1909. — Högsrum s:n, Ekerum, H.A.L. GAD 1913. — Halltorp, L.Z.M., GAD 1913, N.B. — Räpplinge s:n, Borga hage, JOHANSSON 1955. — Borgholm, N.R.M., GAD 1913. — Köping, Lundegård, G.N.M. — Alböke s:n, Alböke 'alvar', L.Z.M. — Persnäs s:n, Trosnäs, L.Z.M. — Hornsjön, C.E. — In a marl-pit close to the outlet of Hornsjön, D.C. — Källa s:n, Långerum, L.Z.M. — 3 km to the north of Byxelkrok, L.Z.M.

Gotland. Sundre, s:n, Kättelvik, L.Z.M. — Burgsvik, Vale, L.Z.M. — Burgsvik, N.R.M. K.C.-L. — Öja, L.Z.M. — Fidenäs, K.C.-L., N.N. — Eke, Smittsarve, L.Z.M. — Rone, 2 km to the north of the church, N.N. — Stora Karlsö, N.L. — Lojsta hajd, point 77.5, L.Z.M. — Klinte, the church, N.N. — Torsburgen, L.Z.M. — Sanda, G.N.M. — Atlingbo, Nygårds, G.N.M. — Eskelhem, G.N.M. — Mästerby, the cemetery, G.N.M. — Norrlanda s:n, Björke, G.N.M. — Stenkumla s:n, T.W. — Västerhejde, near Korpklint, N.N. — Rosendal mire, D.C. — 5 km to the southeast of Visby and in some ponds 2.5 km southeast of Visby, D.C. — Terra Nova, D.C. — Visby: Visborgslätt, N.N., T.W.; D.B.V. Park, S.H-m.; Botanical Garden, G.N.M., D.C. — Österby, 3 km to the east of Visby, N.N. — To the north of Visby, near the shore, N.A. — Visby, Gustavsvik, N.N. — Visby, N.R.M., K.C.-L., T.G. — Källunge, the church, N.N. — IHRE, H.K. — Slite, N.N. — Stenkyrka, to the north of Garde, L.Z.M. — Hall s:n, Medebys, L.Z.M., U.S. — Bunge, H.K. — Fårösund, N.R.M. — Fårö Båta, L.Z.M.; Sudersand, L.Z.M.; northern pilot station, N.N. — Fårö, G.N.M.

Göteborg. Slottsskogen, G.N.M., C.G.K., H.L. — Hisingen, Bjurslätt, MALM 1877. — Göteborg, G.N.M.

Bohuslän. Marstrand: Långö; Koön, G.N.M. — Skaftö, Grundsund, P.H.-A. — Klubban, N.R.M. — Skaftö, N.R.M. — Ljungskile, G.N.M. — Gullmarsfjorden, Alsbäck, G.N.M. — Uddevalla, L.Z.M., C.G.K. — Tanum s:n, Solvik, Linnebacka, L.Z.M. — Tanum, H.B-t. — Bullarsjön, G.N.M., MALM 1877. — Strömstad, N.R.M., A.B-s.

Västergötland. Östra Frölunda s:n, Hid, C.B. — Ärsås s:n, Röstorp, C.B. — Gällstad s:n, Ulricehamn Samrealskola. — Grönahög s:n, Solberga, C.B. — Viared, K.H. — Viared area, HALL 1942. — Borås C.B. — Ulricehamn area, Ulricehamn Samrealskola. — Vist s:n, Ulricehamns Samrealskola. — Hössna, Rönnebråten, H.L. — Dalum s:n, L.Z.M. — Mjörn, Bergsjödal, G.N.M. — Mjörnsjö, G.N.M. — Stenum, L.Z.M., K.G.W. — Västra Tunhem s:n, Nygård, H.B-t. — Hunneberg, N.-G.K. — Halleberg, N.-G.K. — Vänersborg, C.G.K. — Skara area, E.L-n. — Skövde, half way to Billingen, T.G. — Skövde area, C.B.G. — Öglunda, P.O.S. — Billingen, K.C.-L. — Friel, N.-G.K. — Rackeby, N-G.K. — Lidköping, Kinneviken, N-G.K., Källby, Källbyån, N-G.K. — Kinnekulle, KARVIK 1953. — Kållandsö: Odensvik; Billingsö, N.-G.K. — Mariestad, J.F.

Östergötland. Tjärstad, S.S. — Ödeshög: Sunneryd; Visjö, H.L. — Gryt s:n, Röskär, G.N.M. — Gryt s:n, Harstena, L.Z.M., T.G. — Valdemarsvik, L.Z.M., C.M. — Gusum, L.Z.M., C.M. — Mjölby, G.N.M. — Omberg, Stocklycke, L.Z.M. — Skänninge, H.L. — Vallerstad, K.A. — Fågelsta, L.Z.M. — Linköping area, K.E-n., K.A. — Kaga, Kränga, G.N.M. — Rystad s:n: Fröstad; Luestad, F.O. — Vreta kloster, to the east of Gullberg, G.N.M. — Stjärnorp, Roxenbaden, H.L. — S:t Anna s:n; Torönsborg; Engelholm, Djurudden; Kejsarnäs; L.Z.M., T.G. — S:t Anna s:n: Missjö; Stickelholm, L.Z.M. — Skällvik s:n, Stora Bottna, Uvebo, T.G. — Söderköping, Ramunderberget, L.Z.M., T.G. — Norrköping: Karstorp; Okna; Borg; Leonardsberg; Fiskeby; Himmelstalund; Herstaberg, H.B. — Norrköping area, H.B. — Källskären, LÖNNBERG 1920. — Risinge, Horn, H.L. — Hällestad, Borggård, H.L.

Dalsland. Högsäter, N.-G.K. — Kroppefjäll, between Högsäter and Sundals Ryr s:n, L.Z.M. — Järbo, N.-G.K. — Ör, N.-G.K. — Mellerud, C.M. — Tisselskog, Kantedalen and Brudefjället, N.-G.K. — Gestad, Kättarebol, N.-G.K. — Valbo-Ryr, N.G.K. — Ånimskog, N.-G.K. — Dalskog s:n; Källsviken; Vägtjärn, N.-G.K. — Ed, Trolldalen, N.-G.K. — Ärtemark, N.-G.K. — Laxarby, Bågen, N.-G.K. — Åmål, N.-G.K. — Åmål, Fagerhult, N.-G.K. — Mo, Öjersbyn, N.-G.K.

Värmland. Kila s:n, Gambol, R.E. — Trankil s:n, Gyltenäs, L.Z.M. — Kristinehamn area, E.W. — Karlstad, G.N M., G.D.-l. — Stora Kil s:n, Norra Hyen, A.K. — Lene, Forsnor, L.Z.M. — Arvika, Gränsjön, A.E. — Filipstad, G.D.-l. — Brunskog s:n, C.B.G. — Gåsborn, H.W.W. — Skillingsfors, N.L. — Sunne s:n, S.A., — Munkfors, N.R.M. — Sunnemo. G.D.-l. — Nore, D.H. — Hagfors area, E.W., H.L. — Föskefors, D.H. — Ekshärad s:n, Ämten, D.H.; Stora Tippatjärn, HANNERZ 1954. — Norra Ny, D.H. — Norra Finnskoga s:n, Höljes, N.R.M.

Närke. Mariedamm, SUNDEVALL 1846 and 1848. — Lerbäck, Venatorp, H.W.W. — Tisaren, Tisaretorp, G.Ö-t. — Skagershult, W.S.W. Bäcketorp, H.W.W. — Edsberg s:n, Frövi, A.D.; Mosjö, Råby, H.W.W. — Örebro, Västra Mark, H.W.W. — Örebro, H.W.W. — Rynninge, S.T-n.

Södermanland. Oxelösund, Aspa, J.B. — Södra Utö, Källviken, N.R.M. — Utö, O.C. — Katrineholm T.W. — Marsjö, T.W. — Marsjö, T.W. — Vingåker, T.W. — Rön-

ninge, N.B. — Salem s:n, A.A. — Turinge, H.W.W. — Gåsinge, H.W.W. — Huddinge, Balingsholm, K.C.-L. — Mariefred, N.R.M. — Kärnbo, Edsala, H.W.W. — Eskilstuna area, SJÖSTEDT 1920, E.A.

Stockholm. Skarpnäck, A.L-t. — Enskede, C.E., H.a.R., K.L., S.E-n. — Tantolunden, A.L-t. — Djurgården, C.E., N.L. — Judarn, S.E-n. — Ulvsundasjön, S.E-n. — Bromma, T.W. — Kaknäs, H.a.R. — Southern Lidingö, N.R.M. — Haga, N.R.M. — Karlberg Park, G.N.M. — Spånga, N.R.M. — Danderyd, K.H.F.

Västmanland. Fellingsbro, H.W.W. — Frövi, A.D. — Nora area, H.A.L. — Västerås, WALLDÉN 1955, O.H-g. — Hällefors, H.W.W. — Linde, Siggebohyttan, H.W.W. — Ljusnarsberg, Långbro, S.T-n., H.W.W. — Kloten, S.H-m. — Ramsberg, Glyfsan, H.W.W. — Västanfors, Flyten, S.T-n.

Uppland. Haga, NE Hagbyholm, H.W.W. — Viggbyholm, T.W. — Össeby-Garn s:n, Granby, WALDÉN 1954. — Sånga, Alviken; Adelsö, Stakulla, H.W.W. — Österåker s:n: Lervik; Valsjön; Norra Träsksjön, H.a.R. — Svartlögafjärden: Hallonstenarna; Norrskäret, N.R.M. — Sigtuna, K.C.-L. — Uppsala, Botanical Gardens, N.R.M. — Uppsala, Tunaberg, U.S. — Uppsala, N.R.M., LUNDBLAD 1918. — Uppsala area, K.-H.F. — Vendel, S.E. — Singö s:n, Fogdö, K.C.-L. — Östhammar, T.S.

Dalarna. Malingsbo, H-s.L. — Ludvika, K.-H.F. — Norrbärke, DAHL 1943. — Grytnäs, DAHL 1943. — By s:n, B.W. — Stora Tuna, Borlänge village, E.D. — Stora Tuna, DAHL 1943. — Torsång, O.C-n. — Falun, DAHL 1943, KLEFBECK 1949, K.-H.F., O.C-n. — Leksand: Styrsjöbo, Igeltjärn, N.R.M.; several localities, LUNDBLAD 1918. — Leksand, DAHL 1943. — Svärdsjö, DAHL 1943, E.D. — Bingsjö, Dalstugaby, L.Z.M., E-s.M.

Gästrikland. Gävle, HEINTZE 1909, G.M-g. — Gävle area, G.K.

Hälsingland. Söderhamn, L.Z.M. — Norrala s:n, Utvik, L.Z.M.

Triturus vulgaris borealis ssp. nov.

The following table demonstrates the relation in size between sexually mature *T. v. borealis* and *T. v. vulgaris*. (Table 6.)

The difference in the average values of the body length between *borealis* and *vulgaris* cannot be explained by the fact that the northern form is on the whole larger. As we will see later (Tab. 7), the young adult individuals of *vulgaris* are on an average smaller than those of *borealis*, and as this category is larger numerically in our material, it influences the calculations of the average.

The material of *borealis* which was examined consisted of 11 males, 12 females and 8 larvae or young animals. The larvae from Ångermanland (Gideå parish, 63°30′ n. lat.) which were collected at the beginning of July (July 7th, 1954), have a total length of 16–24 mm which gives an average of 19.6 mm. This is considerably less than the corresponding average for *vulgaris* in southern Sweden. By the middle of July the larvae of southern Sweden are on an average 29 mm long and begin their metamorphosis.

Specimens of *borealis* in breeding dress are found at the earliest during the last days of May or at the beginning of June. Spawning cannot therefore be started before this time. As regards the metamorphosis we have no information, but for climatic reasons it can hardly take place later than the first half of August, especially in the interior of the country. It is not known, either, whether the larvae hibernate or not.

TABLE 6. Sizes of mature *Triturus vulgaris vulgaris* and *T. v. borealis*.

Race	Sex	*N*	Total length	σ_M	Body length	σ_M	Tail	σ_M	Fore-limb	σ_M
borealis	♂	11	78.6	±1.55	41.2	±0.84	37.4	±1.03	14.4	±0.24
vulgaris	♂	47	76.7	±1.12	39.5	±0.51	37.1	±0.59	13.8	±0.30
borealis	♀	12	80.3	±1.95	43.2	±1.02	37.1	±1.08	13.9	±0.28
vulgaris	♀	38	74.6	±1.32	39.6	±0.66	34.9	±0.73	12.6	±0.27

Note: All figures in mm.

Those animals which have just become mature, that is to say, the smallest group in breeding dress, measure 70–74 mm in total length (average 72.8 mm), and are somewhat larger than the corresponding group of *vulgaris* in southern Sweden (Tab. 7). The difference between the two groups' total length is 3.07 mm which has a significance coefficient of 2.92.

The significance coefficient is thus sufficiently large, and allows us to observe the difference between the total length of the two youngest groups of mature animals as genuine (although the number of specimens of *borealis* is rather small). This result is not what we had expected. Conditions of growth are worse for *borealis* than for *vulgaris*. The spawning of the *borealis* takes place about 6 weeks later than that of the *vulgaris*, the period of activity is shorter and the temperature of the water is lower. The shorter period of activity is of importance also as regards the metamorphosed animals during their terrestrial period. For animals of nocturnal habits, such as newts, the long northern summer day hardly provides any compensation, but means, on the contrary, inferior conditions as regards nutrition. Therefore we can hardly expect *borealis* to attain a greater size than *vulgaris*, during the same period of growth. The phenomenon of the body length of *borealis* being greater at the onset of puberty is probably due to the fact that the northern form becomes mature at least one year later than the southern *vulgaris*.

TABLE 7. Total length in mature *Triturus vulgaris vulgaris* and *T. v. borealis*, calculated for age-groups.

Race	1st year of maturity				2nd year of maturity			Older	
	Sex	*N*	Total length, mean value	σ_M	*N*	Total length, mean value	σ_M	*N*	Total length, mean value
T. v. vulgaris	♂♂ ♀♀	40	69.77	±0.87	36	78.94	±0.56	11	90.00
T. v. borealis	♂♂ ♀♀	7	72.84	±0.58	11	79.80	±0.57	5	88.14
Diff.[1]			−3.07			−0.86			+1.86

[1] + indicates the difference where *vulgaris* is the larger and − denotes the opposite condition.

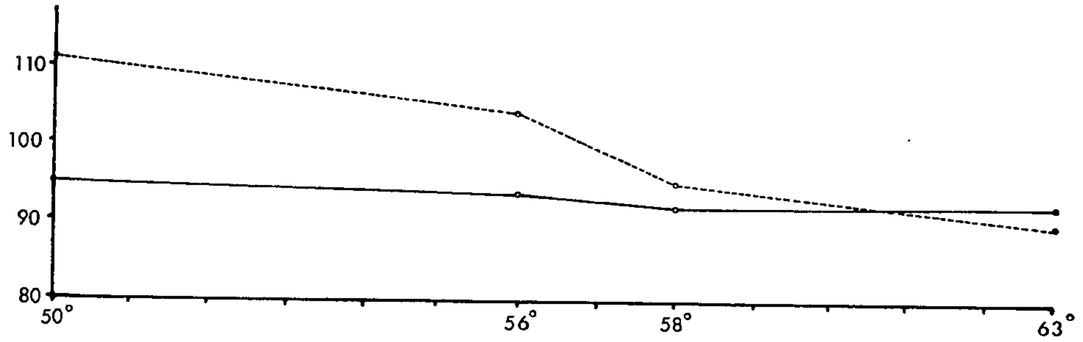


FIG. 7. Maximal size of Smooth Newt transferred to geographic latitudes. Continuous line = females. Broken line = males.

If we also compare the later age-groups (Tab. 7), we notice that *borealis* cannot maintain its lead over the southern form, but begins to fall behind. In the next age-group (II) both forms are equally large, and later the southern form is larger.

A tendency to sexual dimorphism concerning the legs can also be observed in the *borealis*. The male has rather longer extremities. (Tab. 6.)

The difference between the males of the *borealis* and those of the *vulgaris* is seen most clearly in the low crest of the former in breeding dress. The crest varies somewhat in height and development, but is always considerably lower than that of the *vulgaris*. The following figures in Tab. 8 demonstrate this. (Fig. 8.)

For this comparison only individuals with a total length of more than 75 mm have been used. (During the first year of puberty the crest is not fully developed.) The difference between the two forms as regards the height of the crest is thus 2.58, with a significance coefficient of 4.7.

Finally some notes on the size of the body. As regards total length, the males and females (of *borealis*) differ somewhat from each other, but in comparison with *vulgaris* the difference is the reverse. The male *vulgaris* is always larger than the female of the same age. In the *borealis* it seems as if fullgrown females reach a greater size than the males. (Tab. 6 and 9.)

A comparison between the different geographical degrees of latitude shows how the Smooth Newt's body length successively lessens in the direction of the northernmost habitat. (Fig. 7.)

It seems from the above that it is primarily the males whose bodies react

TABLE 8. Height of the crest in breeding dress of *Triturus vulgaris vulgaris* and *T. v. borealis*.

Race	*N*	Height of crest (average)	σ_M
vulgaris	15	5.35	±0.33
borealis	9	2.77	±0.47

TABLE 9. Total length of males and females of *Triturus vulgaris borealis*, calculated for the age-groups.

Age-groups of mature animals of *borealis*	I	II	III and older
♂♂	73.80	79.56	86.50
♀♀	72.10	80.00	89.20
Difference .	1.70	−0.44	−2.70

TABLE 10. Maximum total length of *Triturus vulgaris* in several latitudes.

Total length of the largest specimens, in mm	Rhine-Main district 50° n.lat.	Kent, Eng. 51°	Southern Sweden 55°–58°	Northern Sweden 63°
♂♂	111	104	95	90
♀♀	95	94	92	92
Difference	16	10	3	−2

more strongly to the inferior conditions, while the females are more "conservative" (fig. 7). In comparison with the population of the Rhine-Main district (MERTENS, 1947) the Smooth Newt males in the northernmost habitat have 10 % less body length, while the females have only 3.2 % less. The difference in size between the sexes disappears and in the northern form both sexes are the same size, or the females can be somewhat larger than the males (Tab. 10). SMITH (1954) made the same observations in Britain. He notes that in Scotland the sexes are of the same size.

The sexual organs are immediately dependent on the size of the body. The testicles of the *borealis* are considerably smaller than those of the *vulgaris* (Tab. 11) while the ovaries are about the same in both cases.

As the examination of the stomach contents shows, the main food during the mating period (the aquatic period) is insect larvae. A slight source of inaccuracy is, however, that small and easily digested prey more quickly disappears or becomes unidentifiable, while harder chitin substances retain their form longer. In aquaria the Smooth Newts gladly eat both *Cladocera*, worms and other moving organisms.

There is a considerable difference in the stomach contents of north Swedish and south Swedish specimens. In the northern Smooth Newts dissected, the stomachs are often empty or contain much less food than those of the southern specimens. As the material is collected at random, one can hardly be far wrong in drawing the conclusion, based on the facts, that the supply of food is considerably smaller in the northern areas than in the south. The thin and lanky

TABLE 11. Data concerning the size of testicles and ovaries and contents of stomachs in *Triturus vulgaris borealis* and *Tr. v. vulgaris*.

Collecting area	Date	Total length in mm	Length of testicle in mm	Stomach contents
		Tr. v. borealis		
	♂♂			
Jämtland	28/5	89.0	5.0	remains of insect larva
			4.5	—
Umeå	30/5	79.6	5.0	remains of insect larvae
			5.2	
Jämtland	31/5	81.9	5.4	—
			5.0	
Ångermanland	10/5	77.9	5.2	
	♀♀		Length of ovaries, mm	
Jämtland	28/5	80.0	16.0	remains of fly (imago)
			15.0	
		Tr. v. vulgaris		
	♂♂			
Skåne	22/4	78.4	6.5	*Nemoura cinerea*[1]
			6.0	1 grown and 1 halfgrown nymph
Småland	25/4	82.2	6.3	*Nemoura cinerea*, 2 nymphs
			6.0	*Chironomidae*, 2 larvae
				Culicidae, remains of larva
	♀♀		Length of ovaries in mm	
Skåne	22/4	78.4	14.0	—
Småland	25/4	72.0	13.5	*Nemoura cinerea* 3 nymphs
				Culicidae, 1 larva
				Coleoptera
				Cirtes hemisphaericus, 1 larva
				Trichoptera, 1 larva

[1] All insects det. by P. Brinck.

build of the northern race can be explained by the poor diet. Inferior diet conditions seem to prevail in northern Sweden also during the terrestrial period.

The pattern of the pigment in *borealis* is often composed of smaller specks than in *vulgaris*, especially in the case of the male's breeding dress, which is often speckled or spotted and resembles to some extent the pigment pattern of the larva. The lengthwise ridges on the sides of the back are as a rule lightly marked. In some specimens the tail extends in a thread-like appendage (Stugun, Jämtland). This detail, as well as the low crest, are reminiscent of the southern European races, *meridionalis* and *graecus*.

The northern Smooth Newt lives in a pessimum district, with a pessimum of

FIG. 8. Smooth Newt: From above, male and female of *Triturus vulgaris borealis* ssp. nov.; male from Hanö with tail filament; neotenous male and female from Långseleberget, Stensele. Photo by Lunds Lit. Lab. AB.

temperature, of nutrition and also on account of the short period of activity. Late spawning and the short period of activity which follows mean that the newly metamorphosed young have an inferior start for their hibernation. It is, however, possible that the tadpoles, at any rate some of them, hibernate in the water and become metamorphosed the following summer.

A reduced supply of food, combined with unfavourable weather conditions, results in slower growth and a longer period of development. Delayed adolescence means, however, a reduction of the animal numbers.

The pessimum of nutrition has resulted in a reduction of the body size and also a lessening of some of the male's sexual characters. Actually one should include the male's larger dimensions among the sexual characters.

The sexual organs just before spawning are smaller in the males of *borealis*,

but the females retain comparatively the same size as the southern form. A reduction in the number of spawn would perhaps mean a threat to the survival of the race.

It has not been possible to determine whether there are any changes in the relative length of the extremities between the northern and southern races (Tab. 6). The fore extremities (in *borealis*) are relatively not shorter than those of *vulgaris* in southern Sweden (Tab. 5). (No foreign material has been available for examination.) The same is true of the tail length. We can only establish that Allen's rule in this case does not apply. On the other hand the results which ERNST (1952) published relating to *T. alpestris* in Switzerland correspond with our observations. He has not found any relation between the height above sea level and the length of the tail, or the fore-limbs respectively. His highest collecting ground is at a height of 2000 m above sea level. SCHUSTER (1950), referring to *Salamandra salamandra* in Bayreuth and Traunstein, states the opposite, but the figures presented in his work do not support his assertions.

To sum up, one can say that the northern form can be distinguished from the nominate race by many definite characteristics. Whether all of these characteristics are the result of genetic factors, or are only modifications, we do not yet know. For practical reasons we have considered this form, with its definite demarcation, as a geographic race, and defined it with the term *borealis*.

Diagnosis: the crest in the male's breeding dress is low, on an average half as high as that of the nominate race. The pattern of the pigment is speckled or spotted, the longitudinal ridges on the back are generally marked. The males are as a rule the same length as the females of the same age-group, or even shorter than the females.

T. v. borealis is not a common animal and the population seems to be fairly small. The area for this race includes Ångermanland, Jämtland and Härjedalen. It is also found in the southern part of Västerbotten and in Medelpad.

Terra typica: Jämtland, Ångermanland.

Holotype: No. 86. 1 ♂, from Lockne, Jämtland. Kept in the Zoological Museum of Lund University.

T. v. borealis area is separated from that of the main race by a belt situated between the 61st and 62nd degrees of latitude, in which hardly any specimens have been found. From the whole of north Dalecarlia and southern Härjedalen, for instance, no finds have been reported. It is difficult to judge whether the Smooth Newt is completely absent from this area or not, but in any case it must be very scarce. The southern part of this intermediate country appears to be inhabited by the main race. In the middle there is inaccessible mountain country and large rapid rivers running across the district which have more or less isolated the northern area from the south. The flow of genes has been very sporadic and has probably not occurred at all for long periods. A long period of this kind, with total isolation, probably occurred during the Subcoreal period when the climate was subject to deterioration.

The Smooth Newt reached Sweden fairly early, some time during the early Boreal Age. It spread through nearly the whole country and penetrated by degrees as far as Lapland. During the period of climatic deterioration which followed it receded but left a more or less isolated population in northern Sweden.

It is possible that the isolated existence of the Smooth Newt in the Trondheim district of Norway originated in connection with its spread through Sweden.

The discovery of a special race of Smooth Newt is quite surprising since the northern populations have been considered to be rather homogeneous and the genom with few biotypes. Variability and race formation were thought to be confined to more southern countries, especially to mountain areas with good isolation. As late as in 1951 WOLTERSTORFF & FREYTAG wrote in this sense: "Es wurde häufig darauf hingewiesen, dass die kleinen Wassermolche im nördlichen Teile ihres Verbreitungsgebietes einheitlich bleiben und der Rassenbildung entbehren."

It has also been considered that the period after the glaciation was too short for such conservative forms as the newts to build up any race differentiation in the northern range of population.

Of the European newts *T. vulgaris* has the largest distribution. It occurs from France to Altai, nearly as far as Jenisei (TERENTJEV & ČERNOV 1949) and from Lapland (65° N) in Sweden to Asia Minor, Greece and Italy. According to TERENTJEV & ČERNOV (1949) isolated, probably relictary, populations occur also in Asia at the southern border of the area; e.g. at the northern side of the lake Aral and the lake Balhaš.

In this vast area it is most abundant in the plains but also occurs in the mountains and reaches up to 1500 m, in Kärnten up to and including 2250 m (FISHER 1931).

Like all newts the Smooth Newt is not very agile and cannot easily move any long distances in difficult country. Particularly in the mountains small populations are apt to become isolated.

The race formation in SE Europe and the Caucasus area has been favoured by a more severe isolation and perhaps also to some extent by climatic conditions. The most important characters on which the different races are based are: the low crest, which often loses its dentation and the edges of which become smooth, more strongly marked ridges along each side of the back, the occurrence of the tip-filament and a somewhat different formation of the toe web.

The northern race (*T. v. borealis*) has the same characters; the crest is very low and in some individuals its edges are smooth, the tip-filament is present in some cases, the toe web in the aquatic individuals is not well developed, and in some specimens the ridges along each side of the back are marked.

The area of the northern race is mountainous; it is divided by rivers, by ridges and pine-forests into smaller parts and thus several more or less isolated small populations are formed.

Some of the characters named above occur elsewhere, too, e.g. the tip filament

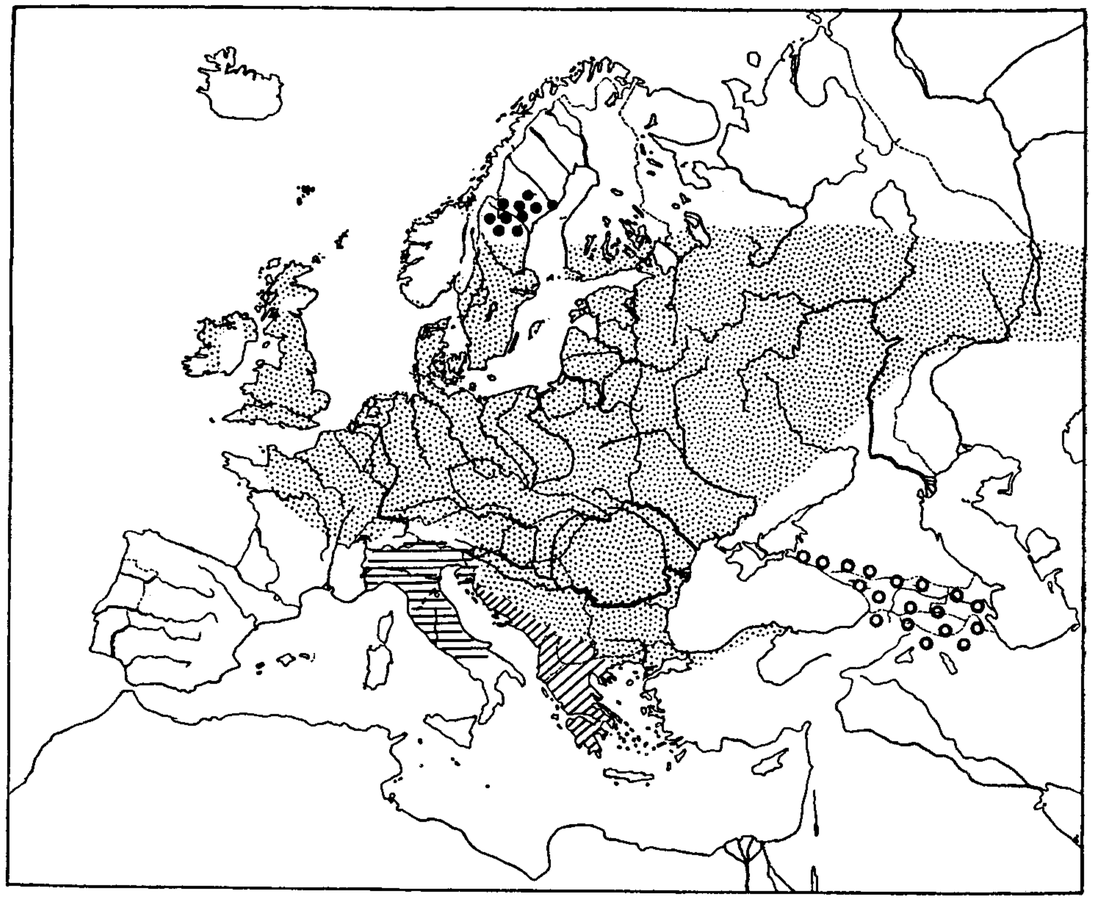


FIG. 9. Distribution of *Triturus vulgaris*. Dotted area = *T. v. vulgaris* (LAUR.). Black dots = *T. v. borealis* ssp. nov. Open circles = *T. v. lantzi* (WOLTERSTORFF). Striated areas in Italy and Greece = *T. v. meridionalis* (BOULENGER) and *T. v. graecus* (WOLTERSTORFF).

has been found in the Smooth Newts on the isle of Hanö off the coast of Blekinge in South Sweden. (Fig. 8.)

Our experience thus confirms the observations from Roumania and Turkey as reported by FUHN & FREYTAG (1952).

T. v. borealis in its very northernmost localities seems to occur in neotenous form.

NEOTENY

In our collections there are three finds of neotenous *T. vulgaris*. One specimen is from Östra Frölunda in Västergötland, 1953 (collector, C. BLIDING); four specimens are from Stensele in Lapland, 65°04′ northern latitude, 1923 (collect. Umeå Läroverk [Grammar school]) and two specimens are from Långseleberget, near Forsvik in Stensele district, 1953 (collector, PER BJUR, donator, SUNE ANDERSSON).

The specimen from Östra Frölunda is a male with a body length of 67.7 mm, a larval crest, with undented edge, with dense normal pigment specks, and with

TABLE 12. Data concerning the size of testicles and ovaries and contents of stomachs in neotenous *Triturus vulgaris*.

Habitat	Sex	T. length	Length of gonads	Index	Stomach contents
Ö. Frölunda	♂	67.7	4.3	6.35	—
Stensele	♂	66.1	3.7	5.60	—
,,	♂	70.2	5.4 3.0	7.69	—
,,	♂	68.0	5.8	8.53	—
Långseleberget	♂	67.2	5.7	8.48	*Corixa*, 1 spec.
,,	♂	75.3	4.0	5.31	—
Stensele	♀	72.0	7.4	—	—

completely swollen cloaca. The gills are missing on one side and on the other are small. Only one testicle is developed, while the other is rudimentary (Tab. 12). The four specimens from Stensele, 1923 are all mature — 3 males and 1 female. All have well-developed gills. The fin-like edge is smooth and larval. There is a clear difference between males and females. The female's crest is lower, especially on the back. The cloacae are well-developed, and as characteristic as they usually are in mature individuals in breeding dress, with the distinctive peculiarities for males and females. The pigment specks of the male are large or fairly large, those of the female are small and closer together. The pigment stripes on the head are missing, or perhaps difficult to distinguish.

The two specimens from Långseleberget (1953) are males, with fully developed cloacae, and the pigment pattern in large specks; they resemble those from Stensele described above. (Fig. 8.)

One can sum up as follows: all our neotenous specimens are fully mature and with a pigment pattern; no albinos have been found. Sexual dimorphism is well developed (crest, cloaca) and the sexual proportion is to the advantage of the males, as the females are decidedly fewer. This is in opposition to the observations which have previously been made in other countries. (BOETTGER & SCHWARZ, 1928. HARTWIG & ROTMANN, 1940.)

When the specimens were dissected it could be established that the sexual organs' degree of development, volume and length completely conform to the conditions among normal sexually mature animals at the beginning of the mating period.

The only habitat which has been described in detail is that of the latest find on Långseleberget. Dr. ANDERSSON, who visited the place on July 20th, 1954, sent me the following description: "It is a deep tarn, on the Långsele mountain, about 500 metres above sea level, in a large conifer forest. I should estimate the diameter of the tarn at 75–100 metres and it was fairly deep; at 5 metres from the shore I could not reach the bottom with a 3 metre long pole. The forest

grew right to the edge of the tarn. Beside the shore there were large patches of moss, about 1½ metres thick, floating on the water. One could easily push a stick through them and feel the water underneath. Further out in the tarn there were patches of peat moss apparently floating. The vegetation along the shores was mostly *Sphagnum* and there was no specially distinctive vegetation in the water."

This tarn is a permanent one. As it is situated in the shade of the woods, and the surface of the water is partly covered by moss, comparatively little sun reaches it, so that it receives little warmth. This also means that the melting of the snow and ice is delayed in the spring and reduces still further the already short period of activity.

Meteorological reports from the neighbouring station at Stensele give us the following picture of conditions:

TABLE 13. Climatic data from Stensele meteorological station.

	May	June	July	Aug.	Sept.
Average temp.	5.2	10.8	14.0	11.4	6.5
Average max.	9.3	16.4	17.7	15.4	10.0
Average min.	0.5	7.0	10.3	9.2	3.6
Days w. temp. below zero . .	13	5	0	2	6

This habitat lies about 200 metres higher than Stensele (meteorological) station, which means a further reduction of 1° in the temperature (ÅNGSTRÖM, 1946, p. 28). In other words, only July and a few days in June and August can be considered as the period of activity for the Smooth Newt. It is true that the temperatures noted above are for the air, but as we have already observed, the conditions of the habitat are such that one cannot expect the temperature of the water to exceed that of the air to any extent. In the south of Sweden, the first metamorphoses take place in the middle of July. This means that the combined development (embryonic–larval) takes 2½–3 months. This occurs in water at a temperature of 20°. For *T. v. borealis* in northern Sweden we must estimate a period of development before the metamorphosis of about 3 months as the minimum, probably more.

In relating these facts to the Smooth Newt population on Långseleberget, we cannot count on a metamorphosis during the first period of activity. The larvae are obliged to hibernate.

Hibernation in the larval state, as such, however, does not necessarily lead to neoteny. Under certain climatic conditions the hibernation of the larvae can be regular or of frequent occurrence. In areas with fairly short summers, where a late and cold spring means a much delayed spawning, or areas with a maritime climate and a long period of activity as in Scania, where spawning can also occur late in the summer, one can consider hibernation of the larvae as a more or less normal condition.

According to FREMERY (1928), there is no reason to state that an abnormally long larval period induces neoteny. He observes also that in the neotenous specimens examined by him the structure of the thyroid gland is different (from the normal); there are fewer follicles and the gland epithelium is atrophied.

The mechanics of larval hibernation have been investigated in detail by TANIGUCHI (1931) and EGGERT (1934).

Spontaneous neoteny has so far not received any satisfactory explanation. For a long time it was considered that it might be caused by certain factors in the environment, of the same kind which can delay or prevent metamorphosis: low temperature (TANIGUCHI, 1931, EGGERT, 1934), inadequate nutriment in the earlier larval stages (D'ANGELO, GORDON, CHARIPPER, 1938, 1941), the alkaline reaction of the water (ROSEN 1938), deficiency of light (TOIVONEN,1951). Other factors which are considered to hinder growth and delay the metamorphosis, such as too rich food (MCCARRISON, 1921), a diet deficient in vitamins (DOETSCH, 1938) and others, can hardly be applicable in natural surroundings.

We have no experimental confirmation that spontaneous neoteny can be caused by one or several environmental factors. In addition, the conditions in the hitherto known habitats of neotenous water-newts are so varying that it would be difficult to believe that the phenomenon can be explained by the influence of any single factor. (See also HARTWIG & ROTMANN, 1940.)

The two last named authors suggest a division of the known examples of genuine neoteny into two categories. In the one case we should be concerned with a direct disturbance of the functions of the thyroid gland, with morphological changes and partial atrophy of the follicle epithelium (FREMERY, 1928; SMITH 1954). Such cases can be classed as *consistently* (HARTWIG & ROTMAN 1940: stabil) neotenous. A hereditary background can here be surmised. In this category we can perhaps place the albinistic, neotenous forms mentioned by SMITH (1954) which are presumably caused by a defective function of the hypophysis.

The majority of the known cases of neoteny are not permanently neotenous but *labile* cases, which sooner or later are metamorphosed, or are capable of being so. In these cases there exists no morphological change of the thyroid gland or the front lobe of the hypophysis, nor any permanent disturbance of the functions of the above mentioned glands. Relying on experimental results with axolotl, the authors (HARTWIG & ROTMANN loc. cit.) suggest that one can consider the spontaneous labile neoteny in *T. vulgaris* (=*taeniatus*) as *an abnormal physiological condition of the hypophysis similar to that which has experimentally been proved in Amblystoma* (HARTWIG & ROTMANN, 1940, pp. 242, 250).

No agreement has been reached as to whether neoteny can be considered to be hereditary or not.

VERSLUIS (1925), quoted by HERRE 1935), and FREMERY (1928) consider

neoteny to be a hereditary condition, but this has been refuted by HARTWIG & ROTMANN (1940).

By crossing a neotenous female with a normal male, SWINDEREN (1925) produced young of which half were neotenous.

RADOVANOVIČ (1953) also presumes, no doubt, a hereditary background when he describes a neotenous form of *T. a. alpestris* as a new geographic race.

WOLTERSTORFF & FREYTAG (1951) observe that, "Eine Sichtung der im Freiland und im Aquarien-Versuch gesammelten Erfahrungen verdeutlicht, dass totale Neotenie, das Geschlechtsreifwerden schon im Larvenzustand, erblich zu sein scheint und—soweit man schliessen darf—allgemein wohl rezessivem, vielleicht auch intermediärem Erbgang gehorcht."

At the present stage, it seems difficult to make any definite conclusions as to whether neoteny is hereditary or not. In spite of the wealth of material, the observations are more or less haphazard, the experiments are too few and in the majority of cases not satisfactorily carried out. It seems, however, probable that the tendency to become neotenous under certain conditions is genetically controlled.*

Similarly, as it is not possible to reach a definite opinion on the role of ecological factors in causing neoteny, we have not, either, succeeded in discovering which factors, if any, influence or set in motion metamorphosis in the neotenous forms. Neither BOETTGER & SCHWARZ (1928), nor HARTWIG & ROTMANN (1940), who have devoted much attention to the problem, have been able to find the solution. As a rule, it has been guessed that higher, or rising temperature is the stimulating factor.

A comparison of known instances of neoteny shows clearly that there is a definite correlation between the occurrence of neotenous water-newts and a certain type of environment. A special characteristic of this type of environment is deep water or tanks with more or less steep walls. As a result of this the temperature in bodies of water of this kind keeps fairly constant and is lower than in other shallow pools or tanks. Similarly, the changes of temperature during the 24 hours are only slight in the lower depths. Water-newts who live near the bottom of such tanks, live in a more or less constant environment.

There exist no detailed and fully satisfactory ecological analyses and descriptions of conditions in water tanks with neotenous water-newts. According to the brief characteristics so far published, we can consider the following finds as belonging to the type above mentioned: KNAUER (1883, p. 228), HAMANN (1880), WESTHOF (1893), ZELLER (1899), SASAKI (1924), BOETTGER & SCHWARZ (1928), HARTWIG & ROTMANN (1940), SMITH (1954), PAVIČEVIČ-ALEKSIČ (1949) and from the same habitat RADOVANOVIČ (1953). We should also here include the habitat on Långseleberget and a number of finds in mountain lakes at a high altitude which ecologically represent the same type. Conditions in Bukumirsko

* Partial neoteny in the form in which it appears among the tailless amphibians is not discussed here.

Jezero in Montenegro (RADOVANOVIČ 1953), and in lakes in Triglavstock (SELIŠKAR & PEHANI (1935) have much in common.

Referring to the neotenous *Dicamptodon ensatus* (ESCHSCHOLTZ) which in larval form lives in running water in western U.S.A., KESSEL & KESSEL write (1944):

"the transformation was delayed when larvae were kept in deep water. May neoteny be common in areas where streams are high and steep-sided?"

SMITH (1954, p. 43): "In *Triturus alpestris*, the Alpine newt, total neoteny is known to occur regularly. In the plains of France and Italy metamorphosis in this species takes place in the usual way, but in the lakes of Lombardy at high altitudes, due presumably to the cold, the development of the tadpole is greatly retarded, and after long residence there a breed has evolved in which neoteny is common."

(Some observations, though considerably fewer, show that neoteny can occur also in shallower bodies of water. (ENTZ 1911), CUNNINGHAM BOULENGER (1912, quoted by HARTWIG & ROTMANN 1940), WOLTERSTORFF (1896)).

A considerable lowering of the water level with the resulting rise of temperature occasions metamorphosis. This is shown, for instance, clearly by information from HARTWIG & ROTMANN (1940, pp. 219, 227 and 228), who carefully observed the process of metamorphosis in the habitat examined by them, and registered in detail the connection between the metamorphosis and the reduction in the volume of water; they did not, however, go into the question of the temperature.

A removal of neotenous individuals to an aquarium results as a rule in metamorphosis, except at exceptionally low temperatures (BOETTGER & SCHWARTZ 1928), HARTWIG & ROTMANN (1940), and others. When removal from natural surroundings to an aquarium takes place, external factors can be of importance in various ways, depending on the length of the transport, the type of container used, the type of environment in the aquarium etc. For instance, considerable warmth during transit, shaking etc., can give the necessary impulse and set the thyreotropic hormone system to work.

The point we wish to make here is, that an unchanging environment, especially in conjunction with a more or less constant and low temperature, seems to be the normal when neoteny occurs among water-newts. In other words, a constant environment tends to "conserve" neoteny. As soon as any considerable changes take place in the ecological regime, the metamorphosis as a rule is started.

Our neotenous water-newts from Lapland correspond to the neotenous form of *T. alpestris* which RADOVANOVIČ (1953) has described as a new geographic subspecies, *T. alpestris montenegrinus* RAD. The habitat, Bukomirsko Lake, lies in eastern Montenegro at about 1500 m altitude. RADOVANOVIČ writes:

"Die Ursache der Neotenie bei diesem Molche kann vielleicht mit der relativ grossen Tiefe 16–18 m und den steil geneigten Uferseiten des Sees, der mit einem Durchmesser von 150–170 m beinahe brunnenartig erscheint, in Zusammenhang gebracht werden."

According to PAVIČEVIČ & ALEKSIČ (1949), the shores of the lake are stony and covered in *Carex*. Other animals noticed were *Odonata*, of which there were

numbers of larvae; *Trichoptera—Leptocerida* and *Limnopohilida*; *Gammarus*, *Gordius* and some leeches.

If one compares the ecological characteristics of Bukomirsko Lake, as described above, with the habitat on Långseleberget, one notices that both are situated in a cold climate, both lakes are comparatively small (100, respectively 170 m in diameter), deep and with steep sides. In spite of the altitude, Bukomirsko Lake has a more favourable situation as far as climate is concerned. The altitude of the sun is higher, and the average temperature for the whole year is probably about 7°, while that of Långseleberget is under 1°. From the photograph in a work of PAVIČEVIČ & ALEKSIČ, Bukomirsko Lake seems to have an open situation, the district is treeless except on one shore, where the mountain side slopes steeply and is covered with trees. The depth of the lake can, however, contribute to a fairly constant temperature in the water.

The tarn on Långseleberget is partly covered by floating patches of moss, the altitude of the sun is less, the temperature is lower, the winter is longer and harder.

We are, however, dealing with separate species *T. vulgaris* and *T. alpestris*, of which *vulgaris* can be considered to be the hardier. A comparison can, therefore, only be approximate.

I have no information as to the reasons why RADOVANOVIČ has distinguished his new form with the rank of sub-species, or geographic race. It is, however, stated to be neotenous, which presumably can be considered to be a permanent neoteny.

From the district round Stensele in Swedish Lapland we know of only two finds, both neotenous. Probably the two neotenous finds from Stensele were collected in the same tarn on the Långseleberget, as well as a neotenous specimen of Warty Newt (p. 245). No metamorphosed specimens have been reported from that district. The district, however, has not been thoroughly examined for this purpose, and we cannot therefore definitely affirm that the metamorphosed form does not exist there, and that we are here dealing with a permanent neotenous form. Certain circumstances lead us to consider that this is likely.

T. v. borealis has its northern limit of existence at the 64° of latitude; the neotenous form has not been found more than a geographic degree further north, in addition, at 500 metres above sea level. It should also be remembered that the northernmost habitat is not situated in an ecologically favourable position, but instead in the worst, as far as conditions of temperature and the production ecology of the water are concerned.

The short summer in Lapland in conjunction with the long and very severe winter make existence difficult for the species in its terrestrial period. A further difficulty is the long northern summer day, which makes hunting possibilities very small for a species of nocturnal habits.

The neotenous aquatic form manages better, both as regards hibernation and the obtaining of food. The tadpoles have not as yet definitely nocturnal habits.

TABLE 14. Collecting and measuring data for *Triturus vulgaris borealis*.

No.	Place	Date	Sex	Total length	Head + body	Tail	Forelimb	Crest (dorsal)	Note
	Jämtland								
1	Lits	30.5.1948	♀	76.8	41.4	35.4	14.4		
2	Lits	30.5.1948	♂	73.6	40.6	33.0	14.2	5.2	
3	Lits	30.5.1948	♀	85.1	44.6	40.5	14.3	—	
4	Häggenås	31.5.1948	♂	81.9	45.2	36.7	15.3	2.3	
5	Stugun	8.6.1948	♀	81.6	44.3	37.3	14.5	—	
6	Lockne	28.5.1948	♂	89.0	43.3	45.7	15.2	4.8	
7	Stugun	8.6.1948	♂	74.4	36.4	38.0	13.7	1.8	
8	Lockne	28.5.1948	♀	80.0	42.8	37.2	13.1	—	
9	Lockne	25.5.1948	♂	78.4	39.8	38.6	14.3	1.6	
10	Lockne	25.5.1948	♀	72.4	39.8	32.6	13.2	—	
11	Lockne	25.5.1948	♀	82.0	44.6	37.6	14.5	—	
12	Lockne	25.5.1948	♀	81.9	44.3	37.6	14.0	—	
13	Risna	28.5.1948	♀	70.0	36.3	33.7	12.1	—	
14	Risna	28.5.1948	♀	77.8	40.0	37.8	12.9	—	
	Ångermanland								
15	Gårdnäs	22.5.1952	♂	84.0	45.1	38.9	15.6	1.2	
16	Gårdnäs	22.5.1952	♀	90.4	47.5	42.9	15.0	—	
17	Edsele	10.5.1953	♂	77.9	41.9	36.0	13.6	3.1	
18	Edsele	10.5.1953	♂	71.8	38.2	33.6	13.2	1.9	
19	Gideå	7.7.1954	♂	80.0	42.0	38.0	14.0		
20	Gideå	7.7.1954	♀	73.9	43.3	30.6	13.7		
	Västerbotten								
21	Umeå	30.5.1948	♂	79.6	42.0	37.6	15.0	2.9	
	Ångermanland								
22	Mädan	15.8.1949	♂	73.8	39.0	34.8	13.9		
23	Gideån	7.7.1954	juv	24.0	14.0	10.0	—	—	
24	Gideån	7.7.1954	juv	17.6	—	—	—	—	
25	Gideån	7.7.1954	juv	23.0	12.0	11.0	—	—	
26	Gideån	7.7.1954	juv	20.2	11.5	8.7	—	—	
27	Gideån	7.7.1954	juv	15.0	—	—	—	—	
28	Gideån	7.7.1954	juv	21.0	10.0	11.0	—	—	
29	Gideån	7.7.1954	juv	16.3	8.9	7.4	—	—	
30	Salteå	14.7.1954	juv	34.7	16.3	18.4	5.2	—	
	Medelpad								
31	Kölsillre	?	♀	92.2	49.5	42.7	15.5	—	
	Lappland								
32	Stensele	1923	♂	70.2	37.2	33.0	—	2.2	neotenous
33	Stensele	1923	♂	68.0	36.8	31.2	—	2.8	neotenous
34	Stensele	1923	♂	66.1	35.9	31.0	—	3.0	neotenous
35	Stensele	1923	♀	72.0	38.9	33.1	—	—	neotenous
36	Stensele	1953	♂	75.3	37.5	37.8	11.5	5.1	neotenous
37	Stensele	1953	♂	67.2	37.0	30.2	9.5	3.2	neotenous

If the metamorphosis does not take place, this means a considerable saving of energy which is valuable in a pessimum of nutrition.

It has been stated that for fully grown water newts a permanent aquatic existence, which is a constitutional necessity, has only ecological disadvantages, WOLTERSTORFF & FREYTAG (1951). In a pessimum district, as in this case, it seems to be the opposite. If the tendency to neoteny is inheritable, a selection takes place, by which neotenous genes in pessimum habitats have a positive selective value.

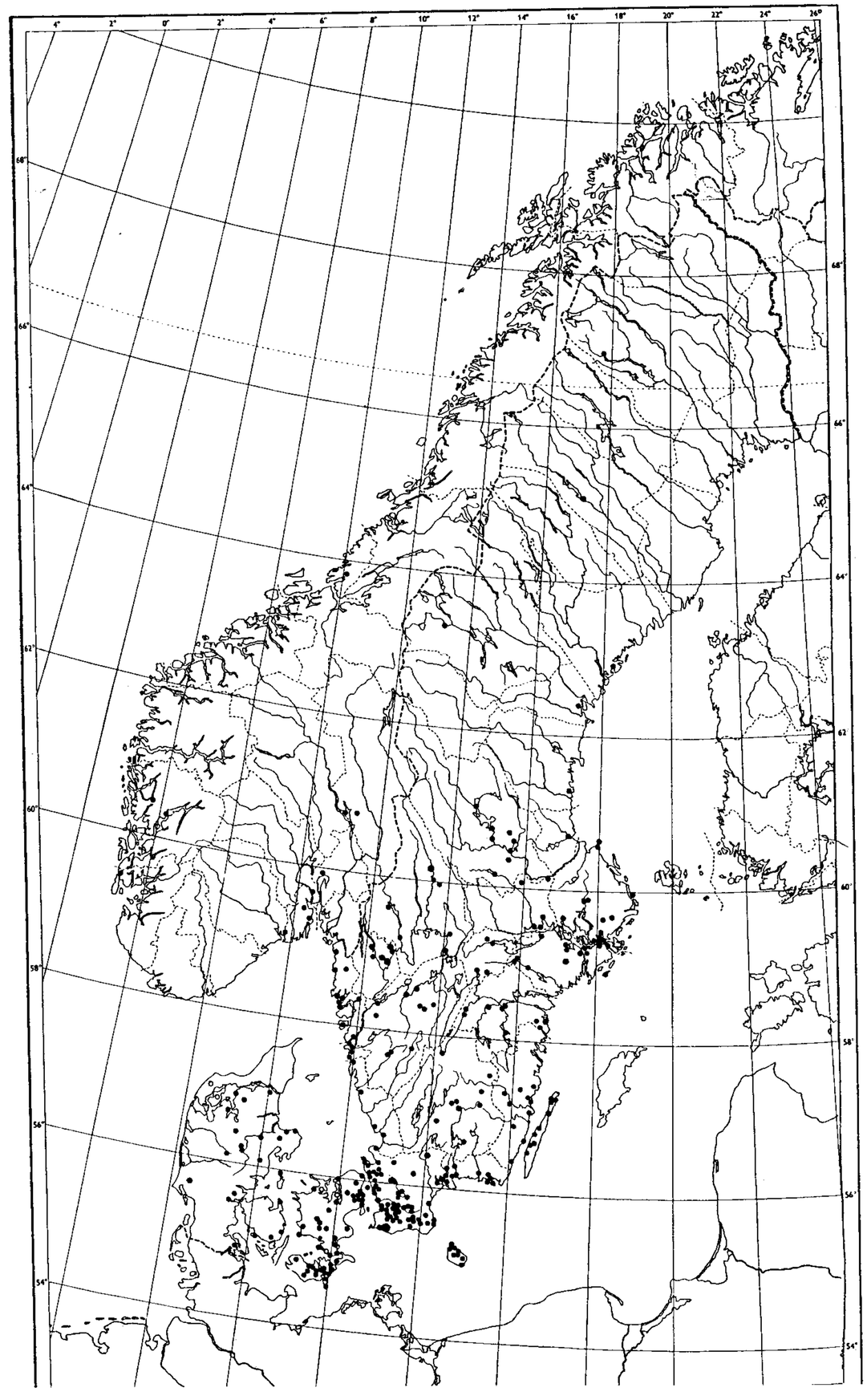
It is interesting that the relation between the sexes is to the advantage of the males; this is the opposite to that of all the previously known neotenous populations from districts further south. These populations have been described as quite temporary and of short duration. The Bukomirsko population also seems in this connection to conform with our material from the Stensele district. According to PAVIČEVIČ & ALEKSIČ (1949), four females and two males were found, which is comparatively considerably more males than BOETTGER & SCHWARTZ (1928), and HARTWIG & ROTMANN (1940) have stated. A more detailed investigation of the most northern neotenous population described here is highly desirable.

OCCURRENCE:

Hälsingland. Färila s:n, B.W.-S. — Ljusdal s:n, BODIN & WITT-STRÖMER 1951, B.W.-S.
Härjedalen. Randsjö, Skjolmberget, P.A.S.
Medelpad. Haverö s:n, Kölsillre, L.Z.M., ALLEGÅRD 1953, K.C.-L. 1948. — Njurunda s:n, Nolbykullen, WALDÉN 1954. — Selånger, GYLLING 1898. — Sundsvall, P.H., R.Ö. — 8 km to the north of Sundsvall, L.L-e.
Jämtland. Rätan, Rätansbyn, T.S. — Bräcke, OLSSON 1883. — Nyhem, Gimdalen, OLSSON 1883. — Nyhem, OLSSON 1896. — Sundsjö: Rissna, Fisksjön, L.Z.M. — Lockne s:n: Långänge, Ångsta; Lassbyn, L.Z.M. — Håsjö, OLSSON 1882. — Brunflo, OLSSON 1896. — Ragunda, Döviken, N.G. — Ragunda, OLSSON 1876. — Stugun s:n: Stränäset, OLSSON 1876; Brynjegård, L.Z.M. — Rödön, Kromom, OLSSON 1876. — Undersåker, OLSSON 1896. — Lit s:n: Prisgård, OLSSON 1883; Smedsta, L.Z.M. — Ytterån, OLSSON 1876. — Vaplan, OLSSON 1876. — Häggenås s:n, Storbränna, L.Z.M. — Hammerdal, OLSSON 1883. — Föllinge, OLSSON 1896.
Ångermanland. Härnösand, L.Z.M. — Härnösand area, EKMAN 1922, S.T-e. — Säbrå, L.S. — Nordingrå, Mödan, L.Z.M. — Gårdsnäs, "Sångbergs grubba", L.Z.M., ERIKSSON 1952, LUNDSTRÖM 1953. — Arnäs, OLSSON 1896, HEDERSTRÖM 1909. — Mo, N.B. — Ramsele, OLSSON 1896, HEDERSTRÖM 1909. — Edsele, Ödsgårdsmon, L.Z.M., LUNDSTRÖM 1953. — Örnsköldsvik area, BARTLER 1953. — Fjällsjö s:n, Backe, OLSSON 1896, HEDERSTRÖM 1909. — Fjällsjö s:n, Tallarant crown forest, L.Z.M.
Västerbotten. Umeå, Norrforsen, L.Z.M.
Lappland. Stensele, Forsvik, EKMAN 1922. — Stensele, G.N.M., L.Z.M.

Triturus cristatus cristatus (LAURENTI). **Warty Newt. Större vattenödla**

Distribution of the species: Occurring in Scotland, England, northern France, Belgium, Holland, Switzerland, Germany, Austria, Czechoslovakia, and Poland. In Russia its northern distribution extends to 58° N, only in the north-west reaching 61° N. Distributed to 63° E and occurring on the east side of the southern Ural



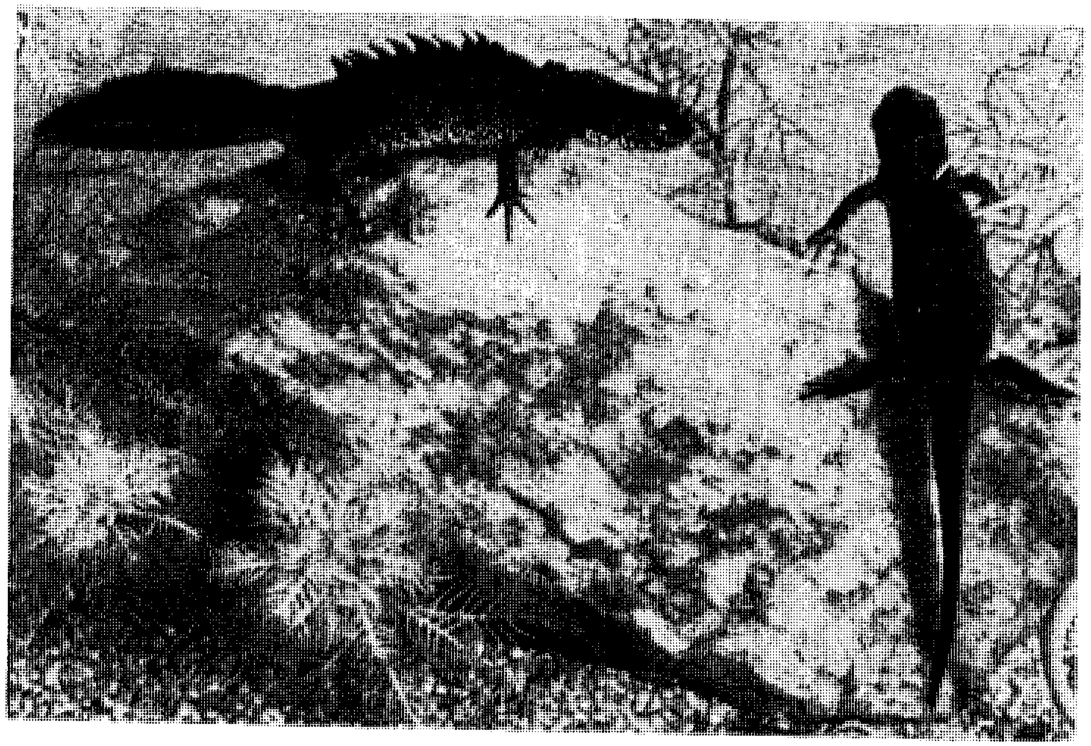


FIG. 11. Warty Newt. Female (right), male (left). Photo by Lunds Lit. Lab. AB.

TABLE 15. The stages of growth in *Triturus cristatus cristatus*.

Date	District and locality	Total length	Note
13/6 1943	Västergötland, Stenum, Hornborgasjön	64 mm	larva
19/6 1954	Blekinge, Mörrum, Buskelund	9–19 mm	forelegs developed
7/7 1950	Blekinge, Mörrum, Stensnäs	20–27 mm	
15/7	Blekinge, Mörrum	57 mm	(tail-tread 9 mm)
21/7 1935	Småland, Aneboda	38–49 mm	
25/7 1950	Blekinge, Mörrum, Stensnäs	30 mm	
2/8 1947	Skåne, Ven, Haken	32–48 mm	
4/8 1927	Skåne, Kullaberg	25–77 mm	
6/8 1950	Blekinge, Mörrum, Buskelund	60 mm	(tail-tread 9 mm)
11/8 1952	Blekinge, Stensnäs	42–58 mm	(tail-tread 5–9 mm)
25/8 1952	Kalmar län, Högsby	68 mm	
27/8 1953	Öland, Persnäs	63–60 mm	4 legs
28/8 1948	Småland, Bjälcbo	38–45 mm	
28/8 1950	Östergötland, Stocklycke, Omberg	50 mm	at least 50 specimens, metamorphosed young
30/8 1953	Öland, Köpingsvik	73 mm	metamorphosed
13/9 1952	Skåne, Röstånga	79 mm	metamorphosed
14/9	Skåne, Övedskloster	75 mm	metamorphosed
5/10 1949	Skåne, Glumslöv	84 mm	metamorphosed
18/5 1943	Kalmar län, Påboda	70–72 mm	metamorphosed

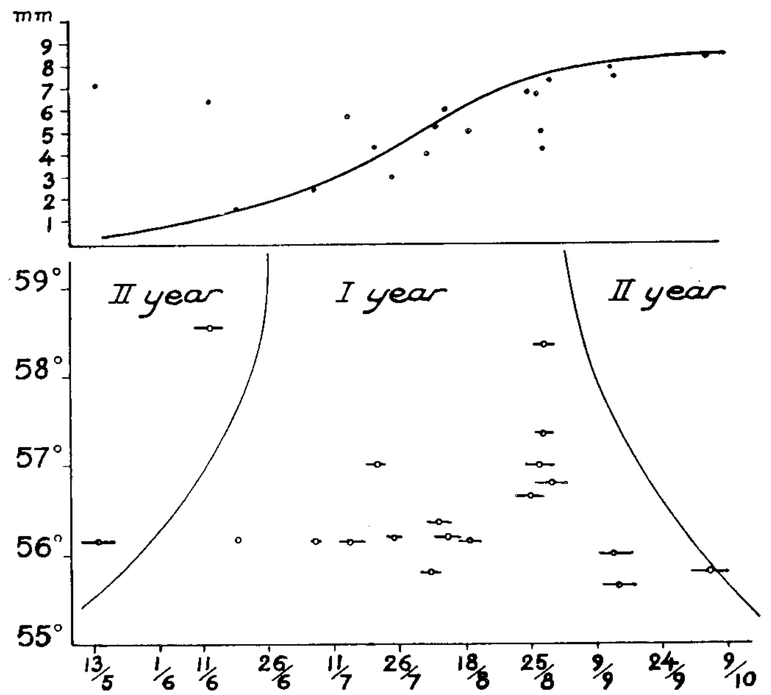


FIG. 12. Above, growth rate of larvae and young specimens of Warty Newt in the 1st year. Below, growth of larvae and young specimens of Warty Newt in the 1st year transferred to geographic latitudes. Sections of lines = total length of specimens. Scale 1:20.

Mountains. Southern border in the east 53° N. Occurring in Ukraina and Bessarabia. Five geographical races have been recorded (MERTENS & MÜLLER, 1940): *Triturus cristatus carnifex* (LAURENTI) in Italy, southern Austria (south of the Danube) and in the western Balkans; *T. c. danubialis* (WOLTERSTORFF) round the lower Danube and in Siebenbürgen; *T. c. dobrogicus* (KURITZESCU) in Dobrudscha; and *T. c. karelini* (STRAUCH) in the eastern Balkans, Crimea, Caucasus, Armenia, and northern Asia Minor right on to northern Persia and *T. c. cristatus* (LAURENTI) in the north.

T. c. cristatus is much rarer in Sweden than the common newt. It extends northwards to central Värmland and southern Dalarna, reaching to about 63° N in the coastland. There may be a gap in western Småland, as it is not recorded from that part of Sweden. On Öland it is rather common but is absent from Gotland. One find has been reported from middle Jämtland (LANG 1926), and two localities have been reported from Lapland. One of these northern finds is fairly old and doubtful, the other is a young specimen from Stensele, Långseleberget, Forsvik, which was kept for two years (1942–1944) in an aquarium in Stockholm. They did not metamorphose, but went on growing to a size of 94 mm, still retaining some gills (CYRÉN 1945). Some adolescent specimens from Scania with belly unspotted yellow were erroneously interpreted by SVEN NILSSON (1842) as *Triton alpestris*.

From the northern parts of the distributional area there are reports of a totally black variety. These localities are:

1. Värmland, Kils parish 18/6 1950, maximum size 123 mm;

2. Dalarna, Jutbo, Kilsbergs parish, May 1947, 117 mm maximum size;

3. Ångermanland, Nordingrå, August 1949, 7 specimens, (GISLÉN 1949, p. 268), max. size 108 mm.

All these specimens are jet black; two specimens from the third locality, however, are partly provided with insignificant yellow spots on the ventral side. Generally the southern specimens are more brownish black on the dorsal side and the northern ones more pure black.

OVE PERSSON 1946, p. 218 ff., investigated the appearance of males and females of the two species of *Triturus* in Scanian ponds. He found that the males arrive earlier than the females, at the beginning of April. Evidently the females stay a little longer in the water than the males. The egg-laying period seems to begin rather late in April, but I have one record of eggs from the 10th of June.

Table 15 and fig. 12 show plainly that the Warty Newt attains a total length of 75–84 mm at the end of the first active period (the first summer). This quite agrees with the records from England. The corresponding figures are here 70–80 mm (in October) (SMITH 1954).

OCCURRENCE:

Skåne. Albäck, Kyrkoköpinge, Dalköpinge vid Trelleborg, S.M. — Maglarp, B.S. — Skurup, northern part, S.S. — Bjäresjö s:n, S.S. — Tosterup s:n, S.S. — Bara s:n, S.S. Bara hundred, LANG 1926. — Svedala, L.Z.M., V.F. — Hyby s:n, S.S. — Klågerup, LANG 1926. — Bökeberg, Sjödikena, K.A. — Lyngby s:n, S.S. — Gustav s:n, S.S. — Genarp, s:n, S.S. — Häckeberga, LANG 1926, Exc. — Veberöd s:n, B.S. — Sövde s:n, S.S. — Röddinge s:n, S.S. — Fyledalen, L.Z.M. — Baldringe s:n, S.S. — Tomelilla, Y.L. — Östra Tommarp s:n, Tågarp, G.N.M. — Simris s:n, to the south of Horsahallen, G.N.M. — Between Simrishamn and Brantevik, H.B-m. — Simrishamn area, N.A.A. — Lomma, LANG 1926, S.S. — Alnarp, L.Z.M., LANG 1926. — Lund, ÅSTRÖM 1859. — Östra Torn, L.Z.M., PERSSON 1947, B.S. — Reften, L.Z.M. — Hardeberga, B.S. — Dalby, L.Z.M S.S. — Dalby Norrskog, H.K. — Södra Sandby, L.Z.M. — Revinge, T.G. —Vombsjön, Exc. — Övedskloster, Ekebäck, L.Z.M. — Bjärsjölagård, Exc. — Tolånga s:n, S.S. — Vollsjö, T.W. — S:t Olof s:n, S.S. — Barsebäcks by, B.S. — Skarhult s:n, S.S. — Kungshult, Exc. — Västerstad, Church, B.H-C. — Hörby, Almarkaröd, O.P. — Maglehem s:n, S.S. — Ven, Haken lighthouse, L.Z.M. — Fjärestad s:n, S.S. — Glumslöv, Hildesborg, L.Z.M. — Landskrona, L.Z.M. — Rönneberga, L.Z.M. — Ottarp s:n, S.S. — Bosjökloster, Exc. — Höör, Långstorp, M.M. — Höör, M.M. — Röstånga, L.Z.M. — Odensjön, H.K. — To the north of Sofiero, H.V. — Hälsingborg area, H.M. — Ramlösa, L.Z.M., S.S. — Raus s:n, S.S. — Kropp s:n, western part, S.S. Bårslöv s:n, S.S. — Bjuv s:n, S.S. — Åstorp, L.Z.M., A.S., U.S. — Vrams Gunnarstorp, N.R.M. — Hässleholm, L.Z.M., HALL 1950. — Trolle-Ljungby s:n, S.S. — Ivetofta s:n, S.S. — Håkanryd s:n, L.Z.M., S.S. — Näsum s:n, S.S. — Kullaberg, L.Z.M., S.S. — Brunnby, S.S. — Mölle, Vattenmöllan, NILSSON 1954. — Mölle, G.N.M. — Väsby s:n, S.S. — Ängelholm, L.L.I., L.Z.M. — Örkelljunga, V.F. — Osby s:n, Röena, HALL 1950. — Båstad, G.M-g.

Blekinge. Sturkö, G.N.M., L.Z.M., A.L-m. — Aspö s:n, Aspö mad, U.S. — Mörrums s:n: Björkenäs, L.Z.M., T.G.; Stensnäs, L.Z.M. — Mörrum, Buskelund, L.Z.M. — Mörrum, L.Z.M. — Jämshög s:n, Norra Röhult, R.J. — Jämshög s:n, R.J. — Ronneby: Hulta, H.W.; Kallingevägen, WESTERLUND 1890. — Ronneby, U.Z.M. — Nättraby, H.A.L. Karlskrona, G.M-g. — Åkeholm, G.W.

Halland. Trönninge s:n, Laxvik, T.G. — Steninge, B.H. — Träslöv, Varberg Samrealskola. — Släp, G.N.M.

Småland except Kalmar län. Väckelsång s:n, C.B.G. — Ryssby s:n, C.B.G. — Berg s:n, Vinninge, S.A-n. — Aneboda: Matsabygget mire, S.T-k.; — Ugglehult ponds, L.L.I.; the fishery ponds, L.L.I. — Aneboda, L.Z.M., LANG 1928. — Granhult s:n, Nottebäck, C.B.G. — Österkorsberga, C.B.G. — Karlstorp s:n, CYRÉN 1910. — Ljungarum s:n, BJURULF 1944. — Jönköping, Östra Jära, BJURULF 1944.

Kalmar län. Påboda, L.Z.M., T.G. — 3 km to the south of Kalmar, R.K. — Kalmar, HEINTZE 1909. — Bäckebo, T.G. — Mönsterås area, Å.D. — Högsby s:n, Gussemåla, L.Z.M., T.G. — Döderhult, Flinshult, G.N.M. — Oskarshamn, G.N.M. — Tveta s:n, N.R.M. — Kristdala, 3 km to the west of Bjälebo, L.Z.M., T.G. — Misterhult, Övrahammar, G.N.M.

Öland. Mörbylånga, LANG 1928. — Färjestaden, L.Z.M. — Torslunda s:n, between Tveta and Gråborg, S.H. — Högsrum s:n: Ekerum; Halltorp, GAD 1913. — Räpplinge s:n, Borga hage, JOHANSSON 1955. — Borgholm, N.R.M., GAD 1913, — 6 km to the north of Borgholm, LANG 1928. — Köpingsvik, Öjkroken, L.Z.M. — Persnäs, L.Z.M. — Hornsjön, C.E. — In a marl-pit close to the outlet of Hornsjön, D.C. — Böda s:n, Byerum, SUNDEVALL 1849. — Böda, G.N.M.

Göteborg. Slottsskogsdammen, MALM 1877. — Slottsskogen, G.N.M. — Gibraltar, G.N.M., MALM 1877. — Pölsebo, G.N.M., MALM 1877. — Hisingen, Bjurslätt, MALM 1877. — Göteborg, G.N.M.

Bohuslän. Hisingen, Björlanda s:n, G.N.M. — Ytterby, T.G. — Tjörn, EKSTRÖM 1850. — Klubban, U.Z.M. — Lysekil, HANSSON 1889. — Gullmarsfjorden, Alsbäck, G.N.M. — Uddevalla, C.G.K. — Tanum s:n, Linnebacka, L.Z.M. — Bro, Näverkärr, H.L. — Naverstad, G.N.M. — Bullaren, G.N.M., MALM 1877. — Strömstad, A.B-s.

Västergötland. Askim: Hult, G.N.M., Otterbäck, G.N.M., MALM 1877. — Viared area HALL 1942. — Borås, C.B. — Ulricehamn area, L.Z.M. — Mellby s:n, Koberg, C.M. — Västra Tunhem s:n, Nygård, H.B-t. — Western Hunneberg, C.G.K. — Stenum, L.Z.M., K.G.W. — Broddetorp s:n, Bjällum, L.Z.M., K.G.W. — Axwall, Högetomt, K.G.W. — Skövde area, C.B.G. — Lidköping, N.-G.K. — Kinnekulle, KARVIK 1953.

Östergötland. Tjärstad, S.S. — Valdemarsvik, L.Z.M., C.M. — Gusum, L.Z.M., C.M. — S:t Anna s:n, Kejsarnäs, T.G. — Omberg: Stocklycke, L.Z.M., GISLÉN 1951; — Djurkälla, G.N.M. — Vidingsjö, K.A. — Vallerstad, K.A. — Linköping area, K.E-n., K.A. — Rystad s:n, Fröstad, F.O.

Dalsland. Steneby, N.-G.K. — Åmål, Nygård, R.E. — Ärtemark, N.-G.K.

Värmland. Visnums-Kil s:n, Nynäs, L.Z.M. — Kila s:n, Gambol, R.E. — Kristinehamn area, E.W. — Arvika, Gränssjön, A.E. — Sunnemo, Abbortjärn, E.D-l. — Råda, D.H. — Ekshärad s:n, Stora Tippatjärn, HANNERZ 1954.

Närke. Mariedamm, SUNDEVALL 1846 and 1849. Askersund, SUNDEVALL 1846 and 1849. — Örebro, Adolfsberg, H.W.W. — Örebro, Mark, the brick-yark, A.D. — Örebro area, SUNDSTRÖM 1868. — Kil s:n, Frösvidal, SUNDEVALL 1846.

Södermanland. Utö, Källviken, N.R.M. — Utö, N.R.M., O.C. — Katrineholm, T.W. — Vingåker s:n, Marsjö, T.W. — Vingåker, T.W. — Björnlunda, K.C.-L. — Södertälje, K.C.-L. — Rönninge, N.B. — Salem s:n, A.A. — Slagsta, S.E. — Mariefred, Kvartinge, U.Z.M. — Mariefred, U.Z.M. — Eskilstuna area, SJÖSTEDT 1920, E.A.

Stockholm. Brännkyrka s:n, H.a.R. — Enskede, C.E., K.L., H.a.R., S.E-n. — Djurgården, C.E. — Judarn, S.E-n. — Ulvsundasjön, S.E-n. — Kammakare street, N.R.M.

— Southern Lidingö, N.R.M. — Bromma T.W. — Kaknäs, H.a.R. — Djursholm, E.H-n. — Stockholm, L.Z.M., SUNDEVALL 1846.

Västmanland. Rytterne s:n: Tidö, J.B.; Lagersberg; Stora Åsby, J.B. — Västerås area, WALLDÉN 1955, B-l.W., O.H-g. — Norberg, B-l. W. — Möklinta s:n, Trekanten, B.W.

Uppland. Ekerö, Stavsund, H.W.W. — Värmdö, Lännersta, T.W. — Viggbyholm, T.W. — Angarnsjön, N.R.M. — Enköping, SUNDEVALL 1849. — Frösunda, E.H-n. — Uppsala, N.R.M., U.Z.M., T.G. — Vaksala, U.Z.M. — Väddö s:n, rock pool, H.K-g. — Hållnäs s:n: Fogelsundet; Källen; Björn lighthouse, S.F-s.

Dalarna. Ludvika, KLEFBECK 1927. — Silvberg s:n, Jutbo, L.Z.M. — Torsång, KLEFBECK 1927. — Gagnef, EKMAN 1922, LÖNNBERG 1937, DAHL 1943. — Falun, LÖNNBERG 1937, DAHL 1943, KLEFBECK 1949. — Stora Kopparberg, DAHL 1943. — Grycksbo, LÖNNBERG 1937. — Leksand, several localities, LUNDBLAD 1918, DAHL 1943. Mora, U.Z.M.

Gästrikland. Gävle area, HEINTZE 1909, G.K.

Hälsingland. Söderhamn, N.A.

Medelpad. Sundsvall, Norra Stadsberget, L.Z.M., H.A.L. Sundsvall.

Jämtland. Undersåker, LANG 1928. L.Z.M.

Ångermanland. Nordingrå, L.Z.M., GISLÉN 1949.

Lappland. Stensele, Forsvik, Långseleberget, L.Z.M. — Kvikkjokk, SUNDEVALL 1849.

SALIENTIA. TOADS AND FROGS

Bombina bombina (LINNAEUS). **Fire Toad. Klockgroda**

OCCURRENCE:

Skåne. Trelleborg, NILSSON 1842. — Jordberga, LINNAEUS 1751. — Skivarp; Ystad; Bergsjöholm, HALLENBORG 1751. — Grönby, L.Z.M. 1858–61, HAGERLÖF 1856. — Börringe, LINNAEUS 1751, MEVES 1868, NILSSON 1842. — Svedala, NILSSON 1842. — Skabersjö, SÖDERBERG 1908. — Malmö area, N.A.K. ± 1905. — Malmö HALLENBORG 1751. — Sövdeborg, LINNAEUS 1751. — Staffanstorp, F.L. 1930. — Lund HALLENBORG 1751. — Löwestad, S.S. — Andrarum, LINNAEUS 1751, — Ven, NILSSON 1842, HAGERLÖF 1856, MEVES 1868. — Rydebäck, Fortuna, G.T. 1930. — Brunnby s:n, Vattenmöllan, G.D-s. 1922, RINGDAHL 1925, SAHLIN 1929, H.B-m. 1935, O.R. 1949, NILSSON 1954. — Mölle mosse, L.Z.M. 1872, 1926 and 1935, G.D-s. 1922, RINGDAHL 1925. Hallands Väderö 1935, introduced and extinguished.

This toad is restricted to the southernmost part of Sweden and it has never been reported as indigenous outside Scania* (Skåne).

In the 18th century the species was still fairly common in this county, but it has since then become more and more rare. The first information concerning the occurrence of the firebellied toad in Sweden is found in LINNAEI Fauna suecica (1746, p. 94), where it is stated regarding "Rana, abdominae fulvo": "Habitat in Scania, Cantat in Cuculus, J. Leche M.D." The statement was thus originally made by the anatomist and prosector JOHAN LECHE, Lund (1704–1764), who became M.D. in 1740. LINNAEUS heard fire toads, or as they were called then and later on "korngrodor" (cornfrogs) or sädespumpor (seed pumpkins), in several places during his Scanian journey (l.c. pp. 123, 244 and 272). HALLENBORG, in his commentary to the Linnean journey, writes (1751) transl. "Fire toads occur over the whole plain all the way from Lund and Malmoe to Skifarp; they then decrease, occurring, though only rarely at Ystad, at Bergsiöholm etc." (l.c. p. 374). SVEN NILSSON knew the fire toad from Ven (1842) and had heard it croaking in the swamps near Trelleborg, at Svedala etc. In his dissertation concerning Grönby parish, JÖNS HAGERLÖF reports it from this, his home (1856), and MEVES (1868, p. 253) tells us that from the ponds at Börringe he occasionally heard the "dull moaning sounds" of fire toads. It was searched for in vain here by SÖDERBERG (1908, p. 254) but had then not been heard for many years and not been captured during the previous 25 years. SÖDERBERG, moreover, got the information

* It is true that a find of *Bombina* was reported from Karlskrona, Blekinge, in 1937 (F. o. Fl. 1937, p. 91). The author thinks that it arrived there by "truck transport from NW. Scania". A closer investigation of this report, however, has revealed that it has been a question of the young of a *Bufo*, probably of *B. viridis*. (Small specks of red on the *dorsal* side of the animal.)

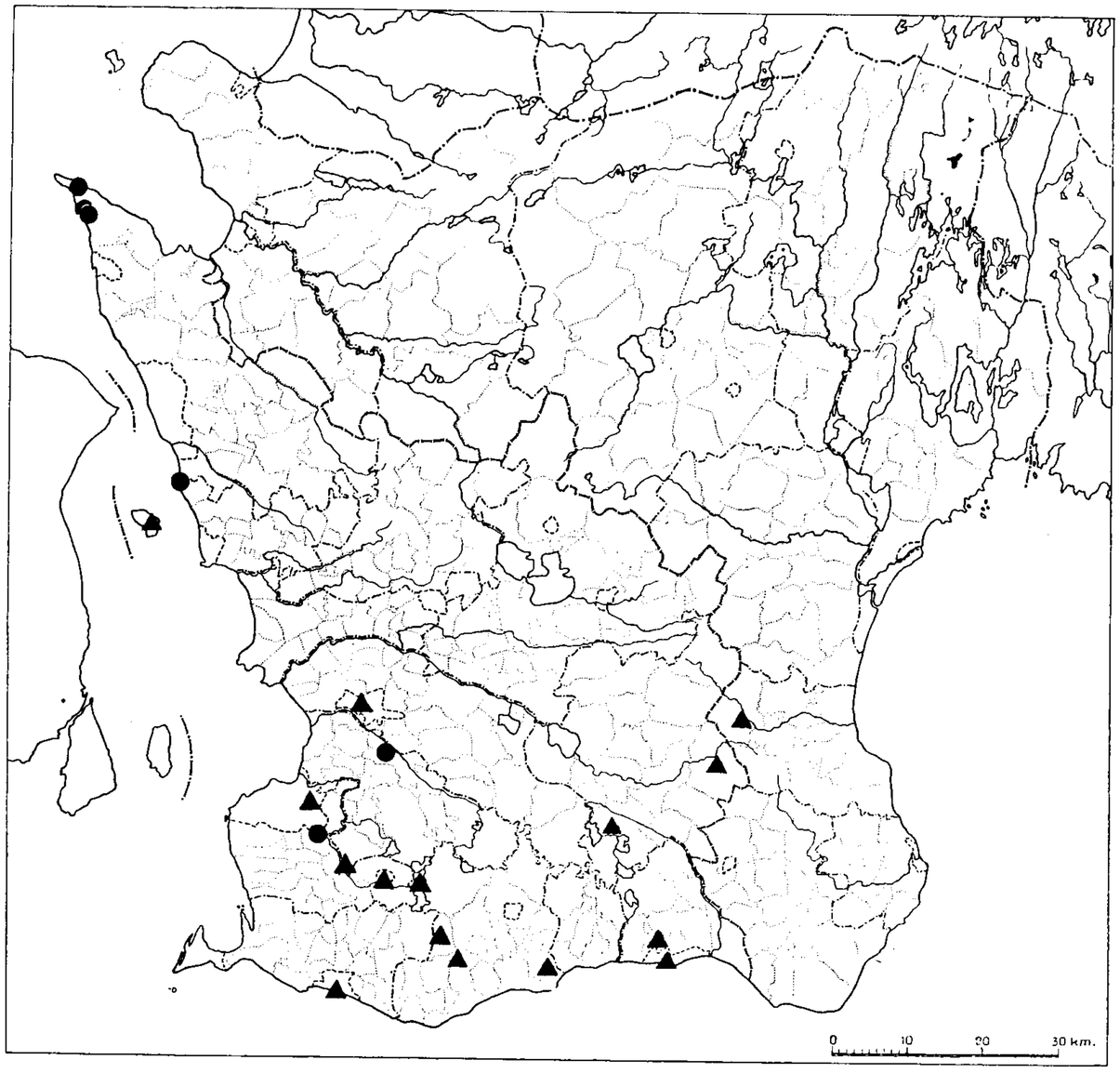


FIG. 13. Distribution in Scania of *Bombina bombina*. Black circles = finds made in the present century. Triangles = older localities.

that the fire toad in older times had been found at Skabersjö. A report of the occurrence of *Bombina* at Kullen and (very doubtful) "Christianstadt" is found in BOULENGER (1888, cf. also BEDRIAGA 1890, p. 590). The last-mentioned locality is not given on the maps.

From the beginning of the 20th century it seemed probable that the fire toad had become extinct in Sweden. Fortunately in 1925 RINGDAHL could report that he had found specimens at Vattenmöllan near Kullen. According to SÖDERBERG (1908, p. 276) it had been observed in this vicinity (at Krapperup, shortly before 1900). In the Zoological Museums of Lund and Uppsala Universities there are

It was later reported from the same locality in 1922, 1926, 1927, 1932, and 1935. During the two last-mentioned years about a dozen specimens were unfortunately collected and taken, in the former case for exchange of other zoological material, in the latter for an exhibition at Hälsingborg. Till about 1940 fire toads were still heard and seen in these ponds. Then came the cold winters of 1940–42. For several years no further information could be gained concerning their occurrence and serious apprehension was felt that the species had definitely become extinct. Fortunately, however, it was refound, heard and seen in 1949. A Bill was quickly passed for its protection and it is to be hoped that the danger, as far as human beings are concerned, is now averted. Even so it is by far the rarest amphibian in Sweden.

The vertical extension of the fire toad is nowadays restricted to some few meters above sea level. Formerly it was reported up to Mölle mosse (84 m above sea level). SVEN NILSSON considers the fire toad originally to belong to S. Europe, and says that it was introduced to Denmark, Ven and Scania contemporaneously with the carp by the Danish chancellor PEDER OXE. Evidently this refers to the statement by A. J. RETZIUS (1800, p. 285) under *Rana campanisona* (as the fire toad was called, inter alia) that PEDER OXE implanted this amphibian "antea ignotam" in Denmark and Scania. According to SVEN NILSSON, fire toads on Ven, like in Denmark, were called Peder Oxes fröer (Peder Oxe's frogs).

The theory that the fire toad is an introduced animal might seem attractive. In fact, it is almost certain that this small, beautifully red-bellied toad with the fine singing voice was sometimes implanted in castle ponds. TROELS-LUND says—certainly after RYGE (1765)—that PEDER OXE had fire toads in his castle ponds at the family estate Gisselfeld (1906, p. 270). The theory that PEDER OXE introduced fire toads has in fact an old origin. In his description of "Peder Oxe til Gisselfeld" RYGE states the following: "Imidlertid lægger RESENIUS ham det til Berømmelse, at han skal værct en av de første, som har ladet indføre Karper og Krebs og andre usedvanlige Fiske at henplantes her i Riget ... Iblandt de usædvanlige Fiske-sorter Peder Oxe har ladet indføre, veed man nu ingen andre af at sige, uden at slags Frøer, som endnu, ham til Amindelse, bære Navn af Peder Oxes frøer; ... Der findes endnu disse Frøer ved Gisselfeld og Walløe, hvorfor mange ere forflyttede til adskillige Herregaarde og andensteds i Landet, hvor de har fundet Liebhabere til deres Musique ..." (However, RESENIUS gives him credit for having been one of the first to arrange for carps and crayfish and other uncommon fish to be imported into this country ... Among these uncommon kinds of fish which Peder Oxe arranged to import, we have now no more to mention than a species of frogs, which still, in remembrance of him, are called Peder Oxe's frogs; ... These frogs still occur at Gisselfeld and Walløe, from where many have been transported to various manor houses and other places in the country, where they have found admirers of their music".) Turning to the above-mentioned statements of RESENIUS (1680, p. 165), the information given is restricted to the

Karper, Krebs og andre usædvanlige Fiske udi disse Lande" (He has also been one of the first to import carps, crayfish and other uncommon fish into these countries). PONTOPPIDAN (1763, p. 658) says concerning the fire toad: "skal være indført af Peder Oxe, da denne Herre længe opholdt sig i Lothringen" (is said to have been introduced by Peder Oxe, as this gentleman made a long sojourn in Lorraine).* I can give one more piece of information from the middle of the 18th century concerning this tradition. It is found in VON APHELEN's translation (1768) of DE BOMARE's Natural History. He remarks in a note on p. 498 "Endnu have vi i Sædland et slags Frøe, som maaske ikke findes i Frankerig, og siges at være bragt her till landet af Peder Oxe, hvorfor de og kaldes Peder Oxes frøer ... Deres formente Opholdsted i Danmark er ved Herlufsholm." (Moreover, there is in Zealand a species of frog, which is perhaps not found in France, and these frogs are said to have been brought to this country by Peder Oxe, therefore being called Peder Oxe's frogs ... Their supposed place of origin is at Herlufsholm.)

PEDER OXE was probably interested in introducing curious and useful animals and plants to Denmark. There are letters preserved in his handwriting which speak of importation of fruit-treesfrom Lorraine (acc. to letter of 1570), and of turnips (letter in 1567) (RYGE l.c.; p. 325 ff.). On the other hand, however, one is easily inclined to overrate the contribution of a great man, one overestimates his influence, one attributes to him both possible and impossible matters in those areas in which he has been interested. Thus, as is clear from the above, one presumes in the case of PEDER OXE, not only that he introduced carp and crayfish, but also (RYGE considers it "rimeligt"—probable) that he introduced oysters. RYGE remarks "Saa meget seer man at det i hans sidste Tid har været Østers Fangst i Norge" (So much is obvious that there has been oyster catching in Norway in his later time).

It can be presumed that PEDER OXE was interested in and had fire toads implanted on his estates and that the inhabitants in this way got their eyes opened for an indigenous, but earlier overlooked animal. (See below under general distribution.)

There is in JACOBAEUS (1686) a very interesting piece of information concerning the occurrence of the fire toad in Denmark. At the same time it is the oldest record of the occurrence of *Bombina* in the Nordic countries which I have been able to procure. After having described a couple of toads, among them a "Rubeta minor" with minimum coloured spots on the belly, he continues (p. 33): "Huic simillimae quae in patria nostra lingua vernacula Peder Oxis Frøer appelantur, quod i Petro Oxenio, Aulae quondam in Dania Praefecto, primo in patriam nostrum illatae *credantur*, aliis Bom-Tudser quod bombos campanarum coaxatione sua aemulentur quae e longinquo satis a viatoribus auditur." The statement about the rôle of PEDER OXE as an importer is here still more vague than among

* (The theory that the fire toad was introduced from Lorraine is erroneous, however. The distribution of *Bombina bombina* extends to the west only as far as Böhmerwald and Thuringia.)

the authors of the 17th century. The second name (Bom-Tudser) which is given in this quotation is especially interesting. The same name is refound in MOTH's Ordbog (Lexicon) from the end of the 17th century. In PONTOPPIDAN (1753, p. 658) there are given as Danish names of "Rana hyla", Klokkefrøen (fire toad), Pèder Oxes Frøe, Bom-Tudse".*

A closer investigation of the word Bom-Tudse indicated that this name may be the original denomination of the fire toad, a name that was still kept side by side with the newer Peder Oxe's Frø, but which by and by was forced aside by this one, finally to disappear completely.

From the middle of the 14th century there is recorded both in Swedish and in Danish a word bambare or bombare (Drummer, KALKAR). This word corresponds to the originally Latin bomba (drum). In the old Danish it became bomme (Swed. Acad. Ordbok). In Bornholm dialects (ESPERSEN) there is a verb bompa = produce a hollow sound (cf. here the description in Linnaei Scanian Journey (p. XII): "Klockgrodorne bomma och sammanringa in på sena aftnarne" (the fire toads "bomma" and toll till late in the evenings).**

In handbooks (KALKAR) the word Bom-Tudse, with a certain amount of doubt, is given as etymologically = German Baumfrosch (low-German Boom), that is, tree-frog. This is erroneous, at least in some cases. The quotation given above from JACOBAEUS shows that Bom-Tudse was the denomination of the fire toad. The fire toad never climbs trees. As evidenced before, Bom-Tudse means about the same as drum-toad. The denomination has roots extending far into medieval times and this strengthens my conception that Bom-Tudse is the ancient Danish name of the fire toad.

Also after the beginning of the 19th century there are records concerning the introduction of fire-toads. COLLIN mentions that it was implanted on some Danish localities between 1830–1870 (cf. also GISLÉN 1935, p. 137; PFAFF 1943 and URSIN 1947). SAHLIN (1929) got the information from the inhabitants in the Mölle area that fire toads were probably implanted on the Krapperup estate in the middle of the 19th century. Perhaps also LINNAEI comment refers to this custom (1751, p. 245): "Jag kan undra, at ingen planterar desse uppåt landet, att höra denna naturens sammanringning genom grodor, derest man icke är öm om sina dammar; ty det berättas at grodorna hämnas på fisken och äta up hans romm även som fisken upäter dem." (I wonder that no one plants these frogs farther up country in order to hear this tolling by Nature through frogs, as long as one is not concerned about one's ponds; for it is said that the toads revenge themselves against the fish and eat his roe just as the fish eats

* The tree-frog *Hyla arborea* is called *Rana arborea*. Other names of the fire toad are *Rana venenata fossilis* (AGRICOLA 1614, pp. 72, 82, GESNER 1554, p. 74), *Rubeta minor flammea* (LIBAVIUS 1601, p. 435), *Rubeta minor* (SCHWENCKENFELD 1603, p. 162). The last mentioned name is also found in DE BOMARE (1768, p. 498) and in RAFF (1784, p. 256), but seems not later to appear in the literature.

** One could here also ask if the Bornholmian word bompa and the still surviving denomination Pumpe in some Danish dialects (cf. Ursin 1947, p. 80) do not refer to this same word (cf. the name quoted by LINNAEUS, sädespumpa).

them.) It is, however, also obvious from this quotation that fire toads were thought to be noxious to the carp roe which certainly meant that one reflected more than once before introducing these small, beautiful animals into the carp ponds.

Even if, therefore, some wealthy gentlemen could allow themselves the luxury of keeping fire toads as decoration animals and "garden warblers", it is not so likely that they were introduced by PEDER OXE (cf. also JUNGERSEN 1907).

The distribution of the fire toad is rather pronouncedly east European. In Russia it almost reaches Ural, the northern border in east Europe lies at about Moscow and S. Latvija (Alt-Rahden, Bauska). Southwards its distribution reaches the Danube and Drave, westwards it only extends to Böhmerwald, Thuringia, Oldenburg and Bremen. It is lacking in Sleswick and Jutland.

Bombina bombina is a lowland species which in the mountains and in western central Europe is replaced by the yellow-bellied *Bombina variegata*.

If our fire toad had distributed itself together with the carp culture, it would be difficult to understand why it is absent from W. Europe. If, on the other hand, one presumes that it is a form which requires at least a tolerably continental climate and that it has its natural western border at Bremen and Oldenburg, its absence from, for instance, Jutland and Sleswick is more easily understandable. A considerably more continental climate is stated for eastern Holstein than for the rest of this province (CHRISTIANSEN 1926, p. 149 ff.). A contributing factor to the western limitation of the fire toad in these areas is probably also to be found in the fact that eastern Holstein is rich in small water bodies, Sleswick, on the other hand, poor in them (cf. CHRISTIANSEN, p. 186).

As to the distribution of the fire toad in Denmark and Sweden, there is scarcely anything that could point to abnormally advanced out-posts of its natural area of distribution. The fire toad is usual in eastern Holstein (especially on the Wagrien peninsula) and continues from there over Fehmern and the coasts of Little Belt to southernmost Sweden. In this area it reaches a little south of the same latitude as its boundary east of the Baltic where, however, the climatical conditions are more continental.*

A rather decided argument against the implantation hypothesis via carp culture and big estates is that the fire toad is reported from a fairly large number of small islands round Funen and Zealand (cf. map). In fact about $^1/_3$ (18) of all localities reported from Denmark are of this nature. It is, however, to be remembered here that the fire toad was set out on about half a dozen localities during the last 100 years (cf. PFAFF 1943, fig. 3, URSIN 1947).

The maps of Scania from the 19th century show that large parts of the lowland were uncultivated areas with unditched swamps and ponds (EHNBOM 1941, fig. 1). Before the intensive cultivation of the country began, large areas within the former range of *Bombina bombina* in Scania, as pointed out by A. NILSSON, were mostly open grass-grown meadows, "fälad", used for pasture (1954, p. 21), similar to the type of locality where it survives up to the present day.

My investigations in 1935 for Sweden, together with those of PFAFF in 1943 and of URSIN in 1947 for Denmark, have shown that the fire toad is rapidly decreasing in the Scandinavian countries. One can then ask what are the causes of this phenomenon. Regarding Sweden it is probable that in some few cases (for instance by refuse and warm water from sugar factories, as at Staffanstorp) the pond water has been too much polluted, but otherwise the cause of the disappearance of the fire toad can scarcely be a destruction of its spawning places. On Söderslätt (e.g. in the Svedala area) there are still thousands of these small ponds where *Bombina* could deposit its roe. It can scarcely be so that its enemies have increased. It may in fact be called in question if the fire toad, except during the larval stage, has any serious enemies—perhaps with the exception of man. When this toad is disturbed, it takes an often-described protective and terrifying attitude and exudes a secretion of considerable poisonousness. According to HASS (1926, p. 66, cf. also VOLSØE 1949, p. 482) it happens that frogs transported in the same vessel as fire toads are seriously affected and even die of this secretion. GADOW, who studied *Bombina*, says too (1909, p. 156): "I know of no creature which will eat or harm them."

It is possible that the proceeding cultivation of the Scanian fields and filling up of the marl pits has played a certain rôle in the disappearance of the fire toad from Scania. However, it seems probable that it has been facing more and more unfavourable conditions for its existence because of the increasingly Atlanticized climate. The still remaining specimens, in the Nordic countries where they are not introduced, are probably surviving relics from the postglacial warmth period.

In order to elucidate this thesis a little further, the following investigation has been carried out concerning the Scanian climate during the last century. The figures represent averages for 5-year periods. As shown below, occasionally cold winters cannot be responsible for the extinction of the fire toad, because in east Europe it is known to survive during much colder winters than in Scandinavia. As is well known, the amphibians have a great longevity*, and it is therefore thought that the spoiling of spawnings during occasionally unfavourable summers cannot be responsible for its extinction. Therefore a longer period of deterioration of the climate seems to be needed to explain a decrease or extinction of the fire toad.

Changes of the Scanian climate after 1860

The three localities mentioned below, like Lund (38 m above sea level) and Ystad (5 m above sea level) given later on, have all at some time been places of occurrence of *Bombina*, as shown in the text.

* Excepting implantation, its distribution in Denmark does not extend N of 56° N. The Vattenmölla localities lie at 56°18′. East of the Baltic the N border lies at 56°25′ N.

* BANNIKOV (1950), for Russia, surmises an age of only about 5 years. It is, however, very probable that the conditions are different in continental Russia.

TABLE 16. Average air temperatures in Svedala, Malmö and Kullen.
Averages for 1901–1930.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average year
Svedala (47 m MSL)	−0.30	−0.78	1.63	5.30	10.35	13.75	16.33	15.47	12.47	8.13	3.51	0.94	7.2
Malmö (5 m MSL)	+0.35	−0.22	2.02	5.54	10.63	14.27	16.61	15.69	12.69	8.54	4.09	1.63	7.7
Kullen (0 m MSL)*	+0.32	−0.07	1.78	5.45	10.54	14.26	16.60	16.03	13.26	8.89	4.35	1.61	7.8

* The meteorological station is situated 61 m a.s.l., but as the locality for the fire toad is situated almost level with the sea the correct figures for 0 m are given.

It is clear from this table that Kullen, especially during August to October, presents the mildest climatical conditions. As it is during these months that the metamorphosis of the fire toad takes place, it is also evident that Kullen has exceedingly favourable conditions for the development of the tadpoles of *Bombina* (cf. also ALLAN NILSSON 1954, pp. 16 ff.).

As stated above, the distribution of the fire toad has been subjected to a rapid decrease in Sweden during the last decades. From being found in several localities in S. Scania in the middle of the 19th century, it became extremely rare during the beginning of the 20th century. From about 1930 there is only a single record from one locality in Sweden, from Kullaberg. The southern side of Kullaberg, where the fire toad is known to occur nowadays, has probably the highest average temperature and the mildest climate in our country.

A rapid decrease has also been recorded from Denmark (PFAFF 1943, p. 50, VOLSØE 1949, p. 484).

As the occurrence localities of the fire toad in Scandinavia constitute the very northern border of its distribution area, it is reasonable to presume a climatical deterioration during the last decades in order to explain its disappearance from former areas of occurrence.

Even a rather large deterioration of the winter temperature, however, would certainly not have any dangerous effect on the occurrence of the fire toad, as this is an east European form accustomed to a continental climate with very cold winters. Thus it is found in Latvia at Bauska (Alt Rahden), where the winter temperatures are much lower than in Scania (av. temp. at Jelgawa: Dec.-March freezing, Jan. −4.30, Febr. −4.80*). It also survived at Kullen during the extremely cold winters of 1940–1942.

During the 20th century the average air temperature for the year has risen by 0.1–0.3° in Scania. The rise of the averages is greatly ascribable to an amelioration of the winter climate, as is evident from the figures below.

* Jelgawa lies 36 km from Bauska. The averages originate from 1926–35. Lund during the same period has Jan. +0.2 and Febr. −0.5°C.

TABLE 17. Average air temperatures in Lund and Ystad in the periods 1861–1900 and 1901–1930.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ave y
Lund													
1861–1900	−0.92	−0.77	0.81	5.28	10.04	14.62	16.39	15.67	12.63	7.80	3.47	0.35	7
1901–1930	−0.32	−0.62	1.68	5.31	10.61	14.15	16.58	15.34	12.19	7.94	3.44	0.89	7
Ystad													
1861–1900	−0.09	−0.28	0.94	4.79	9.23	14.04	16.25	15.69	13.00	8.55	4.28	1.04	7
1901–1930	+0.56	−0.02	1.81	5.08	9.72	13.57	16.12	15.46	12.66	8.81	4.79	1.91	7

As shown by the figures above, there is, on the other hand, a general decrease of the summer temperatures during the 20th century. May has become warmer, but this is counterbalanced by an equally large decrease in June temperatures. The decrease is slightly or not at all discernible in July, becomes very marked again in August and reaches its maximum in September when the month upon an average is 0.3–0.4° colder than during the latter part of the 19th century. As this period, (May) June to September, represents the time of development for the tadpoles of the fire toad, and as the deterioration is most pronounced during the latter part of this season, it is evident that the larval development and subsequent strengthening period for the young fire toad, especially during unfavourable years, will become considerably endangered. From about 1925 the average figures rise again, but by then the fire toad was already extinct in this area.

From Kullen we have no average figures prior to 1881. If we compare the periods 1881–1900 and 1901–30 from Lund and Kullen for the summer months we get interesting figures. (Table 18.)

May during the first three decades of the 20th century has become considerably warmer in Lund, in the case of Kullen a little cooler. Otherwise we find the same general tendency as that depicted above as regards a decrease of the summer temperatures (especially marked in June and September). Still at Kullen the autumn average temperatures lie 1.07° (Sept.) to 0.95° (Oct.) higher than in

TABLE 18. Average air temperatures in Lund and Kullen during May–October in the periods 1881–1900 and 1901–1930.

	V	VI	VII	VIII	IX	X
Lund 1881–1900	10.50°	14.80°	16.44°	15.37°	12.43°	7.56°
1901–1930	10.61°	14.15°	16.58°	15.34°	12.19°	7.94°
Kullen 1881–1900	10.57°	14.87°	16.70°	16.17°	13.52°	8.42°
1901–1930	10.54°	14.26°	16.60°	16.03°	13.26°	8.89°

Lund. This must play an important rôle in the last stages of the tadpole life and the first land life period of *Bombina*.

It is interesting to compare climatically those places along the northern border of its distribution area where *Bombina* is known to occur, in Denmark and in Latvia. In Denmark the late summer and early autumn months are known to be warm and poor in precipitation on those islands where *Bombina* is still common (cf. VOLSØE 1949, p. 484). As for Latvia, the comparison for Jelgawa may be given below. Here the period 1926–1935 will be compared as this is the only one given for the climate of Latvia (cf. KAURI 1948 p. 10 and p. 12).

As shown below, the spring and high summer months in Jelgawa are warmer than in Denmark and Scania while the late summer and autumn are colder in Latvia. This means that in Latvia the tadpoles of the fire toad get an earlier and better start, which probably results in the accomplishment of the metamorphosis at an earlier point of time than in Scandinavia and sufficient time for strengthening of the young toad before the winter season. This is also very necessary as the autumns in Latvia are colder than in Sweden and Denmark.

If we take the sum of monthly average temperatures of the summer months and the warm half of the year we will also get some elucidating figures. (Tables 19, 20).

As evident from the above, in the three first-mentioned localities, where the fire toad still occurs, the sum of the monthly averages in V–X is at least 1.5° higher than in the two last localities. This means, in other words, that the average temperature in the three first-mentioned places lies at least 1° higher than in the two latter during 1½ months.

The precipitation in these localities compared was as follows in table 21.

In Knudshoved the low temperature, the lowest in the localities harbouring fire toads (cf. below), is evidently counterbalanced by the dry climate which includes sunnier days and a warmer microclima for the small water pools (cf. also Danmarks Klima 1933, concerning the distribution of the precipitation in the Danish southern isles, July–September, pls. 34–36).

AURÉN, in 1939, gave a survey of the radiation climate of the Scandinavian Peninsula. From his iso-insolation curves for May to September (pls. IV–VIII) it is evident that in Scania Kullen (and in most months the (W and) S coast strip) is most favoured as regards amount of radiation. This means that the small and unshaded shallow pools in which the fire toad spawns often reach higher temperatures than made possible by the air temperatures, a fact which evidently contributes to favouring the development of the tadpoles.

ALLAN NILSSON, in 1952 and 1953, made a very careful investigation of the ecology and development of the fire-bellied toad at Kullen (1954). Fortunately he found that there was a population in the ponds of probably more than 50 specimens. At least 25 fire-toads were caught, identified and released. NILSSON got his information chiefly about the spawning at Kullen in the warm year of 1953. He found that the eggs were deposited in clumps of about 30–60, totalling in one batch about 280. Each egg had a diameter of about 1.9 mm and the gelatinous capsules were 2.9 and 6.2 mm. The colour of the eggs was brown dorsally and yellowish white ventrally. The eggs were laid in the warm spring of 1953 on the 18th May. The tadpole stage was reached on the 30 May. The colour at this stage was yellowish green. By the 7th June the black chromatophores were melting together to a network, especially on the head and tail. By the 15th June short posterior legs were visible. On the 28th June the total length of the larva was 40 mm. The transparent sides and the ventral parts of the body, like the tail, were iridescent red and blue. In the early part of July the maximum of the total length was reached with 51 mm. On the 11th July (53 days) the first fore limbs were discernible; the maximum size was then only 44 mm. The dorsal side was then olive green marbled with black. By the 16th July most of the larvae had 4 legs; the total length of the larva was then diminished to 38.5–41.6 mm. The metamorphosis was completed 22–26/7 (64–68 days from hatching)

TABLE 19. Average air temperatures in Jelgawa, Knudshoved, Kullen, Lund, and Ystad during May–October in the period 1926–1935.

	V	VI	VII	VIII	IX	X
Jelgawa 5 m 1926–1935 . .	11.9°	15.1°	18.2°	16.3°	12.0°	7.3°
Knudshoved ,, . .	10.5°	14.0°	16.9°	16.4°	13.5°	9.2°
Kullen 0 m ,, . .	10.7°	14.4°	17.2°	16.8°	13.3°	9,0°
Lund 38 m ,, . .	10.6°	14.1°	17.0°	16.0°	12.6°	8.4°
Ystad 5 m ,, . .	9.8°	13.5°	16.6°	16.4°	13.4°	9.3°

TABLE 20. Average air temperatures in Jelgawa, Kullen, Knudshoved, Lund, and Ystad during several months in the period 1926–1935.

	VI–IX	V	X	V–X
Jelgawa 1926–1935	61.6°	11.9°	7.3°	80.8°
Kullen ,, ...	61.7°	10.7°	9.0°	81.4°
Knudshoved ,, ...	60.8°	10.5°	9.2°	80.5°
Lund ,, ...	59.7°	10.6°	8.4°	78.7°
Ystad ,, ...	59.9°	9.8°	9.3°	79.0°

TABLE 21. Average precipitation in Kullen, Knudshoved, and Lund in the period 1926–1935.

	VI–IX	V	X	V–X
Kullen 1926–1935	274.3 mm	46.1 mm	87.3 mm	407.3 mm
Knudshoved 1926–1935	224.2	41.5	71.2	336.9
Lund 1926–1935	226.7	41.7	93.6	407.3

The young then had a body length of 19 mm and the belly was mottled white or pale yellow on bluish ground. A specimen one year old (June 1954) measured 22 mm. Fully coloured specimens are orange red with specifically characteristic markings on blackish ground on the ventral side. The dorsal side is dark olive green with one pair of pale green spots between the shoulders.

In the spring of 1952 the eggs were laid about the same day (20/5) as the following year. As there was a considerably lower insolation in 1952 than in 1953, the result was that the tadpoles were much smaller—they measured 21 mm on 29th June 1952 and 45 mm on the same date in 1953. In the year 1953 the development took only 64–68 days, which may be considered to be exceptionally short. There was also a second period of egg-laying in late June 1953. When studies were broken off on the 29th June 1952, the larvae, which were six weeks old, were grown to a size of only 21 mm, comparable to a less than four weeks old larva in June 1953. This shows the great importance of different water temperatures and insolation. It seems thus that in unfavourable years the larvae may take at least 90 days to develop and may even not reach full development during cold summers.

As pointed out by URSIN (1947, p. 82), the fire toad, in spite of its otherwise continental European distribution, is almost exclusively bound to some islands and coast localities in Denmark. This seems undoubtedly to be caused by the fact that just these areas have a high summer temperature and low precipitation (cf. also JESPERSEN 1945, p. 229 and VOLSØE 1949, p. 484).

An import of fire toads from Denmark to Sweden was tried with the kind assistance of H. HVASS in July 1947. The specimens, 41 in number, had been collected on the island of Nexelö and at Knudshoved Odde, Vordingborg. They were set out by Z. P. WESTRUP, former Swedish Minister in Switzerland, on his estate Bjersgård, Rydsgård (60 m above sea level in the vicinity of Ystad), in three different types of small lakes and ponds (one shallow lake and two small ponds). There were fish: perch, pike etc., and crayfish in the lake, in the ponds only crayfish. In spite of the rather mild winters of 1948–49 and 1949–50 they all seem to have died out, as their voices are not heard any more. This confirms VOLSØE's opinion (1949, p. 484) that attempts to introduce *Bombina* into a new locality are now almost always unsuccessful. In the Ystad case referred to above, the crayfish may be suspected as destructors, especially for the small pond habitats. The fire toad may also make rather strict demands on its habitat and probably only survives in climatically very favoured places, even in Scania. (One may remember here that fire toads during the days of LINNAEUS were common in the district around Ystad and that they may have survived there much longer, as they were said to have been seen not far from there about 30 years ago).

That *Bombina* is a warmth-craving form is also evidenced by the fact that it spawns very late in May or June (cf. COLLIN 1870, p. 313). COLLIN, however, has quoted almost exclusively from central Europe. He reports, though, that he found recently metamorphosed larvae 17/8 1867, together with tadpoles with only vestiges of hind-legs (cf. a Swedish tadpole with 2 legs taken at Kullen

3/8 1927. Length 31 mm, body 13.5 mm, posterior legs 10 mm). BREHM states that the transformation takes place (in Germany) in September or October. It is evident that in case of cool or cold summers the larvae might not have the possibility to carry through their metamorphosis or to carry out the reinforcement stages after this period to be able to eat and to deposit a reserve for hibernation. If the population of full-grown toads is small, the possibility of extinction lies near at hand.

The size of fire toads in our collections varies between 19 and 47 mm.

Nevertheless, it is perhaps not impossible that the fire toad may survive in some other locality in W. or S. Scania. The fire toad is a shy animal, almost always dwelling in water among aquatic plants and, with the exception of the time when it calls, easily escapes attention. Its sound does not seem to be audible far away. LINNAEUS (1751, p. 123) described it in the following way: "Korngrodorna skreko mot aftonen liksom man hade på långt håll och halfva milen bort ringt med stora klockor fast de voro nära i pussarna. Det faller mig helt sällsamt före att detta djurets läte skal höras liksom långt bort ifrån. Om man om sommartiden hvälver et ämbare öfver huvudet och i en sjö drager sig neder under vatnet och då ropar i ämbaret, höres det på samma sätt långt ifrån." (The "korngrodor (seed frogs) called in the evening just as if large bells had tolled far off and miles away, although they were probably close by in the puddles. It seems very strange to me that the call of this animal should be heard as though from far away. If, in summertime, one were to put a bucket over one's head and lower oneself under the water in a lake and then call in the bucket, it would sound in the same way far off.)

N. KEMNER reported to me that about 1905 he found a fire toad under a stone near a small body of water near Malmö. It is, however, scarcely probable that the species remains in the vicinity of that town. Several reports about calls of fire toads from this area have turned out on closer investigation to have originated from *Bufo viridis* which has a warbling tone somewhat resembling bell sounds (cf. LANG 1926).

G. TURESSON told me that about 1930 he saw fire toads in a small pond at Tegelbruket, Rydebäck (55°58′ N). During a visit there, however, we failed to find any specimens.

The vertical distribution of the fire toad was earlier from about 0–50 m above sea level. Nowadays it only occurs in the immediate neighbourhood of the sea.

The fire toad thus has regressed very much during the last century in Denmark and in Scania. Inasmuch as a changed climate is the cause of the decrease of the fire toad in Scania we have no possibility to stop its extinction. Human culture, however, may also have contributed to exterminating the species; many localities for the fire toad in the vicinity of Copenhagen are thus stated to have been destroyed long ago. In this case, too, there is probably not much to be done. One large menace endangering the fire toad comes from collectors who wish to catch it for their collections or use it as a valuable exchange object

number of Swedish fire toads is apparently very small, total extermination could easily be effected in this way. Here, protection would be useful. When it was stated in 1949 that the fire toad was still to be found in the Swedish fauna, steps were immediately taken to get it protected by law in Scania. The bill was passed in April 1951 and it is therefore to be hoped that the last remnants of this interesting species in Sweden will be able to survive.

Pelobates fuscus fuscus (LAURENTI). **Spade Foot Toad. Lökgroda**

OCCURRENCE:

Skåne. Trelleborg (?), GISLÉN 1935. — Falsterbo, M.M. — Between Skanör and Kämpinge, NATHORST 1915. — Räng, NATHORST 1871. — Skegrie, NILSSON 1842. — Steglarp, NILSSON 1842. — Klagshamn, LANG 1926. — Malmö, Fredriksberg, LANG 1926, M.M. — Lomma, M.M. — Klågerup, Assartorp, L.Z.M. — Svedala, Aggarp, L.Z.M.,— Oxie, Tegelbruksgården, M.M. — Lyngby, S.S. — Revingeby, Y.M., T.G., B.S. — Revingehed, L.Z.M., E.H.-M. — Blentarp, Velleröd, K.C.-L., G.N.M., M.M. — Sövde L.Z.M. — Karup meadows, NORDQVIST & RUDEBECK 1947. — Eriksdal, L.Z.M., A.B-h., G.N.M. — Röddinge, E.M-n., LANG 1928, L.Z.M. — Abbekås, NILSSON 1860. — Barsebäck, H.K. — Saxtorp, 500 m to the southeast of the church, L.Z.M., T.G., A.N-n., N.T.-W. — Saxtorp, P.H.-A., L.Z.M. — Rönneberga, NILSSON 1842, 1860. — Kågeröd, E.H.-M. — Hälsingborg, Stattena and Ringstorp, G.N.M., L.Z.M., N.R.M., U.Z.M. — Raus, H.M., L.Z.M. — Råå, L.Z.M. — Råå mire and meadows, N.R.M., MUCHARDT-BENGTSON 1907. — Bjuv, 500 to the south of the church, GISLÉN 1935. Örkelljunga?, LANG 1928.

As evident from the above, *Pelobates* occurs in Sweden only in W–SW Scania. In SVEN NILSSON's Fauna of 1842 it is stated to occur on Gotland also. The statement was doubted already by MEVES (1856) and the locality is not mentioned in the 2nd Ed. of NILSSON's Fauna (1860). This does not prevent HASSELGREN (1910) in his "Gotlands Däggdjur, Reptilier och Amphibier, 2nd Ed." including the species as "sparsely occurring" on this island, a statement which is certainly just as erroneous as the information in his treatise about the occurrence of diverse other forms on Gotland (*Rana temporaria*, *Bufo calamita*, *Triturus palustris*, *Lacerta agilis*).

Excluding the normal area of distribution referred to above, there are other records which must be discussed here. Dr. N. TÖRNQUIST reported the occurrence of larvae of *Pelobates fuscus* in fish ponds at Önnerud, Grava, Vrm. (1938). He thought that larvae had been introduced with fish roe from Korsör, Sdm., a supposition which must be rejected, as spade foot toads have never been found in that part of Sweden. Fortunately these larvae had been preserved and were kept in the Gothenburg Mus., from which they were borrowed. On investigation, however, they turned out to be giant larvae of *Rana temporaria* (Fig. 44). Such giantism is previously known from *Pelobates* and *Rana esculenta.*

Pelobates larvae have also been recorded from Aneboda, Sm. (LANG 1928). Dr. LANG also refers to the discovery of *Pelobates* larvae in the same place by Dr. NORDQUIST in 1924. In the Lund Zool. Museum there is in fact a large tadpole taken by Dr. NORDQUIST in 1924 in the aforementioned place and interpreted,

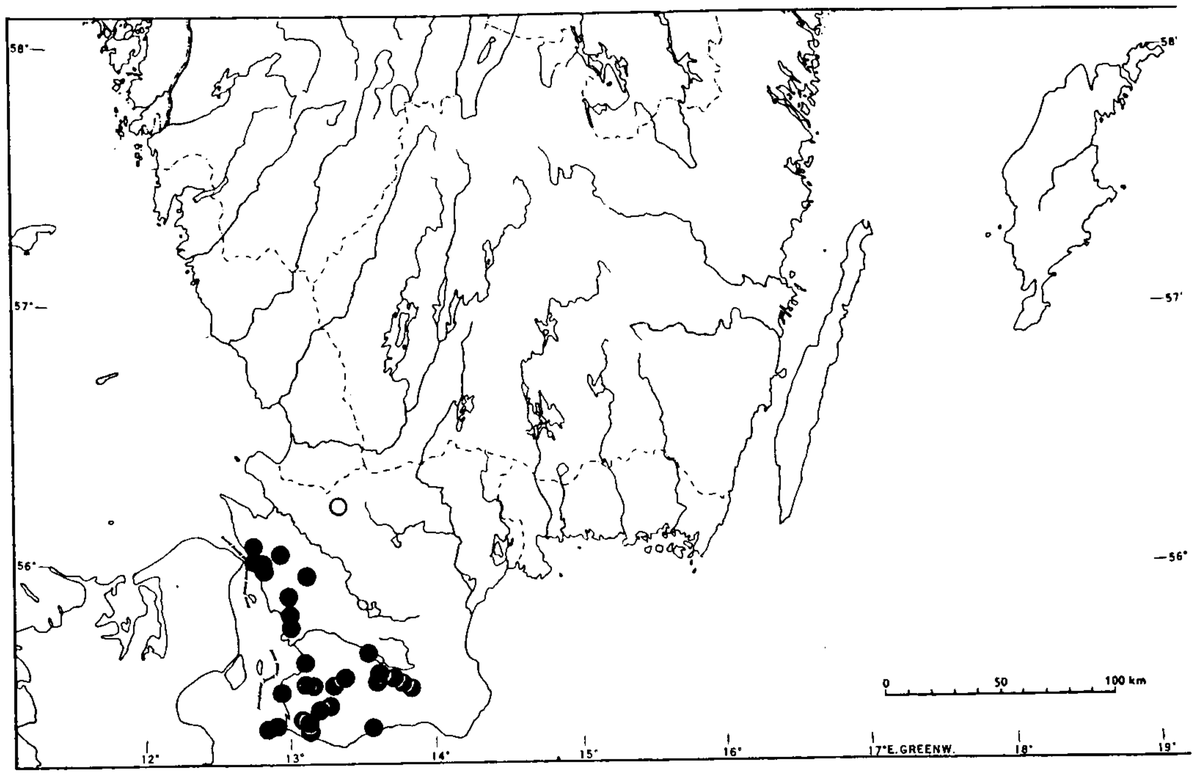


FIG. 14. Distribution in Scania of *Pelobates fuscus*. Open circle = dubious locality.

with an interrogation mark, as *Pelobates*. On closer examination, however, this larva turned out to be a tadpole of *Rana esculenta*. On application to Aneboda concerning this question, Mr. MONTÉN went to the trouble of sending us two tadpole samples taken in the Aneboda fish ponds in 1909 and 1916 by NORDQUIST & NAUMANN and determined as *Pelobates*. In these cases, too, the tadpoles turned out to be *R. esculenta*. As, moreover, Dr. LANG assures me in a letter that he never controlled the appearance of the horny teeth of the larva, but that he, being a young student at that time, relied upon the statement of Dr. NORDQUIST, it is certain that his statements refer to *R. esculenta*. The same can be stated about the Örkelljunga find, situated in N. Scania and reported in LANG's paper. Here, however, the prospects of finding *Pelobates* are greater, as the locality lies tolerably near the normal area of the Swedish distribution of the spade foot toad. This locality is therefore given here, with some doubt. Undoubtedly it is much easier for tadpoles of the edible frog to be introduced into fish ponds, as *R. esculenta* is much more common in central Europe and, besides, it lays its eggs in several lumps which may more easily be deposited with the fish roe than the broad and fairly long egg strings of *Pelobates*.

Consequently, I come to the conclusion that *Pelobates* has never been found in Sweden outside the province of Scania.

The vertical extension of *Pelobates* lies between sea level and 50 m above sea level (Svedala).

As tadpoles of spade foot toads were earlier supposed to be found in carp or other fish ponds, the theory was formerly advanced that spade foot larvae were originally introduced to Sweden with fish fry.

That introduction can take place in this way may sometimes be possible, though, for Sweden, this possibility becomes very much lessened in the light of recent investigations referred to above. Pond culture of carp has been carried on in S. Sweden at least since the 16th century; nevertheless, the synantropic possibility of distribution has to be examined.

The carp has a distribution in Europe which in many respects resembles that of the spade foot toad; it originally arrived from the SE and was distributed with human culture over central and western Europe. As to Sweden, the carp ponds reported from Scania by LINNAEUS (1751) and the recent finding places for *Pelobates* roughly coincide.

An objection to this hypothesis is that nothing indicates that the occurrence of the spade foot toad in Sweden is an artificially advanced area of distribution. In Denmark it occurs on Zealand and in Jutland, almost to the Skaw, i.e. roughly to the same latitude as Kungsbacka, Halland, in Sweden (57°30′ N). It is reported from many localities in N Germany and on the east side of the Baltic it reaches N Estonia (59°15′ N) (KAURI 1946). Nevertheless, it could, of course, be supposed that all these points were artificially advanced in connection with earlier carp culture.

As fullgrown, however, the spade foot toad has certainly never been distributed synantropically. It has no beautiful colours or melodious voice, like *Bombina*, which is extensively distributed, perhaps partly with the aid of human culture; it can produce an unpleasant smell, and, most important of all, the aquatic period of its life is exceedingly short. When it comes to its supposed codistribution with the carp, *Pelobates* has consequently been completely dependent on the larval stage. The question concerning a probable distribution of the spade foot toad together with the carp is therefore intimately associated with the mode of carp transport in olden times.

As pointed out above, the possibility cannot be totally excluded that *Pelobates* larvae may have been introduced on some occasions together with carp fry. According to information from the late Dr. H. NORDQUIST, there was probably no import of carp fry from Germany to Sweden before 1878 or 1879. The spade foot toad, however, had already been reported from Sweden before 1840.

The question is therefore how carp import was effected in ancient times. LINNAEUS, in his Scanian Journey (1751), gives us some valuable information concerning these matters. Speaking of the fish ponds at Wrams Gunnarstorp he says (l.c. p. 366) "Fisken fördes på det sättet i en fyrkantig kista ... at i kistan nedsläptes några stycken låck med karm omkring, at låcken icke måtte komma för när till hvarannan, och woro desse låck med små hål igenom borade, häruti lades grönt gräs, derpå fisk, så låcket, hwarmed fortfors til kistan blef full, då fisken låg i mjuka gräset utan at kramas, och wattnades esomoftast, ... På detta

sättet kunde fisk planteras ifrån aflägsne orter, och föras långa wägen." (The fish were carried in this way in a square chest ... that several lids were let down into the chest, the lids surrounded by coamings in order that they should not come too near to each other, and perforated by small holes. Green grass was laid in the chest, thereafter fish, then a lid, and so on till the chest was full. The fish were then lying in the soft grass without being squashed and were watered every now and then ... In this way fish could be transplanted from remote places and be carried long distances.)

On the occasion of the visit to Lärkesholm (ibid, p. 381) it was noted: "Fisk transporterades lefvande ifrån en ort til en annan, medelst tunnor, på det sättet, at i sprundet sättes en trätratt, som är ofvantil täckt och genomborad med ett hål, at vatten kan esomoftast igenom tratten påslås och dock icke utsqualpas, då det slemmiga vattnet äfven esomoftast utsläppes igenom tappen." (Fish are transported alive from one place to another by means of barrels, in such a way that in the bung is inserted a wooden funnel which is covered at the top and perforated by a hole, so that every now and then water can be poured in through the funnel without spilling out, the slimy water being run off every now and then through the tap.)

On this subject HALLENBORG remarked in his commentary (about 1751, p. 371): "Experiencen har visat, att karp med vanliga karpskutor dock har kunnat föras från Ystads brygga till Stockholm, fast den till Ystad förut är landsvägen uti tunnor förder hela mihlen." (Experience has shown, however, that it has been possible to ship carp in ordinary carp smacks from Ystad pier to Stockholm, though earlier they had been transported in barrels by the high road to Ystad a whole "mihl" (old Swedish mile = 7 Engl. miles).

It is thus evident that during the 18th century only more or less fully grown carp and not carp fry were transported in this way. From LINNAEI comment (1751, p. 378): "Rommen, ... wore et ansenligt capital, om den kunde samlas och spridas i sjöarne." (The roe ... would be a considerable capital, if it could be collected and distributed in the lakes), it is also clear that carp roe transport was not used at that time.

As the distribution of the spade foot toad in connection with carp transport is restricted to the possibility that the larvae became mixed up with carp fry by mistake, it is less likely that it was dispersed together with the carp in olden times.

Certain facts also argue against the codistribution of *Pelobates* and the carp. The spade foot toad is very particular as to the ground where it lives. Partly because of that it occurs only in patches even within its ordinary area of distribution. In order to thrive it requires loose sandy or at least light soil. Such soils occur in several areas of SW Scania (cf. map). If the toad had followed carp transports, it is difficult to understand why it is missing from the Kristianstad plain in E. Scania and the S. parts of Halland where there are plenty of areas with light soil.

The spade foot toad also ought to have had opportunities of distributing itself by carp transports to S. or SW. France, but is there substituted by the species *P. cultripes*. In the whole of England and practically the whole of Holland there are no spade foots. In the first-mentioned country, however, carp culture has been practised at least since the 17th century. If larvae of spade foots had been distributed by carp transports, it is hard to understand why *Pelobates* did not find any suitable soil in England.

It seems therefore most probable that the spade foot toad arrived in the Nordic countries earlier than and without the aid of any fish pond culture.

Pelobates fuscus has a general distribution extending from NW France and Belgium through middle Europe to east of the sea of Aral (see map in GISLÉN 1935, p. 128 and TERENTJEV & ČERNOV 1949, p. 294, completed for the eastern side of the Baltic by KAURI 1946, p. 7). As more conclusively shown by me in the paper quoted above (GISLÉN 1935, p. 126 ff.), it seems probable that *P. fuscus*, which once evolved from *P. syriacus* or a species closely allied to it, after the Glacial Age invaded central Europe from the SE (from the vicinity of the Black Sea and the easternmost parts of South Europe). This or a very closely related species has been found at Wolfenbüttel and Magdeburg by NEHRING 1810 in late Diluvial layers, together with steppe forms such as *Alactaga*, *Arctomys bobac*, *Lagomys* and *Spermophilus*, thus immediately after an Arctic fauna which contained, among other forms, the lemming.

In spite of the area of distribution of *Pelobates fuscus* reaching the Channel in the west, it is missing, as pointed out above, from the British Isles.

During the Boreal Age, after the last glaciation, when England was in broad land connection with the continental part of NW Europe, the spade foot toad did not occur in NW France and Belgium, and had no possibilities of reaching England.

After the final retrogression of the ice cap the post Glacial warmth period eventually set in. During the later Boreal Age with its dry and warm climate, the spade foot had good opportunities of spreading westwards and northwards. During parts of the Ancylus Age S Sweden was lying at least 40 m higher than nowadays and thus via Denmark had land connection with northern Germany. At the end of this period, i.e. about 8–9000 years ago, several warmth-loving forms, such as e.g. *Emys lutaria*, now long since again extinct in this country, arrived in Sweden. It seems very probable that *Pelobates fuscus* also was incorporated in our fauna at that period.

At the present time (besides perhaps the unfavourable influence of a climate which since the Iron Age has become more inhospitable) the distribution of the spade foot toad in Sweden is threatened by the intense cultivation of land, drainage, and the filling up of marl pits. Many spawning localities may have been destroyed in that way. This is even more true of Denmark, where, as WESENBERG-LUND has told me, many localities in the northern part of Zealand have been spoilt. Still, recent investigations in Denmark have shown that *Pelobates* is more

FIG. 15. Spade Foot Toads. Photo by H. GRÄNS.

common than formerly supposed (VOLSØE 1949, p. 886). Its nocturnal habits account for the fact that it is only rarely seen.

In Denmark, COLLIN (1870) found the spawning time for the spade foot toad to be the end of April and WESENBERG-LUND (1932) found new-laid egg strings from the 4th–11th May. During my investigations, I found during three sucessive years (1935–1937) that the eggs were laid between about the 15th and 26th April. The years 1935 and 1937 had warm and rainy Aprils and the eggs seem then to have been deposited in the middle part of the month, in the cold April of 1936 the eggs were probably laid about 26th April (GISLÉN 1937). In 1952, 22 fairly recently laid egg-strings (gastrulae with a small yolk plug) were found on the 17th April. During warm springs the spawning may come still earlier; thus, in 1946, a pair was found copulating in the Saxtorp pond already one of the first days of April. The egg-string is relatively short, perhaps formed by two fused thinner strings. In one case I found it contained about 750 eggs and was 4 dm long (GISLÉN 1935).

The spade foot toad emits its call when sitting on the bottom of the pond. As stated by me in 1937, its croaking is a rather deep sound (about g in the great octave, warying a little according to the depth of water separating it from the surface.

On several occasions dead specimens of *Pelobates* were found in ponds during the spawning season. All these were females of a length of 63–68 mm, thus unusually large. None of these had yet deposited their roe. Some of them were evidently quite recently killed and all had $^1/_2$–$1^1/_2$ cm long oblong scares on the belly, in the inguinal area, or on the thighs. The possibility of, for instance, crows having attacked the toad is excluded, as in this case the wounds would have been located on the back. In the ponds where these phenomena were observed,

FIG. 16, 17, 18. Spade Foot Toad burrowing itself down into the earth. Photos by D. SEGERFELDT.

no fish were found which could be responsible for the death of the animals. Leeches (*Haemopis sanguisuga*) could perhaps have been suspected, but in this case it was inexplicable why the toads had only been attacked in the posterior part and why only females had been killed. Besides, such wounds are not made by leeches. When one remembers that the females are less common than the males (LEYDIG found 4–6 males on one female) and that in one spawning season we found no less than 5 females killed in such a way, this seems to be something more than a coincidence. As is well known, copulation among the spade foots is effected by the males embracing the female in the inguinal region. It is to be remembered that *Pelobates*, which is a digging form (Fig. 16, 17, 18) has on its posterior legs a horny digging knob, 6–7 mm long and 2 mm high and provided with a narrow border as sharp as a blunt knife blade. It does not seem impossible that with the scarcity of females there may be strong competition for the ones available (cf. here also experience from the spawning of the toad below). The competing spade foot males may therefore attack another one which has already embraced a female in the inguinal area with its fore legs. It is then reasonable to suppose that the attacking males, by means of kicks with their muscular posterior legs against the forelegs of the copulating male, try to get him to loosen his grasp round the female. In the process the female may be wounded by the

FIG. 17.

FIG. 18.

sharp digging tubercle and die either by infection or by bleeding to death. It would then be natural that the wounds would be confined to the belly, inguinal tract or thighs.

The growth of the larvae is rapid and, as shown by WESENBERG-LUND (1922), they reach a normal size of about 100 mm. In exceptional cases much larger sizes may occur, though, as shown by WESENBERG-LUND, this is probably not due to the larvae having hibernated, but to a disturbance of the inner secretion, so-called partial neoteny according to KOLLMANN (1884). In the Lund Zoological Museum there is thus a larva measuring 181 mm long and still with only posterior legs developed (length 31 mm). WESENBERG-LUND records a similar specimen of about the same size (1922, p. 222). He found in Denmark that the larvae generally metamorphose in the first half of September, but during cold summers (as e.g. in 1908) unmetamorphosed larvae were still found in the ponds at the beginning of October (op. cit. p. 25).

From Sweden there are tadpoles with 4 legs taken in September (Råå 14/9 1907) and even as early as 22nd July (Klågerup 1920). Two larvae from Sövde (1930), which already possessed 4 well-developed legs on the 9th July, were of a length of 80–83 mm. They are thus at about the same stage of development as the September specimen from Råå referred to above. As a comparison it may be mentioned that larvae which WESENBERG-LUND found transformed at the beginning of September had no forelegs and only traces of hindlegs on the 27th July. The tadpoles, up to a length of about 15 mm, seem to grow rather synchronously but later on there may be greater deviations for different individuals than I found for instance in *Rana temporaria*. In aquarium, tadpoles of the same batch differed on 6th June between 16 and 32 mm, on 2nd July between 27 and 63 mm (as against larvae of *R. temporaria* on 14th June 25–31 mm and on 26th June 27–38 mm resp.).

In more fully grown batches four- and two-legged specimens or even tadpoles without any legs may be found at the same time. The growth may now and then stop completely. Thus I got once, on the 11th Oct. 1935, a specimen devoid of legs and measuring 95 mm long. It lived in an aquarium, apparently without eating much and staying roughly the same size, till 10th July 1936, when it died at a length of 95 mm and still devoid of legs. The larvae generally seem to reach their maximum size at about or a little after the formation of the posterior legs, when the normal length seems to be about 105 mm. When 4 legs are developed, the length varies between 80 and 95 mm in specimens preserved in our collections. Then a very rapid shortening of the tail sets in and the newly transformed spade foot has a body length of 29–36 mm.

The males, easily distinguished by a great shining glandular area on the upper side of the brachium, seem to remain the smaller, as I have never found larger ♂♂ than 56 mm. Swedish females of this species were found maximally to attain a size of 68 mm.

The colour pattern of Swedish spade foots is generally the normal one described and figured from central European specimens (cf. also a detailed description in GISLÉN 1935, p. 102 and figs. 1, 3, 4). The dorsal spots are sometimes more oblong with irregular borders, giving the back a more striped appearance (op. cit., fig. 2).

Hyla arborea arborea (LINNAEUS). **Tree Frog. Lövgroda**

OCCURRENCE:

Skåne. Kullen, BREHM-EKMAN 1946. — Jonstorp, F.P. — Allerum, E.L-t. — Hälsingborg, S.L. — Trälleborg, S.E.L. — Västra Nöbbelöv, NILSSON 1842. — Björkesåkrasjön, S.M. — Värlinge, G.A.N. — Börringesjön, SÖDERBERG 1908. — Lindholmen, NILSSON 1842, O.L. — Börringe, MEVES 1868. — Gustav, SAHLIN 1929. — Fjällfotasjön, SÖDERBERG 1908, SAHLIN 1929. — Skurup, SAHLIN 1929. — Bökeberg, LANG 1926, C.C. — Skabersjö, K.K. — Torup, LANG 1926. — Yddingen, SÖDERBERG 1908, LANG 1926, SAHLIN 1929. — Häckeberga, Sventorp, G.R. — Häckeberga, L.Z.M., SÖDERBERG 1908. — Toppelagård, NILSSON 1842. — Genarp, SAHLIN 1929. — Veberöd s:n, Dörröd, H.E-n., A.M-n. — Krageholmssjön, northern side, Exc. — Årsjö; Krageholm, A-J.O. — Sövestad, SAHLIN 1929. — Högestad, NILSSON 1842. — Örup, SÖDERBERG 1908. — Baldringe, L.Z.M., NILSSON, 1842, SAHLIN 1929. — Tomelilla, N.R.M. — Eriksdal, Ållskog; between Eriksdal and Snogeholmssjön; Blentarp, Karup mire L.Z.M., NORDQVIST and RUDEBECK 1947. — Sövde, SAHLIN 1929. — Gladsax, N.A.A. — Simris s:n, southern limit; Simrishamn; Simrishamn 5 km N, S.S. — Sjöbo, G.R. — Tolånga, Hörr, NILSSON 1842. — Södra Åsum, E.H.-M. — St. Olof, SAHLIN 1929. — 2 km to the west of Stenshuvud, KJELLBERG 1951. — Stenshuvud, L.Z.M., NILSSON 1842, A.D., M.R. — Kivik, Äsperöd, N.R.M., NILSSON 1842. — Between Kivik and Vitemölla, KJELLBERG 1951. — Vitemölla, TJEDER 1951, L.Z.M. — Ravlunda, Klammerbäck, Exc., H.B-m. — South of Degeberga, SAHLIN 1929. — Trolle-Ljungby, G.W. — Ivarstofta (= Ivetofta), NILSSON 1842, SAHLIN 1929. — Ivetofta, Håkanryd, WALLENGREN 1866. — Ivetofta, Allarp, L.Z.M.

The frogs from Ravlunda, which LINNÉ mentions in his "Scanian journey" (Skånska resan, 1751) and the croaking of which he describes, are without any hesitation Tree Frogs.

Blekinge. Sölvesborg, GOSSELMAN 1863. — Mörrum s:n, Björkenäs, several observers.

Kalmar län. Mönsterås s:n, Långnäs, S.Ed.

Gotland. Muskemyr, KAURI 1951.

The distribution of this species is till now chiefly concentrated to Scania. The occurrences in N W Scania may be destroyed nowadays and it may have become extinct there. The find from Jonstorp was made by the well-known ornithologist FRITHIOF PERSSON, who about 1905, when felling a small tree, found two specimens clinging to the tree twigs. They were said to be an inch long and green. It seems therefore impossible that this is a mistake. Prof. E. LINDQVIST and kons. S. LINDER have two reports of *Hyla* from Hälsingborg; the former found it in 1918 in a *Rubus scanicus*-thicket at Allerum, the latter in 1928 in the Jordbo valley, Hälsingborg.

As the species is rare and not easily observed, it may have a somewhat wider distribution than indicated above. Thus there are rumours of occurrences, sometimes, no doubt, well founded, from e.g. the eastern part of Blekinge. As no actually trained zoologists have seen them there, as the reports are sporadic, and as no specimens are preserved from these areas, I have indicated such records

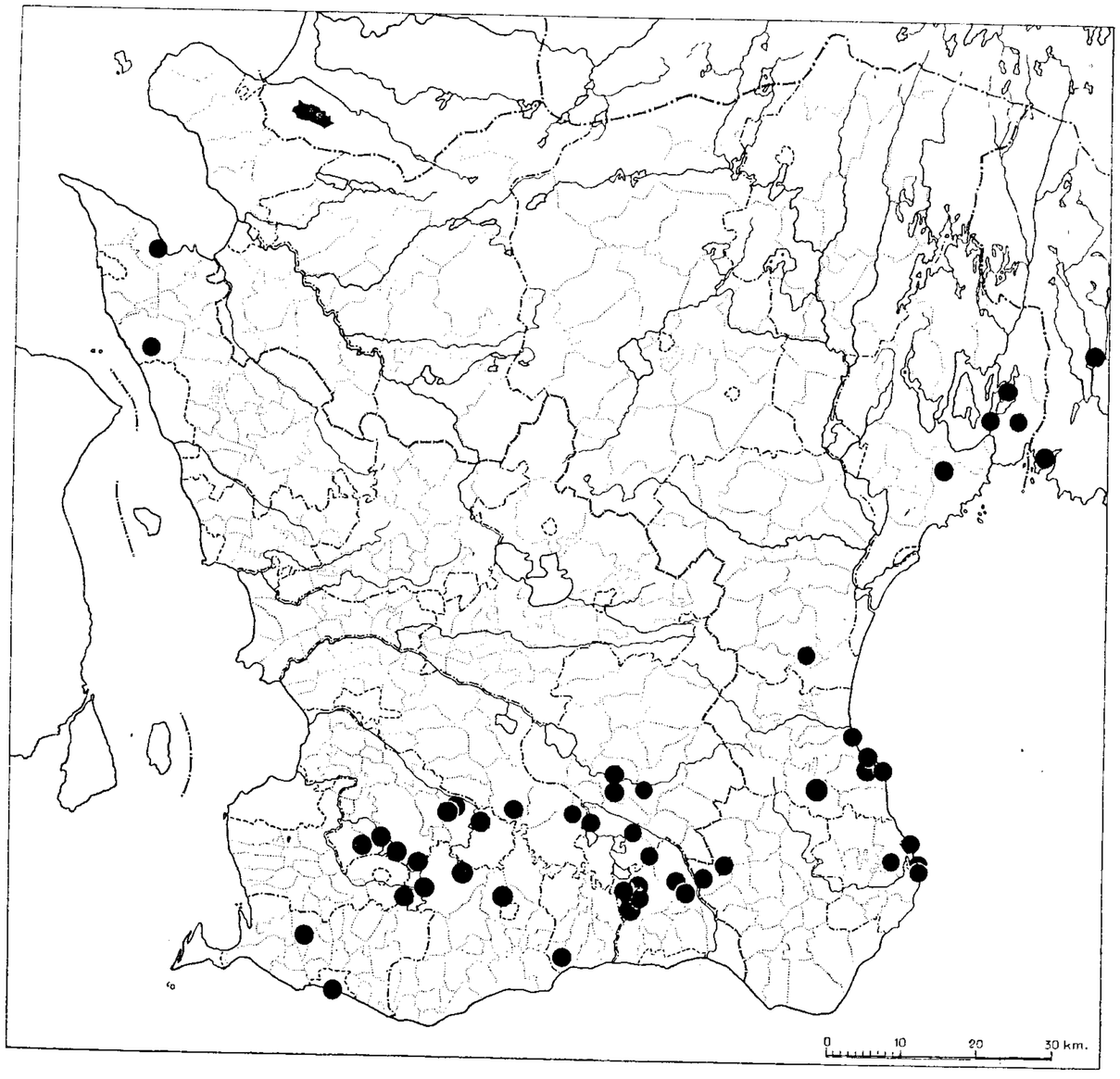


FIG. 19. Distribution in Scania of *Hyla arborea*.

by a ring on the map. Schoolboys in Karlskrona, however, say that they have seen small green tree frogs and the same information was given to me by a man owning an estate at Torhamn, E Blekinge. SVEN NILSSON (1842) gives a statement that Dr. WITT once saw tree frogs in "Calmare län" (loc. cit., p. 75) and HEINTZE (1904) says that at that time he had heard rumours of tree-frogs occurring on W Öland. Schoolboys in Kalmar have recently reported tree frogs from the vicinity of Kalmar. Most recently (1956), Mrs. S. EDIN has reported tree frogs from Mönsterås, Långnäs, N of Kalmar. There may therefore be a possibility of discovering it in the SE-most corner of Sweden.

KAURI in 1951 could report the finding of a tree frog larva from S Gotland, Muske mire. It is true that it had been earlier reported from this island by

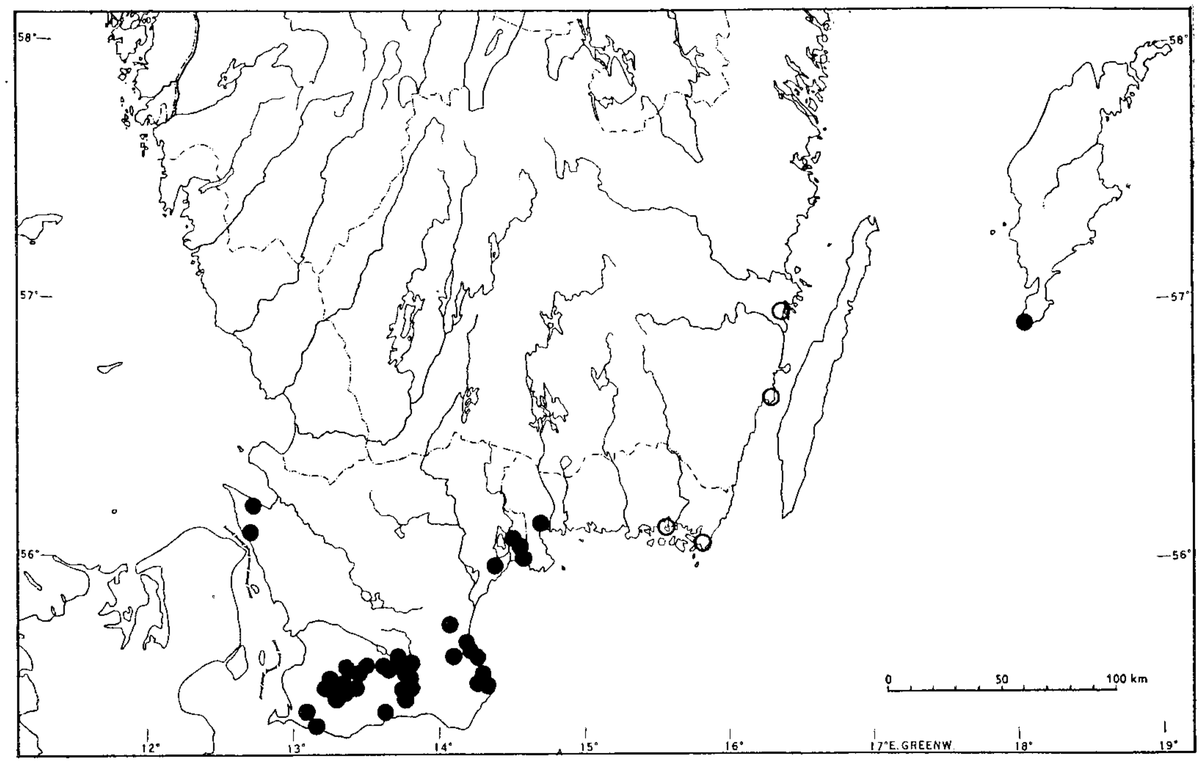


FIG. 20. Distribution in southern Sweden of *Hyla arborea*. Open circles = dubious localities.

HASSELGREN (1910) from a second-hand story, but as this author also reported a number of forms never seen on the islands by other scientists, the record seemed unreliable. Moreover, he made a vague reference to its occurrence on S Gotland. I wrote to him and got the information that as far as he remembered 30 years afterwards it was found in the vicinity of Sudret, i.e. not far from the place where KAURI found it later.

Its vertical distribution extends from 0 to 50, rarely to about 100 m above sea level (St. Olof, Scania).

The distribution of the northern race of the tree frog (*Hyla arborea arborea* LINNAEUS) reaches eastwards at least to the Caspian, westwards to the Channel, southwards to central France, Italy, the Balkans and parts of Asia minor. In Denmark it is found northwards to central Jutland where the limit lies at about Aarhus 56°15′ N (PFAFF 1943). On the east side of the Baltic the northern border seems to be in Lithuania or perhaps in Latvia (about 56° N, perhaps to 56°15′ N).

Mrs. KJELLBERG, in 1951, gave the first and detailed description of the development of this species in Sweden. She took her material from E Scania and studied simultaneously the development in pools of natural occurrence and in outdoor aquaria in Lund. The development was found to run rather synchronously, the pools perhaps being a little ahead because of strong cooling off of the aquarium water during the night. Eggs seem to have been deposited about 1st May or later.

They hatched in the ponds about the 17th May (length of larvae 7.5 mm,

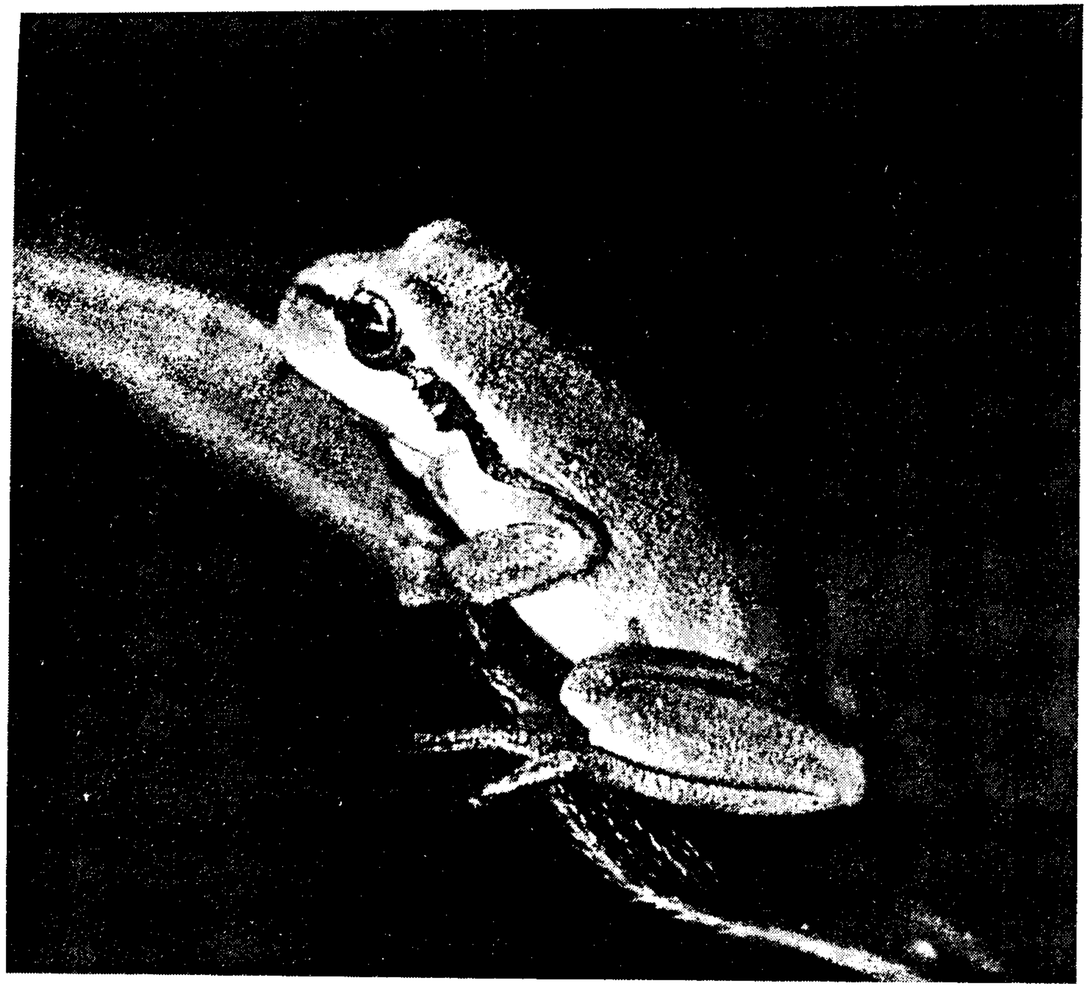


FIG. 21. Young Tree Frog. Photo by D. SEGERFELDT.

body 3 mm), in aquaria 23rd May (length 6.4 mm, body 2.8 mm). On the 19th June the pond tadpoles measured ±17.5 mm and had traces of posterior legs. By the 5th July the average length was 32.5 mm (body 12.6 and posterior legs 2.1 mm). The maximum length of the tail occurred when the posterior legs began to appear and was then ±64 % of the total length. The maximum length of the larvae reached 41–47 mm, as measured from specimens in our collections. Mrs. KJELLBERG found on a visit to the pools on the 26th July that, together with specimens still having only 2 legs, there were also 4-legged tadpoles and even some newly metamorphosed young jumping in the grass. After attaining the 4-legged stage the metamorphosis was completed in only 4 days. On the 10th August there was only one larva left in the pools investigated. Mrs. KJELLBERG concludes consequently that the development lasts about 3 months, that is, roughly about the same time as in central Europe. It is to be remembered, though, that the summer of 1950 was an abnormally warm one with high averages especially in May and June.

FIG. 22. Breeding habitat of Tree Frog. Pool at Kivik in Scania. Photo by D. SEGERFELDT.

Newly transformed tree frogs in our museum measure 14–16 mm; one specimen, evidently of the year's brood, taken in E Scania on 14th September 1948, measured 21 mm. On the same occasion, about 15 more tree frogs were observed. They measured 30–35 mm, and probably emanated from the brood of 1947. The largest specimens seen, then or ever, measured 40–41 mm.

Mrs. KJELLBERG, in the paper quoted, also makes some remarks concerning colouring and motion (tadpoles generally sit still in the vegetation, when disturbed swim much more rapidly than other amphibian larvae).

Bufo bufo bufo (LINNAEUS). **Common Toad. Padda**

The common toad has a remarkably wide general distribution. With the exception of Ireland, Corsica, Sardinia and the Balearic Islands it is found everywhere in Europe except in the northernmost latitudes. Moreover, it appears in N Africa and eastwards extends its occurrence to China and Japan.

In Sweden it has a general distribution through the whole country up to 66° N, the northernmost place reported for it being in the valley of Torne älv, a little north of the arctic circle (see map). It has even been found on Gotska Sandön, though there are no pools where it could deposit its eggs. Evidently

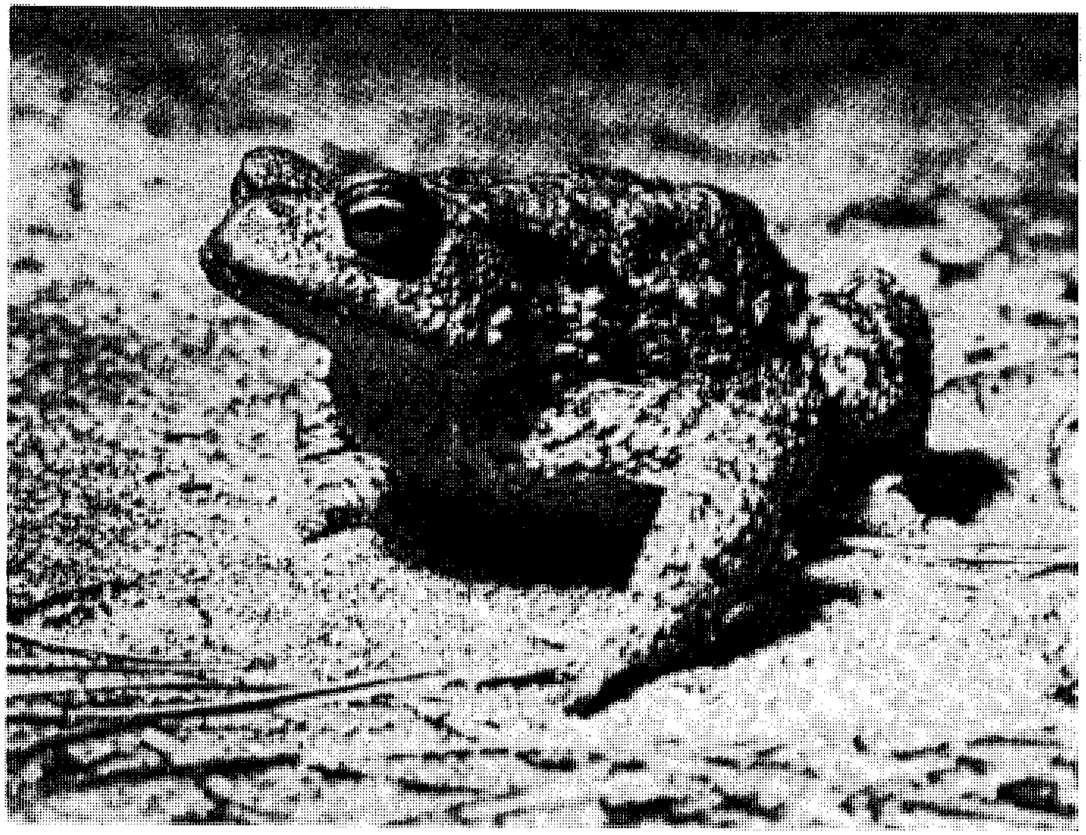


FIG. 23. Common Toad. Photo by D. SEGERFELDT.

in such a case it has either been introduced with hay or has arrived there by wind-drift over the sea. LÖNNBERG 1925 (p. 244) has investigated the salt tolerance of the common toad and found that it easily endures 10 ‰ for 24 hours. EKMAN (1929, p. 60) thought that it was lacking on Öland. However, LINNAEUS reported it already from his Öland journey (1741) from the N. part of the island (near Grankullaviken, 18th June). Peculiarly enough there were no new records before the 1930's. In fact, however, *Bufo bufo* is fairly common on the island. It occurs in Sweden from sea level to an altitude of about 1000 m (Tärna). (Fig. 25, 26.)

The colour is generally uniformly dark brownish, rarely bright brownish or even yellowish with darker spots; in some cases it is almost black dorsally (especially in the north and on Öland). The young are often reddish especially on the parotis glands. The difference in size between males and females is remarkable. While the fullgrown males are generally 6–7 cm (maximum in our collection being 78 mm), the females will become very large, up to 10–11 cm; one specimen from Kalmar län measured 10.8 cm and one even 12 cm from N Öland. (GISLÉN 1935 A, p. 4, 1954, p. 18.)

The number of males is often much larger than that of the females. Therefore at spawning several males may copulate simultaneously with one female. CURRY-LINDAHL (1946 A) reports having seen 5 males copulating with one female.

TABLE 22. Growth of *Bufo bufo* in southern Sweden.

Date	Year	Locality	Size in mm	Note
18/6	1950	Tiarps parish Fårdala Västergötland	13.5	
28/6	1948	N Wamlingbo Gotland	10–10.5	
30/6	1948	Morlanda Bohuslän	17	
5/7	1950	Skärpinge Blekinge	11.5	(2 spp.)
10/7	1948	Grundsjön Blekinge	11–12	
6/8	1950	Skärpinge Blekinge	17	
15/8	1950	Göholm Blekinge	27	
24/8	1944	Billingen Västergötland	9–13	Shaded pool in mountain
23/8	1949	Fjärås Halland	21.5	
25/8	1952	Gussemåla Småland	20.5	
25/8	1952	Bäckebo Småland	16	
26/8	1947	Färsksjön Blekinge	24.5	
26/8	1948	Emsfors Kalmar	16.5–22	
27/8	1950	Alvastra Östergötland	26	
28/8	1148	Kristdala Kalmar	23	
29/8	1949	Vickleby Öland	23.5	
30/8	1948	Byerum Öland	19	
30/8	1947	Strömserum Kalmar	20–29.5	
31/8	1950	Borghamn Östergötland	25.5	
30/8	1952	Stickelskär Östergötland	20–21	(3 spp.)
3/9	1951	S Sandsjö Småland	21	
7/9	1950	Karlshamn Blekinge	19.5–29.5	
10/9	1946	Hanaskog Skåne	18.5–25	
13/9	1952	Röstånga Skåne	18	
17/9	1947	Bosjökloster Skåne	32	
19/9	1946	Thorslunda Öland	29	
20/9	1946	Resmo Öland	29	
20/9	1946	Ottenby Öland	20	
29/9	1957	Lund Skåne	33	
2/10	1951	Lund Skåne	24	
6/10	1951	Falsterbo Skåne	24	
14/10	1942	Munkarps parish Skåne	20.5	
17/6	1943	Yddingen Skåne	30	
18/6	1948	Visby Gotland	42	
15/8	1941	V Rödeby Blekinge	42	
11/9	1950	Lund Skåne	35	
17/9	1947	Bosjökloster Skåne	32	
19/9	1946	Gladvattnet Öland	37	
31/9	1949	Brantevik Skåne	43	
10/11	1947	Klöva Hallar Skåne	39	

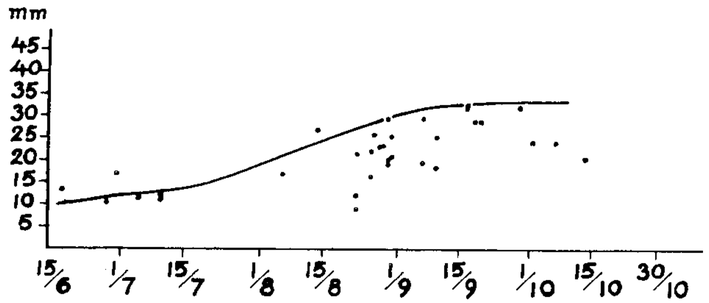


FIG. 24. Growth rate of Common Toad in the 1st year.

I found (1937, p. 150) (evening 30th April 1937 in a lake near Stockholm) a big ball rolling round in the water. In spite of several male toads falling off the ball, when I drew it in to the shore with a bent reed, 9 remained clustered round a giant female and 5–6 more had fallen off during my attempts to get hold of them.

In S. Sweden the toad generally spawns about the middle of April. In exceptionally warm springs we found roe already on the 11th April (1953). CURRY-LINDAHL (1946 A) reports that in the vicinity of Stockholm the spawning time begins between the 22nd and 28th April (1946, p. 4). The maximum size of larvae in our collection is 35 mm (Often, though, they do not grow to more than 30 mm. These are two-legged specimens, leg-length ±6 mm). The metamorphosis in S. Sweden is generally completed at the earliest about 20th June.

In S. Sweden the recently metamorphosed toads are about 10.0–13.0 mm long. On the 25th August they have reached a size of about 20.0 mm, in some cases even more.* And in October they are usually 25.0–33.0 mm. (Fig. 24.) The following year they grow to a length of about 39.0–43.0 mm. During later years the variation will be too large to make sure judgment possible. (Table 22.)

When there is a very cool and shaded position the development may be considerably delayed (cf. 24/8 Billingen, where hundreds of young toads varied between 9 and 13 mm). On the other hand, in sunny localities the development may have proceeded more quickly (cf. e.g. Tierp, Morlanda and Göholm). The growth of young specimens in the northern parts of Sweden may be delayed, as, for instance, 7th August 1949 those from Resele fäbodar Ångermanland measured 14 mm. Young specimens from Kristinehamn 16/6 1941, 45 mm, and 23/9 1945, 43 mm, are probably from the 3rd year.

Specimens from Scania may sometimes have parasitic fly larvae in their nostrils, *Lucilia bufonivora* (cf. LÖWEGREN 1939, p. 10 ff. who also found the same parasite in *Bufo calamita*. LUNDBECK 1927, p. 145, has stated that it occurs exceptionally in Danish specimens of *Rana temporaria*).

* From the same year and locality Skärpinge, Blekinge, the specimens 5/7 measured 11.5 mm and 6/8 17 mm.

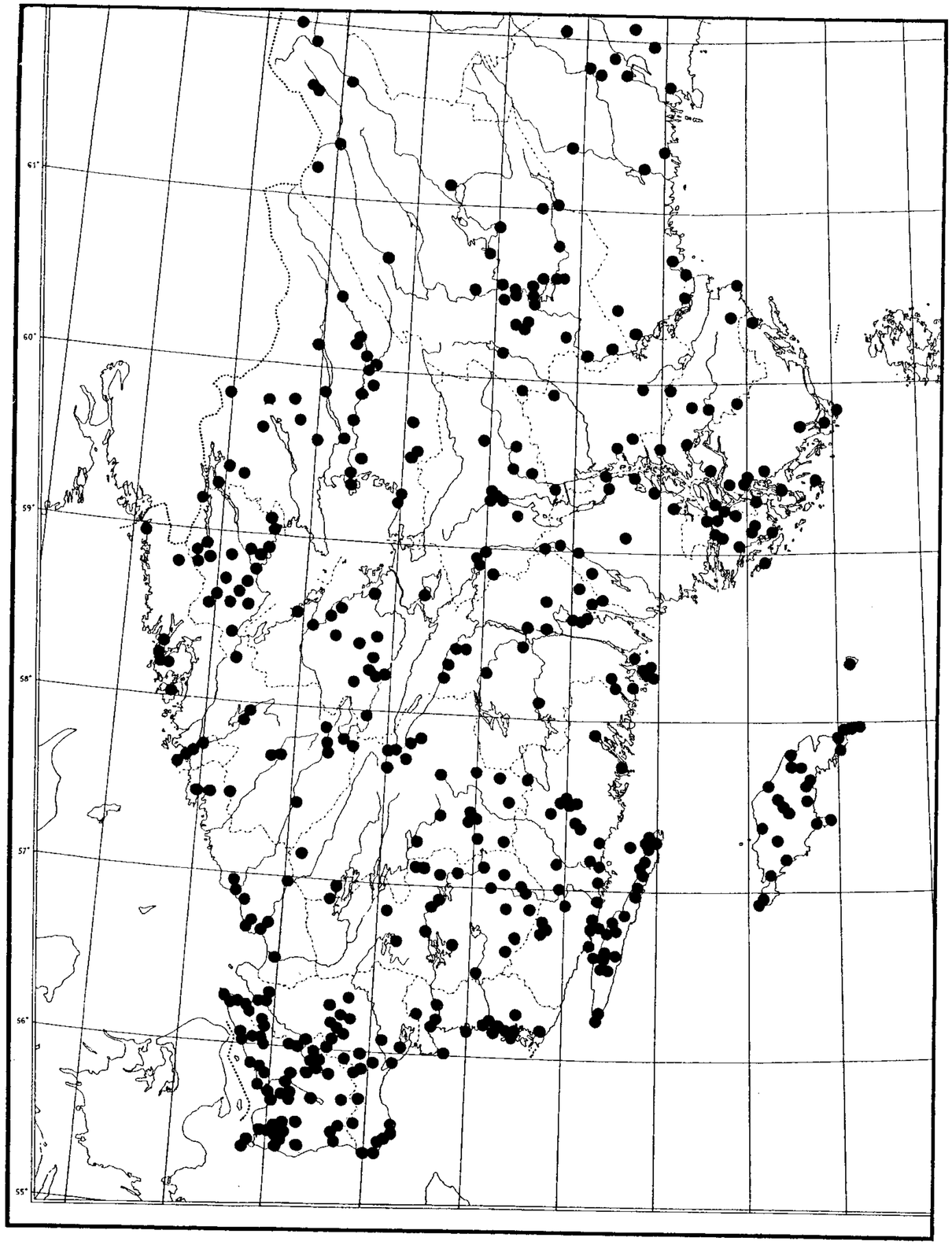
OCCURRENCE:

Skåne. Falsterbo, L.Z.M., B.O.L. — Skanör, M.M., H.a.R., CURRY-LINDAHL 1946. — Trelleborg, K.D. — Eskilstorp meadows, A.K. — Hököpinge, M.M. — Steglarp, SÖDERBERG 1908. — Bröddarp, A.K. — Östra Grevie, Exc. — Fru Alstad, P.H.-A. — Börringesjön, SÖDERBERG 1908. — Jordberga, SÖDERBERG 1908. — Rögla, P.H.-A. — Ystad, P.H.-A. — Kåseberga, T.G. — Löderup, near Sandhammaren, H.L. — Sandhammaren, A.D., Y.M. — Skabersjö, L.Z.M., SÖDERBERG 1908, H.a.R. — Torup, P.H.-A. — Svedala, O.L. — Yddingen, L.Z.M., H.a.R., K.G.W., P.H.-A. — Hyby s:n: Nyvång; Holmeja, H.a.R. — Bara s:n, 1 km to the south of Bokskogen halt, U.S. — Häckeberga, Exc. — Snogeholmssjön, northern part, Exc. — Tomelilla, Y.L. — Borrby, Granliden, H.L. — Östra Hoby, near Kylsgård, H.L. — Bolshög, Stjärnegården, H.L. — Brantevik, L.Z.M., Exc. — Simrishamn, N.A.A., S.S. — Lomma, ÅSTRÖM 1859. — Bjärred, H.B-m. — Lund, Arendala, Y.L. — Lund, L.Z.M., T.G., P.H.-A. — Bjällerup, U.S. — Södra Sandby, K.A. — Krankesjön, T.G., P.H.-A., Y.L. — Silvåkra, M.M. — Vollsjö, A.L-m. — Kristinehov, P.H.-A. — Andrarum, Forsemölla, L.Z.M. — Barsebäckshamn, L.Z.M., H.B-m. — Landskrona, SUNDEVALL 1848, K.A. — Ven, NILSSON & THORSON 1950. — Saxtorp, GISLÉN 1935, T.G., S.S. — Dödsjöbro, Ålstorp, P.H.-A. — Örtofta, K.E. — Eslöv, P.H.-A. — Kungshult, L.Z.M., Exc., P.H.-A. — Bosjökloster L.Z.M., Exc., P.H.-A. — Almarkaröd, O.P. — Between Svensköp and Huaröd, L.Z.M. — Östra Sönnarslöv, H.L. — Munkarp s:n, Ormanäs, L.Z.M. — Höör, Långstorp, M.M. — Höör, M.M. — Linderöd, P.H.-A. — Östra Vram, Vramsån, P.H.-A. — Äsphult, Bosarpssjön, H.L. — Åhus, K.A. — Råå: the brick-yard, L.Z.M.; near the shore, T.G. — Hälsingborg, H.M. — Ekeby, 20 km N Landskrona, C.-E.H. — Böketofta stn., U.S. — Kågeröd, U.S. — Konga, L.Z.M. — Röstånga, L.Z.M., T.G. — Färingtofta, T.G. — Frostavallen, Dagstorpssjön, T.G. — Tjörnarp, H.B.-m. Sösdala, Lillsjödal, H.B-m. — N. Vram s:n, Båv, U.S. — Åstorp, Tingvalla, A.S., U.S. — Klöva hallar, L.Z.M. — Vankiva, Bokeberg, L.Z.M. — Stoby s:n, A.K. — Hanaskog, L.Z.M. Exc. — Ignaberga limestone quarry, A.D. — Välinge s:n: Rögle; Utvälinge, A.N-n. — Trolle Ljungby, Å.U. — Krapperup, H.a.R. — Lerhamn, Exc. — Mölle, Vattenmöllan, NILSSON 1954. — Brunnby s:n, Möllehässle, H.a.R. — Jonstorp s:n, Rekekroken, A.N-n. — Jonstorp, K.C.-L., Exc. — Ängelholm, Rönneå, N.T.-W. S.T-k. —Kullaberg, BEHRENS & MALMBERG 1950. — Rebbelberga, L.L.I. — Munka Ljungby, E.M. — Västersjön, E.M. — Hästveda, A.K., Broby, T.N. — Vittsjö, L.Z.M. — Osby, O.L.

Blekinge. Ryssberget, Grundsjön, L.Z.M. — Hanö, to the south of Ryttaren, L.Z.M.; Bönsäcken, L.Z.M. — Mörrum s:n; Björkenäs, L.Z.M., T.G.; Skärpinge, L.Z.M. — Asarum, L.Z.M. — Åkeholm, L.Z.M., G.W. — Bräkne-Hoby s:n, Spjutsö, L.Z.M. — Listerby s:n, Göholm, L.Z.M. — Listerby s:n, T.G. — Förkärla s:n, Tromtö, L.Z.M. — Ronneby s:n, Vieryd, T.G. — Ronneby area, WESTERLUND 1890, — Aspö s:n, Aspö mad, U.S. — Karlskrona, Hästö, A.L-m. — Karlskrona area, T.S. — Färsksjön, the outlet, L.Z.M., Exc. — Jämjö, L.Z.M., T.G. — To the south of Klakebäck, L.Z.M., T.G. — Jämshög s:n, R.J. — To the west of Rödeby, L.Z.M. — To the south of Rödeby, L.Z.M., T.G.

Halland. Laholm, Kattupssjön, L.Z.M. — Halmstad, B.O.L. — Enslöv, H.A. — Steninge, HANSTRÖM 1950, E.D-l. — Getinge s:n, A.K. — Heberg, Ringsjön, T.G. — 1 km to the east of Falkenberg, T.G. — Falkenberg, 3 km to the northwest, the brick-yard, T.G. — Lindhult, T.G. — Torup, E.D-l. — Fjärås, L.Z.M. — Kungsbacka, Forsbäck, G.N.M.

Småland except Kalmar län. Södra Sandsjö, Dångs kvarn, L.Z.M., Liatorp, T.G. — Väckelsång s:n, C.B.G. — Långasjö, on the western shore of Harebosjön, H.L. — Algutsboda s:n, Stekaremåla, L.Z.M. — Ryssby s:n, L.Z.M., C.B.G., I.G.E. — Skatelöv s:n, C.B.G. — Öja, Gemla, H.L. Växjö, Lunnaby, A.B-n. — Lenhovda, H.L. — Ekeberga,



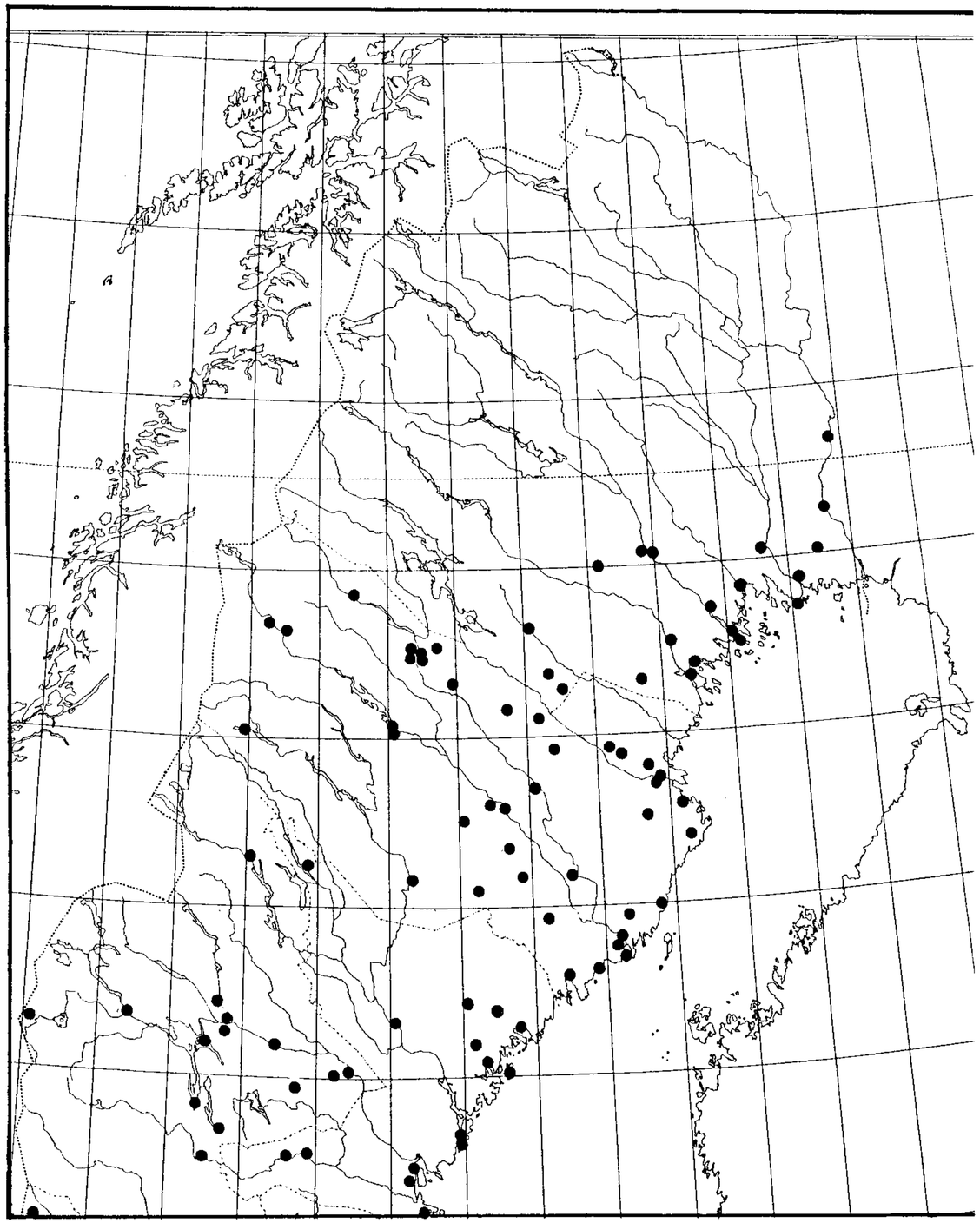


FIG. 25 and 26. Distribution in Sweden of *Bufo bufo*.

FIG. 26.

Ideskruv, H.L. — Älghult, H.L. — Hohultslätt, H.L. — Hälleberga, H.L. — Odensjö, Önnekvarn, T.G. — Södra Unnaryd, Möllekvarn, S.v.F. — Skeppshult, J.P. Aneboda, LANG 1928, L.L.I., M.M. — Ugglehult, L.L.I. — Berg, Vinninge, S.A-n. — Drev, Hultåsen, H.L. — Granhult s:n, Nottebäck, C.B.G. — Nottebäck, Bredhälla, H.L. — Hjälmseryd, O.C-n. — Korsberga s:n, Österkorsberga, C.B.G. — Näshult, M.M. — Sävsjö, H.E.P. — Myresjö s:n, C.B.G. — Vetlanda, Flishult, O.C-n. — 5 km SW Vetlanda, E.F. — Karlstorp s:n, CYRÉN 1910. — Månsarp, G.B. — Tenhult, Öggestorp, G.B. — Nässjö, U.S. — Eksjö, CYRÉN 1910. — Ingatorp s:n, Hjälten, G.N.M., H.L. — Jönköping, T.G. — Jönköping area, BJURULF 1944. — Järstorp, Lomsjön, H.L. — Svarttorp, Visjön, H.L. Strömsholm, J.B.

Kalmar län. Madesjö, SW Otteskruv, H.L. — Madesjö, L.Z.M., T.G. — Svalehult, Hökasjön, T.G. — Kalmar, WESTERLUND 1855. — Björnö, L.Z.M., Exc. — Skägganäs, A.D. — Ryssbylund, H.A.L. — Bäckebo, L.Z.M., T.G. — Allgunnen, GISLÉN 1935, T.G. — Strömserum, Exc. — Strömserum, Allsterån, L.Z.M. — Mönsterås, T.H. — Mönsterås area, Å.D. — Högsby s:n, Gussemåla, L.Z.M., T.G. — Em, T.G. — Emån at Emsfors, L.Z.M. — to the south of Skorpetorpssjön, T.G. — Oskarshamn, O.A. — Jungfrun, L.Z.M., N.R.M., BERNSTRÖM 1939, GISLÉN 1949, DU RIETZ & CURRY-LINDAHL 1950. — Humeln, T.G. — Kristdala, L.Z.M., 2 km to the northwest of Hagelsrum, J.B. — 2 km northeast Vem, J.B., — 2 km to the southwest of Tuna church, J.B. — Tuna s:n, Flohult; Höckhult, J.B. — Tuna s:n, Bredshult, T.G. — Hässleby s:n, Å.D. — Västervik, L.Z.M., Å.H. — Överum, M.M.

Öland. Ottenby bird-watching station, C.E. — Ottenbylund, L.Z.M. — Ås, on the "alvar", L.Z.M. — Resmo 'alvar', G.N.M. — Möckle mire, T.G. — Vickleby, L.Z.M. — Vickleby s:n, Beijershamn, EDELSTAM 1944, C.E. — Gårdby, N.B. — Torslunda, L.Z.M. — Stora Rör, K.A. — Gladvattnet, L.Z.M. — Halltorpshage, C.E., D.C. — Räpplinge s:n, Borga hage, JOHANSSON 1955. — Ramsätra, L.Z.M. — Föra s:n, Marsjöträsk, C.E. — 4 km to the north of Föra village, C.E. — Knisa mire, L.Z.M. — Persnäs, G.N.M. — Persnäs s:n, Steninge, C.E. — Horn, G.N.M. — Hornsjön, D.C. — Sandvik, Byerum, L.Z.M., K.A. — Böda crown forest, T.G. — 5 km to the northwest of Böda, L.Z.M. — Böda s:n, Enerum, S.H. — Böda s:n, Byxelkrok, L.Z.M., L.H.

Gotland. Muske mire, G.N.M. — Vamlingbo, L.Z.M., H.K. — Burgsvik, K.C.-L. — Fidenäs, K.C.-L. — Ronehamn, Halor, N.N. — Lojsta, Slottet, L.Z.M. — Klintehamn, G.N.M. — Torsburgen, G.N.M., L.Z.M. — Gammelgarn, H.B-m. — Östergarns holme, G.N.M. — Roma, Möllebos, N.N. — Between Sjonhem and Viklau, H.L. — Between Norrlanda and Gothem, H.L. — Follingbo s:n, Skrubbs, N.N. — Vallstena s:n: Lina mire, N.N.; Norrgårda, G.N.M. — Visby, Rosendal mire, D.C., K.C.-L. — Visby, L.Z.M. — To the north of Visby, C.A.C. — Tingstäde mire, southern part, N.N. — Martebo mire, N.N. — Stenkyrka s:n, Sudergårda, U.S. — Bunge s:n, Fårösund Södra gattet, N.N. — Fårö, K.C.-L. — Fårö, Norra Gattet, the pilot station, N.N. — Fårö, Norrsunda mire, D.C. — Fårö, Eketräsk, N.N. — Fårö, Sudersand, L.Z.M. — Fårö, Between Holmudden and Skärsände, L.Z.M. — Gotska Sandön, G.N.M., N.R.M.

Göteborg. Påvelund, STÅLBERG 1932. — Långedrag, Käringberget, H.B-m. — Arendal, A.R. — Nya Varvet, H.B-m. — Alelyckan, Näckrosdammen, L.Z.M. — Göteborg, G.N.M.

Bohuslän. Tjörn, EKSTRÖM 1850. — Orust, Torebo, SUNDEVALL 1849. — Morlanda, Malö, L.Z.M. — Morlanda s:n, Skaftölandet, SUNDEVALL 1849. — Kristineberg, Sotholmen, T.G. — Kristineberg, L.Z.M., N.R.M., H.B-m. — Gåsö, G.N.M., L.Z.M. — Alsbäck, G.N.M. — Naverstad, G.N.M. — Strömstad area, A.B.-S. — Skee, L.Z.M. — Långö, Salöfjord, G.N.M.

Västergötland. Tostared, K.C.-L. — Örsås s:n, Röstorp, L.Z.M. — Styrsö, G.N.M. — Jonsered, G.N.M. — Borås, C.B. — Marbäck s:n, L.Z.M. — Ulricehamn, L.Z.M. — Ulricehamn area, L.Z.M. — Vist s:n, L.Z.M. — Strängsered Tohared, C.B., H.L. —

Gullered, two localities, H.L. — Dalum s:n, L.Z.M. — Sandhem s:n to the west of Huvared, H.L. — Viared area, HALL 1942. — Mjörn, Bergsjödal, G.N.M. — Alingsås, Å.H-L. — Tidaholm, Helliden, H.L. — Gärdhem s:n, Velanda, G.N.M. — Östra Gerum s:n, 1 km to the northwest of the church, U.S. — Dimbo s:n, Stora Höga, H.L., U.S. — Dala, to the east of Alebäcken, H.L. — Tiarp s:n, Fårdala, L.Z.M., U.S. — Skara, Sparresäter, SUNDEWALL 1849. — Istrum, E.D-l. — Skövde area, C.B.G. — Billingen, Bjersjö, L.Z.M. — Billingen, K.C.-L. — Skalunda s:n, Framnäs, L.Z.M. — Lidköping, Eolsberg, A.D. — Lidköping, N.G.K. — Kinnekulle, Blomberg, P.O.S. — Kinnekulle, Gössäter, U.S. — Kinnekulle, KARVIK 1953, G.N.M. — Undenäs s:n, Lofalla, H.L. — Mariestad, J.F.

Östergötland. Tjärstad, S.S. — Ödeshög, H.L. — Valdemarsvik, C.M. — Gryt s:n, Harstena, L.Z.M., T.G. — Gryt s:n, Gräsmarö, T.G., Gryt s:n, C.M. — Ringarum s:n, Gusum, J.B. — S:t Anna s:n, Stora Andskär, T.G., S:t Anna s:n, Stickelskär, L.Z.M., T.G. — S:t Anna s:n, Yxnö, U.S. — Kärna, Gärstad, H.L. — Grönlund, K.E-n. — Alvastra, L.Z.M. — Omberg, Stocklycke, T.G. — Borghamn, L.Z.M. — Källstad s:n, Hånger, T.G. — Stjärnorp s:n, K.E-n. — Vånga s:n, Gettorp, H.L. — Norrköping, Eksund, L.Z.M., H.B. — Norrköping, Lindö, H.B. — Norrköping, K.E., H.B. — Tylöskogen, ROSENBERG 1949, K.C.-L. — Finspång, SUNDEVALL 1846 and 1848. — Kolmården, Store mosse, H.B. — Simonstorp, Fläten, H.B.

Dalsland. Frändefors, N.-G.K. — Färgelanda, N.-G.K. — Sundals-Ryr, N.-G.K. — Högsäter, N.-G.K. — Kroppefjäll, between Högsäter and Sundals-Ryr, L.Z.M. — Brålanda, N.-G.K. — Ör, N.-G.K. — Skållerud, N.-G.K. — Järbo, N.-G.K. — Gesäter, Töftedalsån, L.Z.M. — Köpmannebro, G.N.M. — Ånimskog, N.-G.K. — Tydje, Västanå, N.-G.K. — Ed, on the southern point of Skottsjön, P.O.S. — Ed, N.-G.K. — Steneby, N.-G.K. — Rölanda, N.-G.K. — Tisselskog, K.C.-L., C.M., N.-G.K. — Åmål, K.C.-L., R.E. — Mo, N.-G.K. — Nössemark, Dalen, K.C.-L., N.-G.K.

Värmland. Blomskog s:n, Gyltenäs, L.Z.M. — Sillerud, Ölmheden, H.L. — Silbodal, Strömsäter, H.L. — Hammarön, E.D-l. — Karlstad, E.D-l. — Alster s:n, C.B.G. — Vänern, Fallskären, L.Z.M., G.S. — Kristinehamn area, E.W. — Lundsberg, E.W-n. — Storfors, K.-H.F. — Lene, Forsnor, L.Z.M. — Stora Kil s:n, Norra Hyen, A.K. — Ottebol station, Ny, H.L. — Arvika, Gränsjön, A.E. — Brunskog s:n, C.B.G. — Övre Ulleryd, T.S. — Filipstad, E.D-l. — Mangskog s:n, Norra Salungen, C.M. — Skillingmark, Högsäter, H.L. — Sunne s:n, S.A.; Torsby, K.C.-L. — Munkfors, N.R.M. — Sunnemo, E.D-l. Uddeholm, E.D-l. — Hagfors, E.D-l., E.W. — Hagfors area, J.L. — Edebäck, E.D-l. Ekshärad s:n, Västanberg, Föskefors, L.Z.M., D.H. — Stöllet, L.Z.M.

Närke. Mariedamm, SUNDEVALL 1846 and 1848. — Lerbäck, Rönneshytta, H.W.W. — Lerbäck, H.W.W. — Lerbäck s:n, Tisaren, BÄCKGREN 1911. — Tisaren, Tisaretorp, G.Ö-t. — Kvismaren, K.C.-L. — Tysslingen, K.C.-L. — Örebro, Västra Mark, H.W.W. — Örebro, L.L.I. — Närkes Kil s:n, Frösvidal, L.L.I., SUNDEVALL 1846.

Södermanland. Kila s:n, Skiren, G.N.M. — Björkvik s:n, Virå, L.Z.M. — Marsjö, T.W. — Vingåker, T.W. — Katrineholm, T.W. Halla s:n, Ellestasjön, E.J. — Helgesta s:n, Sund, C.F. — Utö, S.E-n. — Hammersta, Sotholmen, T.G. — Grödinge s:n: Kagghamra; Wiad, H.a.R. — Södertälje, T.W. — Rönninge, N.B. — Jordbro, T.G. — Österhaninge, Handen, H.W.W. — Dalarö s:n, H.a.R. — Mariefred, U.Z.M. — Huddinge s:n, Balingsholm, CURRY-LINDAHL 1946 A, 1952, K.C.-L. — Salem s:n, A.A. — Arboga, Nytorp, H.W.W. — Arboga, K.-H.F. — Eskilstuna area, SJÖSTEDT 1920. — Torshälla s:n, Mälarbaden, J.B. — Helgarö, H.W.W. — Strängnäs, H.W.W.

Stockholm. Saltsjöbaden, CYRÉN 1929. — Drottningholm, H.B-m. — Sickla, N.R.M. — Bromma s:n, Rockstad mire; Kyrksjön, H.a.R. — Skeppsholmen, E.M. — Karlberg, N.R.M. — Lidingö, A.L-t. O.D. — Stocksund, N.R.M. — Djursholm, T.G. — Stockholm, N.R.M.

Västmanland. Frövi, A.D. — Fellingsbro, H.W.W. — Linde; Siggebohyttan; Hultasjön, H.W.W. — Västerås, Viksäng, O.H-g. — Västerås, G.D-l., O.H-g. — Västerås area, Walldén 1955, B-l.W. — Tortuna, Karlslund, H.W.W. — Västanfors, Flyten, L.L.I.

Uppland. Ekerö, I.H. — Ingarö, M.M. — Värmdö, Skuru, T.W.; Stafsnäs, K.C.-L. — Stockholm Skärgård, Bytta, N.R.M. — Stockholmsnäs s:n, Kungsängen stn., H.a.R. — Stockholmsnäs s:n, Tibbleviken, H.W.W. — Stockholmsnäs s:n, L.Z.M. — Sollentuna, T.W. — Järfälla, T.W. — Säbysjön, T.W. — Djursholm, Hagberg 1950. — Danderyd s:n, Ösbysjön, H.a.R. — Danderyd, K.-H.F. — Viggbyholm, T.W. — Österåker s:n; Lervik; Brevik; Valsjön; Norra Träsksjön; to the south of Träsksjön, H.a.R. — Möja, Långviksnäs, J.R. — To the east of Möja, N.R.M. — Gillöga, Curry-Lindahl 1955 A. — Enköping, Sundevall 1846 and 1848. — Hjälstaviken, H.K-g., K.C.-L., T.W. — Fiby forest, K.C.-L. — Länna, E.W-n. — Norrtälje, A.L-t. — Heby, T.G. — Uppsala, Tunaberg, U.S. — Uppsala, G.N.M., U.Z.M. — Lidö, K.-H.F. — Arholma, K.-H.F. — Järlåsa s:n, Ramsmossen, H.K-g. — Tämnaren, K.C.-L. — Singö s:n, K.C.-L. — Forsmark, S.F-s. — Lövsta works, S.F-s. — Älvkarleby s:n, 1 km to the north of Hyttön, U.S. — Hållnäs s:n, Fågelsundet, S.F-s.

Dalarna. Malingsbo, H-s.L., K.-H.F. — Ludvika, K.-H.F. — Avesta, A.K. — Avesta area, T.S. — By s:n, Horndal, B.W. — Hedemora, A.K. — Silvberg s:n, Sandvik, E.D.; Ulfshyttan, E.B. — Stora Tuna s:n: Noraå; Skräddarebacken, E.D.; Ornäs; Kalkberget; Rommehed; Dammsjön, E.D.; Duvnäs, S.F.; Repbäcken, A.K. — Floda s:n, Syrholm, T.T. — Gagnef s:n, Djurmo, S.E. — Falun, Klefbeck 1949, A.K., O.C-n. — Sundborn s:n: Karlsbyn, B.T.; Toxen, E.K. — Malung, I.G., K-E.J. — Leksand s:n, B.T. — Rättvik, K-E.J. — Svärdsjö s:n, Envik chapel, Klefbeck 1927. — Enviken, Våckelberget, E.D. — Lima s:n: Tandådalen, E.D. — Bingsjö, E-s.M. — Våmhus s:n, B.L.L. — Amungen, Sundevall 1846. — Transtrand s:n, Norrmundsvalla, E.K. — Särna s:n: near Fulufjäll, Ekman 1922; Njupåsen, Fulufjället, K.C.-L.; Mörkret; Mickelstemplet, J.E.D.; Särnabyn, Ekman 1922, E.K. — Särna, Klefbeck 1927. — Idre, Ekman 1922, Klefbeck 1925 and 1927. — Idre s:n: Floråsen, E.K.; Gröveldalen, Klefbeck 1927. — Storvätteshogna, Klefbeck 1927.

Jämtland. Rätansbyn, T.S. — Berg, Ekman 1922. — Bodsjö s:n, Kälen, Olsson 1896. — Dockyr stn., Myrhem, Olsson 1896. — Dockmyren, G.N.M. — Ragunda stn., Olsson 1896. — Håsjö, Olsson 1896. — Frösön, Ekman 1922. — Stugun s:n: Betlehems bodar, Olsson 1896; Näfverede, Olsson 1882. — Kyrkås, Mosjön, Olsson 1896. — Storlien, N.A.K. — Järpen, Olsson 1896. — Lit, Olsson 1896. — Husås, Olsson 1896. — Ströms s:n, Torsfjärden, L.Z.M., V.O.

Gästrikland. Österfärnebo, Karisjön, K.C.-L. — Torsåker, Kratte forge, L.Z.M. — Valbo s:n, Harnäs, L.Z.M., C.O. — Gävle area, G.K. — Hille, K.F. — Between Gävle and Bönan, Olsson 1882.

Hälsingland. Svabensverk, Sundevall 1846. — Bergvik, through H.A.L. Söderhamn. — Ovanåker, K.E.J. — Norrala, N.R.M. — Ljusdal, Bodin och Witt-Strömer 1951, L.S. — Hybo, L.Z.M. — Delsbo s:n: Stömne, L.Z.M., C.-A.H.; Överälve, K.-H.F. — Hudiksvall, K.E.J. — Älgered s:n, Andersfors, Sundevall 1849. — Ramsjö s:n, Hennan, K.C.-L. — Hassela s:n, K.C.-L.

Medelpad. Njurunda s:n, Skatan fishing hamlet, S.B-t. — Sundsvall, S.B-t. — Skön, K.E.-J. — Haverö s:n, Allegård 1953. — Ånge, L.Z.M., E.M-m. Borgsjö, Sillre, G.G.

Ångermanland. Härnön, S.T-e. — Nora, 10 km to the southeast of the church, S.E. — Ulvöarna, through H.A.L. Umeå, L.S. — Vibyggerå, Skuluberget, S.A-n. — Stora Degersjön, S.A-n. — Örnsköldsvik, Bartler 1953 A, O.H. — Örnsköldsvik, Lungångersmon, L.Z.M., E.B-r. — Resele cattle-shed L.Z.M. — Mo, O.H. — Anundsjö, O.H. — Junsele, Lundström 1953. — Nordmaling, O.H. — Nordmaling, Lögdeå, K.C.-L. — Bjurholm, through H.A.L. Umeå. — Tåsjö s:n, U.Z.M., Ekman 1922.

Västerbotten. Hörnefors, O.H. — Obbola, through H.A.L. Umeå, O.H. — Stöcksjö, through H.A.L. Umeå. — Umeå, Västerhiske, U.S. — Umeå, O.H. — Bygdeå, T.T-r. — Degerfors, O.H. — Degerfors; Kulbäcksliden; Stora Renträsk, K.-H.F. — Bäcksjön, O.H. — Lövånger, Nolbyn, O.H. — Lövånger, Holm 1940, O.H. — Burträsk, T.T-r. — Bureå, T.T-r. — Skellefte s:n, Flocktjärn, Cedergren 1954. — Skellefteå, L.Z.M., T.T-r. — Skellefte s:n, Cedergren 1954. — Boliden, T.L-d. — Norsjö, Bastutjärn, O.H. — Kågedalen, O.H. — Jörn, Klockträsk, T.T-r.

Norrbotten. Önusberg, S.A-r. — Piteå, Hollander 1923. — Norrfjärden, Hollander 1923. — 5 km to the west of Luleå, Trollberget, L.Z.M., E.H. — Between Luleå and Kalla. — Trolltjärn, K.F. — Luleå, Hollander 1923, Klefbeck 1927. — Luleå, Sandön, N.R.M., Lönnberg 1920, Älvsby, Hollander 1923, H.K-g. — Boden, Klefbeck 1927. — Vittjärv, Y.M. — Råneå, Hollander 1923. — Kalix, Storön, S.S. — Morjärv, K.F. — Lappträsk, Y.M. — 15 km to the north of Lappträsk, Y.M. — Sandträsk, Svane huvud, Y.M. — Edefors, Hollander 1923. — Edefors, Spikberg, Ekman 1922. — Nederkalix, E.Y. — Luppio, Y.M., E.H. — Övertorneå, 18 km to the westnorthwest of Poustijoki, Lönnquist 1950. — Makkarajärvi, 5 km to the west of Turtola, Lönnquist 1950.

Lappland. Fredrika, T.L-d. — Åsele, T.L-d. — Örträsk s:n, Långsele, G.H.v.P., O.H. — Örträsk, O.H. — Lycksele s:n; Kroksjö, G.H.v.P., O.H.; Näsland, K.-H.F. — Lycksele, T.L-d., O.H. — Kultsjön, O.H. — Saxån, Stekejokk, near Kultsjön, Holm 1920. — Stensele, T.T-r. — Stensele, Skarfsjö area, O.H. — Storuman, T.L-d. — Malå s:n, Rakkejaur, C.M. — Malå, T.T-r. — Lappträsk, L.Z.M. — Between Aborträsk and Skellefte river, Seijaure, Bergengren 1929. — Sorsele s:n; Gargnäs; Stensund, Gaunitz 1949. — Sorsele s:n, Gaunitz 1927. T.L-d. — Sorsele church-town, Gallgottmyren, Gaunitz 1949, C.B.G. — Sorsele s:n; Maderträsk; Bure, Gaunitz 1949. — Arvidsjaur area, O.H. — Arvidsjaur s:n; Petikån, at the road Glommersträsk-Norsjö, W-d; Skogsträsket, to the NNE of Glommersträsk village, W-d. — Tärna s:n, Rivovardo, G.H.v.P. — Tärna, A.H. Kraddsele, C.B.G. — Between Sandsele and Kraddsele, Gaunitz 1949. — Storavan, K.G. — Laisälven, K.G. — Uddjaur, K.G. — Kuri stn., Kuorijaure, L.Z.M., H.K.

Bufo calamita (Laurenti). Natterjack. Stinkpadda

Occurrence:

Skåne. Falsterbo, L.Z.M., K.C.-L., B.O.L. — Ljunghusen, C.-E.H. — Between Falsterbo and Skanör, N.R.M. Skanör, N.R.M., Söderberg 1908, H.a.R. — Albäck (Trelleborg), Fotevik, S.M. — Östra Klagstorp, Söderberg 1908. — Vellinge, Shore meadows, N.N. — Hököpinge, M.M. — Östra Grevie, N.R.M., Söderberg 1908. — Ingelstad; Kåseberga, Söderberg 1908. — Valleberga; Löderup, Sahlin 1929. — Östra Hoby, N.R.M., Söderberg 1908. — Östra Nöbbelöv, Gislövshammar, H.L. — Vallby, Sahlin 1929. — Gladsax, Tobisborg, H.L. — Simris s:n, S.S. — Simrishamn, N.A.A., S.S. — Limhamn, L.Z.M., Lang 1926. — Malmö, Lang 1926. — Hyby, Sahlin 1929. — Häckeberga, I.A-l. — Lyngby; Genarp; Gödelöv, Sahlin 1929. — Esarp, Lang 1926. — Blentarp, Sahlin 1929. — Karups ängar, L.Z.M., Nordqvist & Rudebeck 1947. — Ilstorp, Sahlin 1929. — Tomelilla, Y.L. — Rörum, P.H.-A. — Lomma, Åström 1859, Lang 1926, Sahlin 1929. — Bjärred, L.Z.M., M.M. — Fjelie, Sahlin 1929. — Lund, L.Z.M. — Stora Råby, T.G. — Kyrkheddinge, Lang 1926. — Södra Sandby; Hällestad, Sahlin 1929. — Silvåkra, M.M., Sahlin 1929. — Krankesjön, H.B-m. — Revinge, Sahlin 1929. — Vombsjön, southern side, T.G. — Veberöd, Sahlin 1929. — Andrarum, Vitemölla, L.Z.M. — Barsebäckshamn, L.Z.M., H.B-m. — Barsebäck; Hofterup, Sahlin 1929. — Lundåkra, H.K. — Saxtorp, L.Z.M., Gislén 1935, Exc., T.G., S.S. — Kävlinge; Maglehem, Sahlin 1929. — Ven, T.N. — Hälsingborg, L.Z.M. — Raus, Sahlin 1929.

— Sorrödssjön; Åhus, L.Z.M. — Yngsjö, H.L., L.Z.M. — Åhus, SAHLIN 1929. — Rinkaby, SAHLIN 1929, P.H.-A. — Skepparslöv, East of the railway station, H.L. — Nymö, SAHLIN 1929. — Trolle-Ljungby, WALLENGREN 1866, SAHLIN 1929. — Fjälkinge, SAHLIN 1929. — Gualöv, SAHLIN 1929, P.H.-A. — Kiaby, SAHLIN 1929. — Ivetofta, L.Z.M., SAHLIN 1929. — Ivö, Flottö, L.Z.M. — Ivön, J.F.P. — Brunnby, SAHLIN 1929. — Jonstorp, Bläsinge, L.Z.M., A.N-n. — Jonstorp, Rekekroken, A.N-n. — Jonstorp, L.Z.M., F.P. — At the mouth of Vegeån, L.Z.M., A.N-n. — Between Rösjön and Västersjön, E.M.

Blekinge. Near the limit to Scania, GOSSELMAN 1863. — Gammalstorp, WESTERLUND 1890. — Norje, L.Z.M. — Mörrum s:n, Björkenäs, T.G. — Mörrum, WESTERLUND 1890. — Ronneby, north of Kallinge bruk, G.N.M., WESTERLUND 1890. — Karlskrona, GOSSELMAN 1863. — Kristianopel, G.N.M.

Halland. Trönninge, Laxvik, L.Z.M. — Trönninge, G.N.M. — Halmstad, HOLLGREN 1906. — Falkenberg, T.G. — Morups Tånge, L.Z.M., P.A., K.C.-L., P.O.S.

Göteborg. Donsö, G.N.M., L.-O.H.

Bohuslän. Rörö, G.N.M. — Marstrand, H.A.L. Örebro. — Marstrand, Koön, G.N.M. — Klädesholmen, G.N.M., MALM 1877. — Valla s:n, Myggenäs, G.N.M. — Tjörn, EKSTRÖM 1850. — Käringön, L.Z.M., HANSSON 1889, ASKLUND 1915. Hälleviksstrand, C.E., S.A. — Gåsö, G.N.M., MALM 1877. — Kristineberg, G.N.M., L.Z.M., — Skaftö, Fiskebäckskil, G.N.M., L.Z.M., U.Z.M., ERIKSSON 1913. Gullmarsfjorden, Flatholmen, L.Z.M. — Smögen, C.F., H.B-m. — Strömstad, Hällekind, K.G.N.

Bufo calamita is a west European species extending from Spain, France, and the British isles through central Europe. It has its eastern border in Poland and is found northwards along the eastern shores of the Baltic to Dagö, Estonia (KAURI 1946, fig. 1). It occurs all over Denmark. In Sweden its general tendency of preferring a mild climate is mirrored in its westerly distribution. In the east it has not been reported north of Kristianopel in Blekinge. EKMAN (1922 p. 130) reports a find of *B. calamita* from Småland, according to a specimen in the RM. This is a small specimen, 32 mm, Smål. 1843. However, the knobs on the underside of the foot show clearly that it is a *B. viridis*. *B. calamita* is fairly common in the S, central and W parts of Scania, becoming rare and restricted close to the very coast in Halland and Bohuslän. From the northernmost locality in the county last mentioned there is a record from Strömstad, where it was heard croaking on Midsummer Eve. As, however, the reporter, Dr. K. G. NYHOLM of Upsala, is a very reliable zoologist who very well knows the natterjack and its call from Kristineberg, Bohuslän, and as the common toad would not croak so late in the year, while the natterjack may be heard during wet and warm evenings almost the whole summer, I have this locality recorded, too. (Fig. 27.)

In Sweden *Bufo calamita* reaches its northern border in Scandinavia. Furthermore, as it is a W European form, one could presuppose that the winter temperatures might play a rôle in regulating its distribution.

The Scanian distribution as to altitude varies between 0–100 m (Andrarum) or 66 m (Rösjön). In all other Swedish counties where the natterjack occurs it is very strictly bound to the sea shore and the occurrence as to altitude seems to be restricted to between 0–20 to 30 m above sea level.

The colour of Swedish specimens is generally a rather dull darkish olivaceous

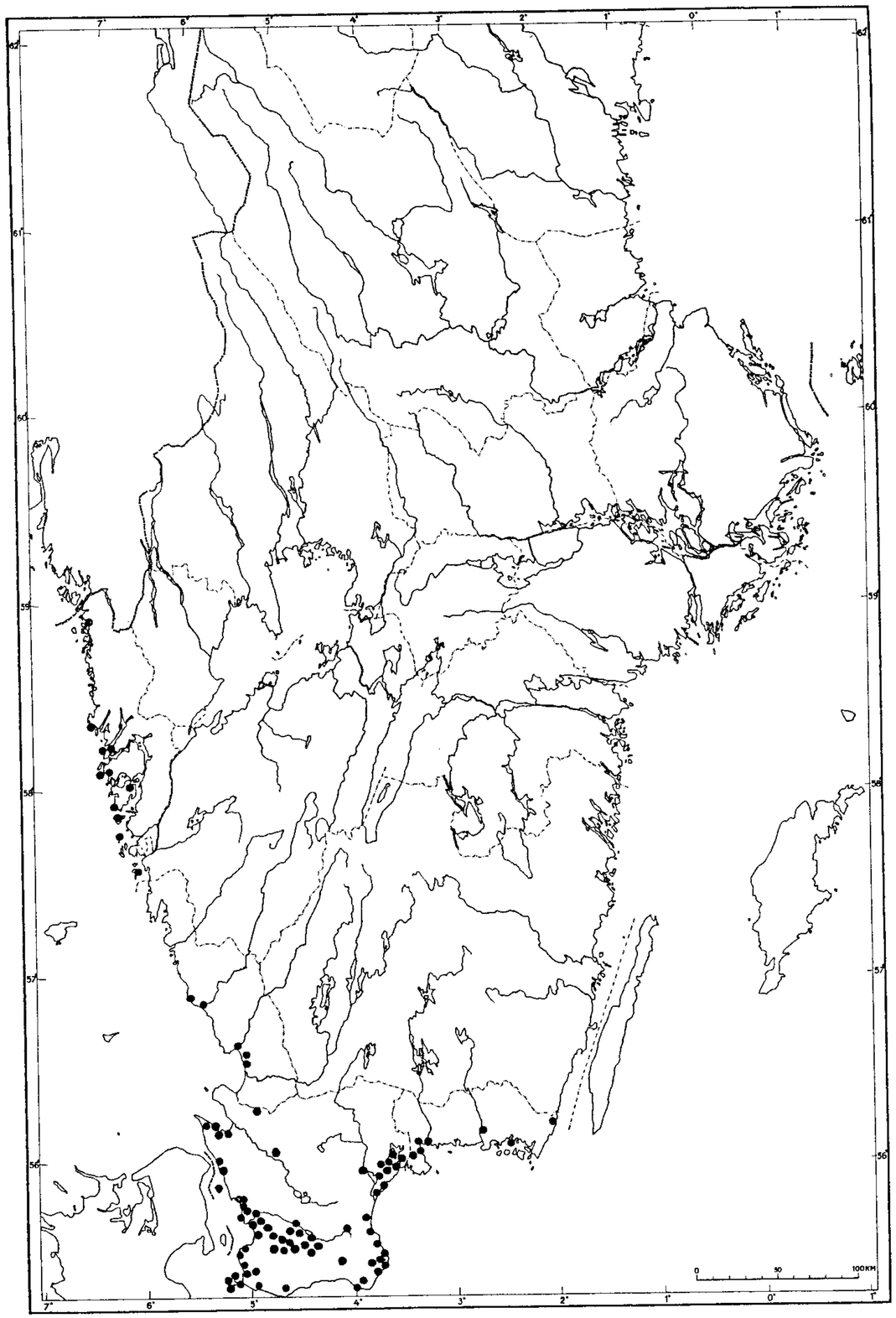


FIG. 27. Distribution in Sweden of *Bufo calamita*.

or grey with the yellow line dorsally and brownish or greenish markings. In Scania, especially the eastern part of it, the colour sometimes resembles that of the variegated toad, the specimens there being provided with greyish green specks on a brighter bottom. The yellow line, though, is always present and the paired knobs on the under-side of the fingers are always typical.

Spawning occurs in May. The institute possesses newly laid eggs from 21st May 1927 collected by SAHLIN. However, the first spawning generally occurs considerably earlier. In 1952 this occurred on the 3rd May in Scania (vide KAURI) and, judging from 12–15 mm larvae 1934 from Kristineberg, Bohuslän, the toad may spawn about the same time in Bohuslän. Still, in small rock pools in shallow water on the shore the brood may often be destroyed, as I observed a warm early summer when the pools dried up in June, leaving a thin film of dead larvae on the bottom. Likewise there may be deposition of roe later on in the summer. Thus we have larvae without hind legs from the end of July. The seashore in the Baltic and Öresund, with shallow brackish water in many places, gives possibilities for spawning. The spawning in brackish water is recorded by BOULENGER (1898), VOLSØE (1949) and SMITH (1951), but the degree of salinity has never been established.

In 1949 on 20th May the spawning of natterjack was observed in Öresund in the bay of Lundåkra in the vicinity of Landskrona by KAURI. The analysis of the water gave a salinity of 3.6 ‰ and pH = 6.7–6.8. (Fig. 31.)

From the 23rd July 1950 there are some larvae from Flatholmen, Bohuslän, with rather large hind legs, total length 22–23 mm (legs being 5–6 mm). Maximum size of the larva will be 28–29 mm according to KAURI's experiences from aquarium cultures. From Käringön Bohuslän we have a metamorphosed young 10 mm, 28th July 1948. From the 8th August 1948 there are from Norje (Blekinge) young toads varying from 14–17 mm. From the 13th September 1943 there is from Scania a specimen 18 mm and from the 10th September 1944 from the same county one sp. 21 mm, which may be regarded as the maximum size at the end of the first year.

The larval development of the species seems to take about 10–11 weeks. The young toads are about 1 cm (9–11 mm) when newly metamorphosed at the end of July. They seem to increase before the first hibernation to about 2 cm. One specimen, obtained on 26th July 1946 at Kristianopel, Blekinge, and measuring 25 mm, must have been in its 2nd year. According to SMITH (1954) the young natterjacks at the end of the second year measure in South England from 26 to 40 mm in length. "The average for 40 specimens caught on 20 September in one locality was 30 mm."

The maximum size of a specimen in our collections is 74 mm in length (a male).

The natterjack does not reach sexual maturity before the age of 4 years.

As metamorphosis generally sets in a long time before the cold autumn days, summer is quite long enough for securing the larval development. Therefore, the restricting factor as to distribution for this species in Sweden is not the summers, which do not endanger larval development, but the comparatively cold winters of the east which may be too severe especially to the metamorphosed specimens.

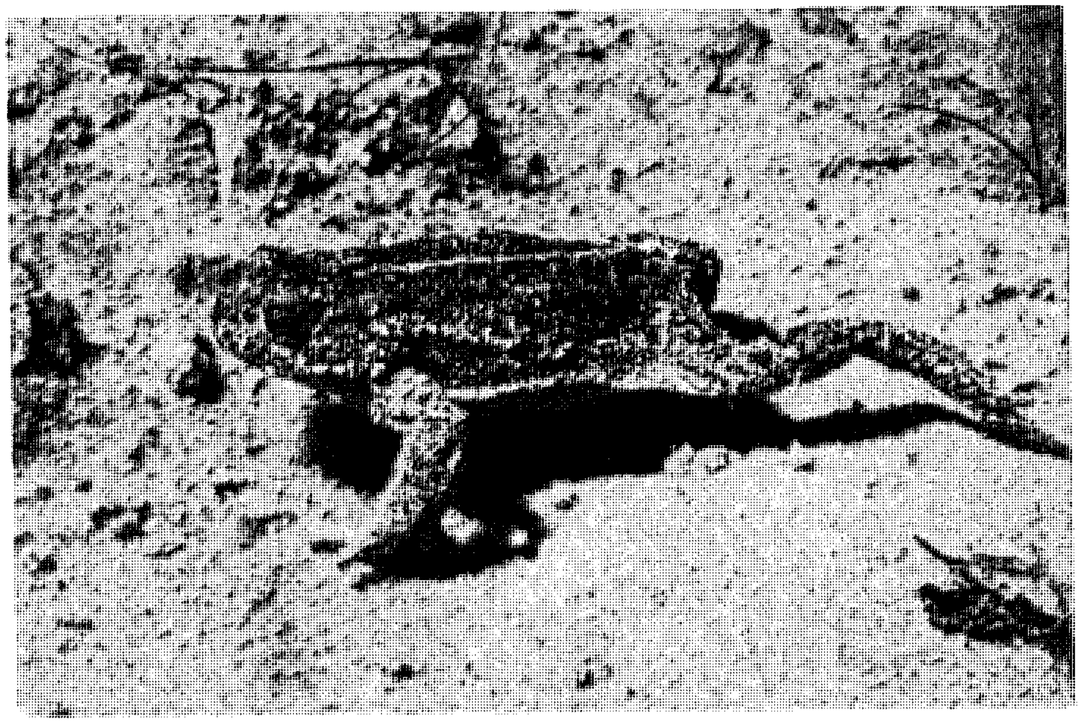


FIG. 28. Natterjack. Photo by D. SEGERFELDT.

Bufo viridis viridis (LAURENTI). **Variegated Toad. Grönfläckig padda**

OCCURRENCE:

Skåne. Hallands Väderö, VALLIN 1955. — Raus, SAHLIN 1929. — Glumslöv, SAHLIN 1929. — Ven, several places, NILSSON & THORSON 1950, A N-n, H.B-m, K.A., U.S. — Borstahusen, L.Z.M., U.Z.M., HANSTRÖM 1927. — Landskrona, HANSTRÖM 1927. — Saxtorp sea shore, L.Z.M., T.G., S.S. — Barsebäckshamn, L.Z.M., H.B-m. — Bjärred, H.B-m. — Lund L.Z.M., NILSSON 1842, T.G., KAURI. — Lomma, L.Z.M., M.M., ÅSTRÖM 1859. — TURESSON 1911, LANG 1926, SAHLIN 1929, N.N. — Alnarp, TURESSON 1911. — Staffanstorp, K.E. — Malmö, G.N.M., L.Z.M., M.M., TURESSON 1911, LANG 1926, A.N-n. — Limhamn, L.Z.M., TURESSON 1911, LANG 1926, SAHLIN 1929. — Klagshamn, N.T.-W. — Vintrie, TURESSON 1911. — Svedala, O.L. — Hököpinge, M.M. — Eskilstorp, N.N. — Östra Grevie, N.R.M., SÖDERBERG 1908. — Vellinge, shore meadows, N.N. — Skanör, L.Z.M., TURESSON 1911, E.M., H.a.R. — Between Skanör and Falsterbo, H.a.R. — Falsterbo, L.Z.M., K.C.-L., KRISTOFFERSSON 1910, B.-O.L. — Ljunghusen C.-E.H. — Gislövsläge, L.Z.M., — Trelleborg, K.D. — Jordberga, N.R.M., SÖDERBERG 1908. — Västra Nöbbelöv, NILSSON 1842. — Löderup, SAHLIN 1929. — Brantevik, G.N.M. — Simrishamn, N.A.A., S.S. — Kivik, Äsperöd, SÖDERBERG 1908. — Vitemölla, H.K. — Trolle-Ljungby, L.Z.M., SAHLIN 1929.

Blekinge. Karlshamn, SPARRMAN 1795 B. Ronneby, SPARRMAN 1795 B., WESTERLUND 1890. — Nättraby, Skillinge, ERIKSSON 1913. — Karlskrona, Sunna, ERIKSSON 1913. —

Karlskrona, L.Z.M., 1949, SPARRMAN 1795 B, GOSSELMAN 1863. — Lyckeby, SPARRMAN 1795 B. — Lösen, ERIKSSON 1914.

Kalmar län. Kalmar: Törneby; Skälby, HEINTZE 1909. — Kalmar, Olsan, HANSON 1950. — Kalmar, L.Z.M., N.R.M., U.Z.M., WESTERLUND 1855, TISELIUS 1868, HEINTZE 1909, T.G. — Somewhere in the vicinity of Ryssby or Ålem, R.S.

Öland. Ottenby, L.Z.M., N.R.M. GISLÉN 1955. — Södra Möckleby, ERIKSSON 1913. — Segerstad, Mellby ör, C.E. — Segerstad, HEINTZE 1909. — Hulterstad, HEINTZE 1909. — Mörbylånga, G.N.M., HEINTZE 1909. — Resmo, N.R.M., HEINTZE 1909, C.F. — Resmo alvar, G.N.M., L.Z.M., K.C.-L., GISLÉN 1947, N.B. — Vickleby, HANSTRÖM 1915, HAGBERG 1950. — Torslunda s:n, between Karlstad and Skogsby, L.Z.M., HEINTZE 1909. — Köping, Ramsätra, HEINTZE 1909. — Borgholm, G.N.M., CEDERGREN 1910, LUNDBLAD 1913, A.F. — Gillaby mire, D.C., — Södviken, D.C. — Persnäs, Sandvik, G.N.M., S.H. — Persnäs, Hjorthamn, CURRY-LINDAHL 1946 D, S.H. — Böda, K.L. — Hornsjön, D.C.

Gotland. Sundre, Kettelviken, L.Z.M. (G. RUDEBECK) 1952. — Visby, Gammelhamn, U.Z.M. 1860. — Visby, N.R.M., 1818 and 1858, LOVÉN 1918. — "Gotland", Sydsv. Dagbl., N.R.M. 1840 and 1849.

Östergötland. Gryt s:n, Häradskär, N.R.M. 1882, U.Z.M., LÖNNBERG 1901.

This species is the rarest one of the genus *Bufo* in Sweden and is almost never found more than 10 km from the coast. Being a SE European, N African and Asiatic steppe form (vide KAURI 1948 fig. 1), it is also bound to the summer-dryest and most radiated parts of the shores of S and SE Sweden. On the west side of the country the distribution stops already at Raus S of Hälsingborg, and the isle Hallands Väderö, the climate in northerly direction in Halland and Bohuslän evidently being too Atlanticized for the species. Kullen, as shown under *Bombina*, is especially well insolated and ought therefore to be thought to harbour this species, but up till now there are no records of it from this locality.

As seen from the list, *Bufo viridis* is recorded in many places along the shores of Scania, and from some few inland localities, Svedala being the place that is farthest removed from the sea. In Blekinge most records, except those from the vicinity of Karlskrona, date back to the 18th century and one gets the impression that the variegated toad is dying out in this county. In Kalmar län the occurrences centre round Kalmar where the species, at least during my childhood, was very common. There is one, not exactly fixed, place of occurrence reported by R. STERNER from a shore locality between Ryssby and Ålem. S. SAHLIN has further informed me that on the island of Örö, Misterhult parish, N. Kalmar län (57°35′ N), the inhabitants told him that in the spring "green frogs" used to spawn in the brackish bays of the Baltic. This may have been *B. viridis*, (but could even have been *Rana esculenta*). LÖNNBERG in 1882 found the variegated toad on Häradskär in the Östergötland archipelago. This is the northernmost occurrence of *Bufo viridis* in Scandinavia (58°9′ N). (Northern border on the east side of the Baltic, in Estonia, 58°22′ N, cf. KAURI 1948.)

As could be foreseen, *B. viridis* is fairly common on Öland, where on the shores and in the alvar areas with their sunny steppe climate it has the best possibilities of thriving in Sweden. On Gotland (Visby gammelhamn) it was found before

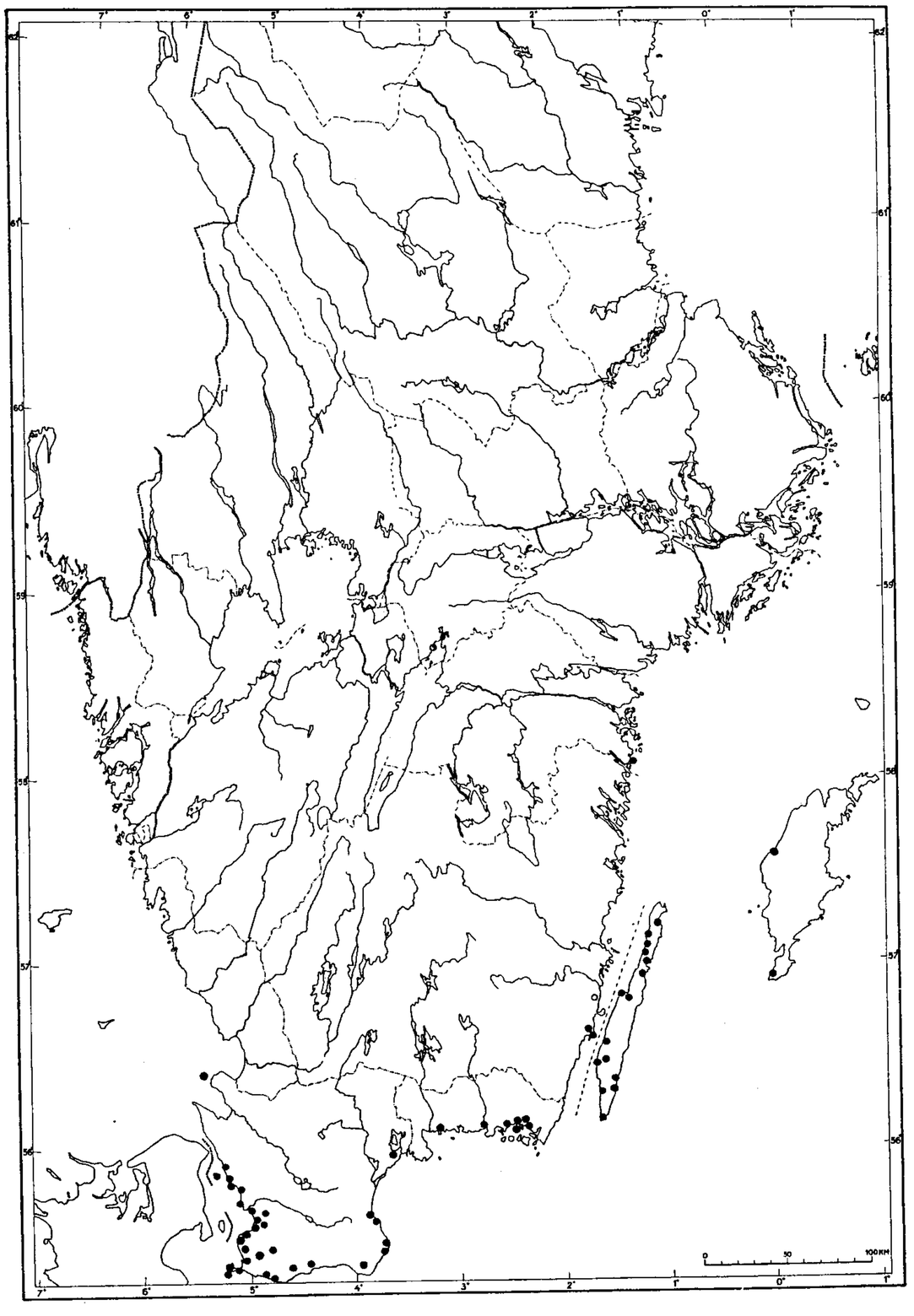


FIG. 29. Distribution in Sweden of *Bufo viridis*.

1860. The species is probably nowadays extinct there. In 1952 it was detected on S. Gotland by G. RUDEBECK.

The vertical distribution of this species extends from 0–30, rarely to 50, metres (Lund, Svedala, Resmo) above sea level.

The largest specimens in our collections are a male measuring 75 mm and a female measuring 85 mm.

In addition to the records given above, there are also some which are most probably erroneous and consequently not recorded in the list (DU RIETZ in 1915 when writing about the fauna on the island of Jungfrun (Kalmar län) stated that "frog larvae" were exceedingly abundant in the fresh water pools at Lervik and that *B. viridis* was rather common in the "southern forest"). As shown by BERNSTRÖM (1941, p. 43), there occurs on Jungfrun only one amphibian, *B. bufo*, not mentioned by DU RIETZ, and this species has been found as larva in the pools as well as fullgrown in the southern forest. HANSTRÖM (1933, pp. 12–13) reported it from shore pools off the island of Hanö, Blekinge. KAURI, WIGSTRAND and I visited the island in August 1950 and thoroughly investigated the shores when wandering round the island. We found a great number of legless tadpoles of the common toad (which was not recorded by HANSTRÖM) and also, much more rarely, larvae of the common frog (2 to 4 legged). The variegated toad was lacking.

Finally, there is in the Lund zoological museum a specimen of *B. viridis* stated to have been taken in 1844 at Odensjö (near Bolmen in W Småland). The record of a locality situated in the rainy and humid areas of W Småland as habitat of the variegated toad was very doubtful and became still more so when I found that the Royal State museum contained, from the same place and time (and evidently collected by the same person), the sun and warmth craving forms *Lacerta agilis* (Odensjö 1840, 1842) and *Coronella austriaca* (Odensjö 1843). I consider these records to be erroneous.

KAURI (1948) has shown that *Bufo viridis* in N Europe is almost completely restricted to the dryest areas where the humidity figures of Martonne do not exceed 34 (1948, figs. 2, 3). It is probably because of this fact that its distribution towards the west in Europe stops east of Jutland, Holland and Belgium and reaches only the easternmost parts of France. KAURI points out that its northern limitation cannot be caused by the winter temperatures as the variegated toad has to face much more severe winter conditions in its northern distributional areas in Russia and Asia. As, however, the summer in N and NW Europe lasts only about the same length of time as that needed for the tadpoles to develop: May, June to August (September), it seems probable that only such areas in the N and NW as can offer really warm and sunny summer months will suffice for giving the shallow pools, in which *B. viridis* spawns, a sufficiently high temperature to secure the possibilities of carrying through a successful metamorphosis of the tadpoles. In Sweden the metamorphosis is usually carried out in the latter part of August. Records tend to show that this toad goes into hibernating quarters

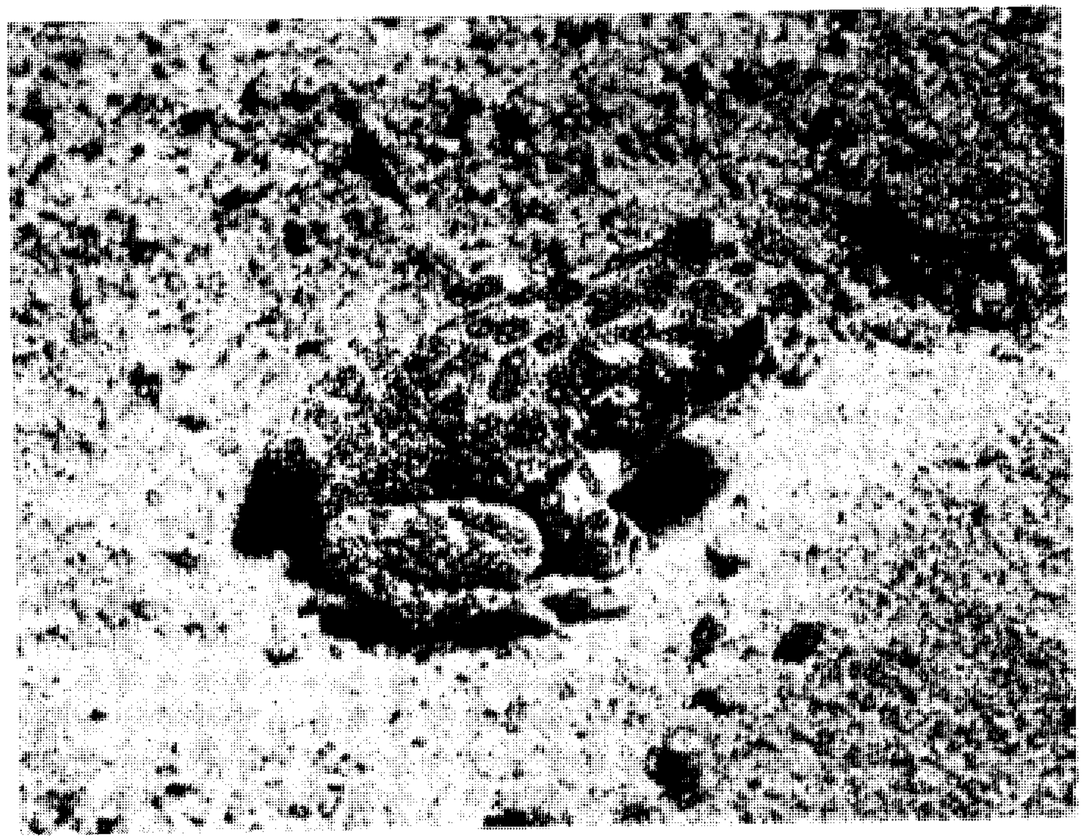


FIG. 30. Variegated Toad (young specimen). Photo by D. SEGERFELDT.

already at the end of September. Probably some time of growth is needed after metamorphosis for the young toad to enable it to endure the coming hibernation. It can be pointed out here that the transformation of the jaws and ability to use them is not acquired by the young toad before some time has elapsed after the metamorphosis.

As elucidated by KAURI (1948), the development of the species in Sweden takes about 3–3 $^1/_2$ months. HEINTZE, on the 2nd June 1909 found masses of eggs of this species at Resmo, Öl., and stated that he had seen spawning specimens from the middle of May to the 20th June. LANG (1926) found the spawning time in W. Scania to vary between 21st and 28th May (1923–1926). In normal springs, however, this toad seems to deposit its eggs earlier.

Normally the spawning seems to begin about the middle of May or even a little earlier. I heard its easily distinguishable warbling song in Kalmar on 15th May 1944 and in 1949 I found small tadpoles of this species, max. length about 16 mm (10–18 mm) and calculated to be of an age of about 2–3 weeks, in a shallow and warm alvar pool at Resmo, Öland, as early as the 30th May. (These larvae later on metamorphosed in aquaria in Lund.) Insignificantly smaller larvae, 10.5 mm or a little more, were taken the same year and day by KAURI at Saxtorp, Scania, shore meadow. As early as the 13th May 1950 KAURI took larvae of this species

at Saxtorp which were about 6.5 mm and calculated to be of an age of about one week or 10 days. The tadpoles grow to a length of about 47–50 mm. (KAURI 1955, p. 85). The larvae taken by KAURI and me, according to him, metamorphosed in out-of-door aquaria in Lund chiefly between 24th and 31st August, in some few cases as early as 11th August. The following year they transformed between 17th and 23rd August. The size of the newly transformed toads was 18–19 mm. In exceptionally favourably situated pools the metamorphosis may appear earlier, though. Thus the Lund Museum has some young, one of them still having a short tail, from Gislövs läge, Scania, 15th July 1947. They had been taken in a very shallow pool very near to the sea shore. It had a gravelly bottom and was partly filled up with sea weeds. The body length of the transformed toads was 13–17 mm. From the 24th August 1874 there is a good collection of young *B. viridis* (14 spp.), varying in size between 16 and 26 mm, 20–22 being normal. From the 17th September 1946 there are 3 small variegated toads, (Resmo alvar, Öl.) of 20–23 mm. And finally from early spring 1945 (26th March) there is one specimen with a body length of 25 mm from Skanör, Scania. Consequently, when metamorphosing, this toad is larger than young of the two other *Bufo*-species. During the autumn it grows to 20–26 mm.

K. LANG (1926, p. 148) has reported that he was successful in obtaining a cross between *B. bufo* and *B. viridis*.

B. viridis is one of the few amphibian species that can stand saline water. Of our Scandinavian toads, it is the one that can stay in brackish water of a higher salinity than other species can stand. According to LÖNNBERG (1926), *B. viridis* has proved to be insensitive to a salinity of 15‰, and can stand even 20‰ salinity. HANSTRÖM (1927) has observed a mass appearance of *B. viridis* near a fishing village on the Öresund coast, north of Landskrona. The year's young of *B. viridis* had invaded the harbour, they were also floating and swimming in great numbers in the water. Presumably, through flooding of the shore meadows, they had been washed out into the Sound, where a north-going current had caught them and brought them to the fishing village. This stay in brackish water had not injured the young toads at all.

South of Landskrona in Lundåkrabukten, *B. viridis* spawns in the Sound. In May the males lie and croak in the shallow pools in the shore meadows, and also in the clumps of reeds near the shore in brackish water. *B. calamita* spawns also in the same spot (p. 288), but *B. viridis* makes its way further out into the Sound, and goes as far as the outermost clumps of reeds if the water is shallow enough. *B. calamita* always stays nearer the shore. The salinity in these spawning grounds can vary considerably, but generally stays between 3.6 ‰ and 4 ‰. Spawn of *B. viridis* in a fairly advanced state of development has been found, but never larvae. One also gets the impression that the males are more active, and readily find their way to the brackish spawning grounds in the Sound. The females, on the contrary, seldom get there. They are fewer, and it is possible that already on their way towards the shore they are caught by the males that have posted

FIG. 31. Breeding habitat of Natterjack and Variegated Toad in Öresund at Lundåkra. Photo by B. KANGRO.

themselves in the many pools in the shore meadow. In this way spawning in the Sound is less frequent. The situation can be the opposite in places where suitable pools on the shore are absent. (GOSSELMANN 1863, LUNDBLAD 1913, ERIKSON 1913).

Rana esculenta (LINNAEUS). Edible Frog. Ätlig groda

OCCURRENCE:

Skåne. Trelleborg, S. MATHIASSON. — Börringesjön, SÖDERBERG 1908, S.M. — Lindved, G.N.M. 1841. — Börringekloster, N.R.M. 1907. — Börringe and Svedala area, NILSSON 1842, SÖDERBERG 1908, SAHLIN 1929. — Svedala, Sjödikena, L.Z.M. 1952, 1953. — Fjällfotasjön, NILSSON 1842, SÖDERBERG 1908, MATHIASSON 1957. — Törringe, SAHLIN 1929, P.H.-A. 1946. — Roslätt, L.Z.M. 1927. — Skabersjö, L.Z.M. 1951, 1953, SÖDERBERG 1908, M.M., S.H-n. 1946. — Torup, G.N.M. 1918, L.Z.M. 1935, N.N. 1929, P.H.-A. 1947, MATTSSON, 1949. — Bokskogen, LANG 1926. — Bökeberg, L.Z.M. 1906, 1952, LANG 1926. — Bökebergsslätt, N.R.M. 1904. — Hyby s:n, Kolahygget, Holmeja, H.K. 1950. — To the west of Yddingen, MATTSSON 1952. — Yddingen, L.Z.M., N.R.M. 1907, MATTSSON 1949, NILSSON 1842, SÖDERBERG 1908, LANG 1926. — Södra Sallerup, Prydesholm, L.Z.M. 1945. — Hyby s:n, Nyvång, H.a.R. 1946. — Hyby, SAHLIN 1929, SÖDERBERG 1908. — Bara, MATTSSON 1949. — Genarp, Häckebergaqvarn, NILSSON 1842. — Malmö: Pildammen; Öresundsparken, MATTSSON 1949. — Hofterup, H.K. — Landskrona, U.Z.M. — Ven, near Kungsgården, NILSSON & THORSON 1950, G.A-m. — Villands härad, L.Z.M. kat. 1844. — Trolle-Ljungby, A. HALL 1950.

Småland except Kalmar län. Aneboda, Nedre Brittelaggdamm, L.Z.M. 1909.

Kalmar län. Gullabo, Kyrkebo bäck, U.Z.M. 1863. — Tveta, N.R.M. 1854, WETTERBERG 1864. — Mörlunda, WETTERBERG 1864. — Väderum, Flohults göl, S.N. 1946, J.B. 1951.

Östergötland. Gusum, L.Z.M. 1855, N.R.M. 1862, NILSSON 1842, B-l.W. — Östra Harg s:n, Rosen, F.O. 1935.

Närke. ?Lerbäck s:n, Tisaren 1819, BÄCKGREN 1911.

Uppland. Bro, GISLÉN 1953. — Hållnäs s:n: Fågelsundet fishing port; Fågeln; Kjällen, FORSELIUS 1948, S.F-s. — Hållnäs s:n, Kjällen, L.Z.M. 1947. — Älvkarleby s:n: Gårdskär fishing port, FORSELIUS 1948, S.F-s.

The species' total area is large and extends from France, Spain and Holland to Turkestan (76° E of Gr.) and from Sahara to Uppland (60° N lat.). According to our opinion the Swedish form should belong to *Rana e. esculenta* L.

The edible frog occurs in Sweden mainly in south-western Scania, where it is recorded from a large number of localities, extending from the vicinity of Malmö down to Svedala and Häckeberga. According to a note in the old journal of the Lund Zoological Institute there was once a specimen in the collection, taken in Villands härad 1844 in northeastern Scania. Dr. S. SAHLIN, who made inquiries in this district of Scania in the 1920's, has kindly told me that he arrived at the conclusion that the specimen may have occurred fairly close to the seashore. However, as the position of the finding place has not been strictly defined, it is only indicated here by a ring on the map.

From Kalmar county there are 4 finding places. In 3 of them there are only records from the 1860's. At Väderum in the northern Kalmar county it still occurs, but is said not to be so common as 25 years ago (vide S. NILSSON). When in 1948 I visited the locality Tveta, Mörlunda, I found open and fertile plains with leafy woods round Emån. Mr. HILDEBRAND SVENSÉN, an interested naturalist there, assured me that he had seen large green frogs and the same statement was also made to me at Mjösebo, Högsby parish, in 1948, and in the southern part of Kalmar county at Vissefjärda in 1945. Maybe further investigations will disclose the occurrence of the edible frog in suitable localities in parts of Kalmar county, other than those hitherto indicated. The localities last mentioned are indicated by a ring on the map. As evidenced under the *Pelobates* larvae taken in the Aneboda fish-ponds, Småland, in 1909, 1916 and 1924, and the developing to spade foot tadpoles, these in reality are larvae of *Rana esculenta*. They have thus occasionally been introduced here with fish-fry. (Indicated by an asterisk on the map.) Even tadpoles taken from September or October have only the posterior legs developed and it is not likely that the species has ever been able to metamorphose and become ripe during these climatically rather unfavourable circumstances (200 m above sea level). Moreover, croaking edible frogs would certainly have been observed by naturalists working in this place.

The specimens taken in the Östergötland locality Gusum have been reported from the 1840's to the 1860's. The evidence shows that they have been found,

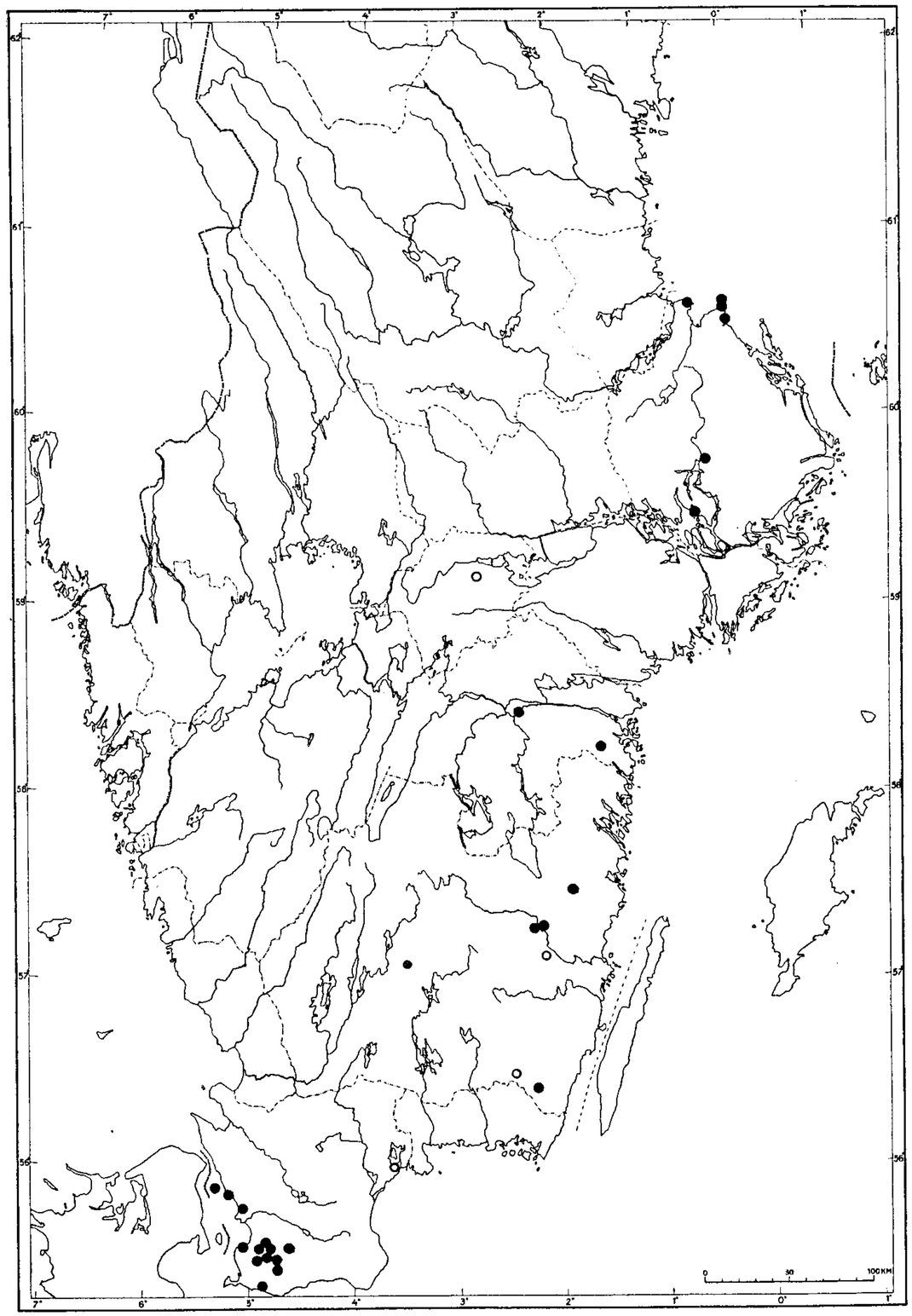


FIG. 32. Distribution in Sweden of *Rana esculenta*. Open circles = dubious localities.

FIG. 33. Edible Frog. Photo by D. SEGERFELDT.

any positive result. On the other hand, one specimen was captured and thoroughly examined by OSSIAN-NILSSON at Roxen in 1935.

The record from Närke is old (1819) and may perhaps not be reliable.

From Uppland, too, there are records of the occurrence of this frog. It was reported by me in 1953 from southern Uppland (GISLÉN 1953) from the vicinity of Enköping (Bro), where specimens were photographed, being unmistakably edible frogs. Further it has been reported from the vicinity of Uppsala and refound there recently by FORSELIUS from the marsh of Kungsängen. Finally, FORSELIUS made the unexpected discovery of this species in several places along the northern coast of Uppland (FORSELIUS 1948). FORSELIUS considered, I think quite correctly, as almost certain that these populations are relicts from the post-glacial warmth period. This variety of edible frog is a rather pronounced var. of *lessonae*.

The west Scanian area of occurrence is a direct continuation of the Danish distribution area. In Denmark it occurs both in Zealand and in Jutland, to a little north of 57° N, and it is common on Bornholm (PFAFF 1943). Here it is partly the nominate race and partly seems to be the variety *ridibunda* and mixtures of both, as evidenced by KAURI (1954) and LARSEN (1950, 1955).

Except for the west Scanian place of occurrence, all the others are east Swedish localities and the distributional area extends northwards to immediately south

FIG. 34. Breeding habitat of Edible Frog in Scania at Bökeberg. Photo by H. KAURI.

of Dalälven river. The scattered picture of the map undoubtedly gives the impression of a former more coherent distribution. The localities where it has been found lie all in the fertile areas of the open plains and leafy wood districts of the east Swedish coastland.

On the eastern side of the Baltic the edible frog continues its distribution northwards to Estonia 59°20′ N (KAURI 1946). It is therefore not so strange as it would seem at first sight that the edible frog under specially favourable climatical conditions may be able to survive so far north also in Sweden.

The measurements of fully-grown tadpoles are: head and body 26.2 mm, tail 48.4 mm, total 74.6 mm. The maximal total length of tadpoles observed 81.9 mm. Young frogs shortly after metamorphosis measure 20–21 mm. In October of the first year they attain a maximal length of 26 mm from snout to vent. By the autumn of the second year they have a length of 33–34 mm. In the third year they attain a size of about 40 mm.

The males' call is heard in the spring as early as about the first May or the last days of April. Spawning, however, occurs rather late, as a rule in the early half of June, but, depending on the weather, it can begin as early as the last week in May. This applies to Scania. In Uppland, according to FORSELIUS (*in litt.*), spawning is said to occur in the last half of May. The same phenomenon, regarding earlier spawning in the north, has been noticed in England (SMITH 1954, p. 115).

In the observation area at Bökeberg, known as the lake ditches, both mating and spawning take place in old peat pits. In the spring the water level is high, on an average 1–2 feet deep. There is no shallow shore zone. The vegetation is fairly profuse and consists of *Stratiotes aloides*, *Elodea canadensis*, *Nymphaea alba*, *Typha latifolia*, *Chara* and other species. During the mating period the toads keep to the middle of the pools where *Elodea* and *Stratiotes* grow in thick carpets and the water is shallow. Spawning also takes place here. Spawning which has started can be broken off on account of a period of bad weather with low temperature, sometimes for as long as two or three weeks, and can continue again when the temperature is again suitable. On June 14th in this spawning place, new spawn were seen together with larvae at least a fortnight old. (Fig. 34.)

Although habitats are to be found near the shore both by the Örcsund in Scania and by the Baltic in Uppland, the edible frog of the country cannot be considered as a strictly coastal variety, in the same way as the *Bufo viridis* or the *B. calamita*. The existence of larvae in lagoons in brackish water has several times been reported. All these observations are, however, from the Mediterranean and the Sahara and refer to the *ridibunda* variety. In Finland the *v. ridibunda* has been found near Helsingfors in the inner bays of the archipelago where the water is practically fresh. (SUOMALAINEN 1941). In Uppland's archipelago the *esculenta* lives in small ponds and rock pools which, at least occasionally, in stormy weather, get small additions of saline water. However, in the Baltic district no spawning places with brackish water have been found.

Rana arvalis arvalis (NILSSON). **Moor Frog. Åkergroda**

ANDRZEJOVSKI in 1832 (p. 342) described a new species of *Rana* which he called *R. terrestris*. The description was made in Latin and contained no figures. It deals with colour characteristics only, the type locality being Wolhynia. It occurs there in a district where *R. arvalis*, *R. dalmatina* and *R. temporaria* are found. The colour was said to be of the striped type. Now it is true that there is a variety of a striped type in *R. arvalis* (see below), but a similar variety is also found in *R. temporaria* (cf. STEENSTRUP 1847, pag. 94).

SVEN NILSSON in 1842 described *R. arvalis* in Swedish from a district in northern Kalmar län. In this area it is the only species of frogs to occur. SVEN NILSSON's description likewise only deals with colour characteristics.

STEENSTRUP in 1847 described in Danish from Zealand, Denmark, a *Rana* which he called *R. oxyrhinus*. The characteristic which he used for distinguishing this species was, among others, the large tubercle occurring at the base of the great toe. A specimen of *R. arvalis* borrowed from Lund was stated by STEENSTRUP to be identical with his *oxyrhinus*. But because the Lund museum specimen from Kalmar län was a female and striped, STENSTRUP supposed, considering that his specimen from Denmark was a male and uniformly brown-coloured, that the Kalmar län specimen should have a different colouration according to its different sex.

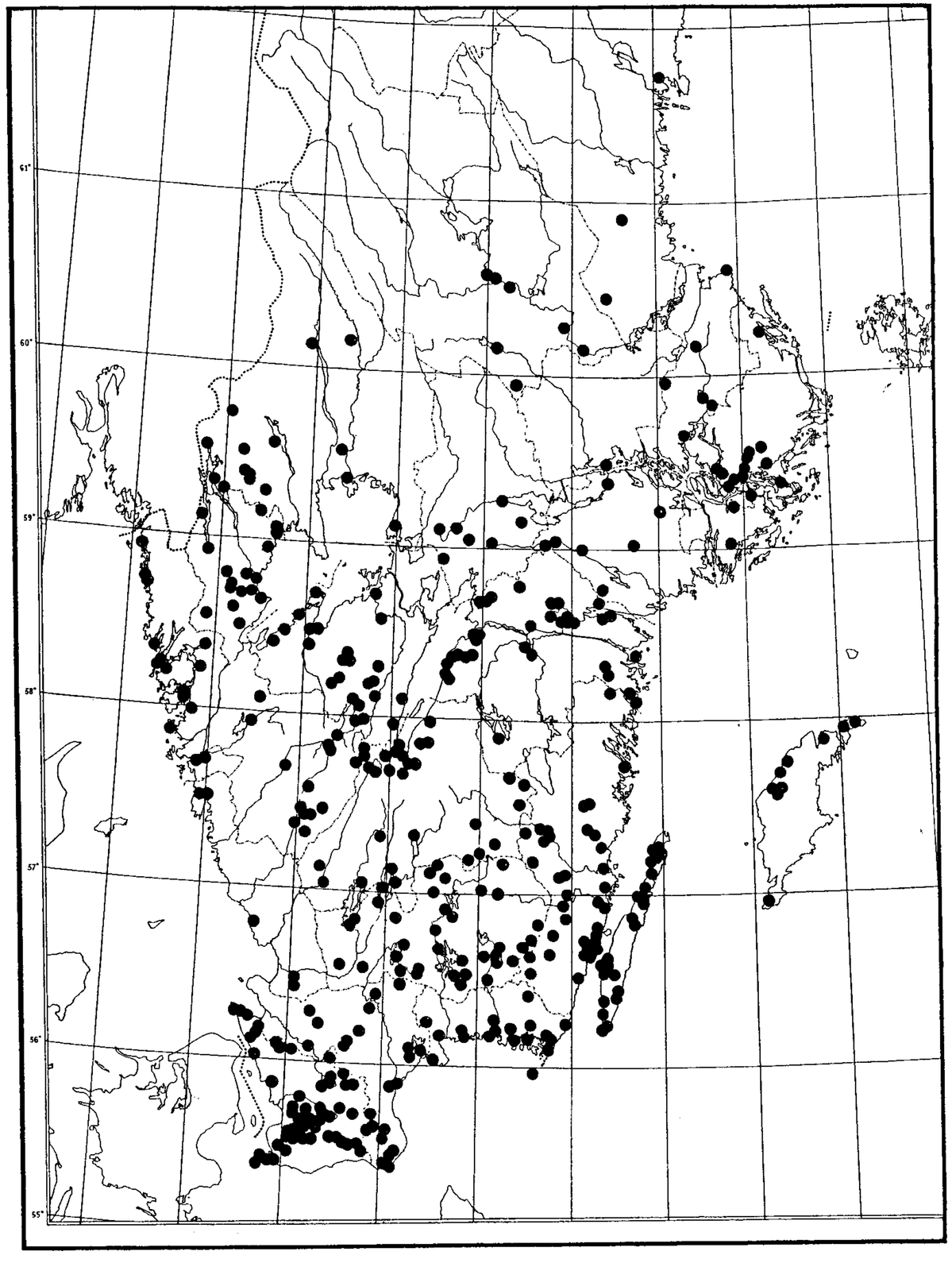
FIG. 35. Moor Frogs taken by S. NILSSON. Lectotype to the right. Photo by H. GRÄNS.

In the second edition of his fauna, SVEN NILSSON 1860 (pag. 105) had included STEENSTRUP's better species characteristics. SVEN NILSSON therefore correctly applied the mark of the tubercle at the base of the great toe as a signifying mark of *Rana arvalis*.

When studying the material in the Lund museum I found two old specimens of *R. arvalis* which I figured and discussed in a paper (1946) showing that they were SVEN NILSSON's type specimens. ANDRZEJOVSKIS specimen is only characterized by colour marks and there is no possibility of finding the type specimen again and no possibility of identifying *R. terrestris*. Finally, *R. arvalis* is the only brown frog occurring in the area where the type specimen was found. The type specimens are preserved and the name *R. arvalis* has been generally used for more than 100 years.

Of the two specimens of S. NILSSON, the female one is indicated here as the *lectotype*. (No. 1. Zool. Mus. Lund.) *Terra Typica:* S. Sweden, Kalmar län.

Distribution: In the west the species occurs to Holland, Belgium and northwesternmost France. Further it is found in Germany, Austria and Hungary. It does not occur in the Mediterranean peninsulas nor in the Crimean. In Russia (TERENTJEV & ČERNOV, 1949) it extends from almost the White Sea to the Jenisei and Altai. In the north it reaches the boundary of tundra from the Kanin peninsula to the bay of Ob. In the south the border extends through the Kirghiz Steppes between 48° and 52° N and across the Ukraine it reaches the Black Sea in the west. In Finland, there is an isolated finding place at Ivalo (68°40′ N)



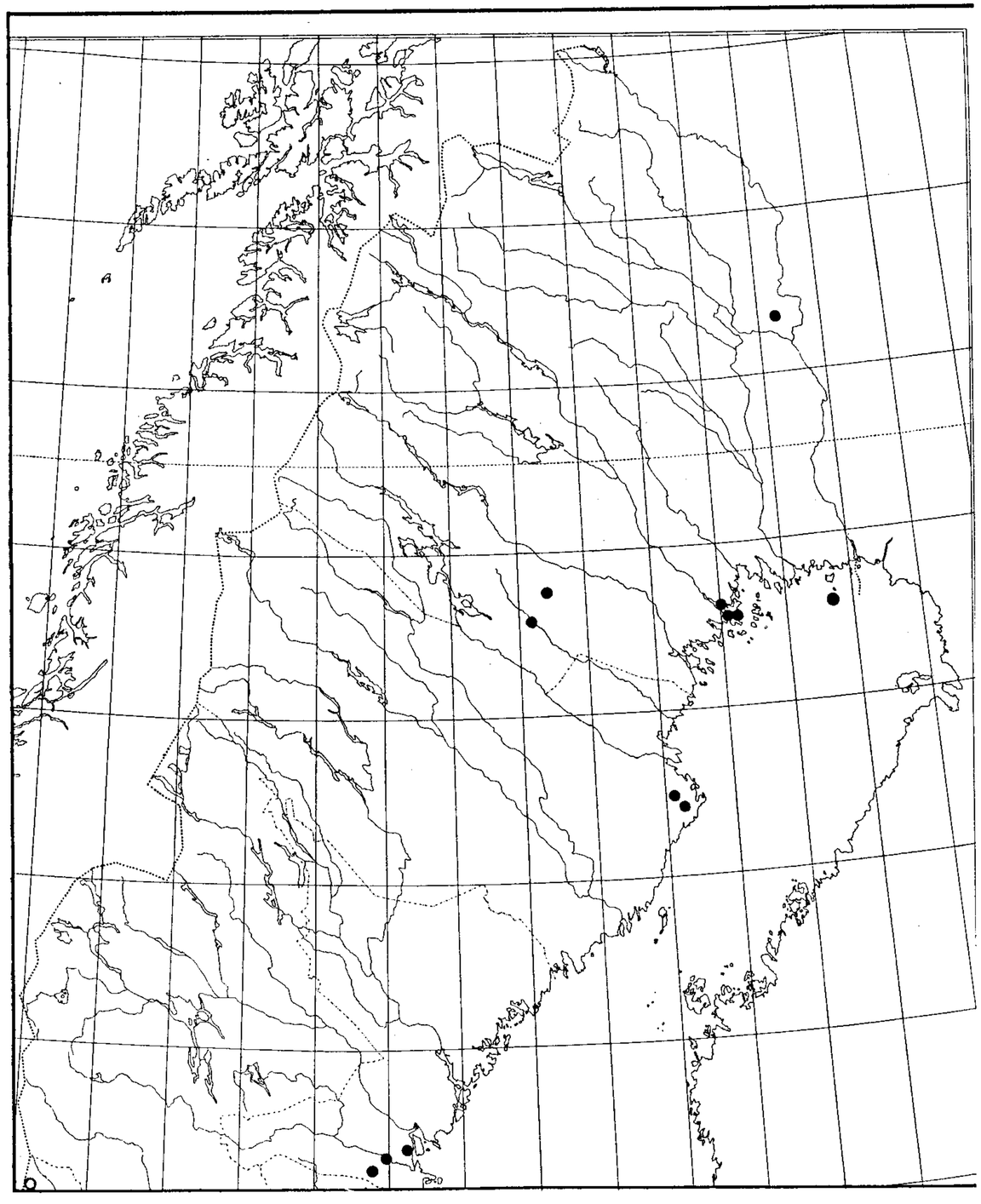


FIG. 36, 37. Distribution in Sweden of *Rana arvalis*.

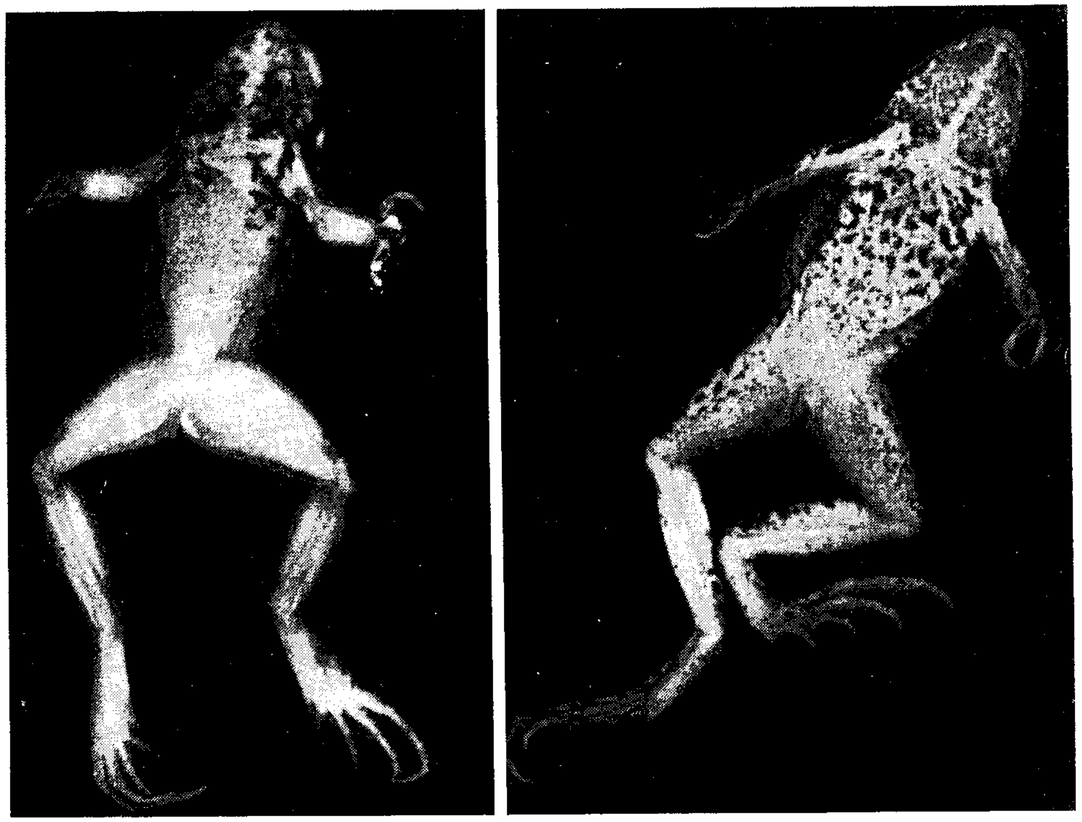


FIG. 38. Moor Frogs with dark coloured throat with a white line in the middle. To the left from Örsås, Västergötland. To the right from Skanör, Scania.

in the vicinity of the Lake Inari (KAISILA 1955). (See otherwise map of western distribution in A. DAHM 1953 and K. CURRY-LINDAHL 1956.)

Rana a. arvalis is fairly common in South and middle Sweden up to Bohuslän, Dalsland, southern Värmland, Närke, Södermanland and Uppland. It is common on Öland and rather scarce on Gotland. This frog begins to become rare in central Värmland, Västmanland, southern Dalecarlia, Gästrikland and occurs sporadically in Hälsingland and Medelpad to 62°20′ N.

North from this there is a gap along the coast of almost 200 km. It appears again at Lövånger 64°25′ N and from there has been found in 7 localities to north of Pajala 67°20′ N. (A. DAHM, 1953; K. CURRY-LINDAHL 1956.)

Vertical distribution: From m.s.l. to about 250 m (South Sweden, S. Solberga) and to 410 m in northern Sweden (Auktsjaur).

Maximum size: males 69 mm, females 65 mm.

During the first year *R. arvalis* in S. Sweden reaches a length of 22–24 mm, in the second year the young frogs attain maximally 37 mm and in the third autumn they reach a size of about 48 mm.

As a rule the underside of *R. arvalis* is completely white. However, there may in relatively few cases be cloudy spots, generally occurring on the throat. In rare cases, especially on Gotland, the greyish spots may appear on almost the whole

FIG. 39. Moor Frog. Photo by D. SEGERFELDT.

underside, only the posterior part of the belly being completely uncoloured. In some few cases the spotting on the throat is fairly strong. In some cases only (from Vg, Sk and from Bl. Torhamn), there is a uniformly dark coloured throat with a white medio-ventral line, just in the same manner as the coloration of the *R. latastei* from Italy. A similar colour variation occurs in our specimen of *R. temporaria* too. (Fig. 38.)

One colour variety generally called forma *maculata* has a densely black-spotted back on a grey ground. This type occurs irregularly in different parts of the country.

Already BOULENGER 1913 figured from Central Europe two differently coloured varieties of *R. arvalis*, one generally brown, and one provided with a broad median light coloured band and one narrow light coloured stripe on each side of a median darker stripe outside the central light coloured band. PFAFF 1943 (pag. 87) when describing the colour varieties of Denmark, pointed out that the brown var. was the only one occurring on Zealand, the small islands around this island and Møen. On the other hand, all specimens from Jutland belong to the striped variety—likewise the greatest part of all specimens from Holland, Belgium and northwestern France even to the westernmost extensions are striped too. The

FIG. 40. Moor Frog. Striped variety. Photo by H. GRÄNS.

specimens in Siberia (Great Tunguska) seem mostly to be of the striped variety (ČERNOV 1914, p. 251) Yenisei and Irkutsk.

In S. Sweden the brown unstriped variety is overwhelmingly in the majority. In fact, out of the thousands of specimens which I have seen in southern and middle Sweden, all are brown, excepting only one specimen from Kalmar län (Årena) and the two specimens which are kept as specimens from SVEN NILSSON's time, which were reported from Kalmar län too. They are, however, not typically striped as the dark striae are broken off several times (fig. 35).

In northern Sweden both varieties occur (cf. CURRY-LINDAHL 1956).

TERENTJEV (1927, p. 71) preliminarily described in Russian a new variety called *R. arvalis issaitchikovi* from Archangel. It was characterized as a form where the tibia was shorter than the femur and the metatarsal tubercle was 1.3–1.6 times shorter than the first toe of the posterior foot. The distance should be greater to the tympanum from the eye than from the mouth-angle, which seems to be a rather unreliable characteristic. The form *issaitchikovi* resembles the *altaica* KASCHTSCHENKO, 1899. Whether *altaica* and *issaitschikovi* are identical is not decided yet.

After considerable trouble I was fortunate enough to obtain through Moscow

TABLE 23. Measures for *Rana arvalis* from Archangel, Swedish Lapland, southern Sweden and Jutland (Denmark).

Locality	Size (mm)	Tibia	Femur	Tubercle	Toe	Tib./tub.	Toe/tub.	F × 10/Tib.	Tub. × 100/Size	Pattern
Archangel										
1.	53	22.0	22.5	3.2	4.8	6.9	1.5	10.0	6.1	str.
2.	53	25.4	23.7	3.0	5.1	8.5	1.7	9.3	5.7	not str.
3.	52	25.5	23.0	3.8	4.5	6.7	1.4	9.0	7.3	partly str.
4.	51	26.8	23.2	3.0	5.6	8.9	1.9	8.7	5.8	str.
5.	50.0	24.4	21.9	3.0	5.2	8.1	1.7	9.0	6.1	not str.
6.	41	19.1	17.7	2.2	4.2	8.7	1.9	9.3	5.5	str.
					Average	**8.0**	**1.7**	**9.2**	**6.1**	
Lapland										
Pajala	39	19.4	17.5	2.1	3.8	9.2	1.8	9.0	5.3	str.
Porsön	58	26.7	25.8	2.9	4.8	9.2	1.7	9.7	5.0	not str.
Lulsundet	51	24.1	23.0	2.5	4.3	9.6	1.7	9.5	4.9	not str.
„	46	22.5	21.9	2.8	3.7	8.0	1.3	9.7	6.0	str.
„	43	22.5	20.0	2.6	3.5	8.7	1.4	8.9	6.1	str.
„	31	14.8	13.7	2.0	2.3	7.4	1.2	9.2	6.4	partly str.
Hertzön	56	28.3	27.5	3.3	5.5	8.6	1.7	9.7	5.9	str.
Vallen	50.0	25.7	24.8	3.2	5.1	8.0	1.6	9.6	6.4	str.
Auktsjaur	35.0	16.5	14.4	1.9	3.1	8.7	1.6	8.7	5.4	not str.
					Average	**8.6**	**1.6**	**9.3**	**5.7**	
Småland										
Dannäs	44	24.9	22.3	2.6	4.5	9.6	1.7	9.0	6.0	
	42	22.8	20.5	2.3	4.6	9.9	2.0	9.0	5.5	
	43	23.0	20.4	2.5	4.2	9.2	1.7	8.9	5.9	
	43	23.9	21.3	2.5	4.5	9.6	1.8	8.9	5.8	
	47	25.2	22.7	2.7	4.9	9.3	1.8	9.0	5.7	
	50	25.9	24.5	2.8	5.2	9.3	1.9	9.5	5.6	
	34	18.3	17.0	2.2	4.0	8.3	1.8	9.3	6.4	
	52	28.9	25.6	3.0	5.6	9.6	1.9	8.9	5.8	
	53	27.1	23.5	2.9	5.1	9.3	1.8	8.7	5.5	
	50	25.3	22.7	2.6	4.9	9.7	1.9	9.0	5.2	
	49	26.6	24.4	2.5	5.1	10.6	2.0	9.2	5.1	
	42	23.4	21.5	2.2	4.8	10.6	2.2	9.2	5.3	
	55	27.0	23.9	3.7	5.0	7.3	1.4	8.9	6.7	
	52	26.6	24.6	3.0	5.0	8.9	1.7	9.2	5.8	
	41	22.6	21.0	2.3	4.0	9.8	1.7	9.3	5.7	
	55	31.0	28.0	3.8	5.7	8.2	1.5	9.0	7.0	
	38	21.5	19.3	2.0	4.1	10.8	2.1	9.0	5.3	
	37	17.9	17.5	1.8	3.7	9.9	2.1	9.8	4.9	
	41	22.5	20.1	2.5	4.3	9.0	1.7	8.9	6.1	
	46	26.0	22.7	2.6	5.1	10.0	2.0	8.7	5.7	
					Average	**9.4**	**1.8**	**9.1**	**5.8**	
Danish striped specimens from Jutland: Diverse localities. Average 28 sp.						**7.6**	**1.5**		**6.5**	
Danish brown specimens from Jutland:										

6 specimens of this form (*issaitschikovi*) collected from the vicinity of Archangel. Among these 6 specimens two were completely striped and a further two had a stripe on the posterior half of the back.

It should be of certain interest to compare the northern Swedish specimens with the Russian ones and with specimens from S. Sweden and Denmark. All the following measurements and comparisons are carried out by KAURI. (Table 23.)

An investigation of the Archangel and upper Lapland specimens shows that the toe divided by the tubercle gives figures that are almost identical, while the 20 specimens from Dannäs, Småland, give considerably higher figures. The same is the case with the index of BOULENGER: tibia divided by the tubercle, which is about 6–8 in the Archangel and Lapland specimens and in the Dannäs specimens about 8 or 9. I have also investigated some 30 specimens from Jutland. The toe is comparatively shorter than the Norrlandic specimens and the tubercle is comparatively larger, but otherwise the figures are so different from those of the northern forms that the Jutland specimens cannot be considered to be identical with the northern forms. The Lapland and the Archangel specimens, on the other hand, are so similar that they must be considered to be of the same variety and can probably be referred to Terentjev's subspecies *issaitchikovi*.

There is a decided difference in southern Sweden between the distribution of *Rana arvalis* and that of *R. temporaria*. While *R. temporaria* has a very restricted occurrence, *R. arvalis* is found from our west coast straight over Småland to and including the Baltic Islands, i.e. from the rainy and sour west with its vast bogs, through the dry limestone districts of the east, where we have many fens or small swamps and highly radiated lags, mostly grown over with Cyperaceae-grasses.

Spawning. In S. Sweden the spawning varies from 3rd April 1953 (Björkenäs, Blekinge), which was an unusually early spring, to 12th April 1952 (Romeleklint) and 20th April 1958 (environs of Lund). During early 1953 we got newly laid eggs in Småland 23rd April (Hinneryd), 24th April (northern end of Furen) and 25th April (Dädesjö). In the north-western part of Småland and south-western Västergötland when, at this time, there was freezing every night, no roe had yet been laid. This roe seems to be laid contemporaneously with the flowering of the sweet gale (*Myrica gale*) or the wood anemone (*Anemone nemorosa*).

CURRY-LINDAHL (1946 A) has investigated the time of spawning in Södermanland (Balingsholm) and found that for the years 1942, 1943, 1945 and 1946 it began in the spring between the 22th April (1946) and 28th April (1945).

I found a new-laid roe-ball at Sundsvall (Stadsberget 62°24′) 15th May 1947.

The roe lies on the bottom, which means that it often develops in cooler water than that of *Rana temporaria* which always floats on the surface. The larvae of *R. arvalis* in Blekinge, where I have observed the time of the metamorphosis, generally seems to occur in the middle of July which means that the development from spawning to metamorphosis takes about 100 days.

FIG. 41. Breeding habitat of Moor Frog. Linderödsåsen, Scania. Photo by H. KAURI.

OCCURRENCE:

Skåne. Falsterbo, L.Z.M., K.C.-L., P.H.-A. — Skanör, Flommen and Stadsparken, H.a.R. — Skanörs ljung, CURRY-LINDAHL 1946. — Ljunghusen, L.Z.M., P.H.-A. — Kämpinge hed, L.Z.M. — Jordholmen, A.K. — Östra Grevie, Steglarp, N.R.M., SÖDERBERG 1908. — Östra Grevie, SÖDERBERG 1908. — Sövestad, S.S. — Stora Herrestad, P.H.-A. — Löderup, G.N.M. — Sandhammaren, A.D., Y.M., — Borrby, G.N.M. — Vallby, Glivarp, G.N.M. — Törringe, P.H.-A. — Skabersjö, Roslätt, P.H.-A. — Skabersjö, L.Z.M., S.S. — Torup, P.H.-A. — Hyby s:n, H.a.R., S.S. — Bara hundred, K.L., S.S. — Lyngby, S.S. — Svedala, Hyltarp, P.H.-A. — Svedala, N.R.M. — Yddingen, M.M. Bökeberg, L.Z.M., P.H.-A. — Fjällfotasjön, N.R.M. — Börringe, P.H.-A. — Gustav, S.S. — Häckeberga, L.Z.M. — Genarp, Gyllebo, L.Z.M., S.S. — Blentarp, Karup, Exc. — Sövde, S.S. — Sövdeborg, K.C.-L. — Krageholmssjön, Lybeck, L.Z.M. — Baldringe, S.S. — Skåne's Tranås, SÖDERBERG 1908. — Smedstorp, S.S. — Norra Nöbbelöv, L.Z.M. — Lund, L.Z.M. — Lund, Kungsmarken, L.Z.M. — Staffanstorp, P.H.-A. — Dalby s:n, Romeleåsen, Fäladsdamm, L.Z.M. — Dalby, S.S. — Södra Sandby, S.S. — Silvåkra, S.S. — Krankesjön, L.Z.M., K.C.-L., P.H.-A. — Revinge hed, H.B-m. — Revingeby, MELANDER 1937, H.B-m, S.S. — Revinge, L.Z.M. — Veberöd, S.S. — Vomb s:n, Helgasjön, L.Z.M. — Bjärsjölagård, Exc. — Vollsjö, L.Z.M. — Andrarum, P.H.-A., S.S. — Kristinehov, L.Z.M., P.H.-A. — S:t Olov, S.S. Esperöd, N.R.M., SÖDERBERG 1908. — Saxtorp, P.H.-A. — Dösjöbro, Ålstorp, P.H.-A. — Örtofta, L.Z.M. — Kungshult, Exc. — Bosjökloster, P.H.-A. — Höör, Sätofta, L.Z.M. — Höör, L.Z.M. — Rörum, P.H.-A. — S. Rörum, Staffanstorp, H.K. — Äspinge, Mansköp, G.N.M. — Svensköp, G.N.M. — Vittskövle, Glasback, G.N.M. — Yngsjö, 8 km to the south of Åhus, L.Z.M. — Raus, S.S. — Norra Vram s:n, Båv, U.S. — Norra Vram, L.Z.M. — Allerum, S.S. — Stenestad, S.S. — Riseberga, S.S. — Norra Rörum, S.S. — Brönnestad, Tormestorp, Exc. — Brönnestad, HALL 1950. — Stoby, A.K. — Bäckaskog, L.Z.M. — Trolle-Ljungby,

L.Z.M. — Ivetofta, Råby, on the shore of Levrasjön, L.Z.M. — Ivösjön, Exc. — Välinge s:n, Rögle, A:N-n. — Kattarp, Tursköp, G.N.M. — Jonstorp, K.C.-L., S.S. — Lerhamn, Exc. — Krapperup, H.a.R. — Mölle, Vattenmöllan, NILSSON 1954. — Brunnby, S.S. — Oderljunga, T.G. — Örkelljunga, T.G. — Hästveda, HALL 1950, A.K. — Osby, Hasslaröd, HALL 1950. — Osby, HALL 1950. — Hökön, L.Z.M.

Blekinge. Sölvesborg, Sandviken, L.Z.M. — Utklipporna, L.Z.M., A.E.S. — Färsksjön, the outlet, L.Z.M., Exc. — Torhamn, L.Z.M., Exc. — Pukavik, L.Z.M. — Mörrum s:n, Björkenäs, L.Z.M., T.G. — Karlshamn, Hunnemara, L.Z.M., Y.L-e. — Tromtö, L.Z.M. — Nättraby, U.S. — Karlskrona, Hästö, A.L-m. — Asarum, L.Z.M. — Ronneby, Torneryd, WESTERLUND 1890. — Hasselstad, L.Z.M. — Kallinge, P.H.-A. — Vieryd, L.Z.M. 4 km to the north of Ronneby, L.Z.M. — Jämjö, L.Z.M., T.G. — Jämshög s:n, R.J. — Rödeby, P.H.-A. — Åkeholm, Togölen, L.Z.M. — Kristianopel, G.N.M. — Sillhövda s:n, Förslövsö, L.Z.M.

Halland. Våxtorp, Vallen, T.G. — Våxtorp, L.Z.M., T.G. — 5 km SE Laholm, T.G. — Steninge s:n, Undermosse, L.Z.M., B.H. — Steninge, HANSTRÖM 1950. — Vallda s:n, G.N.M. — Kungsbacka G.N.M.

Småland except Kalmar län. Tingsås s:n, Sävsjömåla, L.Z.M. — Södra Sandsjö, T.G. — Hinneryd, Gungshult, T.G. — Göteryd, Vissle mire, H.L. — Virestad, Låckansjön, L.L.I. — Virestad, Sönneshult, H.L. — Virestad, Högavång, H.L. — Urshult s:n, near Åsnen, L.Z.M. — Tingsryd, T.G. — Stenbrohult, Toxås, H.L. — Stenbrohult, Rephult, H.L. — Skatelöv, Agnäs, H.L. — Väckelsång, to the north of Fiskestadssjön, H.L. — Älmeboda s:n: to the west of Korrö; Lummemåla, L.Z.M. — Älmeboda, Trällebo, T.G. — Långasjö s:n, Barebosjön, L.Z.M. — Ljuder s:n, Tjugosjö, T.G. — Algutsboda s:n, Stekaremåla, L.Z.M. — Algutsboda s:n, Hermanstorp, H.L. — Angelstad; Bolmen stn.; Biskopsvara, H.L. — Ryssby s:n, Östraby, H.L. — Ryssby s:n, L.Z.M., CURRY-LINDAHL 1948 B, 1951, I.G.E. — Öja, H.L. — Öjaby, T.G. — Växjö, Teleborg, J.B. — Växjö, C.G.K., J.B. — Hälleberga, H.L. — Vittaryd, H.L. — 2 km to the south of Långaryd, T.G. — Dannäs s:n, Toftnäs, L.Z.M. — Toftaholm, L.Z.M. — To the north of Furen, T.G. — Moheda, L.L.I. — Dädesjö, T.G. — Lenhovda, H.L. — Skeppshult, L.Z.M. — Våxtorp, H.L. — Aneboda, L.L.I., L.Z.M., M.M., LANG 1928. — Lamhult, L.L.I. — Vinninge, Berg, L.Z.M. — Ramkvilla, H.L. — Södra Solberga, Lökaryd, H.L. — Åseda, H.L. — Lemmhult s:n, L.Z.M., Å.H. — Kävsjö s:n, on the southern shore of Kävsjön, L.Z.M. — Nydala, L.Z.M., V.W.E. — Näsby s:n, Hällinge, G.N.M. — Karlstorp, CYRÉN 1910. — Byarum, Stigamo, BJURULF 1944. — Angerdshestra s:n, BJURULF 1944. — Månsarp, BJURULF 1944. Edshult s:n, Gummarp, L.Z.M. — Ingatorp s:n, Alvestorp, G.N.M. — Mariannelund, L.Z.M. — Mulseryd s:n, Röksberg, L.Z.M. — Rogberga s:n, BJURULF 1944. — Öggestorp, BJURULF 1944. — Bottnaryd s:n, Svansö, L.Z.M. — Bottnaryd s:n, to the west of the church, G.N.M. — Dummemosse, G.N.M., K.C.-L. — Jönköping, Rosenlund, L.Z.M. — Järstorp s:n, BJURULF 1944. — Bankeryd, Tranghalla, STÅLBERG 1932. — Strömsholm, J.B. — Haurida s:n, Sandvik, L.Z.M. — Haurida s:n, to the west of Härsjön, G.N.M. — Bunnsjön, L.Z.M.

Kalmar län. Värnanäs, P.H.-A. — Vissefjärda s:n, Lockatorp, L.Z.M. — Vissefjärda, L.Z.M. — Oskar s:n, Lillaverke, T.G. — Hossmo, L.Z.M. — Rinkabyholm, Dunö, L.Z.M., HANSON 1948. — Kalmar, L.Z.M. — HEINTZE 1909. — Kalmar area, HANSON 1950. — Dörby s:n, Smedby, U.S. — Dörby s:n, Nygärde, T.G. — Kläckeberga s:n, Wesslö, L.Z.M., Exc. — Åby s:n, Stävlö, L.Z.M., Exc. — Madesjö, H.L. — Ryssby s:n, Ryssbylund, HEINTZE 1909. — Ryssby s:n, L.Z.M., — Sandslätt, T.G. — Bäckebo, L.Z.M., T.G., H.L. — Strömserum, L.Z.M., Exc. — Ålem, T.G. — Allgunnen, L.Z.M., GISLÉN 1935. — Mönsterås area, Å.D. — Högsby s:n: Mjösebo; Gussemåla, L.Z.M., T.G. — Emsfors, L.Z.M. — Fagerhult, Välsgårda, H.L. — Döderhult s:n, G.N.M. — Virserum, near Hultarp, H.L. — Tveta s:n, HEINTZE 1909, NILSSON 1842. — Gårdvedaån, Ämmenäs,

HEINTZE 1909, G.N.M. — Målilla s:n, three localities, G.N.M. — Målilla s:n, Årena, L.Z.M. — Målilla s:n, H.L. — Kristdala, L.Z.M. — Hummeln, Baggetorpsqvarn, L.Z.M. — Tuna s:n, Flohult, L.Z.M., J.B., T.G. — Tuna s:n, Bredshult, T.G. — Västervik, L.Z.M., Å.H. — Tryserum, Sjönero, G.N.M.

Öland. Ottenby, to the south of the lighthouse, N.R.M., K.C.-L. — Ottenbylund, L.Z.M., K.C.-L., HEINTZE 1909. Södra Möckleby, Albrunna Lund, C.E., D.C. — Smedby s:n, Hammarby, G.N.M. — Segerstad s:n, Mellby, HEINTZE 1909. — Hulterstad, HEINTZE 1909. — Resmo, N.R.M., HEINTZE 1909. — Resmo "alvar", L.Z.M. — Möckle mire, L.Z.M., HORN AF RANTZIEN 1955. Exc., C.E. — Vickleby, Karlevi, Exc. — Between Stenåsa and Gårdby, HEINTZE 1909. — Beijershamn, L.Z.M., EDELSTAM 1944, C.E. — Torslunda, Runsbäcksby, L.Z.M. — Färjestaden, L.Z.M. — Bredsätra s:n, Övre Sandby, L.Z.M. — Köping, Öjmossen, G.N.M., C.E. — Löt s:n, Torparehorva, L.Z.M. — Löt, Petgärde, C.E., D.C. — Föra, Djurstad, C.E. — Alböke s:n, Korntorp, L.Z.M. — 10 km to the south of Persnäs, K.C.-L. — Persnäs s:n, to the west of Södviken, L.Z.M. K.C.-L. — Lofta; Knisa mire, K.C.-L. — Källa s:n, Långerum, L.Z.M. — Hornsjön, L.Z.M., C.E., D.C. — Vedborm fen, L.Z.M. — Böda, Byrum, L.Z.M. — Böda s:n, Svartviksmyren, JOHANSSON 1955 A. — Böda, to the north of Svartvik, D.C., HANSSON 1950. — Böda, L.Z.M., C.E., S.H.

Gotland. Sundre s:n, Muske mire, G.N.M., L.Z.M., H.L. — Follingbo s:n, Rosendal mire, D.C., N.N. — 6 km to the southeast of Visby, C.E. — Terra Nova, D.C. — Endre s:n, to the east of Ölbäck, L.Z.M. — Visby, Brissund, K.C.-L. — Lummelunda, L.Z.M. — Fleringe, L.Z.M. — Fårö: Farnevik fen, D.C.; Lauters, D.C.; Eke fen, K.C.-L.

Göteborg. Slottsskogen, G.N.M., MALM 1877. — Kärralund, G.N.M., MALM 1877. — Bäversjön, G.N.M.

Bohuslän. Långö, Sälöfjord, G.N.M. — Jörlanda, G.N.M., H.L. — Valla s:n, Myggenäs and Almön, G.N.M. — Tjörn, EKSTRÖM 1850. — Morlanda, Fröjdendal, L.Z.M. — Ljungskile, G.N.M., MALM 1877. — Fiskebäckskil, N.R.M., P.H.-A. — Kristineberg, G.N.M. — Skaftön, U.Z.M. — Skaftö, Skåret, P.H.-A. — Uddevalla, L.Z.M. — Bro, Näverkärr, H.L. — Grebbestad, G.N.M., MALM 1877. — Tanum s:n, Linnebacka, L.Z.M. Strömstad, Öddö, N.R.M.

Västergötland. Östra Frölunda s:n, Hid, L.Z.M. — Ambjörnarp s:n, Skummenäs, L.Z.M. — Örsås s:n, Röstorp, L.Z.M. — Tranemo, Ömmestorp, L.Z.M. — Svenljunga s:n, Änglarp, L.Z.M. — Hillared s:n, Dunsjön, L.Z.M. — Borås, C.B. — Strängsered, Komosse, H.L. — Ulricehamn, L.Z.M. — Ulricehamn area, L.Z.M. — Vist, L.Z.M. — Dalum, L.Z.M. — Lerum, Stenkullen, CURRY-LINDAHL 1948 B, Alingsås, Å.H-l. — Gustaf Adolf, G.N.M. — Fivlered, Ulvarp, G.N.M. — Sandhem, Hunared, G.N.M. — Långared, Frishulan, L.Z.M., CURRY-LINDAHL 1948 B, Å.H-l. — Vartofta, N.-G.K. — Yllestad, G.N.M. — Vättak, Bronan, G.N.M. — Brandstorp, Alvasjön, N.-G.K. — Gökhem, at the church, A.D. — Mösseberg, Skogsgården, U.S. — Mösseberg, eastern side, H.A.L. Falköping. — Gerumsberget, St. Höga, H.L. — Tiarp s:n, Fårdala, U.S. — Dala s:n, Alebäcken, G.N.M. — Hornborgasjön, L.Z.M., — Häggum s:n, U.S. — Axvall, Högetomt, A.D. — Karaby s:n, N.-G.K. — Trässberg, N.-G.K. — Tådene, Storeberg, N.-G.K. — Råda, N.-G.K. — Lidköping, N.-G.K. — Kinnekulle, KARVIK 1953. — Framnäs, L.Z.M. — Östen, G.N.M., L.Z.M., K.G.W. — Ottersta s:n, Billingsö, N.-G.K. — Mariestad, B.F.

Östergötland. 2 km to the north of Sund church, J.B. — Ödeshög s:n, Visjö, G.N.M. — Ödeshög s:n, Orrnäs, L.Z.M. — Omberg, Stocklycke, G.N.M., L.Z.M. — Väfversunda, on the western shore of Tåkern, G.N.M. — 4 km to the south of Ringarum church, J.B. — Källstad s:n, Hånger, L.Z.M., T.G. — Hof s:n, N.R.M. — Bjälbo, Marstad, G.N.M. Gryt s:n: eastern part of Stora Ålö, G.N.M.; Danebosjön, G.N.M., L.Z.M., C.M. — Gusum, N.R.M., H.A.L. Västerås. — S:t Anna s:n, Yxnö; Kejsarudden, L.Z.M.

— Fivelstad, G.N.M. — Hagebyhöga, to the southwest of Hagebytorp, H.L. — Västra Stenby: Fågelstad; Hålan; to the north of Skeppstadsjön, H.L. — Linköping, L.Z.M. — Kaga s:n, to the north of Lera, G.N.M. — Stjärnorp, Bjän, H.L. — Vånga s:n, Glan limeworks, H.B. — Kullerstad s:n: Laxfjärden, L.Z.M., H.B.; Okna; Runken, H.B. — Borg s:n: Vi; Herrebrokärr, H.B. — Bråviken, Svinsundsfjärden, H.B. — Östra Stenby, Ållonö, H.B. — Godegård s:n: Storgölen; Rödja; Ånshult; H.L. — Risinge s:n: Skiren, H.L.; L.Z.M., H.B.; Viberga fen, H.B. — Krokek, Hampsjön, G.N.M. — Tjällmo s:n, to the west of Brötkullen, H.L.

Dalsland. Ödeborg, N.-G.K. — Sundals-Ryr, N.-G.K. — Kroppefjäll, KARVIK 1953 A. — Ör, N.-G.K. — Frändefors, N.-G.K. — Mellerud, LANG 1928. — Järn, N.-G.K. — Järbo s:n, Hult, LANG 1928. — Järbo, N.-G.K. — Tisselskog, N.-G.K. — Köpmannebro, G.N.M. — Tingvalla, Åstjärn, G.N.M., O.N. — Ed, LANG 1928, N.-G.K. — Tydje, N.-G.K. — Åmål, Fjället, R.E. — Åmål, LANG 1928, R.E. — Nössemark, N.-G.K., — Mo, N.-G.K.

Värmland. Visnums-Kil, L.Z.M.; — Kilsviken, K.C.-L. — Svanskog, Hugnerud, H.L. — Trankil s:n, Gyltenäs, L.Z.M. — Blomskog, H.L. — Långserud, Myrsjön, the eastern part, H.L. — Sillerud: Häljebyn; Kjestadmossen, H.L.; Klubbtjärn, H.L. — Silbodal, between Kållcboda and Sällaby, H.L. — Between Karlstad and Jakobsberg, HEINTZE 1909. — Töcksmark, H.L. — Stora Kil s:n, Norra Hyen, A.K. — Glava, H.L. — Järnskog, H.L. — Torsby, at Fryken, L.Z.M. — Ekshärads s:n, Föskefors, L.Z.M., D.H., O.H.

Närke. Laxå, Karamossen, H.L. — Tisaren, Tisaretorp, L.Z.M., G.Ö-t. — Viby on the southern shore of Vibysjön, H.W.W. — Skagerhult s:n, Skagerhultsmossen, L.Z.M., A.D. — Svartå works, SUNDSTRÖM 1868. — Asker, H.W.W. — Kvismaren, K.C.-L. — Örebro, Oset, L.Z.M., K.C.-L. — Tysslingen, K.C.-L.

Södermanland. Björkvik s:n, Vivå, L.Z.M. — Mavsjö, T.W. Vingåker, T.W. — Katrineholm, T.W. — Halla s:n, Hallbosjön, ROSENBERG 1952, K.C.-L. — Helgesta s:n, Sund, C.F. — Ösmo, near Segersäng, T.G. — Södertälje, K.C.-L. — Between Flintsjön and Frejdalen, H.W.W. — Huddinge s:n, Balingsholm, CURRY-LINDAHL 1946 A, 1952, K.C.-L. — Eskilstuna area, SJÖSTEDT 1920.

Stockholm. Värmdö, T.W. — Bromma: Judarn, H.a.R.; Riksby, S.E-n.; Kyrksjön, H.a.R. — Dammtorpssjön, C.E. — Djursholm, Ekebysjön, C.E. — Stockholm, N.R.M.

Uppland. Stockholmsnäs s:n, to the south of Kungsängen stn., H.a.R. — Järva, T.W. — Spånga s:n, L.Z.M. — Järfälla; Säbysjön, L.Z.M., T.W.; Hägerstalund, L.Z.M., N.R.M. — Viggbyholm, T.W. — Täby, Gävsjön, C.E. — Österåker s:n: Träsksjön; Valsjön, H.a.R. — Vallentuna, Angarnsjön, H.a.R., K.C.-L. — Össebygarn, N.R.M. — Hjulsta s:n, Hjälstaviken, H.K-g. — Danmark s:n, Bergsbrunna, B.W. — Uppsala, U.Z.M., S.E. — Järlåsa s:n, Ramsmossen, H.K-g. — Vendel, S.E. — Börstil, Avesta samrealskola, — Hållnäs s:n, Fågelsundet, S.F-s.

Västmanland. Tidö; Gröggen, WALLDÉN 1955. — 3 localities in western part, WALLDÉN 1954.

Dalarna. Malingsbo s:n, Haraldstorp, H-s.L. — Avesta, A.K. — Ludvika, CURRY-LINDAHL & MELLQUIST 1949. — Hedemora, A.K. — Stora Tuna s:n, Repbäcken, A.K. — Gagnef s:n, Bäckan, DAHL 1943. — Gagnef s:n, CURRY-LINDAHL & MELLQUIST 1949. — ?Grövelsjön, A.W-t.

Gästrikland. Torsåker, Kratte forge, L.Z.M., P.A. — Ockelbo, C.B.G.

Hälsingland. Hudiksvall, L.Z.M.

Medelpad. Tuna s:n, Matfors, L.Z.M.; Långsjön, WALLDÉN 1954. — Sundsvall, T.G.

Västerbotten. Lövånger: Broträsk, O.H.; Vallen, HOLM 1939, N.R.M.

Norrbotten. Luleå: Lulsundet, L.Z.M., N.R.M.; Hertsön; Porsön, L.Z.M., E.H. — Luleå, L.Z.M. — Haparanda Sandskär CURRY-LINDAHL 1955 A, 1956. — Between Pajala and Kihlangi, Kaunisjoki, pt. 161.6, L.Z.M., DAHM 1953.

Lappland. Arvidsjaur, LILJEBORG 1849. Auktsjaur, Granträskån, L.Z.M., H.K.

Rana temporaria temporaria (LINNAEUS). **Common Frog. Vanlig groda**

Distribution: This species is not indigenous in Ireland where it was introduced to Dublin in the 17th century (SMITH 1954). Otherwise it is common in Scotland, England, France, but is lacking in the south of this country. It is substituted in the Pyrenees and in the north-west of Spain by *Rana temporaria parvipalmata.* Eastwards it is distributed across central Europe and Russia to the Ural Mts. The southern border reaches 46° N in northern Italy, extends in the Balkans through Albania, Jugoslavia, Bulgaria (BURESH & ZONKOV 1941) and across Ukraina between 50°–52° N.

The northern border extends in Scandinavia to the coast of the Atlantic and Arctic Ocean and continues in Russia along the southern border of the tundra, to the Ural and Ob River, eastwards of which TERENTJEV (1949) found it to be substituted by a smaller species *R. shensinensis* DAVID. In the far east *R. temporaria* reappears in the Ussuri-district, on Saghalin and the island of Hokaido (TERENTJEV & ČERNOV 1949).

In Sweden *R. temporaria* has a peculiar distribution. It is common in Scania, but absent from the Baltic islands, Öland and Gotland. (One record from Gotland in the Gothenburg Museum turned out to be larvae of *Bufo bufo.*) In Denmark it is also absent from the islands Langeland, Lolland, Falster, Møen, and Bornholm, where in all cases the rainfall is scanty. Further it is lacking in the part of Blckinge east of Karlshamn and in Kalmar län. But it is likewise absent in the western boggy part of middle Sweden except for a narrow strip in western Halland where *Rana temporaria* appears again along the west coast. On the other hand, there is a broad area in the middle part of Småland extending from between the lakes Möckeln and Åsnen up to Nässjö where the common frog is found when the lake types show more or less meadowy shores. North of this *R. temporaria* is common again in Östergötland and Västergötland. Further northwards it occurs all over Sweden to the northernmost area. The ecological causes of the remarkable gap of distribution in southern Sweden are rather obscure. *R. arvalis* is common in the great *Sphagnum* bogs of the west and in the east in the small peat bogs of Kalmar län and in the fens of the Silurian islands.

Vertical distribution: 0–850 to 1000 m above sea level.

Largest size: 82 mm male, 93 mm female.

Colour very variable. Usually this species is preponderatingly brown, sometimes greenish grey, reddish brown, or almost brick-red. (As figured by ROESEL VAN ROESENHOF.) The underside is commonly nebulously grey, especially on the belly. In case of reddish specimens the underside is generally provided with light reddish specks. In one case (a Scanian specimen) the underside was found to be almost black-specked. A densely black-dotted specimen may occur, but is fairly rare. RENDAHL & WESTERGREN have described a peculiarly long-legged form of this type. A striped form may occasionally be found. One specimen from Haparanda was almost lilac red. A frog which was otherwise brown-red (from Nederluleå)

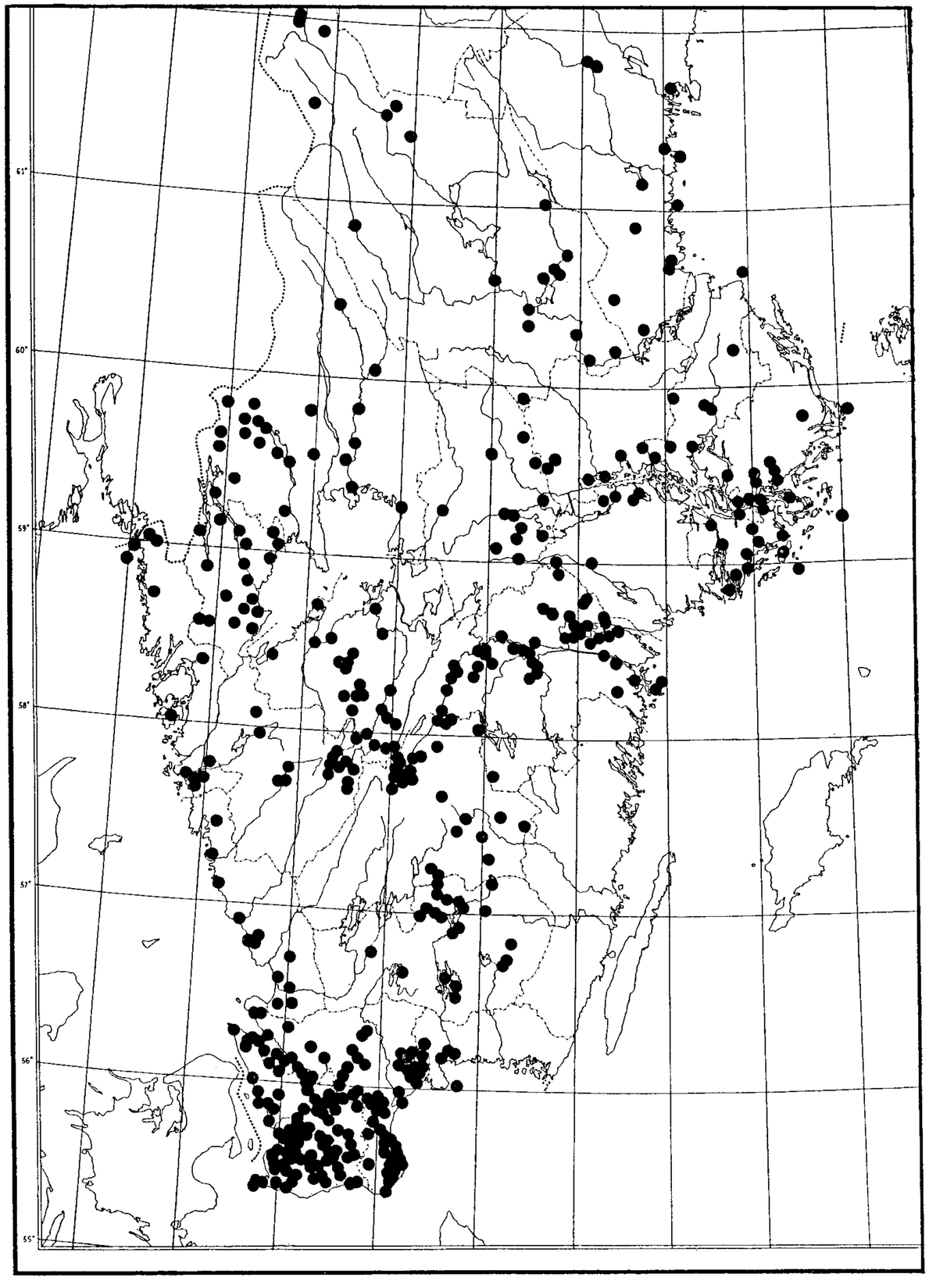


FIG. 42, 43. Distribution in Sweden of *Rana temporaria*.

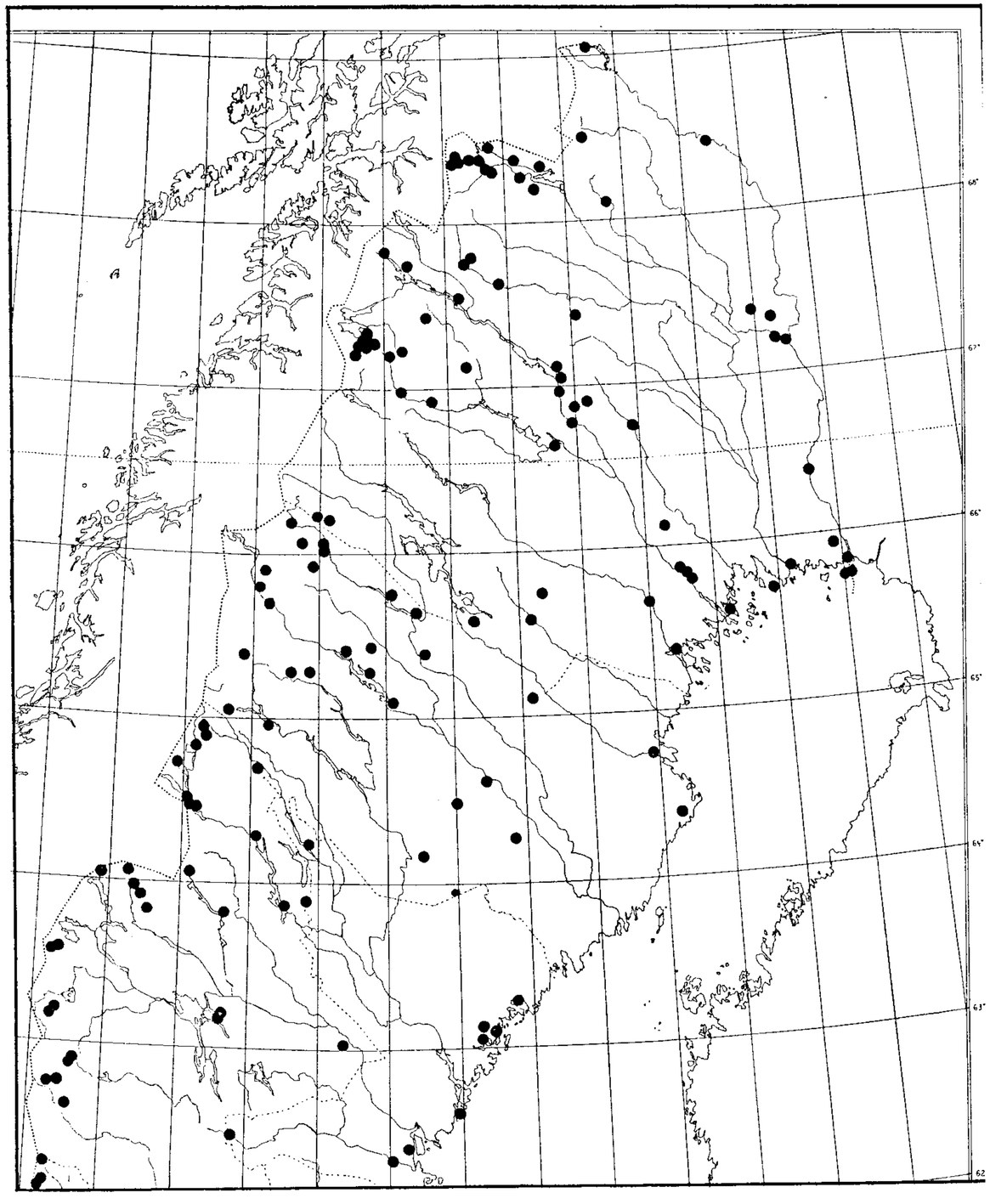


FIG. 43.

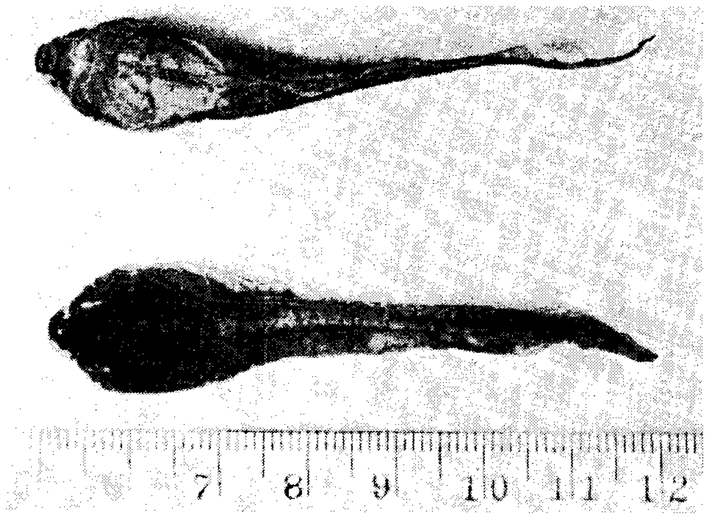


FIG. 44. Giant tadpoles of Common Frog. Photo by H. GRÄNS.

was described to be almost lobster-red on the underside. One specimen from Västergötland had black specks, so densely distributed on the dorsal side that it became completely black. The Norrlandic forms are commonly provided with black tarry specks on the dorsal side. There seem to be many red specimens in Norrland. In several cases the skin is fairly warty and rather similar to that of the toads in the Norrland area.

The spawning of *R. temporaria* comes in Lund about the 5th April and varies between 31st March (1953) and 22nd April (1958). At Balingsholm, Södermanland, CURRY-LINDAHL (1946 A) found it to begin between 11th April (1946) and 22nd April (1945). In Kiruna (67°44′ N) I found newly laid eggs on 31st May 1947, when the ice was still partly lying on the small ponds. The roe is floating and the eggs therefore subjected to the warmth of the surface during the days and the cold nights. Data on the spawning in the *Betula* zone of mountains in Swedish Lapland have been given by CURRY-LINDAHL (1958). According to him, spawning may occur from the middle of May to the end of June, depending on the latitude and the altitudinal levels. In the same pools in the mountains different contingents (populations?) may spawn at different times during the same year beginning at about 23–24 May and still spawning on 29 June. This was the case in Njåtsosvagge in Lule lappmark, where spawning took place, newly laid eggs were found, and lots of 12–15 mm long larvae were recorded on 29 June.

The size of the larvae of *R. temporaria* reaches generally 45 mm. In rare cases it may grow to a giant size with a length of the specimens reaching 60–70 mm (with small posterior legs). Such specimens were found by TÖRNQVIST in Önnerud, Grava, Värmland, October 1937 (fig. 44). He mistook them for larvae of *Pelobates fuscus*. However, it is here a question of gigantism, earlier reported in *R. esculenta* and *Pelobates fuscus*.

In the larvae in Scania, metamorphosis during warm years comes already on the 10–20th June i.e. after 65–75 days. (Size: 12–13 mm of the young fry). In the same year in September–October the young frogs have grown to 26–33 mm and in the autumn of the second year to 46–49 mm. In the third year they attain a size of about 61–67 mm.

In northern Sweden the larvae are in metamorphosis at the end of July or at more northerly latitudes at about the 10th of August.

K.-H. FORSSLUND (1946) 20/6 1925 reported from 890 m Långfjället, Idre, Dalarna, some frog larvae still having the legs lacking. He thought that he had found hibernated young but, as the larvae had no legs, it is rather certain that at that time of the year they were normal and showed no special delay in development.

OCCURRENCE:

Skåne. Falsterbo, L.Z.M., P.H.-A. — Skanör: Flommen, M.M., H.a.R.; Stadsparken, H.a.R. — Skanör, L.Z.M. — Ljunghusen, P.H.-A. — Vellinge, P.H.-A. — Hököpinge, M.M. — Skegrie, P.H.-A. — Trelleborg, P.H.-A. — Fuglie, Steglarp, N.R.M., SÖDERBERG 1908, P.H.-A. — Östra Grevie, N.R.M., Exc., T.G. — Västra Ingelstad, Broddarp, A.K. — Fjärdingslöv, P.H.-A. — Fru Alstad, P.H.-A. — Västra Vemmenhög, Trekronor, P.H.-A. — Solberga, Torsjö, P.H.-A. — Skivarp, P.H.-A. — Skårby, P.H.-A. — Bjäresjö, P.H.-A. — Krageholmssjön, L.Z.M. — Ystad, Breasten, P.H.-A. — Ystad, P.H.-A. — Kåseberga, T.G. — Sandhammaren, L.Z.M., A.D., Y.M. — Borrby: Granliden, G.N.M.; Östra Hovby, N.R.M. — Östra Hoby, P.H.-A. — Vallby, Glivarp, G.N.M. — Tygelsjö, P.H.-A. — Segeå, at Lundavägen, P.H.-A. — Görslöv, L.Z.M. — Nevishög, Torreberga, H.B-m. — Södra Sallerup, L.Z.M. — Törringe, P.H.-A. — Svedala, Hyltarp, P.H.-A. — Skabersjö, L.Z.M. — Torup, M.M. — Yddingen, Roslätt, P.H.-A. — Hyby s:n: Sjödikena, H.B-m.; Bökeberg, L.Z.M., Kolahygget; Eksholmssjön; Borup, U.S. — Börringe, SÖDERBERG 1908, P.H.-A. — Börringesjön, P.H.-A. — Börringe, Lemmeströ, P.H.-A. — Romeleåsen, Hylla, P.H.-A. — Häckeberga, Exc. — Everlöv, Östarp, P.H.-A. — Everlöv, T.G. — Blentarp s:n, Karup meadows, K.C.-L. Exc. — Sövdesjön, K.C.-L., — Snogeholmssjön, K.C.-L., — Sjöbo, K.C.-L. — Ilstorp, P.H.-A. — Eriksdal, Exc., A.D. — Röddinge, P.H.-A. — Ullstorp, the church, A.D., Y.M. — S:t Olof, Exc., H.L. — Bolshög, Stjärngården, H.L. — Östra Tomarp, G.N.M., P.H.-A. — Östra Vemmerlöv, H.L. — Rörum, Vik, G.N.M., H.L. — Baskemölla, P.H.-A. — Simrishamn, L.Z.M., P.H.-A. — Åkarp, P.H.-A. — Lomma, G.N.M., ÅSTRÖM 1859. — Lund, L.Z.M., Exc. — Stora Råby, T.G. — Odarslöv, P.H.-A. — Dalby, Sjöstorp, L.Z,M., Södra Sandby, L.Z.M. — Dalby, P.H.-A. — Södra Sandby, Linnebjer, L.Z.M. — Södra Sandby, L.Z.M., P.H.-A. — Krankesjön, P.H.-A. — Veberöd, Skogsmöllan, L.Z.M. — Vombsjön, southern side, T.G. — Vomb, Exc. — Bjärsjölagård, Exc. — Tolånga, L.Z.M. — Vollsjö, L.Z.M , A.L-m. — Andrarum, L.Z.M., Exc., P.H.-A. — Kristinehov, L.Z.M., P.H.-A. — Brösarp, the church, A.D., Y.M. — Vitaby s:n, Torup, G.N.M., M.M. — Vitaby, the church, A.D., Y.M. — Klammerbäck, near Vitemölla, H.B-m. — Kivik, Eljaröd, L.Z.M., P.H.-A. — Stenshuvud, L.Z.M., A.D., Y.M. — Landskrona, K.A. — Ven, NILSSON & THORSON 1950. — Barsebäck, L.Z.M., A.L-m, H.B-m. — Häljarp, Häljarpsgården, L.Z.M., S.F. — Saxtorp, L.Z.M., Exc., P.H.-A., S.S., T.G., Y.M. — Dösjöbro, Ålstorp, P.H.-A. — Örtofta, Exc., H.B-m. — Eslöv, P.H.-A. — Kungshult, Exc. — Gudmundtorp, Rolsberga, P.H.-A. — Löberöd, Rövarekulan, T.G. — Hörby, P.H.-A. — Hörröd s:n, near the church, H.L. — Borrestad, L.Z.M., Exc. — Vittskövle,

G.N.M. — Råå, T.G. — Glumslöv, P.H.-A. — Svalöv, G.M. — Röstånga, T.G. — Billinge, 5 km NE of the church, A.D. — Stehag, L.Z.M. — Sjöholmen, T.G. — Bosjökloster, L.Z.M., Exc., P.H.-A. — Höör, Sätofta, L.Z.M., Exc. — Höör, H.B-m. — Södra Rörum, Gunnarp, H.L. — Södra Rörum, T.G. — Linderöd s:n: Byrhult; Pårup; Spångarp, H.L. — Linderöd, T.G. — Svensköp, Hultaleby, G.N.M. — Östra Sönnarslöv: Maltesholm; SW of the church, H.L. — Östra Sönnarslöv, Exc. — Everöd, Lyngby, H.L. — Lyngsjö s:n, Bäcklunda, G.N.M. — Vramsån, P.H.-A. — Åhus, Äspet, M.M., K.A., P.H.-A. — Rinkaby, P.H.-A. — Mjöhult, Exc. — Strövelstorp, Örjamöllan, P.H.-A. — Hyllinge, Ekebro, P.H.-A. — Åstorp, Tingvalla, A.S. — Åstorp, L.Z.M., U.S. — Norra Vram, Båv, U.S. — Klöva Hallar, L.Z.M. — Klippan, Rönneå, L.Z.M. — Ljungbyhed, L.Z.M. — Skäralid, L.Z.M. — Färingtofta, T.G. — Västra Torup, L.Z.M. — Tjörnarp, Sjöberga-sjön, H.B-m. — Sösdala, Lillsjödal, U.S. — Brönnestad, L.Z.M. — Ignaberga, A.D. — Vinslöv, A.D. — Balsberg, Exc. — Oppmanna, G.N.M. — Bäckaskog, L.Z.M. — Trolle-Ljungby, Tosteberga, L.Z.M., H.L. — Gualöv, P.H.-A. — Ivö, A.D., Y.M. — Ivetofta s:n; Krogstorp, H.L.; Råby, L.Z.M.; — Barnakälla, L.Z.M. — Ivetofta s:n, R.J. — Ivösjön, Exc. — Brunnby s:n, Krapperup, H.a.R. — Farhult s:n, Häljaröd, L.Z.M., A.N-n. — Farhult, L.Z.M. — Vegeholm, L.Z.M., A.N-n. — Ängelholm, Rönneå, N.T.-W., S.T-k. — Förslövs s:n; Segelstorp; Fogdarp, L.Z.M. — Rösjöholm, L.Z.M., — Oderljunga, T.G. — Stoby s:n, A.K. — Lursjö, A.K. — Hästveda, A.K. — Arkelstorp, G.N.M. — Villands Vånga, T.G. — Näsum s:n, R.J.

Blekinge. Hanö, Bönsäcken, L.Z.M. — Mörrums s:n: Björkenäs, T.G.; Kylingaryd, L.Z.M. — Asarum, L.Z.M. — Jämshög, L.Z.M.

Halland. Östra Karup, L.Z.M., K.G.W. — Våxtorp, T.G. — 5 km to the east of Laholm, T.G. — Laxvik, L.Z.M., P.A., A.D. — Marbäck, L.Z.M. — Steninge s:n, Stensjö, L.Z.M., B.H. — Steninge, L.Z.M., K.C.-L., Hanström 1950, B.H. — Getinge s:n, A.K. — Falkenberg, T.G. — Morups tånge, K.C.-L. — Varberg, Varbergs samrealskola, Backa, Väröbacka, G.N.M., P.H.-A. — Fjärås, L.Z.M.

Småland except Kalmar län. Urshult, Exc. — Urshult, Västerbotorp, H.L. — Åsnen, Sirkön, Exc. — Liatorp, T.G. — Kånna, to the southeast of Lunnarp, H.L. — Ljuder, Tjugosjö, T.G. — Ljuder, Slätthult, H.L. — Kosta, T.G. — Växjö, C.G.K. — Växjö, Sandsbro, H.L. — Mistelås, T.G. — 2 km to the west of Slätthög, T.G. — Moheda, to the north of Furen, H.L. — Moheda, H.L. — Söraby: Bröttjaryd; Vartorp, H.L. — Dädesjö, T.G. — Berg, Vinninge, L.Z.M. — Nottebäck, Klavreström, N.R.M., Gaunitz 1939, 1949, Rendahl & Westergren 1939. — Aneboda, Lang 1928. — Lamhult, G.N.M. — Algunnen, L.Z.M. — Hjälmseryd, L.Z.M. — Korsberga, H.L. — Vetlanda, L.Z.M. — Norra Sandsjö, Prinsnäs, G.N.M. — Karlstorp, Cyrén 1910 — Stensjö, Rödjenäs, L.Z.M. — Edshult s:n, L.Z.M. — Månsarp s:n, L.Z.M., Bjurulf 1944. — Nässjö s:n, Isåsa, L.Z.M., Å.H. — Barnarp s:n, Bjurulf 1944. — Rogberga s:n, Bjurulf 1944. — Sandseryd s:n, Bjurulf 1944. — Ljungarum s:n, Hedenstorp, Bjurulf 1944. — Solberga, H.L. — Jönköping: Torpa, G.N.M.; Tranghalla, G.N.M., Stålberg 1932; Strömsberg, K.C.-L. — Huskvarna, H.L. — Järstorp, Bjurulf 1944. — Bankeryd, Bjurulf 1944. — Dunime mosse, K.C.-L. — Skärstad s:n, Landsjön, Bosgård, L.Z.M., T.G. — Skärstad, Bjurulf 1944. — Vireda s:n: Lövsta; Viredaholm, H.L. — Tranås, Tranås Säteri, L.Z.M. — Gränna, Getingaryd, G.N.M. — Adelöv s:n: Ulvsbo; Björstorp, H.L.

Göteborg. Slottsskogen, G.N.M. — Delsjön, G.N.M. — Lundagården, G.N.M. — Göteborg area, Malm 1877.

Bohuslän. Hisingen, Arendal, A.R. — Angered, Gunnared, H.L. — Partille, H.L. — Tjörn, Ekström 1850. — Hönö, K.C.-L., — Grötö, K.C.-L. — Uddevalla, L.Z.M. — Tanum s:n, Vitlycke, L.Z.M. — Kärnö s:n, Sydkoster, L.Z.M. — Strömstad, Hälsö (Hällesö), G.N.M. — Näsinge s:n, Sundby, N.R.M. — Hogdal, L.Z.M.

Fig. 45. Common Frog. Photo by D. Segerfeldt.

Västergötland. Askim s:n, Otterbäck, Hovås, G.N.M. — Angered, H.L. — Grönahög s:n, L.Z.M. — Grönahög s:n, Solberga, L.Z.M., C.B. — Viared-area, Hall 1942. — Borås, Buttorp, L.Z.M., C.B. — Borås, G.N.M., C.B. — Fristad s:n, Öresjö, C.B. — Marbäck, L.Z.M. — Ulricehamn, L.Z.M. — Ulricehamn area, L.Z.M. — Strängsered, Brännebråten, H.L. — Gullared, H.L. — Hössna, Kinnared, H.L. — Hössna s:n, L.Z.M. — Vist s:n, L.Z.M. — Timmele s:n, L.Z.M. — Dalum s:n, L.Z.M. — Habo, Eskhult, L.Z.M.; — Mullsjö, H.L. — Torp, Å.H-l. — Fivlered, Ulvarp, H.L. — Gustav Adolf: Kämparp, H.L.; Sandhem, H.L. — Sandhem, Träsåsen, G.N.M. — Långared, Frishulan, Å.H-l. — Härja, Vitared, G.N.M. — Ålleberg, eastern part, G.N.M. — Velinge, G.N.M. — Gerumsberget: Mularp, G.N.M.; to the north of Stora Höga; Åsle, H.L. — Baltak, Ormestorp, G.N.M. — Mösseberg, Jättene, U.S. — Mösseberg, H.A.H. — Plantaberget, Kungslena, H.L. — Fröjered, G.N.M. — Karaby s:n, N.-G.K. — Hornborgasjön, K.-G.W. — Broddetorp, Bjällum, L.Z.M., K.-G.W. — Bolum s:n, T.S. — Stenum, L.Z.M. — Billingen, K.C.-L. — Billingen, to the southeast of Varnhem, U.S. — Lidköping, L.Z.M., N.-G.K. — Kinnekulle, Karvik 1953. — Källby s:n, Källbyån, N.-G.K. — Östen, L.Z.M., K.G.W. — Mariestad, L.Z.M., B.F., J.F. — Otterstad s:n, Stora Björkön, N.-G.K.

Östergötland. Rydsnäs, L.Z.M. — Ödeshög s:n: Stava, L.Z.M.; Öninge, H.L. — Omberg, Stocklycke, L.Z.M. — Väversunda, G.N.M. — Väderstad, H.L. — Bjälbo: Älgsjöarna, H.L.; Marstad, G.N.M. — Slaka, G.N.M. — Gusum, N.R.M. — Borghamn, L.Z.M. — Hagebyhöga, to the southwest of Hagebytorp, G.N.M. — Fivelstad s:n, Fågelstad, H.L. — Skänninge, H.L. — Västra Stenby: Skeppstad; Fågelstad, H.L. — Klockrike, H.L. — Vreta Kloster, Gullberg stn., H.L. — Kaga s:n: Lera, G.N.M.; at the mouth of Svartån, L Z.M. — Linköping: Berga, L.Z.M., B.W-n.; Nykvarn, L.Z.M. — Söderköping, L.Z.M., T.G. — Husby, T.G. — Gryt s:n, Gräsmarö, T.G. — S:t Anna s:n;

Båskär, L.Z.M., T.G. — Kristberg s:n, at the brook close to the church, U.S. — Stjärnorp, A.D. — Ensjön, H.B. — Kullerstad, H.L. — Runken, H.B. — Norrköping, Eksund, L.Z.M., H.B. — Fiskeby, L.Z.M., H.B. — Leonardsberg, H.B. — Kvillinge, H.a.R. — Svärtinge, H.B. — Ringstad, H.B. — Dagsberg s:n, H.B. — Svinsundsfjärden, H.B. — Allonöfjärden, H.B. — Krokek, Hampsjön, H.B. — Krokek, G.N.M. — Risinge s:n, Risten, H.B. — Finspång, Bönern, H.B. — Hällestad, Norra Klintorp, H.L. — Simonstorp: Bolen; Fläten, H.B. — Skedevi s:n, H.B. — Skedevi s:n, Skarbjörke, Behm 1914.

Dalsland. Gunnarsnäs s:n, C.M. — Färgelanda, N.-G.K. — Gestad, N.-G.K. — Between Högsäter and Sundals-Ryr s:n, L.Z.M. — Högsäter, Skallsjö, N.-G.K. — Sundals-Ryr, N.-G.K. — Ör, N.-G.K. — Mellerud, Holm, C.M. — Järn, N.-G.K. — Järbo, N.-G.K. — Tisselskog s:n, Buterud, C.M. — Tisselskog, C.M., N.-G.K. — Ed s:n, Äng; N.-G.K. — Dals-Ed, N.-G.K. — Tydje, N.-G.K. — Mo, Öjersbyn, N.-G.K. — Ärtemark, Norra Lund, N.-G.K. — Laxarbyn, N.-G.K. — Åmål, R.E. — Nössemark, Dammarne; Kölviken, N.-G.K. — Torrskog, Kesnacken, N.-G.K.

Värmland. Vänern, Kilsviken, K.C.-L. — Visnums-Kil s:n, Stormossen, K.C.-L. — Kila, Säterskog, H.L. — Trankil s:n, Gyltenäs, L.Z.M. — Silbodal, H.L. — Karlstad area, T.S. — Kristinehamn area, E.W. — Degerfors, Duvedalsängen, H.W.W. — Holmedal, Kroken, H.L. — Hillringsberg, H.L. — Stavnäs, H.L. — Forsnor, Lene, L.Z.M. — Stora Kil s:n, Norra Hyen, A.K. — Mölnbacka, Lusten, L.Z.M. — Nedre Ullerud, T.S. — Östervallskog, Djurskog, H.L. — Järnskog: Mosstakan, H.L.; the south end of Hemsjön, H.L. — Älgå: Gränsjön, A.E.; Sulvik, H.L.; near the south end of Ränken, H.L. — Skillingmark, Olerudberget, H.L. — Eda, Hugn, G.N.M. — The southwestern shore of Rottnen, L.Z.M. — Munkfors, N.R.M. — Hagfors area, E.W. — Norra Ny s:n: Värnäs, C.M.

Närke. Svennevad, Sottern, H.K-g. — Hallsberg, A.D. — Sköllersta s:n, A.D., G.W-g. — Lännäs, Hampetorp, H.K-g. — Norrbyås s:n, A.D., G.W-g. — Örebro, Oset, L.Z.M. — Örebro, A.D., H.K-g., H.L. — Hjälmarsberg, H.L. — Götlunda, A.D.

Södermanland. Torö, Lilludden, H.W.W. — Ösmo, Västervik, H.W.W. — Ösmo, Herrö, J.B. — Tungelsta, Träsksjön, T.G. — Ornö, Huvudskär, G.N.M. — Katrineholm, T.W. — Halla s:n, Hallbosjön, Rosenberg 1952, K.C.-L. — Ornö, J.B. — Grödinge s:n, to the north of Wiad, H.a.R. — To the east of Västerhanninge, H.W.W. — Dalarö, J.B. — Södertälje, K.C.-L., T.W. — Huddinge s:n, Balingsholm, Curry-Lindahl 1946 A, 1952, K.C.-L. — Nacka s:n: Dammtorpssjön, C.E., H.a.R.; Källtorpssjön, H.a.R. — Råby, Rekarne, to the south of Grå torp, H.W.W. — Eskilstuna, Sjöstedt 1920. — Kjula, Heby, H.W.W. — Jäder, to the north of Strand, H.W.W.

Stockholm. Mälarhöjden, Sättra, H.W.W. — Bromma: Riksby, S.E-n.; Judarn, H.a.R. — Bromma, L.Z.M. — Haga, N.R.M. — Karlberg, Bomsjön, N.R.M. — Stockholm, N.R.M. — Stockholm Skärgård, L.Z.M. — Stockholm area, L.Z.M., V.O.

Västmanland. Munktorp, Lilla Sandviken, H.W.W. — Rytterne s:n, J.B. — Linde, Siggebohyttan, H.W.W. — Finnåker, H.W.W. — Västra Skedvi, to the north of Stakbo, H.W.W. — Bro, Rotsjön, H.W.W. — Västerås, Djäkneberget, O.H-g. — Västerås, Walldén 1955, O.H-g. — Björksta, H.W.W. — Nyhammar, A.D.

Uppland. Grönskär, the lighthouse, N.R.M. — Värmdö, T.W. — Lidingö, O.D. — Viggbyholm, T.W. — Stockholmsnäs s:n, Tibbleviken, H.a.R. — Stockholmsnäs s:n, L.Z.M. — Järfälla s:n, K.C.-L. — Österåker s:n: Brevik; Valsjön; Vinsjön, H.a.R. — Täby, Gävsjön, C.E. — Össebygarn s:n, H.a.R. — Tillinge, Borgen, H.W.W. — Enköping, Björnbo, H.W.W. — Hjälstaviken, H.K-g., K.C.-L., T.W. — Uppsala, U.Z.M. — Börje s:n, Hesselby, U.Z.M. — Estuna s:n, Norra Malma, H.K-g. — Arholma, Ovanskär, H.B-m. — Järlåsa s:n, Ramsmossen, H.K-g. — Tämnaren, K.C.-L. — Dannemora, K.C.-L. — Near the lighthouse of Björn, S.F-s.

Dalarna. Malingsbo, H-s.L. — Avesta area, T.S. — By s:n: Fullstaängarna; Kyrkbyn; Årängarna, E.D. — By s:n, B.W. — Hedemora, Hovran, K.C.-L. — Silfberg, Sandvik, E.D. — Stora Tuna, 14 localities, E.D.; Frostbrunnsdalen, K.C.-L. — Gagnef, Tjärnaberget, J.E.D. — Gagnef, E.D. — Falun, L.Z.M., Klefbeck 1949, A.K., E.K. — Falun, Kopparberg, E.K. — Sundborn, Karlsbyn, B.T. — Sundborn, E.K. — Svärdsjö, E.D. — Malung area, 6 localities, H.W.W. — Lima s:n, Tandödalen, E.D. — Bingsjö: near Bingsjön, E-s.M.; Tvärån, E-S.M. — Bingsjö, L.Z.M., E-s.M. — Älvdalen: Rivsjön, E.K.; Jöllen, E.D., H.E.; Skarptäkt, E.K. — Särna: Fulufjäll, Curry-Lindahl 1949 A. — Idre: Städjan; Foskros; Långfjället; Huskläppen; Fosksjön, E.K. — Idre, Långfjället, A.D., K.H.F. — Idre, Slagufjäll, K.H.F.

Gästrikland. Österfärnebo, Karisjön, K.C.-L. — Torsåker, Kratte forge, L.Z.M. — Gävle area, G.K. — Hille, K.F. — Ockelbo, C.B.G. — Axmar s:n, Kusön, L.Z.M.

Hälsingland. Skog s:n, N.R.M. — Norrala s:n, Utvik, L.Z.M. — Norrala s:n, N.R.M. — Idenor s:n, Stenberg, H.A.L., Sundsvall. — Ljusdal, Bodin & Witt-Strömer 1951, L.S. — Hybo, S.G. — Rätan, K.C.-L.

Härjedalen. Ljusnedal s:n, Backvallen; Gisudalen; Mittåfjället, K.C.-L. — Skarsfjället, K.C.-L. — Storsjö s:n: Deltamyren at Kesusjön, Stortuvan, L.Z.M.

Medelpad. Tuna s:n, Matfors, L.Z.M. — Sundsvall, H.A.L., S.B-t., T.G.

Jämtland. Blåhammarstugan, Lang 1928. — Snasahögarna, Lang 1928. — Östersund, Rannåsen, G.N.M. — Östersund, L.Z.M., N.R.M. — Åre: Åreskutan, K.C.-L. — Åre: Mörvikshummeln, Persson & Sörlin 1953, K.C.-L. — Mansjön, L.G., H.K. — Laxviken, V.O. — Duved: Skalstugan, Curry-Lindahl 1948 A. Skalsvattnet, K.C.-L. — Strömsund, V.O. — Strömsund, Långåsen village, L.Z.M. — Offerdal: Bäitjandurre; Krutejaure; Klåmkse, Faxén 1948. — Kall s:n, Björkede, G.N.M. — Kall s:n, between Burvattnet and Björkvattnet, Faxén 1948. — Valsjöbyn, V.O. — Ströms s:n, Torsfjärden, L.Z.M. — Frostviken, Gussvattnet, N.R.M. — Gäddede, V.O. — Frostviken, U.Z.M. — Saxvattnet, L.Z.M. — Frostvikens s:n: Jormlien, N.R.M., U.Z.M., K.C.-L., V.O.; Ankarede, U.Z.M., V.O. — Between Ankarvattnet and Borgafjällen, 11 localities, K.C.-L. — Sarkenjaure, Grundsjön, Djupsjön, K.C.-L. — Hehtajaure, K.C.-L.

Ångermanland. Härnön, S.T-e. — Vibyggerå: Docksta; Sörgällstasjön, S.A-n. — Vibyggerå s:n, Kälaviken, L.Z.M. — Norra Ulvön, Bartler:1953. — Örnsköldsvik, Bartler 1953, A.L. — Tåsjö s:n, U.Z.M.

Västerbotten. Umeå, K.C.-L. — Vännäs, K.C.-L. — Lövånger, Holm 1940, O.H. — Burträsk, K.C.-L. — Skellefteå, L.Z.M.

Norrbotten. Öjeby, L.Z.M. — Långträsk, K.C.-L. — Älvsby s:n, Älvsbyn, H.K-g. — Storforsen, K.C.-L. — Luleå, Hertsön, L.Z.M., E.H. — Boden, L.S. — Vittjärv, Y.M. — Between Vittjärv and Framnäs, U.S. — Över-Luleå s:n, Kusträsk, L.Z.M. — Edefors: Bodträskfors, K.C.-L. Kalix, Rånö, N.R.M. — Kalix, G.B-n. — Haparanda Skärgård; Riskilä, L.Z.M. Tervalehto, Curry-Lindahl 1956. — Skomakaren, Curry-Lindahl 1956. — Haparanda, Torne Furö, L.Z.M. — Haparanda, A.L-n. — Bäverbäck, Iso Karsikkojärvi, V.O. — Sandträsk, H.K. — Matarängi, L.Z.M. — Övertorneå, Nilsson 1842. — Between Pajala and Kihlangi, Kaunisjoki, L.Z.M., Dahm 1953, Curry-Lindahl 1956. — Pajala, Kengisfors, L.Z.M., Pajala, Käymejärvi, L.Z.M. — Pajala, L.Z.M. — Pajala, Saalasvuoma, K.C.-L. — Junosuando, Lauttakoski, K.C.-L. — Leipiojärvi, K.C.-L. — Muodoslompolo: Muonionalusta, K.C.-L. — Kätkesuando, K.C.-L.

Lappland. Åsele, Källåliden, K.H-F. — Örträsk s:n, Långsele, G.H.v.P., O.H. — Lycksele s:n: Kroksjö, G.H.v.P., O.H.; Näsland, K.-H.F. — Saxnäs, L.Z.M. — Klimpen, Nieritjåkko, L.Z.M. — Klitvallen, L.Z.M. — Vardofjäll, L.Z.M. — Dikanäs; Henriksfjäll, L.Z.M. — Storuman, Avasund, L.Z.M. — Kyrkberg; Kyrkberget; Fårträsk, S.A-n. — Strömsund, to the east of Harvikberget, L.Z.M. — Vilhelmina s:n, Daimanplatån, K.C.-L. — Malå s:n, Rakkejaure, C.M. — Between Slagnäs and Avaviken, Trindberget,

L.Z.M. — Arvidsjaur, Herrevare, L.Z.M., H.K. — Arvidsjaur, L.Z.M. — Tärna; Hemavan; L.Z.M. — Tärna, Björkfors, C.B.G. — Tärna: Laxfjället; Norra Storfjället, E.K. — Tärna, A.H. — Auktsjaure, Granträsk, L.Z.M., H.K. — Sorsele S:n: Abbmoberget; Nalovardo; Kyrkberget; Stor-Ajgert; Stora Tjulträsk, GAUNITZ 1949. — Ammarfjället, Marsivagge, K.C.-L. — Juobbo, — Vindeldalen, CURRY-LINDAHL 1950 A. — Vindeldalen, Ajtelnasfors, K.C.-L. — Dalovardo, K.C.-L. — Svaipa: Räkerjokk; Bosjusjaure; Tjålmejaure, K.C.-L. — Vaikijaure: Randijaure area; Saskam, L.Z.M. — Stora Lule älv, Liggabyn, H.K. — Nattavara, H.K. — Kvikkjokk, Tarrakaisestugan, L.Z.M. — Kvikkjokk, N.R.M., NILSSON 1860, K.C.-L. — Kamajokk, K.C.-L. — Pårekjaure, K.C.-L. — Muddus National Park, GUSTAFSON & OLSSON 1947, V.O. — Muddusjokk, L.Z.M. — Stora Lule älv: opposit Muddus; Porjus; Luspebryggan, A.D., G.W-g. — Near Porjus, BERGSTRÖM 1931. — Keppoape, L.Z.M. — Tarradalen: Tarreluoppal, N.R.M., CURRY-LINDAHL 1950, K.C.-L. — Tarrekaise, K.C.-L. — Tarradalen, K.C.-L., O.C. — Tjuoltadalen, K.C.-L. — Sarek, Njåtsosvagge, K.C.-L. — Njåtsossjöarna, K.C.-L. — Kvikkjokk: Aktse, Y.M.; Sjaunja, G.N.M. — Sjaunja area, BERGSTRÖM 1930. — Virihaure area: Staddajokk; Vehejokk; Stalojokk Valley; Riddojokk; Ketjaurejokk (Ketjokk); Ketjaure; Ketjaure Plain; WINGSTRAND 1951, K.C.-L.; Staloluokta, L.Z.M., WINGSTRAND 1951, K.C.-L.; Unna Titir; Stuor Titir, WINGSTRAND 1951, K.C.-L. — Sarek, Sarvesvagge, CURRY-LINDAHL 1948 C. — Gällivare s:n; Harrå, G.N.M. — Suorva, the Tourist Station, A.D., G.W-g. — Suorva, FORSSLUND 1924. — Kaitum, A.D., G.W-g. — Between Kaitum and Singisstugan, A.D., G.W-g. — Vuolle Kaitumjaure, G.D. — Stora Sjöfallet National Park: Julletjokko; Kalajaure; Alemusjaure, WESTERBERG 1922. — Between Kebnekaise and Kårsotjåkko, Kaukulvagge, KLEFBÄCK 1927. — Between Vistasvagge and Nikkoluokta, A.D., G.W-g. — Jukkasjärvi s:n, Vittangijärvi, K.C.-L., E.R. — Pirtimusjärvi, K.C.-L. — Nakerijärvi, Y.M. — Övre Soppero: Övre Lainio älv: Ruodnajokk; Keukeskero; K.C.-L. — Kaisepakte, G.N.M. — 3–4 km to the south of Abisko, A.D., G.W-g. — Abiskojokk, L.Z.M. — Abisko, Jebrenjokk, L.Z.M. — Torne träsk area, Sarvasjokk, G.N.M. — Between Jukanjaure and Låktatjåkko, A.D., G.W-g. — Låktatjåkko, E.H.-M. — Torne träsk, Ripaisenjärvi, Y.M. — Vassijokk, L.Z.M. — Björkliden, L.Z.M. — Torne träsk, Ortojoki, L.Z.M. — Vassijaure stn., A.D., G.W-g. — Vassijaure sten., Kärkevagge, L.Z.M. — Vassivardo area, to the north of Vassijaure stn., A.D., G.W-g. — Torne lappmark, L.Z.M. — Sautso, K.C.-L., LARSON 1947. — Karesuando, N.R.M., NILSSON 1860. — Treriksröset, Kilpisluspa, O.R-g.

Rana dalmatina (BONAPARTE). Jumping Frog. Långbensgroda

Rana dalmatina was first in 1907 stated as belonging to the Swedish Fauna. The record was made on Öland where many other localities have later been found. Two years later it was also reported from the opposite side of Kalmar sound. For decades these were the only areas where it was known to occur in Sweden. In 1928 one locality was found in Scania and the first find in Blekinge is dated as late as 1916 (CURRY-LINDAHL 1956); refound 1946 by VON SYDOW.

Now, thanks to intensified faunistic exploration, there are 4 finds from eastern Scania, 11 localities from Blekinge, 7 from Kalmar län, 29 from Öland and 1 from N. Halland (KÖNIG 1958). On Öland the species has not been able to conquer the great space of Stora Alvaret in the South. (WAHLGREN's report on *R. dalmatina* in Möckelmossen is certainly erroneous.) In spite of thorough investigation I have not been able to find it in the Ottenby forest (south of this alvar) where *R. arvalis* is common. On the other hand, it does not seem that the

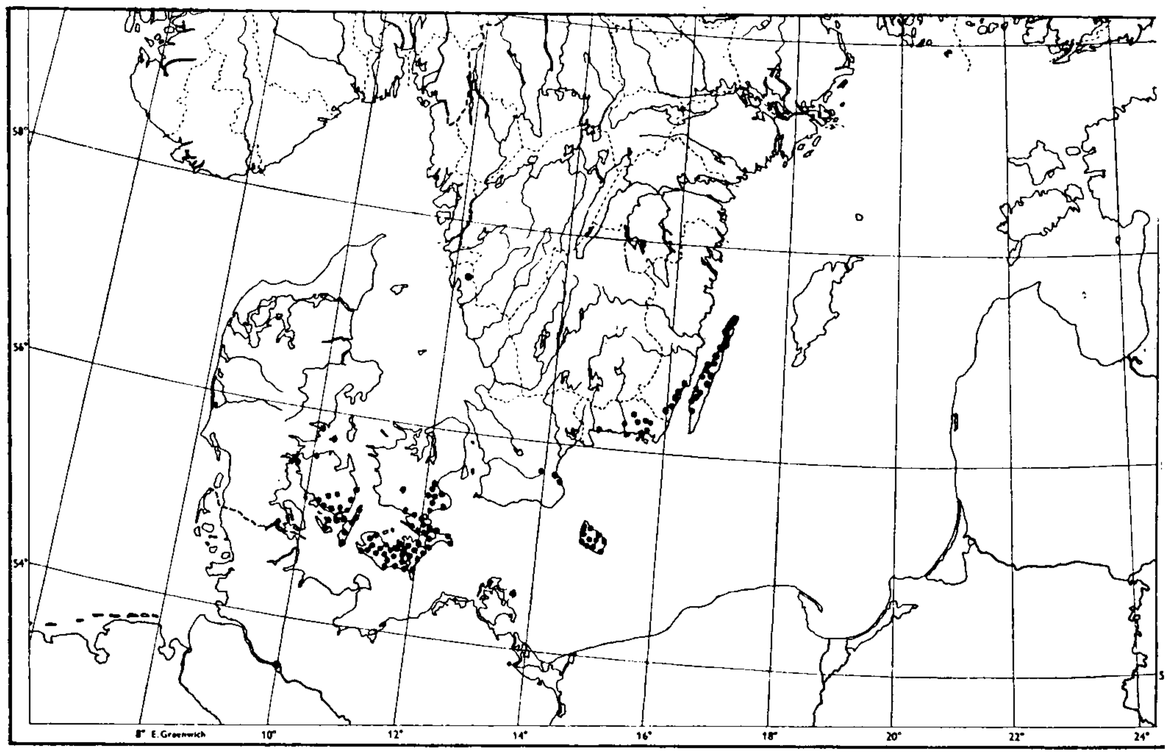


FIG. 46. Distribution in Sweden, Denmark and northern Germany of *Rana dalmatira*.

wide alvar spaces north of Köpinge and Borgholm have prevented the species from invading N Öland. In 1953 no less than 9 localities were found N of Borgholm to Böda.

Though the first find recorded was from Öland in 1907, the species was probably discovered, but erroneously interpreted, much earlier in Blekinge. WESTERLUND, when (in 1890) describing the fauna of the Ronneby area, enumerates two species of *Rana*, *R. arvalis* and *R. temporaria*. Now *R. arvalis* is common in the area in question, but *R. temporaria* has not been found in Blekinge east of Karlshamn in the westernmost part of the county. On the other hand, *R. dalmatina* does not seem to be rare in the Ronneby area and it is therefore most probable that WESTERLUND had specimens of *R. dalmatina*, but interpreted them as *R. temporaria*, a mistake which was very natural at that time, as *R. dalmatina* was not known from Scandinavia then. The first record from Denmark dates from 1892.

PFAFF (in 1945) has given an excellent description of the Danish distribution of this species. From his map (fig. 12) it is evident that this frog occurs on most of the smaller southern Danish islands, on Funen, S Zealand and Bornholm. On the other hand, his reference to the occurrence of *R. dalmatina* on Runö, Estonia (cf. PFAFF 1945, fig. 14), is based upon an erroneous statement, as pointed out by KAURI (1946, p. 178).

The occurrence of this species in Scandinavia is extremely interesting. As clearly evidenced on PFAFF's map (1946, fig. 14) it is unquestionably an excellent

example of a relic from the postglacial warmth period. Its present Scandinavian distribution is separated by a gap of about 300 km from the central and south European distribution of this species, as the northern border of its occurrence in central Europe lies at about 51°N. MERTENS, however, states recently that it has also been found in the Hamburg District (1947, p. 96).

In the Lund Zoological Museum there is, moreover, a skeleton of a frog, taken by ANDER during a trip to Rügen in 1924, which indubitably belongs to this species. This find, which is the first from the coast of N Germany, fits thus into the relic area grouped along the borders of the SW Baltic.

I have seen practically all Swedish localities where this frog has been found. Judging from PFAFF's characterization of the Danish localities the Swedish ones seem to be a little different. From Denmark is stated that it is chiefly bound to beech forests and comparatively dry localities; in the second place it is to be found among shrubs of raspberries and blackberries. In Sweden I have almost never seen it in beech forests. Generally it is found in oak or elm forests or in dense shrub forests of that type in which especially Öland abounds. The type is almost always that of a fertile decidous forest with an undervegetation of hazel, sloe, hawthorn, raspberries, blackberries and high grass. As the frogs generally squat till almost trod upon and then quickly make high jumps in the jungle described they are often very difficult to catch. The map shows that the species is not found far from the mildening climatic influence of the sea.

The vertical distribution of *R. dalmatina* extends from about sea level to 60 m above the sea (Rödeby).

The spawning season for this frog, contrary to most earlier statements, is very early. PFAFF thus (1945, p. 66) reports from Denmark newly laid eggs from the middle of March. In Sweden there are only two reports, from Blekinge (Göholm), from where we received newly laid eggs at the beginning of April. In 1952 WIGSTRAND and I collected eggs in the gastrula stage till a stage when the larva begins to curl up inside the egg-jelly on the 20th April at Göholm and Gökalv. The number of eggs in one batch was calculated to be about 1450. Judging from the rate of later out-of-door development, the different eggs had been deposited roughly between the 5th and 15th April. From 9th June 1943 the total length is about 36 mm (body length 13–16 mm, posterior legs about 2.5 mm). From Öland I have larvae, taken on 9th May 1949 and measuring 26–32 mm (body length about 10–13 mm) with insignificant oriments of posterior legs (1.5 mm long). The transformation seems to take place between the 15th and 30th August. Thus I have from Blekinge (Göholm 15th August, 1950) 4-legged specimens (one with the fore-legs only rudimentary, the other ones with all 4 legs well developed) in all stages of transformation from larvae with a tail totalling 40–42 mm to fully transformed young with a body length of 18 mm. From the 30th August I have from Färjestaden, Öl., a newly transformed specimen with a body length of 13 mm together with a specimen with a rudimentary tail.

measuring 28 mm must probably be 1 1/2 year old. The smallest size class from August 15th to September 20th has a body length of 13–24 mm (15 spp. measured from different years), the next smallest 27–36 mm (10 spp. measured). Larvae from Färjestaden brought up out-of-doors in Lund in aquaria transformed as early as the 3rd August (16 mm body length). One of the specimens was kept until the 27th August and then measured 18.5 mm. 6 specimens from E Scania (Åhus) taken on 3rd August measured 12.7–24.0 mm.

The development of *R. dalmatina* therefore lasts 4–4.5 months, thus almost twice as long as that of *R. temporaria*.

The maximum size of Swedish specimens kept in our museum is 67 mm, 50–60 mm being the average.

OCCURRENCE:

Skåne. Stenshuvud, L.Z.M. 1949, T.G. 1949 — Kivik, L.Z.M. 1950. — Andrarum s:n, Kristinehov, L.Z.M. 1928. — 3 km to the south of Åhus (at Helgeå) L.Z.M. 1948.

Blekinge. Karlshamn, Väggaparken, L.Z.M. 1950. — Listerby s:n, Gökalv, L.Z.M. 1950. — Listerby s:n, Göholm, L.Z.M. 1950, 1952, 1953, GISLÉN 1951. — Ronneby, Persborg, L.Z.M. — Karlskrona: Vämmö; Lyckeby, Vedeby, L.Z.M. 1949. — Karlskrona, L.Z.M. 1950. — Tving, Alnaryd, L.Z.M. 1947, P.H.-A. 1947. — Fridlevstad, Jämnsunda, L.Z.M., P.H.-A. — Rödeby, Blånebolet, v. SYDOW 1946. — Rödeby, L.Z.M. 1946, 1947, 1949, P.H.-A. 1947, P.v.S. 1946.

Öland. Kastlösa, HEINTZE 1909. — Resmo, G.N.M. 1928, 1931. — Lilla Vickleby, N.R.M. 1907, HEINTZE 1909. — Vicklcby, HANSTRÖM 1915. — Färjestaden, Runsbäck G.N.M. 1945, L.Z.M. 1944, N.R.M. 1909, C.-B.N. 1949, S.H. 1945, HEINTZE 1909. — Färjestaden, L.Z.M. 1942, 1946, 1948, 1949, P.H.-A. 1947, S.H. 1942. — Torslunda s:n, KULLENBERG 1953. — Torslunda and between Skogsby and Kalkstad, N.R.M. 1910, HEINTZE 1909. — Lenstad mire, T.G. 1949, T.G. 1953. — Runsten s:n, Spjutterum, T.G. 1949. — Runsten s:n, at the forking of the road Dyestad-Runsten stn., L.Z.M. 1949. — Högsrum s:n, Österskog, K.C.-L. 1953. — Långlöt s:n, Ismantorp, L.Z.M. 1943, 1949. — To the south and north of Stora Rör, HEINTZE 1909. — Stora Rör and Rälla tall, G.N.M. 1909, L.Z.M. 1909, 1947. — Ekerum, L.Z.M. 1909. — Gladvattnet, L.Z.M. 1946. — Halltorp, N.R.M. 1938, L.Z.M. 1946, C.E. 1946, N.B. 1940, R.S. 1945, D.C. 1944, C.E. 1944, 1947, K.C.-L. 1953. — Öj, C.E. 1944, 1947, D.C. 1950. — 2.5 km to the south of Borgholm Castle, L.Z.M. 1953 — Borga hage, L.Z.M. 1953, JOHANSSON 1955. — Borgholm, U.Z.M. 1928, HEINTZE 1909. — Köping, L.Z.M. 1947. — Alböke s:n, Alböke alvar, 2 km to the southwest of the church, L.Z.M. 1953. — Persnäs s:n: Knisa; 1 km to the northeast of Södviken; 1 km to the north of the church, L.Z.M. 1953. — Källa s:n: Långerum; 1 km to the north of Källa, L.Z.M. 1953. — Högby s:n, Horn, L.Z.M. 1953. — Böda s:n: 1 km to the southwest of Byerum; 3 km to the east of Stora Mossen, L.Z.M. 1953.

Kalmar län. Torsås, L.Z.M. 1953. — Söderåkra, L.Z.M. 1946, 1948, 1952. — Voxtorp, N.R.M. 1891, HEINTZE 1909. — Värnanäs, L.Z.M. 1947, N.R.M. 1910, U.Z.M. 1928, Karol. H.A.L. Örebro 1910. P.H.-A. 1947. — Vassmolösa, C.E.M. 1946. — Rinkabyholm, Dunö, L.Z.M. 1945, 1947, CURRY-LINDAHL 1945, P.H.-A. 1947. — Rinkabyholm, L.Z.M. 1952.

Halland. Fjärås s:n, Stensjön. KÖNIG 1958.

SAURIA. LIZARDS

Lacerta agilis agilis (LINNAEUS). **Sand-Lizard. Sandödla**

The Sand-Lizard is distributed over the greater part of Central Europe and the western parts of Central Asia to Altai, Baikal and Sajan. It is distributed in the south to Tian-Sjan and Transcaucasia, but is lacking in the desert regions of Tadzhikistan (Transcaspia). The typical form *Lacerta agilis agilis* ranges over S. England, Holland, Belgium, France, and Central Europe to Estonia (KAURI 1946), Poland, NW Jugoslavia and the Dnieper River. In the greater part of European Russia, from Carelia (KAISILA 1948) in the north to Caucasia in the south, and Central Asia, it is substituted by the geographical race *L. a. exigua* EICHWALD. In Roumania and the western Dnieper District it is represented by the form *L. a. chersonensis* ANDRZEJOWSKI, in the Balkans, south to 41°–42°N, by *L. a. bosnica* SCHREIBER, in NE Caucasia and Dagestan by *L. a. boemica* SUCHOW, in W Caucasia by *L. a. paradoxa* BEDRIAGA and in Transcaucasia by *L. a. brevicauda* GÜNTHER.

The Swedish distribution is restricted to S and central Sweden though it is decidedly rarer than the Smooth Snake (*Coronella austriaca*). *Lacerta agilis* is fairly common in Scania with about 50 localities. It is reported from several localities in Blekinge and Kalmar län, whereas it is rare in Halland, Småland, Östergötland and still rarer in Västergötland, Bohuslän, Dalsland, Södermanland, Uppland and Gästrikland.

In the NW the Sand-Lizard has its northern border in Bohuslän at Strömstad-Drivnäs, not far from the Norwegian frontier (LZM). In the NE it occurs at Uppland, Viggbyholm. Further it has been reported (1907), taken and released, by lektor O. B. SANTESSON from the southern slope of Slottsbacken, Uppsala. The specimens were large and greenish. Lektor SANTESSON tells me that he had seen thousands of Common Lizards and was acquainted with the Sand-Lizard from northern Scania. Dr. B. LUNDGREN has reported another specimen which he observed every summer 1911–1915 near the bath-house at Älvkarleö Manor. "It became so tame that it could be fed (cf. SMITH 1954). The size was something between 19 and 22 cm, according to a measuring-stick which could be placed along the side of the specimen. The colour was greenish with white spots. It was observed at least some twenty-odd times." It is also recorded by P. OLSSON (1882) from between Gävle and Bönan. Finally, a specimen is preserved in the N.R.M. Stockholm. It emanates from Dalecarlia, Mora (1840) and is a small,

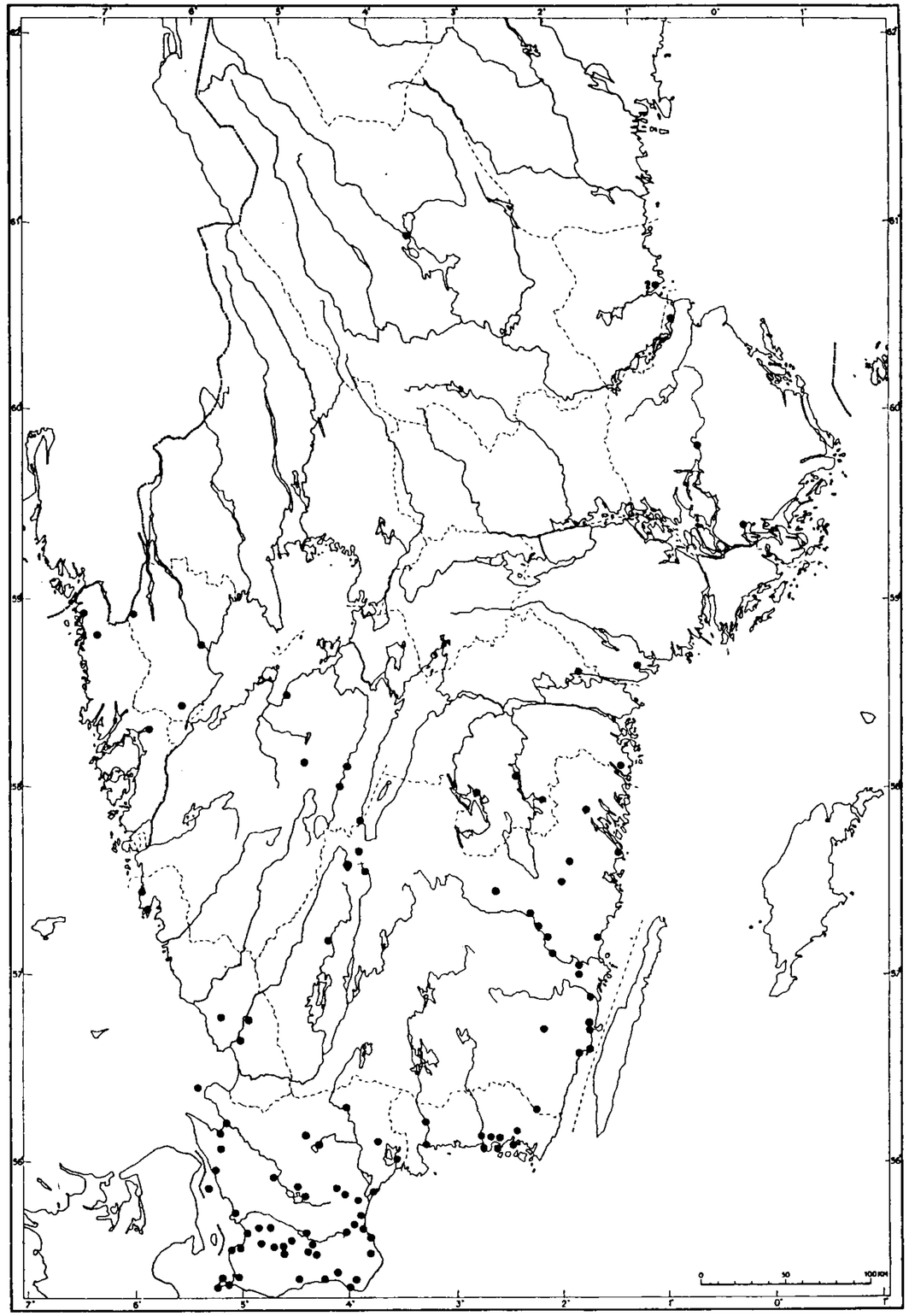


FIG. 47. Distribution in Sweden of *Lacerta agilis*.

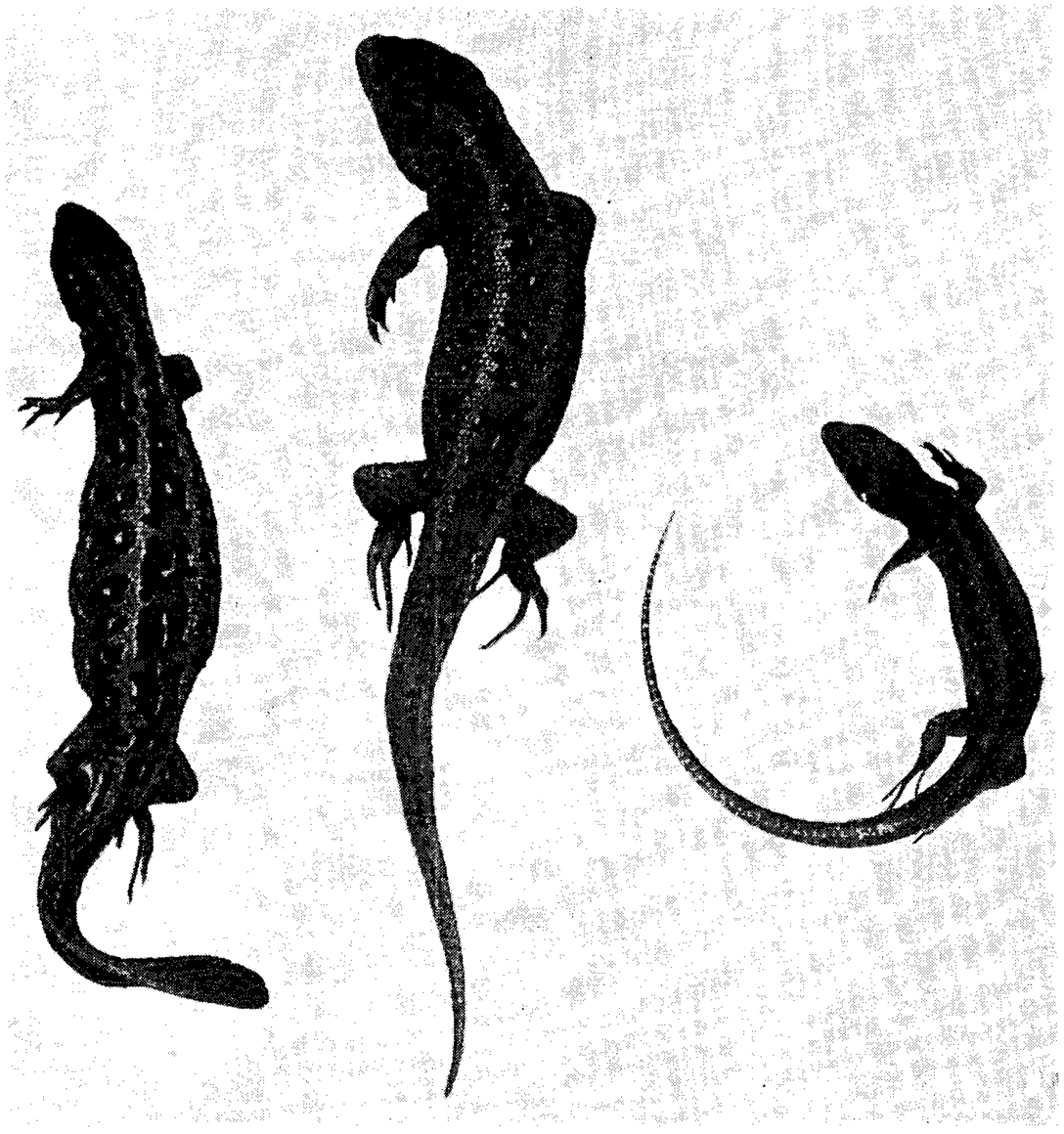


FIG. 48. Sand Lizard. From the left, female, male and a melanic specimen from Habo, Västergötland. Photo by H. GRÄNS.

fairly dusky-coloured specimen, undoubtedly from an isolated area. This find is certainly of relictary nature.

KLEFBECK (1927) reported several localities from Dalecarlia, too, but according to CYRÉN (1944) all these notices refer to *L. vivipara*. TENOW recorded it from Värmland (1880) and recently it has been verified from the vicinity of Karlstad. All the other so-called Sand-Lizards sent in to me from there have been found to be spotted specimens of *L. vivipara*. It has never been recorded from the Baltic islands.

In taxonomic literature the number of frenal plates between the eye and the nasal opening is given as the best distinguishing mark between *L. agilis* and

TABLE 24. Data concerning copulation, egg laying and hatching in *Lacerta agilis* in out-of-door vivaria.

No.	Copulation	Egg deposit.	Number of days cop. dep. egg.	Hatching	Number of days dep. egg. hatching	Tot. development in days
1	May 8th	June 17th	39	Aug. 26th Aug. 29th	69, 72	108, 111
2	May 8th	June 22nd	44	Aug. 25th Aug. 27th Aug. 28th	63, 65 66	107, 109, 110
3	May 9th	June 24th	45	—	—	—
4	May 11th	June 24th	43	Aug. 29th	65	108
5	May 11th	Aug. 1st Aug. 5th	—	—	—	—

L. vivipara. In *L. agilis* the frenal plates should be 2, in *L. vivipara* one. As correctly pointed out by CYRÉN in 1928, this characteristic, though generally very stable, may show irregularities which may obscure the interpretations and make them misleading (1928, figs. 1–5). Therefore additional distinguishing characteristics may be needed too. He points out that in *L. agilis* the dorsal midrib has sharply keeled scales which are lacking in *L. vivipara*. Further the mid line in *L. agilis* almost always seems to have a broken off white dorsal midline. JUNGERSEN (1907) has given a very good characteristic, later verified by HASS (1936) and by CYRÉN (1944), that the claws of the forefeet are 1 $^1/_2$ times longer than those of the posterior feet in *L. agilis*. In *L. vivipara* the claws are stout and short and of the same length in the fore and hind-feet. Except for in tiny young this is a very good mark. Young *L. agilis* may not have so distinctly developed long claws. Tiny young are generally finely dotted with small whitish specks latero-dorsally, the white medio-dorsal dotted line running lengthwise is still not generally developed then.

At Habo NE of Jönköping District a variety was found. It was greyish brown with a still darker brownish marbled band lengthwise on the back. After preservation in alcohol the specimens are almost black. The small white dots, similar to those in the young specimens, were sometimes missing. This variety, known only in some few specimens (10.5–12.5 cm), seems to be a striking variation. Those specimens found in the vicinity of e.g. Taberg or in Månsarp are of the usual type of coloration.

The largest specimen known from Sweden measures 22.6 mm. Generally the tail is broken and when regenerated does not grow out to normal length.

In out-of-door vivarium in Lund it was possible to settle (1954) that the copulation occurred the first time on the 8th and 11th of May, the deposition of eggs on June 17th, 22nd and 29th, and the hatching between the 25th and 29th of August (RÜDEBERG 1954).

The table above presents in detail the data of reproduction and development according to RÜDEBERG (1954). Attention should be called to the fact that the summer 1954, when the above-mentioned observations were made, was exceptionally cold and devoid of sunshine. The rate of development of the embryos depends on temperature and, consequently, in northern countries, on radiation. During less favourable summers the development may proceed for 90 days according to ROLLIANT (1934) but during warm summers for only 40 days.

As an exceptional regarding copulation and egg-laying in the autumn HEROLD's observation (1932) may be noted. Eggs of *L. agilis* were found as late as September 8th (1931) and four days later they contain well-developed embryos.

In indoor vivarium the egg-laying was observed to occur already in the month of March (K. SWAHN, in litt.).

Vertical distribution from mean sea level to about 100 m, rarely to 300 m (Taberg). Occurring on sandy slopes especially along the shore or inland on dry meadows.

OCCURRENCE:

Skåne. Falsterbo peninsula, southwestern point, SAHLIN 1929. — Falsterbo, SAHLIN 1929. — Skanör, L.Z.M. — To the south of Ljunghusen, S.S. — Räng s:n, S.S. — Västra Nöbbelöv, NILSSON 1842. — Between Ystad and Trelleborg, NILSSON 1842. — Ystad, G.N.M. — Stora Köpinge s:n, S.S. — Kåseberga, L.Z.M., SAHLIN 1929. — Löderup, B.K., S.S. — Limhamn, LANG 1926. — Malmö, Beijer Park, LANG 1926. — Hohög, M.M., LANG 1926. — Husie, LANG 1926. — Nevishög, LANG 1926. — Lyngby, LANG 1926. — Toppe ladugård, LANG 1926. — Genarp, LANG 1926. — Gödelöv s:n, S.S. — Häckeberga, L.Z.M., NILSSON 1860. — Sövde, L.Z.M., — Sjöbo, St.L. — Snogeholmsjön, northern side, L.Z.M., CURRY-LINDAHL 1955 A, NORDQVIST & RUDEBECK 1947, Y.M. — Östra Vemmerlöv, SAHLIN 1929. — Lomma, ÅSTRÖM 1859, LANG 1926. — Lund, L.Z.M. — Staffanstorp, LANG 1926. — Fågelsång, NILSSON 1842. — Södra Sandby, L.Z.M. — Veberöd, SAHLIN 1929. — Övedskloster, L.Z.M. — Äljaröd, N.R.M. — Brösarp, N.R.M. — Ravlunda s:n, Haväng, CURRY-LINDAHL 1955 A, O.B.S. — Vitemölla, H.K. — Kivik, B.K., O.B.S. — Stenshuvud, A.D., O.B.S., Y.M. — Hofterup s:n, SAHLIN 1929. — Vittskövle, O.B.S. — Maglehems ora, SAHLIN 1929, H.L. — Knäbäck, K.A. — Ven, M.M., NILSSON & THORSON 1950, F.O., N.A.K. — Billinge, NILSSON 1842. — Höör, NILSSON 1842, O.P. — Fulltofta, O.P. — Västra Vram, U.Z.M., H.L. — Östra Sönnarslöv, SAHLIN 1929. — Åhus, Espet, O.B.S. — To the south and north of Hälsingborg, SAHLIN 1929. — Råå, SAHLIN 1929. — Raus s:n, S.S. — Kattarp, LANG 1926. — Oppmanna s:n, Spegelvik, O.B.S. — Ivetofta, SAHLIN 1929. — Vegeholm, A.N-n. — Ängelholm, SAHLIN 1929. — Stoby s:n, Läreda, S.L. — Stoby s:n, L.Z.M., S.L. — Hallands Väderö, CYRÉN 1919, HANSTRÖM 1937, RINGDAHL 1937, VALLIN 1947, 1949, H.M. — Hörja s:n, HALL 1950. — Osby s:n, Hörneled, HALL 1950. — Osby s:n, on the eastern side of Osbysjön, SAHLIN 1929.

Blekinge. Karlshamn, L.Z.M. — Ronneby, Gökalv, T.G. Ronneby, Göholm, O.M. Ronneby, Hulta, H.W. — Ronneby, G.N.M. — Ronneby area, WESTERLUND 1890. — Hjortsberga s:n, Johanneshus, G.M-g. — Karlskrona: Studentviken; Västra Mark, O.T. Karlskrona, Vämmö, G.M-g., H.A.L. — Karlskrona, L.Z.M. — Nättraby s:n, Skärva, G.M-g., O.T. — Rödeby, L.Z.M., T.G. — Åkeholm G.W.

Halland. Enslöv s:n, Arlösa, L.Z.M. — Enslöv s:n, Årnilt, H.A. — Fröllinge, NILSSON 1842. — Onsala s:n, Gottskär, Draget, G.N.M. — Vallda s:n, Sandön, CURRY-LINDAHL 1955 A, E. DAHL 1952, D.C., H.L. — Onsala peninsula, KULLENBERG 1942, T.B., H.L. D.C. — Släp s:n, Lissgården, G.N.M.

Småland except Kalmar län. Kulltorp at Storån, WIBECK 1929. — Karlstorp s:n, Kolsjön, CYRÉN 1946. — Byarum s:n, Eckersholm, CURRY-LINDAHL 1949 B, Å.H. — Eckersjön, BJURULF 1944. — Månsarp s:n, Sjöhult, G.B., Å.H. Taberg, L.Z.M. BJURULF 1944, CURRY-LINDAHL 1949 B, CYRÉN 1931. — Månsarp s:n, L.Z.M. — Hästra s:n, Bjärsved, Å.H.

Kalmar län. Torsås s:n, Slätafly, B.S-z. — Rinkabyholm, Dunö, B.H. — Kalmar, L.Z.M., U.Z.M., HEINTZE 1909. — Nybro, L.Z.M. — Björnö, L.Z.M. — Ryssby area, TISELIUS 1868. — Ålem, L.Z.M., S.H. — Fliseryd s:n, Ramshult, G.N.M. — Fliseryd, WELANDER 1932. — Högsby s:n, Huseby, B.B-t. — Högsby, L.Z.M. — 5 km to the south of Oskarshamn, L.Z.M. — Oskarshamn, HEINTZE 1909, O.A. — To the east of Ryningsnäs, H.L. — Mörlunda, Hellinge, H.L. — Mörlunda, H.L. — Målilla, A.J. — Tuna s:n, Sjöhagen, ARNELL 1931, A.J. — Hjorted, L.Z.M., A.J., G.J. — Västervik, Hästhagssjön, S.B. — Överum, L.Z.M., E.M-m.

Bohuslän. Uddevalla, Bräcke, O.B.S. — Lur s:n, N.R.M. — Strömstad, Drivnäs, L.Z.M., A.B-s.

Västergötland. Habo s:n, Stora Fiskebäck and two other localities, L.Z.M., BJURULF 1944. — Härja s:n, NW of the church, G.N.M. — Near Tidaholm, KARVIK 1951. — Mösseberg, near Falköping, KARVIK 1951, K.A. — Kinnekulle, Blomberg, KARVIK 1951, 1953, P.O.S.

Östergötland. Malexander s:n, N.N. — Oppeby s:n, Idhult, L.Z.M., S.T. — Rimforsa, S.S. — Gryt s:n, Danebosjön, C.M. — To the north of Glan, L.Z.M., H.B. — Krokek, to the south of Torsjön, L.Z.M., H.B. — Bråviken area, NILSSON 1860.

Dalsland. ?Frändefors s:n, Dykälla, LANG 1928. — Gunnarsnäs, C.M. — —?Upperud, LANG 1928.

Södermanland. Nyköping, Kärrboda, CYRÉN 1940.

Uppland. Viggbyholm, L.Z.M., T.W. — Uppsala, Slottsbacken, O.B.S. — Älvkarleö, B.L-n.

Dalarna. Mora, N.R.M.

Gästrikland. Between Gävle and Bönan, OLSSON 1882.

Lacerta vivipara (JACQUIN). **Common Lizard. Skogsödla**

Lacerta vivipara has a general and common distribution from the British Isles and the western part of France through Europe. The distribution continues through the whole of Siberia south of the Polar Circle and extends in the south to latitude 50° N and eastwards to the sea of Ochotsk. In Europe its southern border lies at about 45° N, transgressing a little more southwards in S. France. There is, moreover, an isolated outpost in the NW Pyrenees.

This lizard seems to be common everywhere in Sweden, at least in the south and central parts of it. It is also found on our Baltic islands. In Norrland the occurrence, no doubt on account of our lack of knowledge, appears to be more scarce. Still, even up to the 68th latitude there are several finding places along Torne Träsk. The very northernmost place in our country is Karesuando, 68°30′ N.

CYRÉN (1944) has reported about the colour-variation of *L. vivipara.* A series,

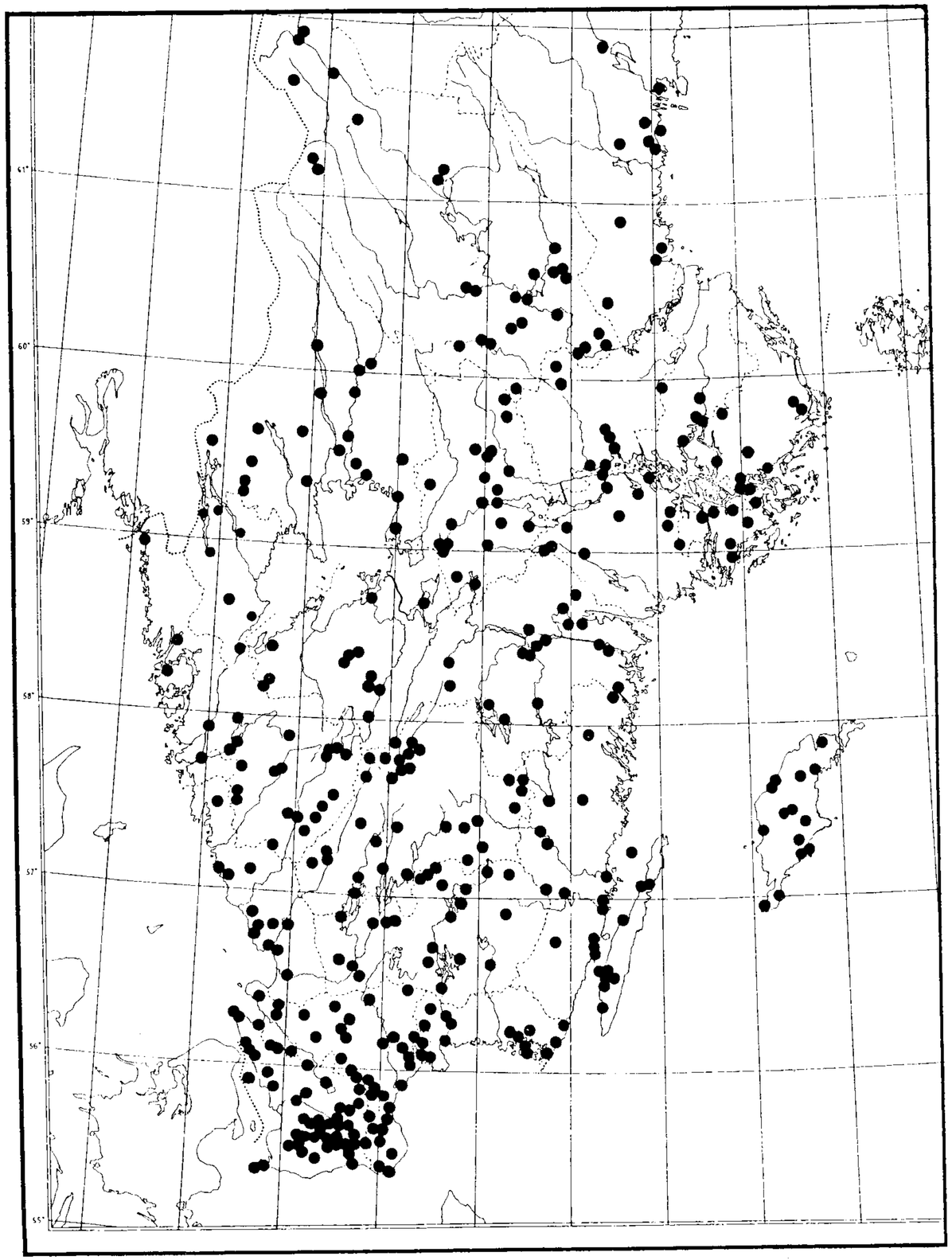


FIG. 49, 50. Distribution in Sweden of *Lacerta vivipara*.

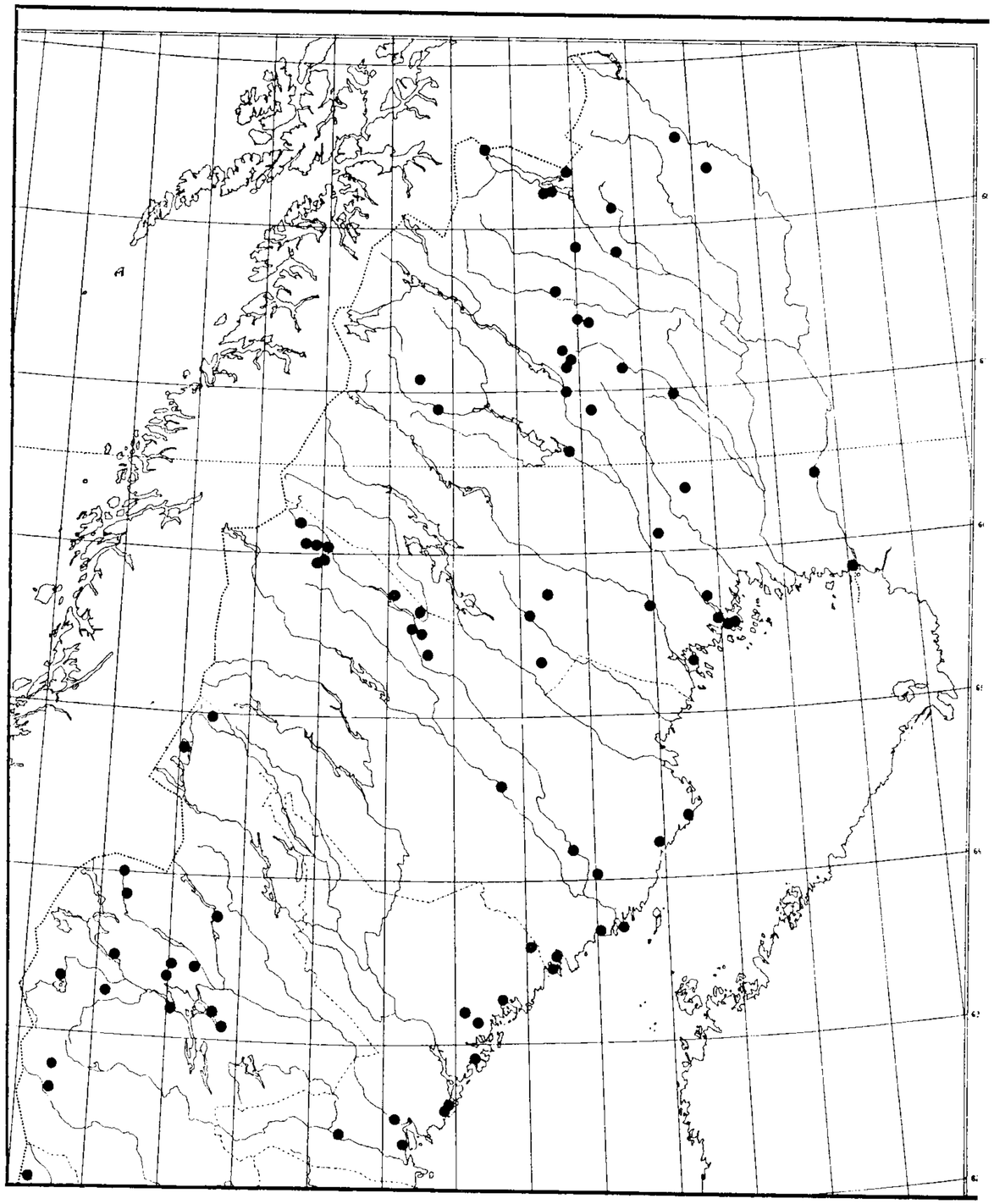


FIG. 50.

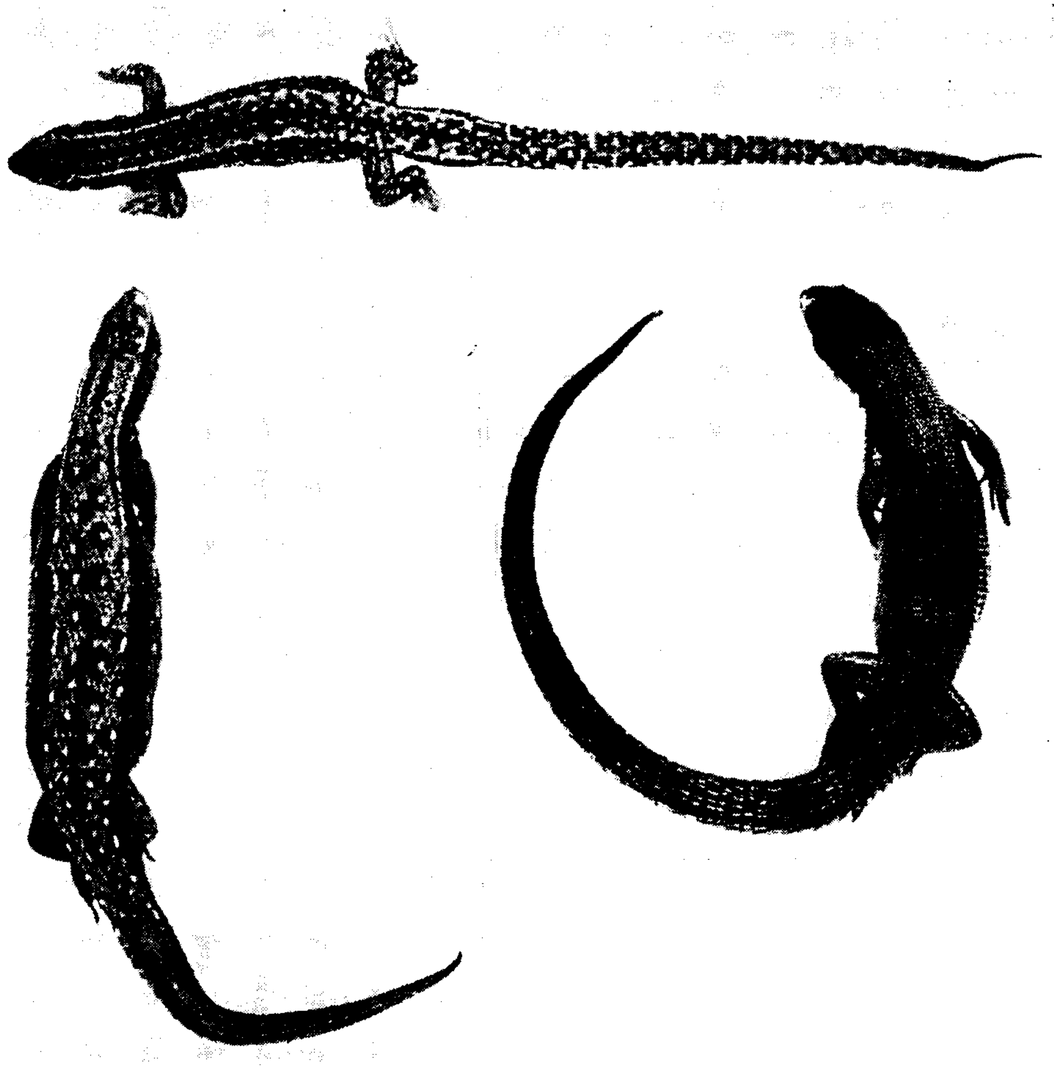


FIG. 51. Common Lizard. Male (upper), female (left) and a melanic Common Lizard from Danderyd, Småland.

as shown by him, varies between uniformly dark brownish to lighter shades with grey nebulous spots. Often there may be black specks with a white eyespot in the centre. Very often there is a darkish midrib. Some few shades varying between these extremes are given on a plate here. LUNDSTRÖM (1939) has reported a melanic colour-type. (Fig. 51.)

Maximum size reaches 15–17.5 cm (BRUUN 1925).

According to HVASS (1936), this lizard should mate in May and females should be pregnant for about three months. Judging from a specimen in our collection, where we have a fully ripe young from the 19th of July, the mating must thus have taken part already in April.

The smallest specimens measured in our collections are:

Blekinge. Bastasjö 19/7 1937, 44.3 mm—newly hatched, one embryo with intact membranes measuring 16 × 9 mm.

Östergötland. Husaby 26/8 1952, 47.9 mm.

Jämtland. Sävsjön 15/9 1949, 48.3 mm.

Dalsland. Kroppefjäll 20/5 1951, 55.1 mm—second year young.

Skåne. Hanaskog 10/9 1946, 55.8 mm.

OCCURRENCE:

Skåne. Falsterbo, L.Z.M. — Skanörs ljung, NILSSON 1842. — Börringesjöns area, NILSSON 1842. — Gärdslöv s:n, S.S. — Ystad, G.N.M. — Löderup s:n, S.S. — Sandhammaren, L.Z.M., A.L-m, K.G.W.:— Skabersjö s:n, M.M., S.S. — Torup, L.Z.M. — Bokskogen, L.Z.M., LANG 1926. — Bökeberg, L.Z.M., LUNDSTRÖM 1939. — Hyby s:n, S.S. — Lyngby s:n, S.S., Gustaf s:n, S.S. — Genarp s:n, B.O., S.S. — Gödelöv s:n, S.S., Glimminge s:n, S.S. — Everlöv s:n, S.S. — Blentarp s:n, S.S. — Ilstorp s:n, S.S. — Sövde s:n, to the south of Sövdesjön, Exc. — Sövde s:n, S.S. — Snogeholmssjön, northern side, Exc., Y.M. — Between Eriksdal and Snogeholmssjön, Exc. — Sövestad s:n, S.S. — Röddinge s:n, Lönbostället, L.Z.M. — Baldringe s:n, S.S. Tomelilla, L.Z.M. — Smedstorp s:n, S.S. — Lund, NILSSON 1842. — Hardeberga s:n, S.S. — Fågelsång, NILSSON 1842. — Bonderup s:n, S.S. — Hällestad s:n, S.S. — Silvåkra, L.Z.M., Exc. — Veberöd s:n, S.S. — Vombs fure, L.Z.M., A.L-m. — Vomb s:n, S.S. — Björka s:n, S.S. — Öved s:n, Tullesbo, T.G. — Öved s:n, S.S. — Södra Åsum s:n, S.S. — Östraby s:n, S.S. — Fränninge s:n, S.S. — Kristinehov, Exc. — Andrarum s:n, Exc., S.S. — Fågeltofta s:n, H.F., S.S. — S:t Olof s:n, S.S. — Ravlunda s:n, Knäbäck, K.A. — Saxtorp s:n, S.S. — Örtofta, Exc. — Skarhult s:n, S.S. — Långaröd s:n, S.S. — Huaröd s:n, S.S. — Degeberga s:n, S.S. — Maglehem s:n, S.S. — Ven, A.N. — Ottarp s:n, SAHLIN 1929, S.S. — Röstånga s:n, S.S. — Bosjökloster s:n, Stanstorp, L.Z.M., — Äsphult s:n, Bosarpssjön, H.L. — Linderöd s:n, Pårup, H.L. — Svensköp, H.L. — Västra Vram, U.Z.M. — Östra Sönnarslöv s:n, S.S. — Åhus, Espet, L.Z.M., K.A. — Åhus, K.A. — Kulla Gunnarstorp, N.R.M. — Allerum mire, MUCHARDT 1912, S.S. — Hälsingborg, N.R.M. — Raus s:n, SAHLIN 1928, Välluf s:n, SAHLIN 1929, S.S. — Norra Vram s:n, Vrams Gunnarstorp, U.S. — Skäralid, L.Z.M., U.Z.M., E.M. — Perstorp. L.Z.M. — Sösdala, Lillsjödal. U.S. — Hanaskog, L.Z.M., Exc. — Fjälkestad s:n, Balsberget, Å.U. — Oppmanna s:n, S.S. — Kiaby s:n, S.S. — Trolle-Ljungby s:n, S.S. — Gualöv s:n, S.S. — Ivetofta s:n, S.S. — Näsum s:n, R.J., S.S. — Kullaberg, Kapellet, U.S. — Kullaberg, BEHRENS & MALMBERG 1950. — Brunnby s:n, S.S. — Strövelstorp s:n, Vegeholm, L.Z.M., A.N-n. — Munka-Ljungby, E.M. — Förslöv, Segelstorp, L.Z.M. — Västersjön, E.M. — Örkelljunga, Sonnarp, B.O. — Vankiva s:n, L.Z.M. — Stoby s:n, A.K. — Hjärsås s:n, S.S. — Vånga s:n, S.S. — Lursjö, A.K. — Hästveda s:n, L.Z.M., A.K. — Vittsjö, L.Z.M. — Osby s:n, S.S. — Örkened s:n, Bökön, H.L.

Blekinge. Sölvesborg, Valje, Exc. — Sölvesborg, H.L. — Torhamn, Orranäs, Exc. — Torhamn, L.Z.M., Exc. — Karlskrona, Tjurkö, L.Z.M. — Karlskrona, P.v.S. — Karlshamn, L.Z.M. — Nättraby s:n, Skärva, O.T. — Kallinge, P.H.-A. — Hjortsberga s:n, Johannishus, O.T. — Angerum s:n, Bastasjö, L.Z.M., A.L.-m. — Rödeby, P.v.S. — Jämshög s:n, R.J. — Svängsta, P.H.-A. — Åkeholm, I.R. — Kristianopel, Abramsäng, GOSSELMAN 1863. — Kyrkhult, H.L.

Halland. Laholm, T.G. — Snöstorp s:n, Hult, L.Z.M. — Halmstad, H.A.L. Halmstad, B.O.L. — Steninge, HANSTRÖM, 1946, 1950, B.H. — Getinge s:n, A.K. — Fröllinge, G.N.M. — Slättåkra s:n, Stämhult, T.H-g. — Enslöv, Årnilt, L.Z.M. — Heberg, Ringsjön, T.G. — Tvåker, G.M-g. — Varberg, Varberg Samrealskola. — Svartrå s:n, Skinnarlyngen, G.N.M. — Förlanda s:n, Eskhult, G.N.M.

Småland except Kalmar län. Almundsryd: Tröjemåla; Norraryd, H.L. — Göteryd, Vissle mire, H.L. — Traryd, K.C.-L., H.L. — Hinneryd, H.L. — Västra Torsås, Sällön, H.L. — Väckelsång s:n, C.B.G. — Almeboda s:n, Vinnås, G.N.M. — Odensjö, N.R.M. — Bolmsö, Å.H. — Ljungby, K.C.-L., P.-A. — Tutaryd, Harsnäs mire, H.L. — Ryssby s:n., L.Z.M., C.B.G. — Skatelöv s:n, C.B.G. — Växjö area, N.R.M., LÖNNBERG 1927. — Gårdsby s:n, Gasslanda, BRUNDIN 1923. — Lenhovda, between Lillesjön and Möckeln, H.L. — Skeppshult, J.P. — Villstad s:n, Smålandsstenar, L.Z.M. — Villstad s:n, Västra Sögen, H.L. — Torskinge, Liljenäs, H.L. — Värnamo, K.C.-L., G.A., H.L. — Gällaryd, between the church and Olsgård, H.L. — Slätthög s:n, Broaskog, L.Z.M., L.L.I. — Åboda Klint, T.H. — Moheda, Kopparås, L.L.I. — Aneboda, LANG 1928. — Allgunnen, Lamhult, E.M. — Berg s:n, Vinninge, S.A-n. — Söraby, Bröttjaryd, H.L. — Granhult s:n, Nottebäck, C.B.G. — Nottebäck, Bredhälla, H.L. — Åsenhöga s:n, Kramphult Knatt, H.L. — Kävsjö bog, K.C.-L. — Kävsjö, K.C.-L., H.L. — Tofteryd, H.L. — Sävsjö, H.E.P. — Myresjö G.N.M., C.B.G., H.L. — Vetlanda bog, G.N.M. — Vetlanda, H.L. — Ramkvilla, H.L. — Österkorsberga, C.B.G. — Karlstorp s:n, Kolsjön, CYRÉN 1946, H.L. — Karlstorp, G.N.M., L.Z.M., CYRÉN 1910. — Hässleby s:n, A.D. — Ingatorp s:n, Alvestorp, H.L. — 2 km to the east of Taberg, BJURULF 1944. — Taberg, BJURULF 1944. — 2 km to the northwest of Taberg, BJURULF 1944. — Månsarp s:n, Karshult, L.Z.M., G.B. — Mulseryd s:n, Ryd, G.N.M. — Barnarp s:n, to the northwest of Odensjö, BJURULF 1944. — Rogberga s:n, G.B. — Sandseryd s:n, 1 km to the southwest of Nyarp, BJURULF 1944. — Bottnaryd s:n, Häverryd, G.N.M. — Bottnaryd s:n, Dumme bog, BJURULF 1944, H.L. — Ljungarum s:n, near the mouth of Tabergsån, BJURULF 1944. — Jönköping, BJURULF 1944. — Järstorp s:n, Klämmetstorp, BJURULF 1944. — Järstorp s:n, between Alamo and Dumme bog, BJURULF 1944. — Järstorp s:n, Eskilstorp, BJURULF 1944. — Hakarp s:n, Smedstorp, G.B. — Svarttorp s:n, H.L. — Bankeryd s:n, G.B. — Skärstad s:n, G.B. — Ölmstad s:n, Sandvik, J.B.

Kalmar län. Kalmar, H.A.L. Kalmar, CYRÉN 1928. — Nybro, L.Z.M. — Kläckeberga s:n, Wesslö, Exc. — Åby s:n, Stäflö, L.Z.M. — Strömserum, L.Z.M., Exc. — Ålem s:n, Timmernabben, L.Z.M., S.H. — Allgunnen, Solö, T.G. — Allgunnen, GISLÉN 1935, T.G. — Kråkemåla, L.Z.M. — Em, T.G. — Jungfrun, CURRY-LINDAHL 1950 B, 1951 B, DU RIETZ & CURRY-LINDAHL 1950, K.C.-L. — Tveta s:n, to the northwest of the church, G.N.M., H.L. — Målilla s:n, Stensryd, G.N.M., H.L. — Målilla s:n, Årena, H.L. — Hultsfred, HEINTZE 1909. — Tuna s:n, Höckhult, J.B. — Rumskulla, Silverån, G.N.M., H.L. — Överum, E.M-m. — Tryserum s:n, Sjönerosjön, G.N.M.

Öland. Degerhamn, G.N.M., D.C. — Mörbylånga s:n, 2 km to the east of Borgby on Stora Alvaret, L.Z.M. — Resmo, L.Z.M., N.R.M., N.B. — Möckelmossen, L.Z.M., C.E., N.B. — Vickleby alvar, G.N.M., L.Z.M., Beijershamn, Exc., D.C., EDELSTAM 1944. — Torslunda s:n, KULLENBERG 1953. — Borgholm, M.M. — Persnäs s:n, Knisa mire, K.C.-L. — Persnäs, K.C.-L.

Gotland. Sundre s:n, Muske mire, G.N.M. — Öja s:n, Burgsvik, K.C.-L. — Öja s:n, Rondarfve, L.Z.M. — Fide s:n, Fidenäs, K.C.-L. — Burs s:n, Heffride, G.N.M. — När s:n, Nyudden, N.N. — Garde s:n, B.P. — Klintehamn, Vandrarhemmet, N.N. — Kräklingbo s:n, Gurfiles, G.N.M., — Björke s:n, Norrgårda, G.N.M. — Atlingbo s:n, Källgårds, G.N.M. — Visby, Kopparsvik, U.Z.M. — Visby, Norder strand, N.N. — Visby, Snäckgärdsbaden, N.N. — Hejnum s:n, G.N.M. — Slite, Länna, G.N.M. — Fleringe s:n, to the west of Hässle, G.N.M.

Göteborg. Göteborg, G.N.M. — Göteborg area, G.N.M.

Bohuslän. Morlanda s:n, Torebo, MALM 1877. — Skredsvik s:n, Smörkullen, K.G.W. — Svarteborg s:n, CURRY-LINDAHL 1947 B. — Strömstad, A.B-s.

Västergötland. Älvsered, L.Z.M. — Håcksvik s:n, Moga, H.L. — Ambjörnarp s:n, H.L. — Axelfors, Revesjö, H.L. — Örsås, H.L. — Tostared s:n, K.C.-L. — Tranemo s:n, between Uddebo and Kleven, H.L. — Sätila, G.N.M. — Nittorp s:n, to the northeast of the church, H.L. — Hindås, G.N.M. — Viared, K.C.-L. — Viared area, HALL 1942. Borås, G.N.M., C.B. — Lerum, G.N.M. — Skallsjö s:n, G.N.M. — Vist s:n, L.Z.M. — Ulricehamn area, L.Z.M. — Gullered s:n, two localities, H.L. — Hössna s:n, two localities, H.L. — Borgstena, G.N.M. — Habo s:n, Dummeådalen, H.L. — Nol, G.N.M. — Mjörn, G.N.M. — Mjörnsjö, G.N.M. — Sandhem s:n, two localities, H.L. — Stora Mellby s:n, Gendalen, H.L., — Essunga s:n, Nossebro, H.L. — Tiarp s:n, Fårdala, U.S. — Tidaholm, Uddestorp, G.N.M. — Dala s:n, to the east of Alebäcken, H.L. — Hornborgasjön, K.C.-L. — Broddetorp s:n, Bolum, T.S. — Vänersborg, C.G.K. — Kinnekulle, KARVIK 1953. — Gammalstorp, L.Z.M. — Billingen, to the south east of Varnhem, U.S. — Billingen, K.C.-L. — Skövde area, C.B.G. — Mariestad, J.F. — Undenäs s:n, near Lilla Valsjön, H.L.

Östergötland. Malexander s:n, Landsnäsudde, L.Z.M. — Blåvik s:n, Hallången, L.Z.M. — Opphem s:n, E.W-n. — Valdemarsvik, L.Z.M., C.M. — Ödeshög s:n, to the north of Visjö, to the north of Alvastra, H.L. — Omberg, HEDBERG & ÖHRN 1950, CURRY-LINDAHL 1955 A, H-M. — Kärna s:n, Kärna borg, H.L. — Linköping, Berga, L.Z.M., B.W-n. — Linköping area, G.N.M., K.E-n. — Kaga s:n, Lera, G.N.M. — Rystad s:n, Fröstad; Luestad, F.O. — Söderköping, G.N.M. — Mogata s:n, Husby, L.Z.M., T.G. — Östra Skrukeby, H.B. — Stjärnorp, L.Z.M., S.T. — Borg s:n, Torlunda and Vi, H.B. — Borg s:n, H.B. — Norrköping, Ringstad, H.B. — Norrköping, BOHMAN 1946, H.B. — Svärtinge, H.B. — To the north of Svärtinge, Ryssnäs, CYRÉN 1945. — Risten, H.B. — Simonstorp, H.B. — Tylö forest, K.C.-L.

Dalsland. Kroppefjäll, KARVIK 1953 A. — Several localities, KARVIK 1953 A. — Sannerud, Laxarby; Gestad, Kättarebol; Torrskog, Bråtön; Nössemark, Kölviken; Dals-Ed, N.-G.K.

Värmland. Kilsviken, K.C.-L. — Stormossen, K.C.-L. — Kristinehamn area, E.W. — Degerfors, Duvdalsängar, H.W.W. — Silleruds s:n, Hälljebyn; Harnäs; Ölmheden, H.L. — Borgvik Works, L.Z.M. — Borgvik s:n, Borgvikssjön, N.L-n. — Borgvik s:n, L.Z.M. — Skattkärr, L.Z.M. — Alster s:n, C.B.G. — Holmedal s:n, Kroken, H.L. — Lundsberg, E.W.-n. — Stora Kil s:n, Norra Hyn, A.K. — Nedre Ullerud, T.S. — Älgå s:n, Gränssjön, L.Z.M., A.E. — Brunskog s:n, C.B.G. — Munkfors, N.R.M. — 9.5 km to the north of Sunne, J.B. — Sunne s:n, S.A. — Råda s:n, G.N.M. — Hagfors area, J.L. — Torsby s:n, Oleby, J.B.

Närke. Hammar, H.W.W. — Askersund, between Donafors and Östra Laxsjön, H.L. — Laxå, to the northwest of Bodarnesjön, H.L. — Skagershult: Ågrena; west of Porla; Bäckatorp, H.W.W. — Hallsberg s:n, Tisaretorp, G.Ö. — Kumla s:n, Ekeby, H.W.W. — Lännäs, H.W.W. — Örebro, Kränglan, H.W.W. — Örebro, A.D. — Tysslingen, K.C.-L. — Hovsta s:n, A.D. — Kil s:n, Lockhyttan and Marka, A.D.

Södermanland. Marsjö, T.W. — Vingåker, T.W. — Katrineholm, T.W. — Ösmo s:n, Himmelsö, J.B. — Ösmo s:n, Segersäng, T.G. — Vårdinge, A.L-t. — Julita s:n, G.N.M. — Länna, S.E. — Björktorp, H.W.W. — Gåsinge, Blacksta, H.W.W. — Södertälje, U.Z.M. — Rönninge, N.B. — Huddinge s:n, Bialite, CURRY-LINDAHL 1952, — Huddinge, Balingsholm, CURRY-LINDAHL 1952, K.C.-L. — Huddinge, Stensätra mosse, K.C.-L. — Huddinge, H.W.W. — Österhanninge, Handen, H.W.W. — Nacka, Snörom, H.W.W. — Mariefred, Hedlanda, A.L-t. — Mariefred, U.Z.M. — Eskilstuna area, SJÖSTEDT 1920. — Härad, H.W.W. — Tosterön, Björndalen, H.W.W. — Torshälla, Mälarbaden, J.B.

Stockholm. Stockholm, Haga, N.R.M. — Stockholm, N.R.M.

Västmanland. Näsby, Hult, H.W.W. — Frövi, A.D. — Nora, Holmsjön, K.H.F. Linde; Siggebohyttan; Bromsjöbodar, H.W.W. Rytterne s:n, Tidö, U.Z.M., J.B. — Rytterne s:n, Lagersberg, J.B. — Västerås, Viksäng, O.H-g. — Västerås area, H.A.L. Västerås,

WALLDÉN 1955. — Skultuna s:n, Forsby, O.H-g. — Skultuna, O.H-g. — Ramsberg, K.H.F. — Kloten, K.H.F. — Västervåla s:n, Flytet, L.L.I. — Norberg, H.A.L. Västerås.

Uppland. Lidingö, N.R.M., O.D. — Danderyd, K.H.F. — Östra Ryd s:n, Rydboholm, N.R.M. — Stockholms-Näs s:n, H.a.R. — Österåker s:n, Lervik; Brevik; Valsjön; Täljö; Norra Träsksjön, H.a.R. — Vallentuna s:n: Klosterbacken; Lingsberg; Angarnsjöängen, FORSHEDEN 1952. Hjälstaviken, H.K-g., K.C.-L. — Alsike s:n, Kungshamn bog, U.Z.M. — Estuna s:n, Norra Malma, H.K-g. — Estuna s:n, Uddboö, A.L-t. — Lagga s:n, Norreda, H.K-g. — Sigtuna, K.C.-L. — Ultuna, Gottsunda, U.Z.M. — Uppsala, L.Z.M., U.Z.M., NILSSON 1860. — Uppsala area, U.Z.M. — Järlåsa s:n, Ramsmossen, H.K-g. — Dannemora s:n, Skyttorp, K.C.-L. — Singö s:n, Fogdö, K.C.-L.

Dalarna. Malingsbo, H.L-g., K.H.F. — Ludvika, Norrvik, K.H.F. — Avesta area, T.S. — Grytnäs, K.-H.F. — By s:n, Rossberga, E.D. — By, B.W., E.D. — Nyhammar s:n, Skattlösberget, K.-H.F. — Korsnäsberget, E.D. — Silvberg s:n, Rämshyttan and Sandvik, J.E.D. — Ulfshyttan, E.B. — Stora Skedvi s:n, Norshyttan, T.W. — Stora Tuna, 5 localities, E.D. — Mockfjärd, E.K. — Borlänge, T.G. — Floda s:n, Syrholm, T.T. — Falun, KLEFBECK 1949, E.K. — Stora Kopparberg s:n, E.K. — Sundborn s:n, between Ryggen and Logården, E.D. — Sundborn s:n, Toxen, E.K., B.T. — Karlsbyn, B.T. — Svärdsjö, KLEFBECK 1927. — Lima s:n: Lillnärfjället, K.-H.F., — Hundfjället, E.D. — Våmhus, K.-H.F. — Orsa s:n, Fryksås, B.T. — Älvdalen s:n, Bunkris, E.K. — Fulufjället, Rösjön, K.C.-L., K.-H.F. — Särna, K.-H.F. — Idre, K.-H.F. — Idre s:n, Himmeråsen, K.-H.F. — Idre s:n, Långfjället, Huskläppen, E.K.

Gästrikland. Torsåker s:n, Kratte forge, L.Z.M. — Gävle area, G.K. — Hille, K.F. — Ockelbo, C.B.G.

Hälsingland. Söderhamn, Tupptjärn, N.A. — Rengsjö s:n, Höle, N.A. — Norrala s:n, T.G. — Enånger s:n, Dragviken, N.A. — Enånger s:n, Lindefallet, N.R.M. — Idenor s:n, H.A.L. Hudiksvall. — Delsbo s:n, Överälve, K.-H.F. — Ljusdal area, BODIN & WITT-STRÖMER 1951.

Härjedalen. Sånfjället, CURRY-LINDAHL 1951. — Tennäs s:n, Bruksvallarna, N.R.M. — Ljusnedal s:n, Skarvfjället, Ösjökläppen, CURRY-LINDAHL 1951 A. — Ljusnedal s:n, Gröndalen, K.C.-L.

Medelpad. Tuna s:n, Långsjön, WALLDÉN 1954. — Viskan, H.A.L. Sundsvall. — Sundsvall, S.B-t. — Sundsvall area, H.A.L. Sundsvall, S.B.-t. — Indal, H.A.L. Sundsvall, S.B.-t.

Jämtland. Brunflo, OLSSON 1876. — Östersund, Odensala, OLSSON 1876. — Östersund, G.N.M., OLSSON 1876. — Hallen, OLSSON 1876. — 5 km to the north of Ånn, H.V. — Välliste, GAUNITZ 1949. — Aspås s:n, Näversjö, OLSSON 1876, — Alsen, OLSSON 1876. — Offerdal, OLSSON 1876. — Kall s:n, Sågvallen cattle-shed, L.Z.M. — Kall, OLSSON 1876. — Föllinge s:n, Lövsjön, L.Z.M. — Kall s:n: Mjölkvattnet; Krönavajje, FAXÉN 1948. — Frostviken s:n, Blåsjön, N.R.M., DE BRUN 1927. — South of Daimanjåppo, K.C.-L.

Ångermanland. Säbrå s:n, Fröland, L.Z.M., E.H.S. — Säbrå s:n, H.A.L. Härnösand, S.T-e. — Härnösand area, S.T-e. — Nordingrå, O.F. — Vibyggerå s:n, Pålsjön, S.A-n. — Stora Degersjön, Lappviken, S.A-n. — Gideå s:n, Grössjön, T.L-d. — Örnsköldsvik area, BARTLER 1953. — Nordmaling s:n, Gråskären, H.A.L. Umeå, HOLM 1928. — Lögdeå, N.R.M.

Västerbotten. Hörnefors, Norrmjöle and Sörmjöle, T.L-d. — Holmsund T.L-d. — Tavelsjön, T.L-d. — Degerfors s:n, K.-H.F. — Robertsfors, L.F. — Lövånger, HOLM 1940, O.H.

Norrbotten. Älvsby s:n, Älvsbyn, H.K-g. — Piteå, Renön, N.R.M. — Nederluleå s:n, Måttsund, L.B-m. Luleå, Kallax, T.G. — Luleå, Lulsundet, N.R.M. — Luleå, Hertsölandet, A.L-d. — Luleå, Sinksundet, T.G. — Luleå, L.Z.M., Å.Ö. — Boden area, V.O. — Haparanda, NILSSON 1860. — Sandträsk, L.Z.M., H.K. — Övertorneå, U.Z.M.

Lappland. Lycksele, T.A-t. — Between Aborträsk and Skellefteälv, BERGENGREN 1929. — Sorsele s:n; Abbmoberget; Rankbäcken; Maderträsket; Nalovardo; Kyrkberget; Vuomajåkko; Stor Ajgert; Stora Tjulträsket; Soloive; Stora Ålge; Ammarfjäll; Lilla and Stor Juobbo; Snuortje, GAUNITZ 1949. — Arvidsjaur s:n, Herrevare, H.K. — Auktsjaur Granträskå, H.K. — Upper part of the valley of Vindelälven, K.C.-L. — Gällivare s:n southeastern part, Polkem, E.W-n. — Jokkmokk, Å.W. — Muddusjokk, Åkkosvare, H.K — Muddusjaure, N.R.M. — Muddus National Park, GUSTAFSON & OLSSON 1947. — Tarra Valley, BRINCK-WINGSTRAND 1951. — Kvikkjokk: Vallivare, LÖWENHJELM 1843 — Kvikkjokk, Prinskullen, L.Z.M., P.B. — Kvikkjokk, N.R.M., BRINCK-WINGSTRAND 1951, K.C.-L. — Upper Kamajokk, K.C.-L. — Near Porjus, BERGSTRÖM 1931. — Gällivare s:n: Avakajo; Moskajaure; Kasajokk, G.N.M. — Gällivare area, E.K-a, E.W-k — Gällivare s:n, Sjaunja, BERGSTRÖM 1930. — Gällivare s:n: Lina älv, Allavare; Harrå Tjärroketje; Harrå, to the southeast of Tuolpak; 20 km to the northwest of Fjällåsen Kuosatsvare, G.N.M. — Pårekjaure, K.C.-L. — Southern Jukkasjärvi area, E.K-a E.W-k. — Jukkasjärvi, N.R.M. — Kiruna, G.N.M. — 30 km to the north of Kiruna S.E., S.H-m. — Torneträsk stn., Vorevardo, G.N.M. — Torneträsk, Pålnovaare, U.Z.M Å.H-m. — Torneträsk, northern side, N.R.M. — Kaivaara, LARSON 1947. — Vittangijärvi, K.C.-L. — Pirtimusjärvi, K.C.-L. — Karesuando, Mertavaara, L.Z.M. — Karesuando s:n, 15 km NNE Liedakka, Vuokaisenkero, K.C.-L. — Ruodnajokk near Lainio river, K.C.-L.

Anguis fragilis (LINNAEUS). **Slow-worm. Ormslå**

Anguis fragilis is a chiefly European form extending from the British Isles France and Spain in the west to southern Finland and Russia, being there distributed to 65° or 61° N. Eastwards it appears to Tobol River (70° E) where the border turns to the south extending to 50° N, where the species avoids the southeast Russian steppe. The Slow-worm then appears in Caucasus, Asia Minor, and northern Iran. *Anguis* does not occur on the Sardinian Island. According to SMITH (1954) it is recorded from NW Africa too, from Tunis (Ain Draham) Algeria (Bone) and the Sahara.

The Swedish occurrence covers the south and central part of the peninsula It becomes scarce in central Värmland and Dalecarlia, appearing in Gästrikland and Hälsingland, and from Medelpad along the coast to Lövånger (64°30′ N) One or two localities are reported from far inland from Ångermanland and GAUNITZ (1949) has reported it from southern Lapland which, however, needs confirmation. It is common on Öland. Only two finds are reported from Gotland by apparently reliable persons, though there are no specimens actually collected from this island. Consequently, the occurrence on Gotland is somewhat uncertain

The vertical distribution extends from m.s.l. to 350 m on the Småland highland and to about 300 m in Dalecarlia.

New born young are silvery grey on the dorsal side and black on the underside In the middle of the silvery grey there is a narrow longitudinal stripe extending along the back, ending forwards with a rectangular speck. In front of this there is generally a black spot on the head. This stripe usually disappears during the first or second year. As the animals grow older the dorsal side generally takes

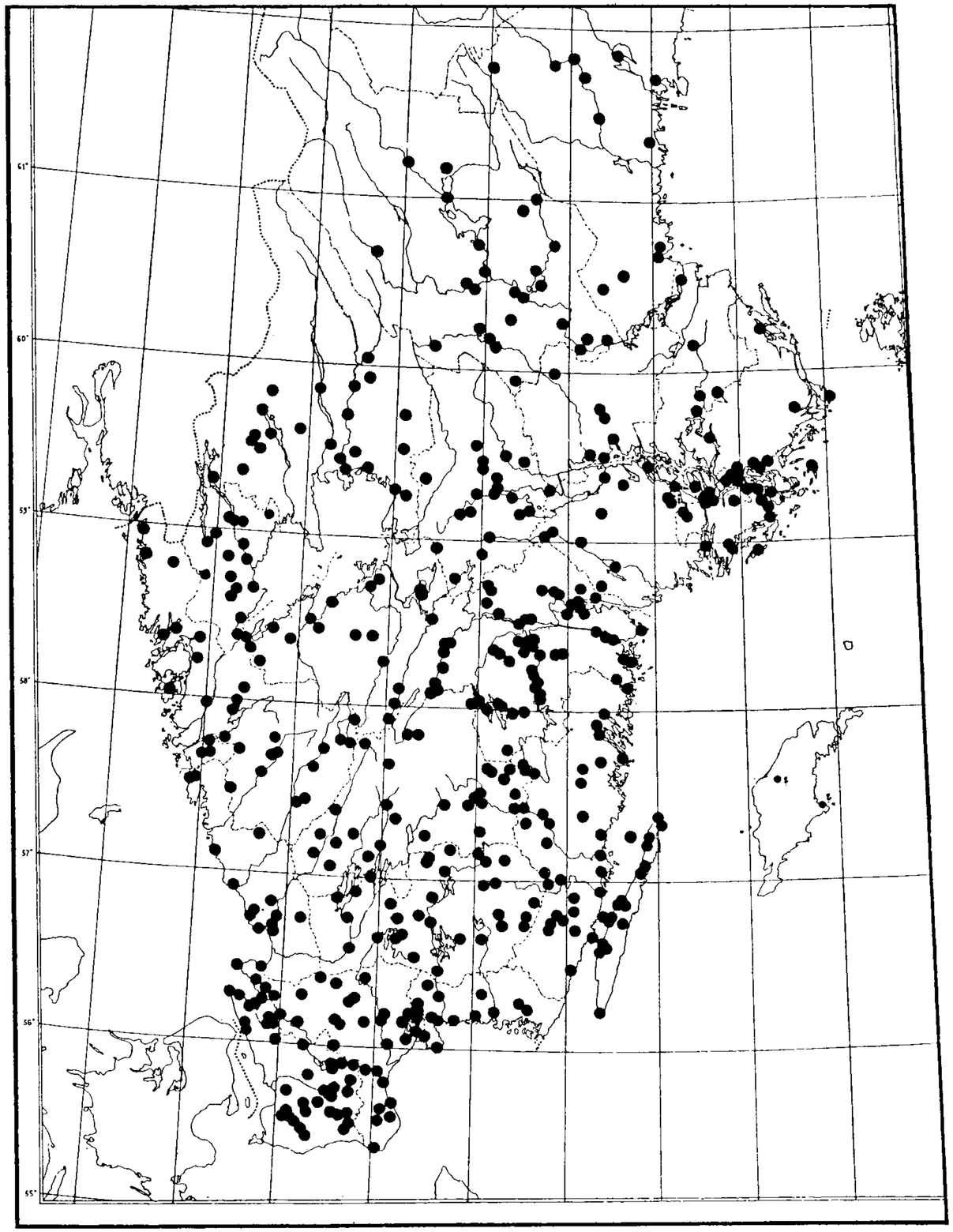


FIG. 52, 53. Distribution in Sweden of *Anguis fragilis*.

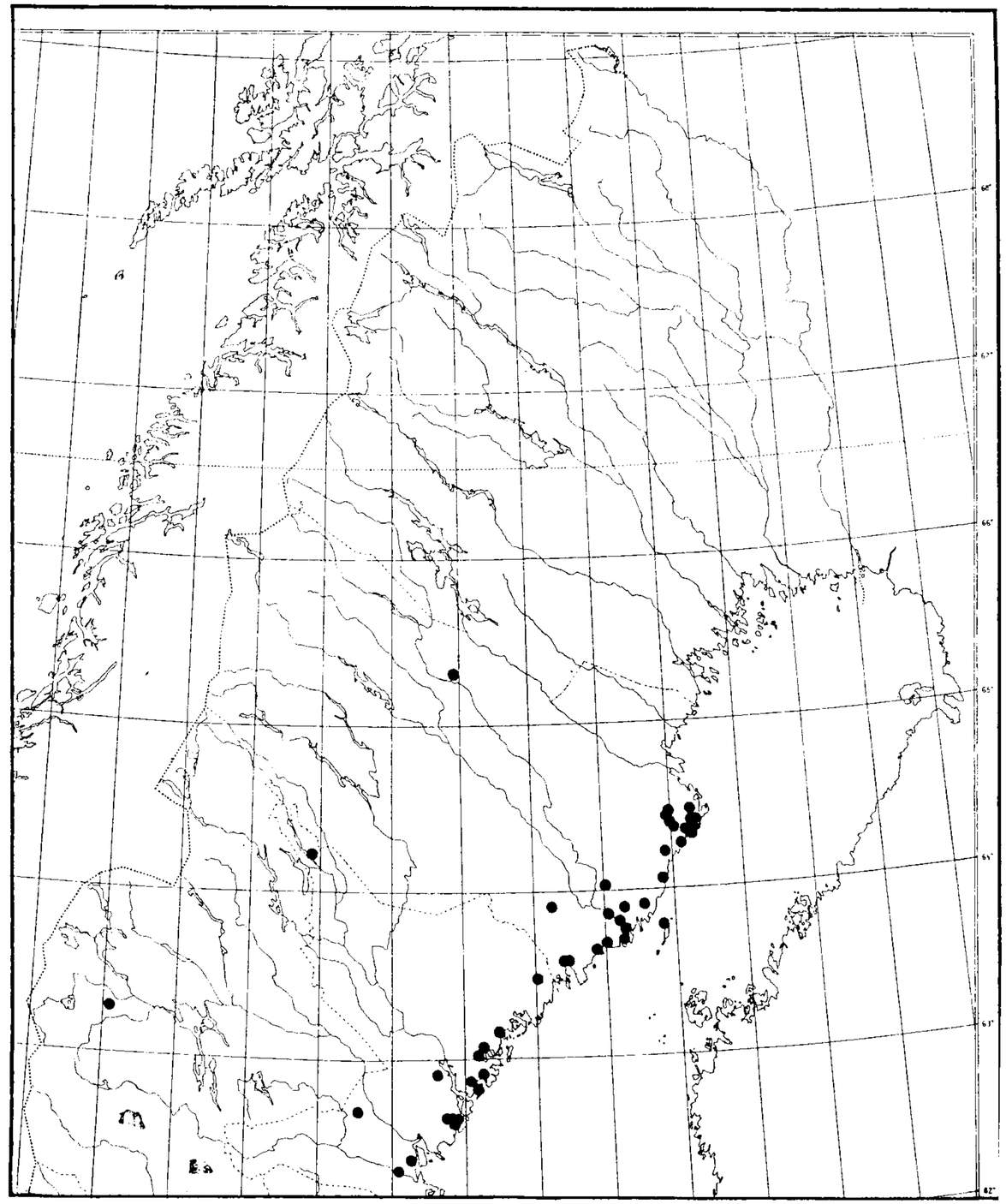


FIG. 53.

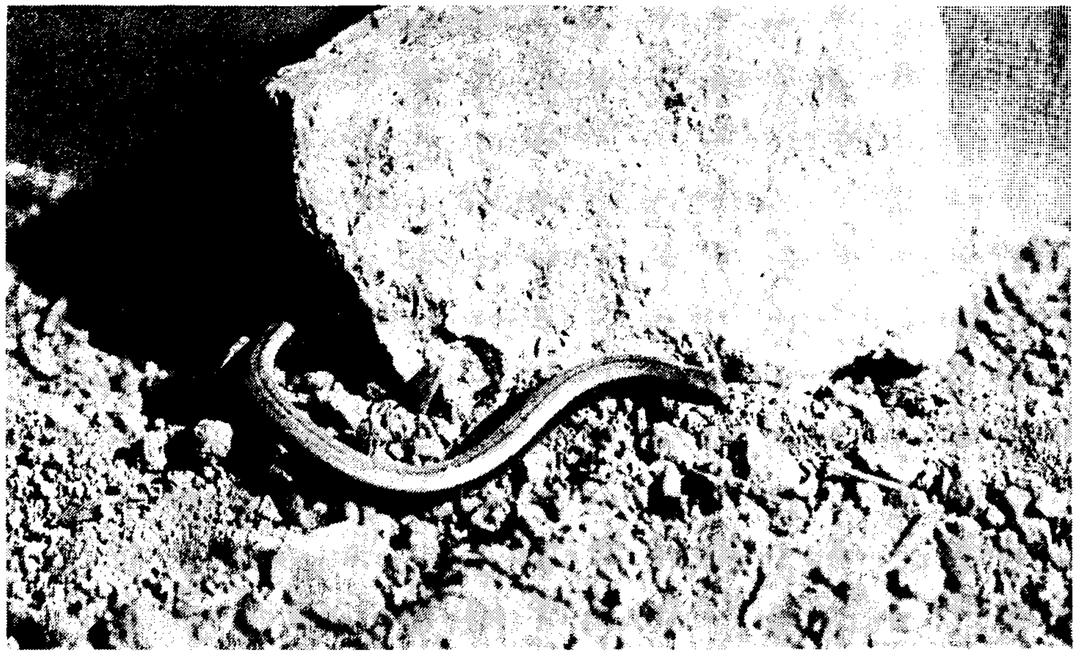


FIG. 54. Slow-worm. Photo by O. HALLDIN.

a greyish or brownish to red-brown colour at the same time as the ventral side lightens from blackish to greyish and when moulting often presents a bluish tint. In some cases older specimens, even up to a length of 25 cm, may retain the lengthwise dorsal band and the transition between the dorsal and ventral coloration may sometimes remain fairly sharp. In the Gothenburg Natural History Museum there is a very rare ebony-black specimen. (From Seglora, Ågårda, Vg. 1946. Now dark brown in alcohol.) The bluespotted variety *colchica* (male), which otherwise is widely distributed, is not recorded from Sweden but is known from as far north as Estonia, the eastern Baltic island Ösel and S Finland.

Length among Swedish specimens maximally 42.2 cm. Most of the larger specimens have regenerated tails and therefore are abnormally short.

The slow-worms are generally found resting under stones and rocks and appear in the open only in the early morning and in the evening.

Hibernation begins late in September or in the first half of October.

The mating, rarely observed, takes place in early spring, in Sweden in May. The young are born in August. In 1935 I described the hatching of a litter of young in an unusually large female. 14 embryos were born, one of them being a sterile egg. The capsule enclosing the embryo generally bursts about 1 minute after hatching. The stalk of the yolk sack often dries up a few minutes after the young has begun to creep. After one larger embryo often a smaller one is born. The membranes of the embryo sack generally break after about 20 minutes. The embryo usually leaves the pellicle after three quarters of an hour. The length of the new-born young varies between 8 and 11 cm. The interval between two births is generally rather variable, between 20 minutes and 1 $^1/_2$ hour, so that the total time for a hatching amounts to several hours.

OCCURRENCE:

Skåne. Löderup s:n, Löderups strandbad, H.L. — Gärdslöv, S.S. — Gustaf, S.S. — Sövestad, S.S. — Fjällfotasjön, M.M. — Baldringe, S.S. — Skabersjö, L.Z.M., S.S. — Bökeberg, L.Z.M. — Hyby, S.S. — Bokskogen, K.L. — Häckeberga, K.A. — On the road between Häckeberga and Skurup, H.B-m. — Sövde, S.S. — To the north of Snogeholmssjön, Exc., H.L. — Röddinge, L.Z.M. — Eriksdal, Exc. — Smedstorp, S.S. — Östra Vemmerlöv, Stråntemölla, H.L. — Genarp, S.S. — Gödelöv, S.S. — Romeleåsen, A.L-g. — Veberöd, S.S. — S:t Olof, S.S. — Stenshuvud, G.N.M., Y.M., A.D. — Lund, J.B. — Öved, S.S. — Harlösa, S.S. — Fränninge, S.S. — Östraby, S.S. — Långaröd, S.S. — Ven, NILSSON & THORSON 1950. — Maglehem, S.S. — Skarhult, S.S. — Hörby, O.P. — Huaröd, S.S. — Degeberga, S.S., K.E. — Fulltofta, O.P. — Äspinge, H.L. — Svensköp, H.L. — Röstånga, S.S., E.H.-M., A.N-n. — Odensjön, N.A.A. — Ekeby, C-E.H. — Hälsingborg, N.R.M. — Hälsingborg area, H.M. — Lillsjödal, L.B-d. — Kristianstad area, Å.U. — Trolle-Ljungby, S.S. — Ivetofta, S.S. — Gunnarp (Gunnarstorp), L.Z.M. — Vrams Gunnarstorp, N.R.M. — Sorrödssjöarna, C.-E.H. — Allerum, S.S. — Åstorp, A.S. — Kvidinge, Kärreberga, U.S. — Tormestorp, B.O. — Finja s:n, L.Z.M. — Hörröd, G.N.M. — Hanaskog, Exc. — Oppmanna, S.S. — Hjärsås, S.S. — Vånga s:n, Bonslätt, G.N.M. — Vånga, S.S. — Näsum s:n, Sibbarp, G.N.M. — Näsum, S.S. — Sonarp, B.O. — Välinge s:n, Tånga, A.N-n. — Välinge s:n, S.S. — Strövelstorp s:n, Vegeholm, A.N-n. — Brunnby s:n, Skäret, N.R.M. — Kullaberg, Mölle, G.N.M., BEHRENS & MALMBERG 1950, A.N-n., H.V. — Munka-Ljungby, E.M. — Örkelljunga, V.F. — Lursjö, A.K. — Hästveda, A.K. — Hjärnarp, B.O. — Förslövsholm, B.O. — Vittsjö, H.C., B.S. — Skånes Fagerhult s:n, Yxenhult, L.L.I. — Osby, Hasslaröd, HALL 1950. — Osby, G.N.M. — Hallands Väderö, B.O., VALLIN 1947, 1949. — Båstad, V.F.

Blekinge. Mjällby s:n, Hällevik, L.L.I. — Valje, E.M. — Gammalstorp s:n, Kylinge, G.N.M. — Mörrums s:n, Björkenäs, T.G. — Mörrums s:n, L.Z.M. — Between Orranäs and Torhamn, L.Z.M. — Karlshamn, G.N.M. — Karlshamn area, L.Z.M. — Järnavik, T.G. — Ronneby area, WESTERLUND 1890. — Torskors, A.L-m. — Bastasjö, A.L.-m. — Jämshög, L.Z.M., R.J. — Rödeby, P.v.S., T.G. — Åkeholm, G.W. — Backaryd, Angsjön, H.L. — Kyrkhult, Fåglaboda, H.L.

Halland. Stjernarp, L.Z.M., K.G.W. — Söndrum s:n, S.T. — Skedala, K.E. — Enslöv, H.A. — Bredared, H.A.L. Halmstad. — Steninge, HANSTRÖM 1946, 1950, B.H. — Getinge s:n, A.K. — Slättåkra s:n, T.H-g. — Ramsjöholm, Varberg samrealskola — Varberg, Varberg samrealskola. — Gunnarp s:n, CURRY-LINDAHL 1946 C. — Fagered s:n, H.A.L. Hudiksvall. — Särö, G.N.M. — Släp s:n, S.S.

Småland except Kalmar län. Almundsryd, K.-H.F. — Härlunda, Långhult, H.L. — Traryd, H.L. — Pjätteryd, Osnaköp, at Helgeån, H.L. — Diö, V.F. — Liatorp, T.G. — Väckelsång s:n, C.B.G. — Linneryd, K.E.J. — Annerstad, E.H.M. — Agunnaryd, Målensjön, northern side, H.L. — Vislanda, Moshult, H.L. — Skatelöv s:n, C.B.G. — Ekeberga, Fagerhult, K.-H.F. — Ljuder, Slätthult, H.L. — Algutsboda s:n, Hällasjö, C.M. — Algutsboda, Östra Stamphult, H.L. — Odensjö, L.Z.M., N.R.M. — Angelstad, Hölninge, H.L. — Ryssby s:n, C.B.G. — Öja, to the west of Gemla, H.L. — Hälleberga, to the north of the church, H.L. — Dädesjö, Linnebjörkessjön, H.L. — Lenhovda, Alstern, northwestern part, H.L. — Vittaryd, 2 km to the west of Vidöstern stn., H.L. — Berg s:n, Vinninge, S.A-n. — Jölluntofta, Blängsbo, H.L. — Skeppshult, J.P. — Kärda, close to Åminne, H.L. — Moheda: Fiolen; Åkhult mire, L.L.I. — Aneboda, L.Z.M., L.L.I., LANG 1928. Nottebäck, Bredhälla, H.L. — Nottebäck, C.B.G. — Sjösås, to the west of Harshult, H.L. — Villstad, Sägen, H.L. — Reftele, to the west of Flahultsjön, H.L. — Kulltorp, H.L. — Värnamo, G.A. — Asa, E.H.M. — Hjälmseryd, O.C-n. — Korsberga s:n, Lida, H.L. — Österkorsberga, C.B.G. — Hagshult, H.L. — Norra Hestra, on the eastern slope of Isaberg, H.L. — Skillingaryd, K.-E.J. —

C.B.G. — Vetlanda: Näsby: near Lindåssjön, H.L. — Mellby: to the south of Tångerda; Fageräng, H.L. — Ökna s:n, Pukabo, H.L. — Karlstorp, CYRÉN 1910 — Bellö s:n, Marhult, H.L. — Hult: close to Stuveryd; Försjön, H.L. — Ingatorp, at the railway station, H.L. — Between Ingatorp and Alvestorp, H.L. — Månsarp, G.B. — Bottnaryd, G.N.M. — Svarttorp, Ramsjöholm, G.N.M. — Skärstad, Gestra, G.N.M. — Gränna, Getingaryd, G.N.M. — Tranås, L.Z.M., K.-H.F.

Kalmar län. Halltorp s:n, Värnanäs, G.N.M. — Madesjö s:n, Otteskruv, H.L. — Nybro, H.L. — S:t Sigfrid NNW Trekanten, H.L. — Kalmar, WESTERLUND 1858. — Kristvalla, Övre Rösebo, H.L. — Kristvalla, Skårebo, H.L. — Kristvalla, C.M. — Skäggenäs, L.Z.M. Exc. — Bäckebo, Stenbrohult, H.L. — Strömserum, Alsterån, L.Z.M., Exc. — Kråkemåla, Uvahult, H.L. — Kråkemåla, to the northeast of Boasjö, H.L. — Algunnen, L.Z.M., GISLÉN 1935, T.G. — Mönsterås, T.H., Å.D., — Enefors, Emån, L.Z.M. — Fågelfors, O.A. — Oskarshamn, O.A. — Jungfrun, L.Z.M., G.N.M., BERNSTRÖM 1941, CURRY-LINDAHL 1950, T.G., GISLÉN 1949, — Virserum, L.L.I. — Mörlunda, Lilla Sinnerstad, T.G. — Jöreda, Venshult, H.L. — Målilla, to the north of Stensryd, H.L. — Målilla, H.L. — Kristdala, Hägerum, G.N.M. — Tuna s:n, Bredshult, T.G. — Hässleby, A.D. — Pelarne, close to Nyebro, H.L. — Hjorted s:n, Mjöshult, J.B. — Rumskulla, H.L. — 6.5 km to the southwest of Gladhammar church, J.B. — Västervik, Hästhagssjön, S.B. — Gamleby, J.B. — Överum, E.-Mm, M.M. — Västra Ed, Tinderred, L.Z.M. — In the skärgård off Östra Ed, S.T.

Öland. Ottenby grove, E.W. — Vickleby groves, K.C.-L., C.E. — Beijershamn, D.C., K.C.-L., EDELSTAM 1944. — Torslunda s:n, KULLENBERG 1953. — Torslunda s:n, Kalkstad, L.Z.M. — Färjestaden, Exc. — Stora Rör, HEINZE 1909. — Ismantorp, D.C. — Ekerum, Exc. — Räpplinge, Borga hage, G.N.M., Exc., JOHANSSON 1955. — Köping, Skede mire, G.N.M. — Borgholm, N.R.M., HEINZE 1909. — Föra, Marsjö, G.N.M. — Persnäs, Lilla Horn, G.N.M. — Horn, G.N.M. — Hornsjön, D.C. — Böda, Byerum, G.N.M. — Böda, Grankulla, N.A. — Böda, at the northwestern point, G.N.M.

Gotland. Katthammarsvik, LEIF LINDBERG i Gotlands Allahanda 1942. — Follingbo s:n, C.A.C. — Visby, C.A.C.

Bohuslän. Romelanda, Lysegården, H.L. — Tjörn, EKSTRÖM 1850. — Ljung s:n, J.B. — Gullmarsfjorden, Allsbäck, G.N.M. — Skredsvik, N.R.M. — Uddevalla, C.G.K. — Naverstad, G.N.M. — Lur s:n, Buar, N.R.M. — Strömstad, N.R.M.

Västergötland. Tostared, K.C.-L. — Örsås at Lillån close to Risa, H.L. — Seglora, H.L. — Torpa Castle at Åsunden, K.G.W. — Mölndal, G.N.M. — Mölnlycke, G.N.M. — Hindås, G.N.M. — Viared area, K. HALL 1942. — Borås, C.B. — Bredgården to the east of Åsunden, K.G.W. — Gullered, Bäcken, H.L. — Strängsered, Brännebråten, H.L. — Partille, N.A. — Lerum, G.N.M. — Bredared s:n, G.N.M. — Kölingared, to the north of Brängen, G.N.M. — Habo, U.Z.M. — Brandstorp s:n, N.-G.K. — Gustaf Adolf, to the south east of Baskarp, H.L. — Gustaf Adolfs s:n, U.Z.M. — Mjörn, G.N.M. — Kilanda on the way to Sjövik, H.L. — Östad, H.L. — Mjörnsjö, G.N.M. — Långared s:n, Frishulan, Å.H-l. — Bäreberg, H.L. — Fröjered, to the west of Orleka, H.L. — Hunneberg, N.-G.K. — Halleberg, N.-G.K. — Vänersborg, C.G.K. — Järpås, N.-G.K. — Friel, N.-G.K. — Hasslösa, Vinninga, E.S. — Lidköping, N.-G.K. — Varnhem, C.G.K. Billingen, H.A.L. Örebro, T.S. — Skövde area, C.B.G. — Kinnekulle, KARVIK 1953, L.L.I., N.G.K. — Karlsborg, A.R. — Mariestad, J.F. — Hassle, Hj.S. — Undenäs: Holmgildret; Fräckestad; Lilla Valsjön, H.L.

Östergötland. Svinhult, H.B. — Torpa s:n, Torpön, S.T. — Tidersrum s:n, Misterfall, E.S-n. — Kisa, S.T., S.S. — Blåvik, Liljeholmen, S.T. — Malexander s:n, Landsnäs, S.T. — Malexander, C.-E.H. — Hägerstad, S.S. — Kättilstad, S.S. — Tjärstad, Opphem, S.T. — Tjärstad, S.S. — Brokind, S.T., B.O. — Vårdnäs, S.T., S.S. — Valdemarsvik, C.M. — Gryt s:n, Syltvik, C.M. — Ödeshög, Gyllinge, S.T. — Ödeshög s:n, Stava, T.G.

— Ödeshög, H.L. — Omberg, close to Hjässan, J.B. — Omberg, Mullskräerna, U.S. — Omberg, Djurkälla, G.N.M. — Omberg, F.O., H.B. — Veta, Solberga, S.T. — Östra Tollstad, Tomta, S.T. — Nykil S.T. — Skeda, Mutebo, S.T. — Vist, Sturefors, S.T. — Björsäter, S.T. — Värna, S.T. — Värnasjön, S.T. — S:t Anna s:n: Breviken; Ramsdal, U.S. — S:t Anna s:n, Engelholm, G.N.M. — Hjulsbro at Stångån, S.T. — Malmslätt, S.T. — Linköping, Djurgården, S.T. — Linköping area, K.E-n. — Rystad, S.T. — Skällvik s:n, Stegeborg, G.N.M. — Mogata s:n, Husby, T.G. — Söderköping, T.G. — Ljungsbro, S.T. — Stjärnorp, H.L., S.T. — Roxenbaden, S.T. — Arkösund, S.T. — Kristberg, Karlsby, S.B. — Kristberg, Svansäter, H.L. — Okna, Runken, H.B. — Lövstadsjön to the south of Norrköping, H.B. — Kummelby, H.A.L. Sundsvall. — Norrköping area, H.B. — Konungsund, H.B. — Ryssnäs at Glan, H.B. — Ringstad, H.B. — Kvillinge, H.B. — Krokek, Sjövik, G.N.M. — In the western part of Kolmården, K.E-n. — Kolmården, Stora 'mossen, H.B. — Kolmården, N.R.M. — Godegård: De Geersfors; Höksjön, H.L. — Godegård, N.R.M. — Finspång, H.B. — Ysunda at the northernmost part of Glan, H.B. — Risinge, H.L. — Näkna, H.B.

Dalsland. Gestad, Timmervik, N-G.K. — Sundals-Ryr, N.-G.K. — Ör s:n, Säter on the eastern slope of Kroppefjäll, H.L. — Järn s:n, C.M. — Dalskog, L.Z.M. — Åsens bruk, P.D. — Ödsköld s:n, C.M. — Ed s:n, Bälnäs, N.-G.K. — Lerdal, Tisäter, N.-G.K. — Edselskog, Lövåsen, N.-G.K. — Tisselskog s:n, C.M. — Håbol, H.L. — Ärtemark, N.G.K. — Bengtsfors, N.-G.K. — Laxarby, N.-G.K. — Mo, Vassbotten, N.-G.K.

Värmland. Blomskog s:n, Gyltenäs, L.Z.M. — Sillerud, Häljebyn, H.L. — Björneborgs bruk, Grytsjön, A.D. — 7 km to the south of Degerfors, C.E. — Degerfors, Duvdalsängen, H.W.W. — Kristinehamn area, E.W. — Karlstad, H.A.L. Härnösand. — Stavnäs, H.L. — Grava s:n, Skåre, C.M. — Alster s:n, C.B.G. — Granemo, H.L. — Lenungshammar, H.L. — Glava, H.L. — Gränssjön, A.E. — Between Stora Gla, Övre Gla and Älgsjön, O.N. — Kil s:n, A.K. — Lundsberg, VON ROSEN 1940, E.W. — Älgå: between Sulvik and Kolsjön; on the southwestern slope of Ränkesnipan, H.L. — Brunskog s:n, C.B.G. — Övre Ullerud, T.S. — Filipstad, E.D-l. — Gunnarskog s:n, C.M. — Sunne s:n, Fryken Valley, S.T. — Sunne s:n, S.A. — Munkfors, N.R.M. — Sunnemo, E.D-l. — Hagfors area, J.L., E.W.

Närke. Olshammar, to the north of Aspa, H.L. — Lerbäck s:n, AF ROBSON 1911. — Laxå, Prästtorp, H.L. — Tisaren, Tisaretorp, G.Ö-t. — Kvistbro, H.L. — Edsberg, Riseberga, H.W.W. — Asker, H.W.W. — Lännäs, Segersjö, H.W.W. — Latorp, H.W.W. — Örebro, Kränglan, H.W.W. — Örebro, A.D. — Almby, Hjälmarbaden, H.W.W. — Hovsta s:n, A.D. — Kil, Ullavi, L.I. — Kil; Tomasboda; Klockhammar, H.L. — Kil, Lockhyttan, A.D., H.L. — Kil s:n, Marka, A.D.

Södermanland. Kila s:n, on the road between Kila and Virå, H.a.R. — Kila s:n, H.a.R. — Halla s:n, E.H-n. — Katrineholm, T.W. — Marsjö, T.W. — Vingåker, T.W. — Mörkö, N.R.M. — Ösmo, Himmelsö, J.B. — Hårsfjärden, H.B-m. — Ösmo, J.B. — Utö, S.E-n. — Dalarö, C.E. — Hälleforsnäs, S.T. — Turinge: Rudkulla; Nykvarn, H.W.W. — Mariefred, U.Z.M. — Hedlandet, A.L-t. — Salem: Ersboda; Ängstugan, H.W.W. — Salem s:n, A.A. — Huddinge s:n, Balingsholm, K.C.-L. — Huddinge, N.R.M. — Tyresö s:n, Brevik, A.K-n. — Tyresö, N.R.M., J.B. — Nacka, Dammtorpssjön, H.a.R. — Storängen, G.R. — Lännersta, T.W. — Säterbo, Sjölunda, H.W.W. — Eskilstuna area, SJÖSTEDT 1920. — Kjula, Runsätershage, H.W.W. — Tosterö, A.L-g. — Toresund, Herrestad, H.W.W.

Stockholm. Bromma, S.E-n. — Karlberg, N.R.M. — Haga, N.R.M. — Stockholm, N.R.M.

Västmanland. Fellingsbro, Öby, H.W.W. — Näsby s:n, Frövi, A.D. — Nora area, H.A.L. Västerås, — Ryttene s:n, Lagersberg; Tidö, J.B. — Västerås, G.D-l. — To the northwest of Västerås, L.L.I. — Västerås area, H.A.L. Västerås, WALLDÉN 1955. — Skultuna s:n, O.H-g. — Svanå, N.R.M. — Västervåla, Ombänning, L.L.I.

Uppland. Björkö, S.E-n. — Ekerö, I.H. — Järva, K.C.-L. — Lidingö, O.D. — Ingarö s:n, Beatelund, K.C.-L. — Ingarö, M.M. — Danderyd; Klingsta, N.R.M. — Danderyd, Enebyberg, K.-H.F. — Danderyd, Näsby, N.R.M. — Järfälla s:n, K.C.-L. — Täby s:n, Ella, N.R.M. — Hästängsudd, H.B-m. — Österåker s:n, Täljö, K.H.F. — Österåker s:n, Lervik, H.a.R. — Möja, Långvik, J.R. — On an island off Möja, N.R.M. — Vallentuna, Angarnsjöängen, FORSHEDEN 1952. — Sigtuna, K.C.-L. — Norrtälje, Uddeboö, A.L.-t. — Uppsala-Näs, O.B.S. — Bondkyrka s:n, Vårdsätra, O.B.S. — Uppsala, U.Z.M. — Funbo, S.T. — Söderby, Karl s:n, HANNERZ 53. — Arholma, K.H.F. — Vendel, S.E. — Fogelö, K.C.-L. — Östhammar area, T.S. — Älvkarleö, O.H.

Dalarna. Malingsbo, Lövtjärn, K.-H.F. — Malingsbo, H-s.L. — Sävsnäs, EKMAN 1922. — Ludvika, K.-H.F. — Brunnsvik, K.-H.F. — Avesta, A.K. — Grytnäs, K.-H.F. — By s:n, B.W. — Grangärde, K.-H.F. — Hedemora, EKMAN 1922, A.K. — Silvberg S:n, Ulfshyttan, E.B. — Stora Tuna, Norån, E.D. — Stora Tuna, E.D. — Mockfjärd, E.K. — Borlänge, T.G. — Vika, KLEFBECK 1927. — Floda, Lissfors, T.T. — Gagnef, KLEFBECK 1927. E.D. — Falun, KLEFBECK 1927, 1949. — Stora Kopparberg, K.-H.F. — Malung, KLEFBECK 1927, I.G. — Leksand, KLEFBECK 1927, O.L-d. — Svärdsjö, KLEFBECK 1927. — Dådran, KLEFBECK 1927. — Bingsjö village, E-s.M. Ene Bingsjö village E-s.M. — Mora, KLEFBECK 1927. — Orsa, Kryksås, B.T. — Älvdalen, H.E.

Gästrikland. Torsåker, Kratte forge, L.Z.M. — Årsunda, O.H. — Gävle, O.H. — Gävle area, HEINTZE 1909, G.K. — Between Gävle and Bönan, OLSSON 1882. — Hille, K.F.

Hälsingland. Norrala, N.R.M., T-t. — Arbrå, B.W.-S. — Los, H.L. — Järvsö, L.Z.M. — Järvsö s:n, B.W.-S. — Hudiksvall, H.A.L. Hudiksvall. Färila, B.W.-S., H.L. — Ljusdal s:n, BODÉN & WITT-STRÖMER 1951, H.L., L.S., B.W.-S. — Norrbo s:n, N.R.M.

Härjedalen. Sveg s:n, Siksjön, K.C.-L.

Medelpad. Tuna s:n, Matfors, P.D. — Sundsvall, Norra Stadsberget, S.B-t. — Sundsvall, O.H. — Holm s:n, OLSSON 1876.

Ångermanland. Gådeå, O.H. — Härnösand area, CURRY-LINDAHL 1945, O.H. — Säbrå, Billsta, through H.A.L. Härnösand. — Säbrå, H.A.L. Härnösand. — Gudmundrå s:n, Nästvattnet, O.H. — Nora s:n: Berghamn; Frök, through H.A.L. Härnösand. — Nora s:n Ramsta, O.H. — Between Nora and Nordingrå, S.E. — Nordingrå, O.F. —Vibyggerå: Möja; Docksta, S.A-n. — Vibyggerå, L.S. — Nätra s:n, Näske, O.H. — Örnsköldsvik area, BARTLER 1953. — Gideå, K.-H.F. — 25 km to the north of Trehörningsjön, through H.A.L. Umeå, — Tåsjö, MODIN 1916.

Jämtland. ?Välliste fjäll, GAUNITZ 1949.

Västerbotten. Nordmaling, Aspeå, H.A.L. Umeå. — Nordmaling, T.L-d. — Hörnefors, T.L-d. — Norrmjöle, H.A.L. Umeå. — Obbola, through H.a.L. Umeå. — 15 km to the west of Bösta, through H.A.L. Umeå — Röbäck; Bergsboda, T.L-d. — Umeå, Håkmark, O.H. — Umeå, T.L-d. — 2 km to the north of Umeå, T.L-d. — 10 km to the north of Umeå, H.A.L. Umeå. — Holmön, O.H. — 40 km to the north of Granbäck, through H.A.L. Umeå. — Sävar, B.W.-S. — Tavelsjö, T.L-d. — Bygdeå, O.H. — Robertsfors, through H.A.L. Umeå, T.L-d. — Ånäset, Skäran, T.L-d. — Lövånger s:n, Kräkånger, HOLM 1940, O.H. — Lövånger s:n; Ytterbyn; Broträsk; Böle; Avan; Gärde; Lövvattnet; Bodan; Nolbyn, Mårtensboda; Vallen; HOLM 1940, O.H. — Lövånger, Daglösten, O.H. — Lövånger, T.L.-d. — Burträsk revir, O.H.

Lappland. ?Sorsele, Gargnäs, GAUNITZ 1949. — ?Sorsele: Vuomatjåkko; ?Stor Ajgert; ?Stora Tjulträsk, GAUNITZ 1949. — ?Soloive; Stora Ålge; ?Juobbo, GAUNITZ 1949.

SERPENTES. SNAKES

Coronella austriaca austriaca (LAURENTI). **Smooth Snake. Hasselsnok**

General distribution: Occurring in southern England, Holland, Belgium, northwestern France, down to central Spain, through central Europe, Italy, Sicily, the Balkan Peninsula to northern Greece, eastwards from Riga to 67° E, Caucasus, Asia Minor and Northern Iran.

Coronella austriaca occurs very rarely in Denmark. During a hundred years it has been taken in only seven localities and it was found the last time in 1914 in that country.

In Sweden it has not been recorded in western Scania. Only in the eastern part of this county, where more continental climatological conditions prevail, does it begin to appear and become fairly common. In Blekinge, Kalmar län and Östergötland it is even quite abundant. It is a little rarer in Södermanland and found in many places round Stockholm and round Mälaren. It occurs in several places on our two Baltic Islands. It is common again in the vicinity of Gothenburg, through southern Bohuslän and S.W. Västergötland. There are scattered localities in N. Bohuslän, Dalsland, round the Väner lake and in Närke. In Halland and S.W. Småland it is exceedingly rare and absent from the W. part of central Småland, E. Västergötland and W. Scania. N. of this area there are rare finds in central Uppland, and one find in S. Dalecarlia. A couple of old finds are noted by GYLLING (1898) from Medelpad and S. EKMAN relates about a find from Ångermanland, 62°35′ N. In recent time it is reported from Hälsingland, Hudiksvall district, SIGURD HANSTRÖM 1958.

In Norway it is confined to the sunny and warm valleys of the S.W. coast and to some places in the E. lowland. For Finland it has chiefly been reported on Åland (two old localities from this county and a recent find from 1950). Maybe it once occurred on the Finnish mainland. (There is an old doubtful find from Heinola half a century ago.) It is not known from Estonia, nor from the eastern Baltic Isles Ösel and Dagö (KAURI 1946).

Evidently this species is much favoured in the parts of S. Sweden, with more continental climate, becoming rather abundant in the S.E. part of the country. In all it has been reported from about 170 localities in Sweden.

Vertical occurrence from m.s.l. to about 250 m Småland and Ö. Korsberga. It is generally found in sunny clearings in the forest and on mountainous slopes. It is an excellent climber of trees and shrubs. The colour is more brilliant in young specimens. A months old young from June (20.5 cm) shows the following mark-

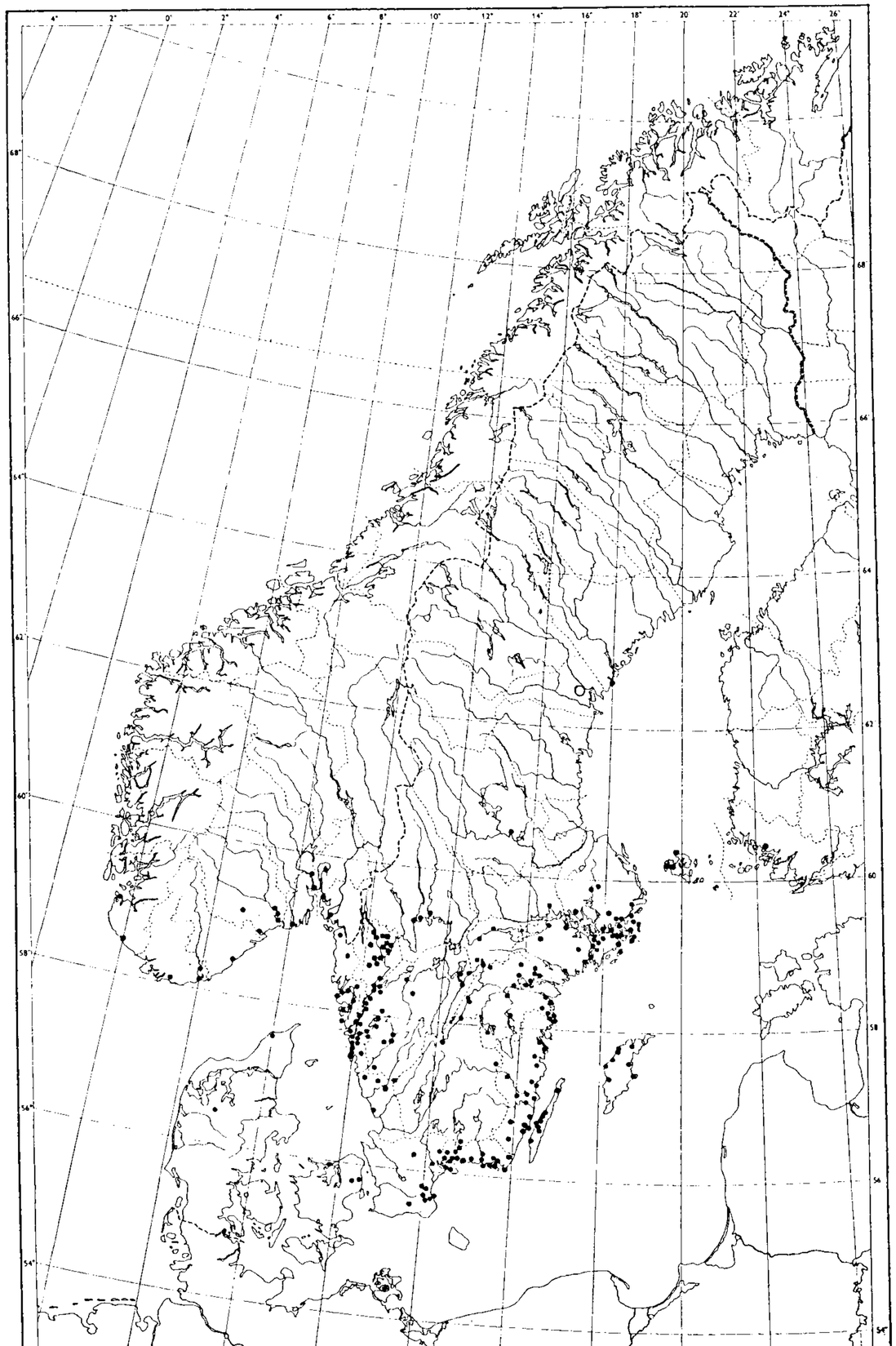


FIG. 56. Smooth Snake climbing a tree. Photo by G. HÅKANSSON.

ings: A black narrow band straight over the snout (this band seems to fade in older specimens). On the head a black quadrangular spot, a little narrower forwards and broader backwards, ending abruptly in the back region. On each side of the head there is a narrow black line from tip of snout to about 6 cm behind the head. It then continues as a dark row of specks along the sides of the body. These specks seem to disappear in old specimens. Ventral side of the head is red in young specimens. In the back region there is an oblong pair of specks which in older specimens may form a continuation backwards as two handles on the large dorsal speck of the head. Further caudalwards there are paired specks continuing the marking; they are more or less rounded. These form the chief dorsal marking on the upper side on grey or brown ground.

There may be more dark-coloured specimens. I have a specimen from Uddevalla, a very dark blackish slate-grey with almost no markings.

Maximal size: Generally given as 75 cm. TORSTEN BRODIN (1951), however, has measured a specimen from the vicinity of Gothenburg which proved to be 83 cm long.

The measurements of the largest specimens from England in the British Museum, according to SMITH (1954), are, males 48.0–56.3 cm, females 51.1–62.3 cm. The average length of the Russian spec[illegible]

Mating, according to BRODIN (1951), takes place during May. He gives the time for the births as the end of August, and we have one female from Oskarshamn which produced her young on 7th September 1948. The 8 young, born in captivity, moulted on 24th September. Their skins measured 23 cm, i.e., subtracting a 10–15 % lengthening of the skin, 20–21 cm.

OCCURRENCE:

Skåne. To the north of Snogeholmssjön, C.E.M. — Tryde, L.Z.M. — Tunbyholm, Y.L. — Äspcröd, NILSSON 1860. — Andrarum s:n: Kristinehov, Hallamölla, A.B-n. — Stenshuvud, eastern side, H.L. — Fjälkestad, SAHLIN 1929. — Ivetofta s:n, Levrasjön, K.C.-L. — Ivetofta s:n: Håkanryd; Allarp, WALLENGREN 1866. — Ivetofta s:n, between Allarp and Barnakälla, K.C.-L. — Ivetofta, WALLENGREN 1866. — Finja s:n, Hörlinge, S.L. — Finja s:n, HALL 1950. — Näsum s:n, Klagstorp, W.B. — Immeln, M.M.

Blekinge. Sölvesborg, GOSSELMAN 1863, WALLENGREN 1866. — Torhamn, GOSSELMAN 1863. — Listerby s:n, Gö, L.Z.M. — Förkärla s:n, Almö, O.T. — Karlskrona area, NILSSON 1842, GOSSELMAN 1863. — Mörrum s:n, near Sandbäck, T.G. — Karlshamn, L.Z.M., WALLENGREN 1866. — Karlshamn, Sandvik, T.G. — Lyckeby s:n, Verkön, H.A.L. Karlskrona. — Lyckeby area, GOSSELMAN 1863. — Åryd s:n, Guön, L.Z.M., C.M. — Nättraby s:n, Sjuhalla, GOSSELMAN 1864. — Nättraby area, GOSSELMAN 1863. — Ronneby, M.M. — Augerum s:n: Torskors; Bubbetorp, P.v.S. — Augerum, P.v.S. — Jämshög s:n, Boafall, L.Z.M. — Jämshög s:n, Jämshögsby area, R.J. — Djupadal, Sörby, WESTERLUND 1890. — Kallinge, Ronneby Samrealskola. — Åkeholm, G.V. — Ringamåla, Knaggelid, H.L. — Fågelmara, O.T.

Halland. Steninge glassworks, CURRY-LINDAHL 1946 C, G.D-l. — Steninge, L.Z.M., HANSTRÖM 1946, 1948, 1950. B.H. — Krogsered, T.B. — Ullared, T.B. — Valinge, T.B. — Fjärås s:n, Stensjön, L.Z.M., ROSENGREN 1949, — Fjärås s:n, Sundsjön, G.N.M. — Vallda s:n, K.C.-L. — Särö, CURRY-LINDAHL 1955 A, D.C., H.L. — Släp s:n, Kullavik, G.N.M. — Släp s:n, K.T.

Småland except Kalmar län. On the west side of Mien, C.M. — Odensjö s:n, NILSSON 1860. — Karlstorp s:n, Kolsjön, CYRÉN 1946. — Karlstorp, G.N.M., N.R.M., CYRÉN 1910. — Ljungarum, Råslätt, BJURULF 1944. — 10 km to the north of Gränna, T.H-g.

Kalmar län. Torsås s:n, Strömby, L.Z.M. — Hossmo, TISELIUS 1868. — Dörby s:n, Ulfsborg, L.Z.M. — Dörby s:n, Ingelstorp, TISELIUS 1868. — Kalmar, Törneby, HEINTZE 1909. — Kalmar area, HEINTZE 1909. — Nybro, L.Z.M. — Ryssby s:n, Rockneby, U.Z.M. — Ryssby s:n, Ryssbylund, TISELIUS 1868. — Hornsö crown forest, S.H. — Algunnen halt, near Allgunnen, T.G. — Mönsterås s:n, between Åsevad and Guttorp, Å.D. — Mönsterås s:n, Kofverhult, Å.D. — Högsby s:n, Stora Sinnern, L.Z.M., T.G. — Fliseryd, WELANDER 1932. — Emån, U.Z.M. — 5 km to the south of Oskarshamn, L.Z.M. — Döderhult s:n, Ekern, G.N.M. — Döderhult s:n, N.R.M. — Tveta s:n, Lilla Sinnerstad, N.R.M. — Misterhult s:n, Virum, G.N.M. — Hjorted s:n, A.J. — Near Västervik, EKMAN 1922. — Törnsfall, S.B.

Öland. Resmo, WESTERLUND 1855. — Lenstad, S.H. — Algutsrum, HEINTZE 1909, K.-F.D. — Glömminge s:n, Röhälla, WESTERLUND 1855. — Högsrum, Stora Rör, HEINTZE 1909, S.H. — Repplinge s:n, to the east of the road Borgholm-Halltorp, near Strandtorp, R.E. — Repplinge, L.Z.M. — Borgholm, L.Z.M., N.R.M., WESTERLUND 1855. — In the neighbourhood of Hornsjön, E.W-n.

Gotland. Fröjel s:n, Hejdes, G.N.M. — Torsburgen, A.K., T.G. — Tofta, T.G. — Gothem s:n, Råbyträsk, N.A. — Visby, Katrinelund, L.Z.M, H.K. — Visby area, N.R.M. — Lummelunda church and Björkome. L.Z.M., H.K. — Lummelunda D.C., K.C.-L., T.G. — Lärbro s:n, Tängel, G.N.M.

Göteborg. Slottsskogen, Lilla Änggården, G.N.M., MALM 1877. — Slottsskogen, G.N.M., MALM 1877. — Delsjö area, Långvattnet, G.N.M. — Hisingen, G.N.M., MALM 1877. — Göteborg, G.N.M., NILSSON 1860. — Göteborg area, G.N.M., KARVIK 1951.

Bohuslän. Kungälv, G.N.M. — Marstrand, Instön, G.N.M. — Marstrand, Koön, L.Z.M., N.C. — Romelanda, G.N.M. — Tjörn, CEDERSTRÖM 1876, NILSSON 1842. — Norum s:n, Stenungsö, K.C.-L. — Myckleby s:n, Stillingsö, H.A.H. — Skaftöland, Klubban, S.E. Skaftöland: Östersidan; Lunnevik, G.D-s. — Skaftö, U.Z.M. — Kalvön, O.N. — Uddevalla, Kasen, L.Z.M. — Uddevalla, C.G.K. — Naverstad, G.N.M., MALM 1877. — Näsinge s:n, HANSSON 1889.

Västergötland. Kalv s:n, Stapelsbo, A.A-n. — Kungsäter, T.B. — Billdal, MALM 1877. — Kållered s:n, Sagås, G.N.M. — Askim s:n, Brottkärr, H.L. — Västra Frölunda s:n, Flatås, G.N.M. — Mölndal, G.N.M. — Härryda s:n, Härsjösand, O.J-n. — Sandhult s:n, Viaredssjön, BLIDING 1951. — Borås, Vännedsjön, BLIDING 1951. — Säven, BLIDING 1951. — Partille, N.A., S.O. — Lerum, G.N.M. — Jordfallet, G.N.M. — Bohus, G.N.M. — Hemsjö s:n, Stora Färgen, Granö, U.Z.M. — Bolltorp, Stora Trän, HANSSON 1926. — Långared s:n, Frishulan, CURRY-LINDAHL 1948 B, A.H-l. — Tunge, to the northwest of Garn stn., H.L. — Lilla Edet, T.S. — Velanda, K.F. — Anten, KARVIK 1951. — Trollhättan, G.N.M. — Hunneberg, KARVIK 1947, NILSSON 1842, N.-G.K. — Halleberg, KARVIK 1947, 1953, N.-G.K. — Kålltorp, HALL 1942. — Vänersborg, Vassbotten, G.N.M. — Råda s:n, G.N.M. — Karlsborg, KARVIK 1951, 1953, C.G.K. — Undenäs, KARVIK 1951. — Undenäs s:n, to the north of Bocksjön, H.L. — Tiveden, CURRY-LINDAHL 1944 A.

Östergötland. Asby s:n, N.R.M. — Tjärstad s:n, Opphem, HANNERZ 1929, E.W-n. — Gryt s:n, Breviksnäs, L.Z.M., K.H-a. — Gryt s:n, Syltvik, Lillebo, S-d.E-n. Gryt s:n: Vångsten, Lövudden; Ekdalen, N.I. — Gryt s:n, K.H-a. — Valdemarsvik area, C.M. Gusum works, NILSSON 1842. — Gusum, N.R.M. — Västra Tollstad s:n, Dagsmossen, E.W-k. — In the neighbourhood of Omberg, BOHMAN 1840. — Linköping, LUNDBERG 1918. — S:t Anna s:n, the abandoned church, T.G. — Mogata s:n, Kalkbrinken, T.G. — Vånga s:n, Grensholmen, H.L. — Borg s:n, Alsäter, A.M. — Ensjön, N.R.M. — Norrköping, N.R.M., SUNDEVALL 1845. — Krokek s:n, Sandviken, A.M. — Krokek s:n, Fjuk, G.N.M. — Krokek s:n, Lilla Älgsjön, N.R.M. — Risinge s:n, to the south of Bönern, H.L. — Godegård, N.R.M. — Simonstorp, A.M. — Rejmyre, A.M.

Dalsland. Gestad s:n, Gällnäsudde, KARVIK 1947, N.-G.K. — Ör, N.-G.K., — Vrångebäck, N.-G.K. — Kroppefjäll, KARVIK 1953 A. — Dals-Ed s:n, to the east of Stora Le, N.-G.K. — Fröskog s:n, Österbyn, KARVIK 1947. — Fröskog s:n, N.-G.K. — Tydje, N.-G.K. — Tösse, N.-G.K. — Edselskog, — Tisselskog, Heneviken, — Ånimskog, Salebol, — Skållerud, Möllerud, — Dalskog, V. Köttsjön S-end, — Steneby, V. Högen, N.-G.K. — Bengtsfors, HANNERZ 1929. — Laxarby s:n, N.-G.K. — Ärtemark, Tegane, HANNERZ 1929. — Åmål, Högbergsåsen, L.Z.M., R.E. — Åmål, Fjället, R.E.

Värmland. Tveta s:n, Skärsmyr, R.E. — Kilsviken, G.S. — Skåre, JANZON 1925.

Närke. Hammar s:n, Karol. H.A.L. Örebro. — Donafors, CURRY-LINDAHL 1944 A, H.L. — On the northern part of Vättern, SUNDSTRÖM 1868. — Kvistbro s:n, SUNDSTRÖM 1868. — Latorp works, S.R. — Kil s:n, Frösvidal, Ullaviklint, L.Z.M.

Södermanland. Nyköping, Rosenkälla, J.S. — Nyköping, SPARRMAN 1795 a. — Trosa, N.R.M. — Mörkö, NILSSON 1860, N.R.M. — Sjunda estate, E.P. — Grödinge s:n, Axaren, CURRY-LINDAHL 1952, — Grödinge s:n, Wiad, H.a.R. — Grödinge s:n, Kagghamra, H.a.R. — Ornö, Hässelmara, G.D-s. — Spirudden, WEYLANDT 1953. — Rönninge s:n, Riksten, T.L. — Salem s:n, A.A. — Huddinge s:n, Bialite, CURRY-LINDAHL 1952. — Huddinge s:n, Balingsholm, CURRY-LINDAHL 1952, K.C.-L. — Norra Södertörn, CURRY-LINDAHL 1951 B. — Tyresö s:n, Flaten, CURRY-LINDAHL 1945, E.W-k. — Tyresö, N.R.M. — Nämdö, CYRÉN 1941. — Eskilstuna, SJÖSTEDT 1920. — Strängnäs, S:t Erik spring,

Strängnäs Museum. — Strängnäs, B.v.S., H.H. — Strängnäs, Eldsund, H.W.W. — Näshulta s:n, Boda, H.W.W.

Stockholm. Saltsjöbaden, Harstigen, L.Z.M. — Nacka, Nackagård, B.C. — Nacka, Duvnäs, SPARRMAN 1795 a. — Nacka s:n, H.a.R., EDELSTAM 1954. — Bromma, D.C., N.L. — Stockholm, N.R.M. — Stockholm area, NILSSON 1842.

Västmanland. Västerås, H.A.L. — Västerås; Västerås area, FLODERUS 1925, WALLDÉN 1955.

Uppland. Ingarö, Solvik, L.Z.M. — Ingarö, Grisslingsfjärden, Storholmen, E.W-k. — Ingarö, N.R.M., M.M., CYRÉN 1937, HOLM 1937. — Smaller island outside Ingarö, N.R.M. — Värmdö s:n, Stora Kalvholmen, CURRY-LINDAHL 1949 B. — Runmarö, D.C. — Tynningö, O.T. — Djurö s:n, Norra Vindö, Abborrkroken, CYRÉN 1941. — Djurö s:n, Norra Vindö, U.Z.M. — Angarn: Angarnsjöängen; Klosterbacken; Lingsberg, FROSTHEDEN 1952. — Österåker s:n, Åsätra, N.R.M. — Österåker, N.R.M., C.E. — Möja, Narrstavsudde, CEDERHOLM 1941. — Möja, Åverksö, N.R.M. — Möja, Långviksnäs, CURRY-LINDAHL 1945, J.R. — Ingmarsö, LÖNNBERG 1925. — Ljusterö, Östra Lagnö, G.L. — Länna, U.Z.M., LÖNNBERG 1901. — Uppsala, NILSSON 1860. — Rasbo, U.Z.M., LÖNNBERG 1901. — Österbybruk, CURRY-LINDAHL 1949 B.

Dalarna. Aspeboda, Vallsfors, DAHL 1943.

Hälsingland. Njutånger s:n, Buberget, S. HANSTRÖM 1958.

Medelpad. Some few times, GYLLING 1898.

Ångermanland. Härnön, EKMAN 1922.

Natrix natrix natrix (LINNAEUS). Ringed Snake or Grass-snake. Snok

The species occurs in the whole continent of Europe except in the extreme north. From Russia it extends to eastern Siberia from 62° N in the west to 54° N in the east, and penetrates to 110° E. The southern border there proceeds from the E to the W along about 42° N. It is not found in the steppes between the Balchash and Caspian Sea. Further it occurs in Caucasus, Asia Minor, Iran, Syria, Israel and Algeria and Morocco. According to MERTENS (1947), nine geographical races are known.

In Scania *Natrix natrix natrix* seems to be fairly rare or extinct in the cultivated areas, especially in the west. Otherwise it is common both on our Baltic islands and in the south and central part of the country, up to central Värmland, southern Dalecarlia, and in the E coast areas along the Baltic. The northernmost locality where I have seen it is Sundsvall, 62°20′, but undoubtedly it occurs much farther north. HOLM (1934, 1937, 1940) has expended a great deal of energy in collecting records of the occurrence of the grass-snake in the north. He has been reproached for his lack of criticism in regard to some of these records. It is true that some of them are founded on too-scanty information. Such reports and similar others have been omitted here or given with an interrogation mark. On the other hand, when there are notes of snakes having white or yellow spots on the back or when there are records of finds of clutches of eggs in dung-hills or similar places, I think that most of the finds must be considered valid. This is especially the case when the recorder is a naturalist who knows grass-snakes from southern Sweden. There are many such finds made by a variety of observers. Even if there should be some mistakes, the number of valid records seems to be

sufficient to show that grass-snakes occur in several ecologically favourable localities in Norrland and even on the southern slopes of mountains in Lapland.

In the Lund museum we have a specimen of a young snake taken at Nattavaara in a hay-stack imported from southern Sweden. This shows that along transport lines there may be, in certain cases, an import of southern origin too. North of Sundsvall I have marked with a simple dot such records as are verified by notes of specimens with white or yellow spots on the neck or of eggs.

Mr. HOLM has a number of records from Lövånger 64°30′, a place which is known for its comparatively high radiation. My pupil Mr. FRENNESSON found a dead grass-snake at Edefors, 66° N.

Many of the northern finds are fairly old, for which there seem to be several reasons.

HOLM 1934 (p. 247) has made a valuable investigation which seems to show that the so-called grass-snakes in Frostviken in northern Jämtland were black adders. Evidently many natives nowadays only distinguish between adders, which have zig-zag band, and snakes which are thought to be black, i.e. they generally confound black adders and grass-snakes. Once they certainly knew the grass-snakes well, as in places they called the snakes "tomt-orm" and fed them as domestic animals in the immediate vicinity of the houses. This goes back to an old tradition that grass-snakes were holy animals, or at least benevolent creatures. The progressing atlanticization of the climate probably caused the snakes to become rare, the decreasing superstition of the natives tended to weaken the tradition concerning the "tomt-orm" and so, finally, the distinction between grass-snakes and black adders was forgotten.

There may also be other causes of the extinction of the grass-snakes. In old-time agriculture, when simple dung-hills were common at the farm houses, the snakes' eggs had a natural ecological habitat where they could hatch in the warmth of the dung-hill, which has a higher temperature and therefore presented a more favourable micro-climate than the surroundings. Therefore a considerably better climate could be perpetuated in the immediate surroundings of human culture. There are several stories from old times of snake-eggs being found in dung-hills near stables in northern localities. Also, the access to such localities in winter could give the grass-snakes ameliorated conditions for hibernation. In modern agriculture, where dung-hills have been substituted by closed-in concrete dung-pits, the possibilities for the snakes to lay eggs in such surroundings were not so good. Consequently, the eggs could no longer survive, and as for the grass-snakes themselves, they could not sustain the winters.

Though there may therefore still be grass-snakes surviving in favourable localities in northern Sweden, they are evidently rare, and as the population of Norrland is very sparse the occasions when they are observed are very few. The whole problem of the ecology and distribution of grass-snake in Norrland demands an explanation.

Vertical distribution: From o to at l[illegible]

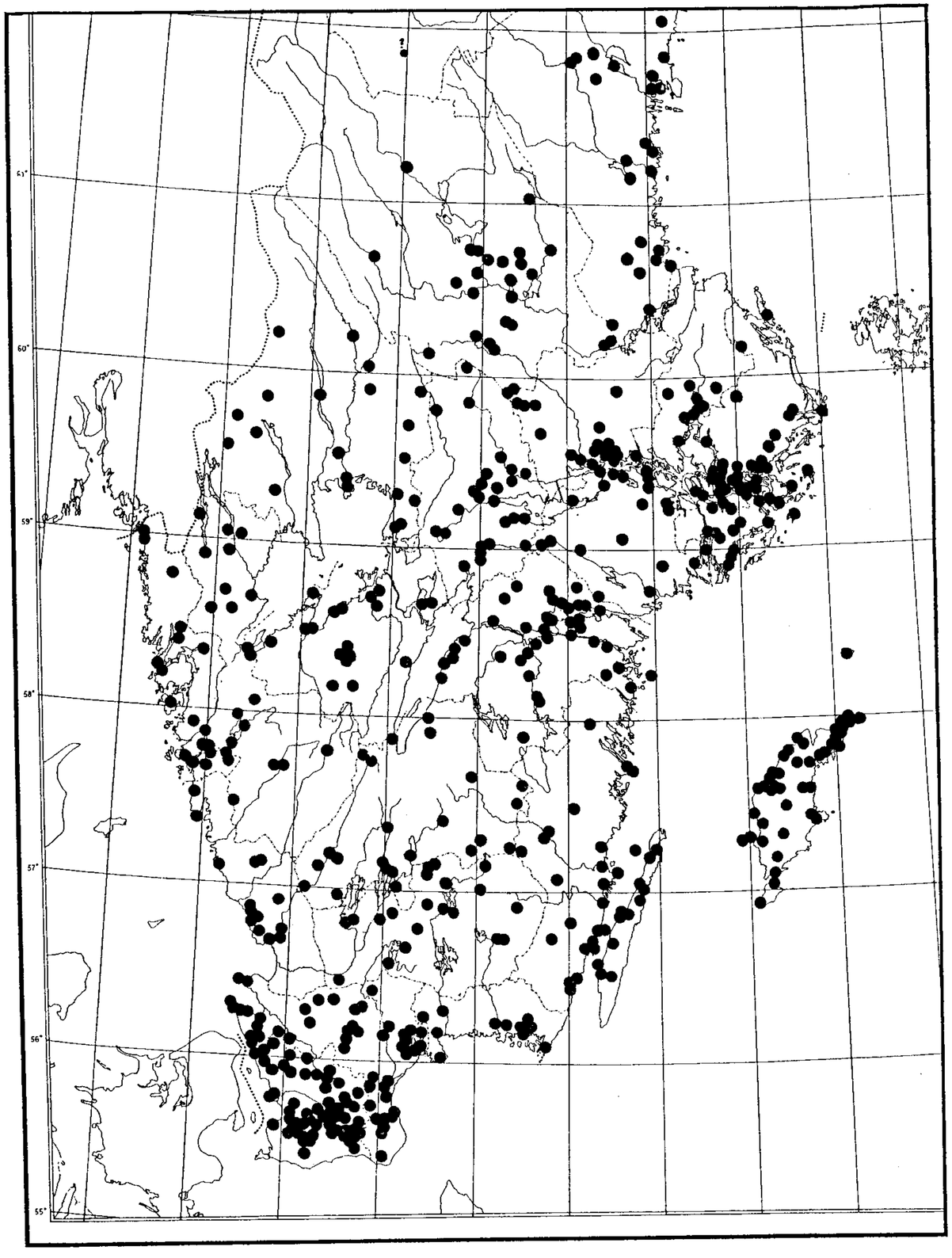


FIG. 57, 58. Distribution in Sweden of *Natrix natrix natrix*.

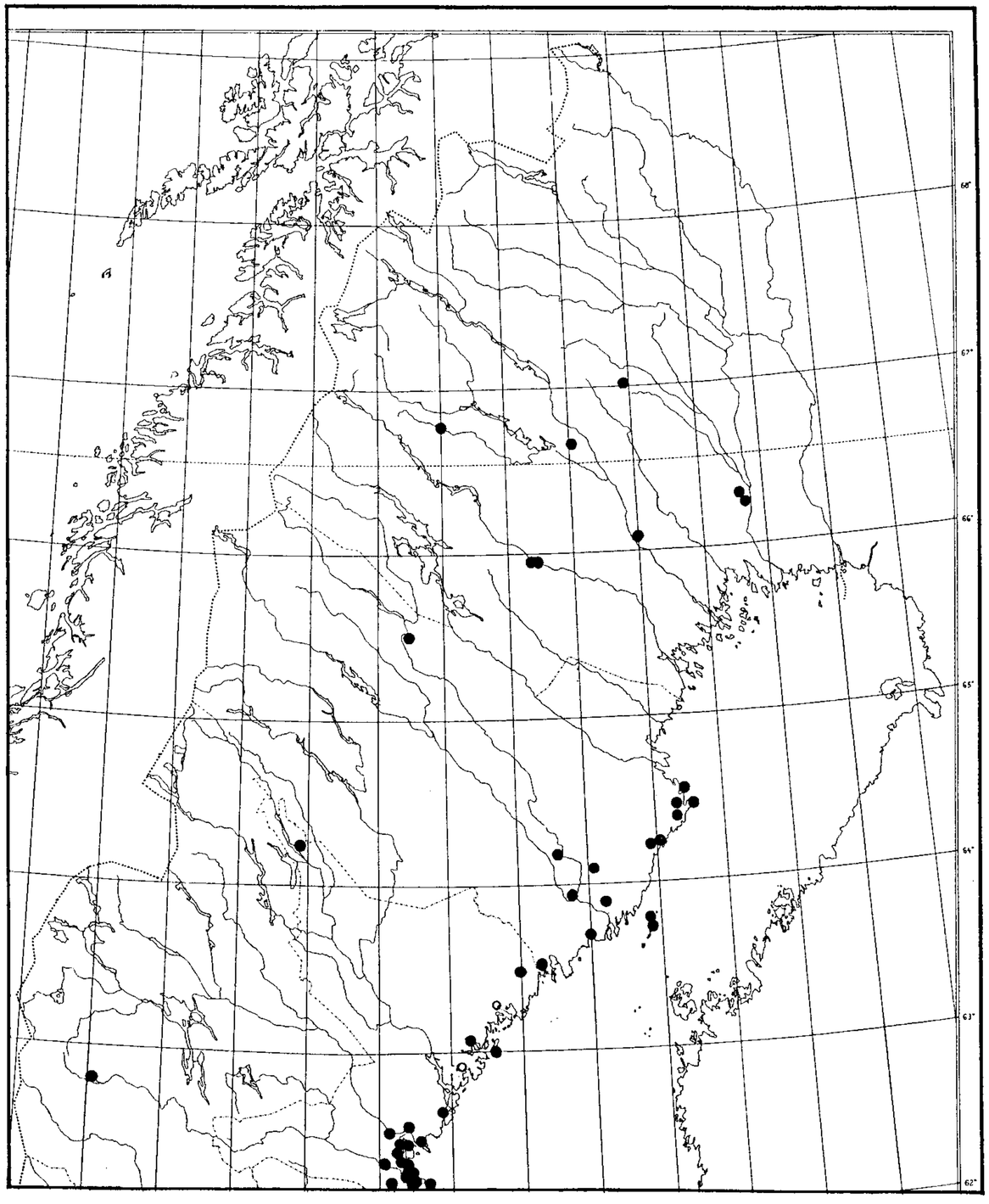


FIG. 58.

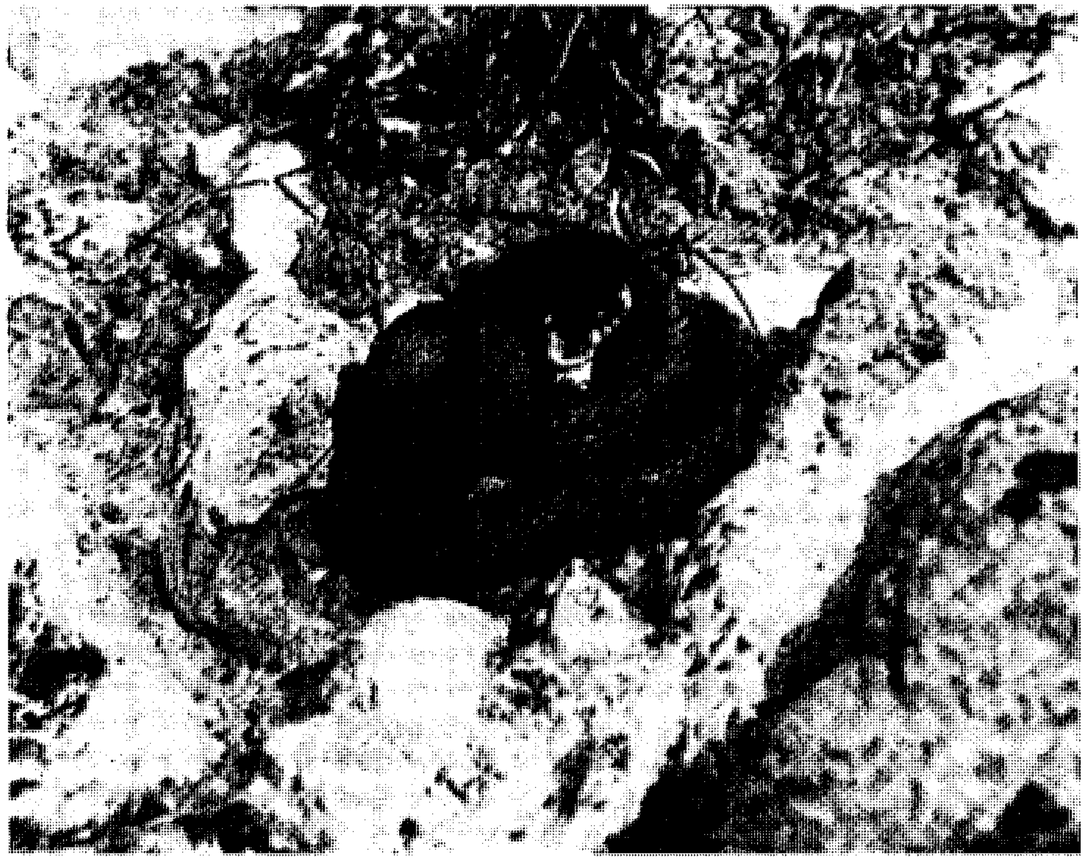


FIG. 59. Ringed Snake. From Långhammars, Fårö, Gtl. Photo by Gösta Håkansson.

if the records are true, they may even penetrate to about 400–500 m above sea level.

Size: The grass-snakes attain a size greater than that of any other Swedish snake. The males attain the fairly moderate length of about 70 cm, whereas the females may grow much longer. We have one record of 132 cm for a specimen which was in captivity in Hälsingborg for several years. There is even a record of a find from southern Halland, not preserved, which was said to measure 142 cm.

Colour: The colour varieties of Swedish grass-snakes.*

A. The bright-coloured belly variety. No black spots on the belly plates. Evidently this form is very rare. I have seen only one specimen which had the usual yellow spots behind its head, encircled on the posterior rim with dark brown markings and otherwise pale brown (Fig. 60).

B. The ventral plates more or less black or black-spotted.

1. Dorsal side uniformly slate gray or grayish black. The ground colour may be more light gray, brown or greenish. There may also be small dark dots, uniformly intermingled with the ground colour or arranged in about 6 long rows (speckled variety). White or yellow spots behind the head, which may be rather insignificant in some cases, and in rare cases even absent. The commonest variety. Old females have the back spots sprinkled with small black dots, the back spots therefore becoming rather darkish in colour (Fig. 59, 61).
2. The adder-coloured variety. The dorso-medial row of specks is connected with a zig-zag band. A very rare type known both on the mainland and from Gotland (CYRÉN, 1945). It is possible that this variety is only a phenomenon of old age (Fig. 62).
3. The barren variety. A lateral row of large vertical bars or spots on each side of the body and two rows of smaller spots on the back. The collar spots behind the head: usually rose-, yellow- or red-coloured. This form seems to be restricted to Gotland and resembles the varieties of southern and western Europe (cf. *helvetica*) (Fig. 63, 64).
4. The melanistic variety. No trace of bright collar spots behind the head. Dorsal side jet black. Ventral side with white spots, especially on the neck and the chin. Numerous on Gotland and rare on the mainland.

To the melanistic variety may be added also the almost black specimens from Gotland with or without the bright back-spots. Several irregularly strewn white specks on the dorsal side. Very rare (Fig. 65).

* E. MODIN (1934, p. 93), has reported an albino from Hälsingland which was white with red eyes, but there seems to be some doubt whether it was a question of an adder or a grass-snake.

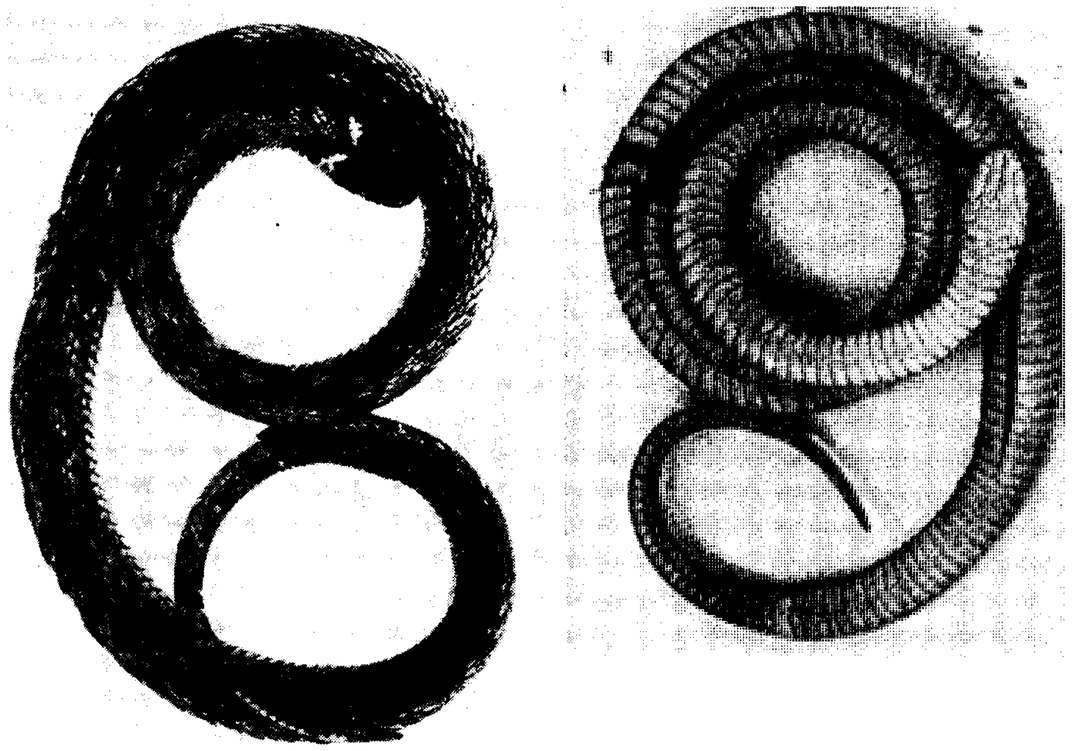


FIG. 60. Ringed Snake. Bright-coloured belly variety. From Aneboda, Sm. Photo by H. Gräns.

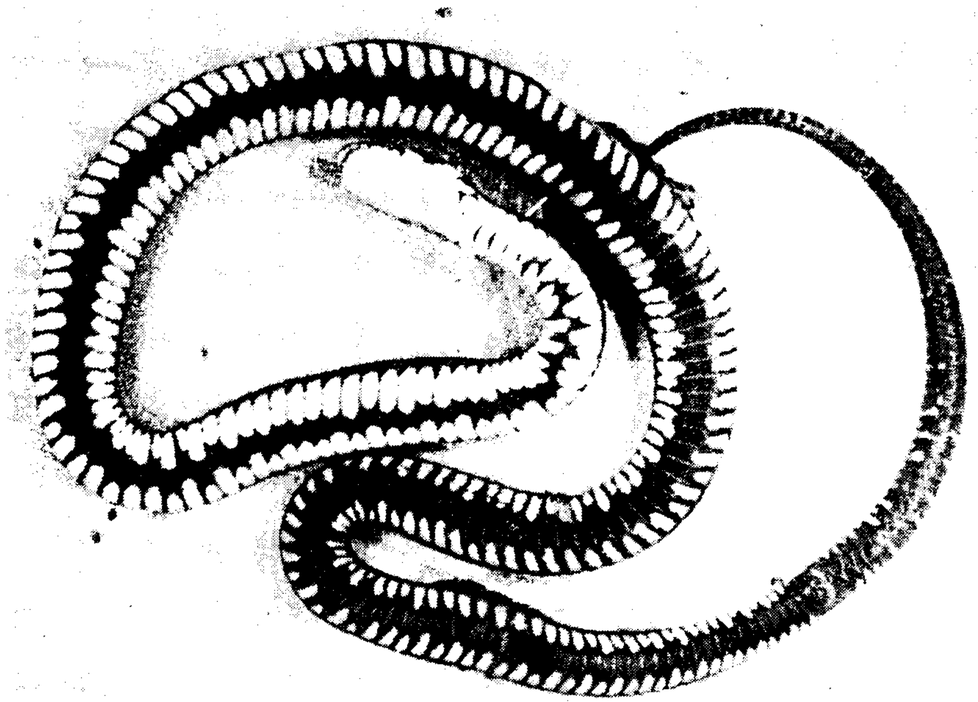


FIG. 61. Ringed Snake. Speckled variety. From Vesslö, Kalmar län. Photo by H. Gräns.

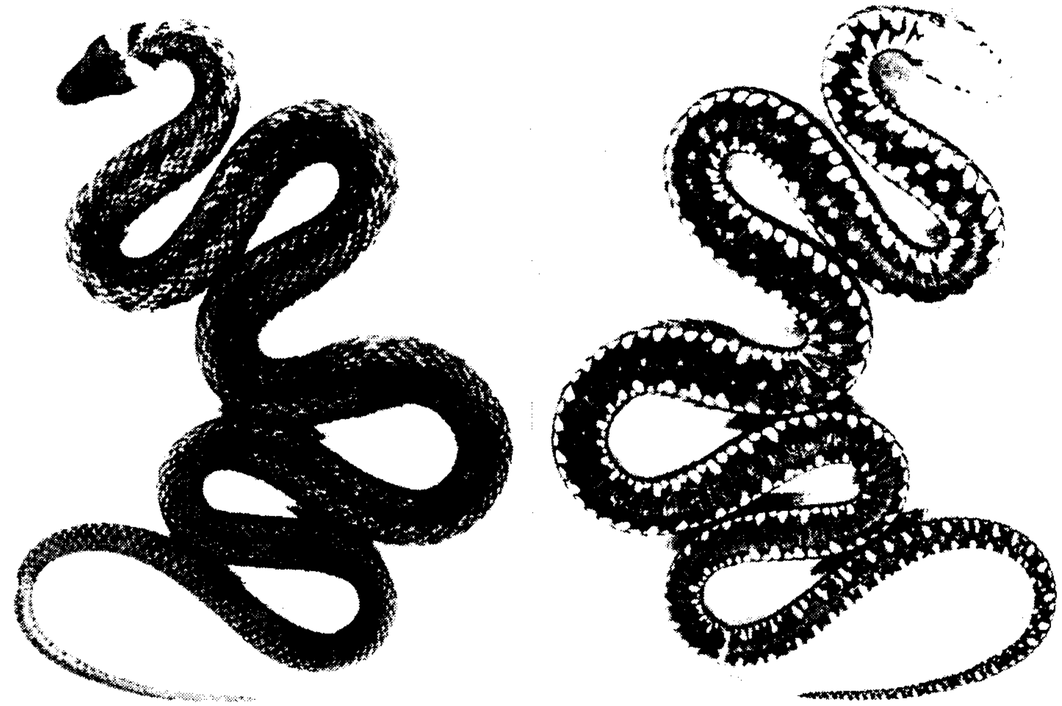


FIG. 62. Ringed Snake. Adder-coloured variety. From Rosenfors, Kalmar län. Photo by H. Gräns.

PFAFF 1935, CYRÉN 1945, CURRY-LINDAHL 1946 B, and EDELSTAM 1947 have made preliminary studies of the different varieties of grass-snakes in their collections. EDELSTAM 1946 has invented a very good method for identification of a grass-snake after capture. He has shown that the type of individual pattern does not vary during the life of the specimen. It seems that this could inaugurate a fruitful study of the variation of the different snakes. VOLSØE (1950, p. 467) says that the coloration of the Danish grass-snakes is very uniform. The slate-gray coloured snake with yellow back-spots is the predominating type. No black snakes without back-spots are known from Denmark. There is only one deviating form, corresponding to what has been called the speckled variety, and this one seems to be chiefly restricted to Jutland. Concerning England compare also SMITH (1945, p. 225–226).

The stock of grass-snakes of the Swedish mainland must have been recruited via the Danish isles. Consequently one ought to expect the Swedish mainland variety to be very uniform too. One could presuppose that the speckled variety should appear there now and then and it is found, too, but, as far as I know, only in the eastern part of Sweden. We have only two varieties in western Sweden, the uniform one and the black variety without neck-spots. The last-mentioned is distributed as far west as in Västergötland and Dalsland. The distribution of the other three varieties is restricted more or less to the eastern part of South Sweden, particularly to Gotland.

It is well known that the coloration of the grass-snakes of southern Europe is

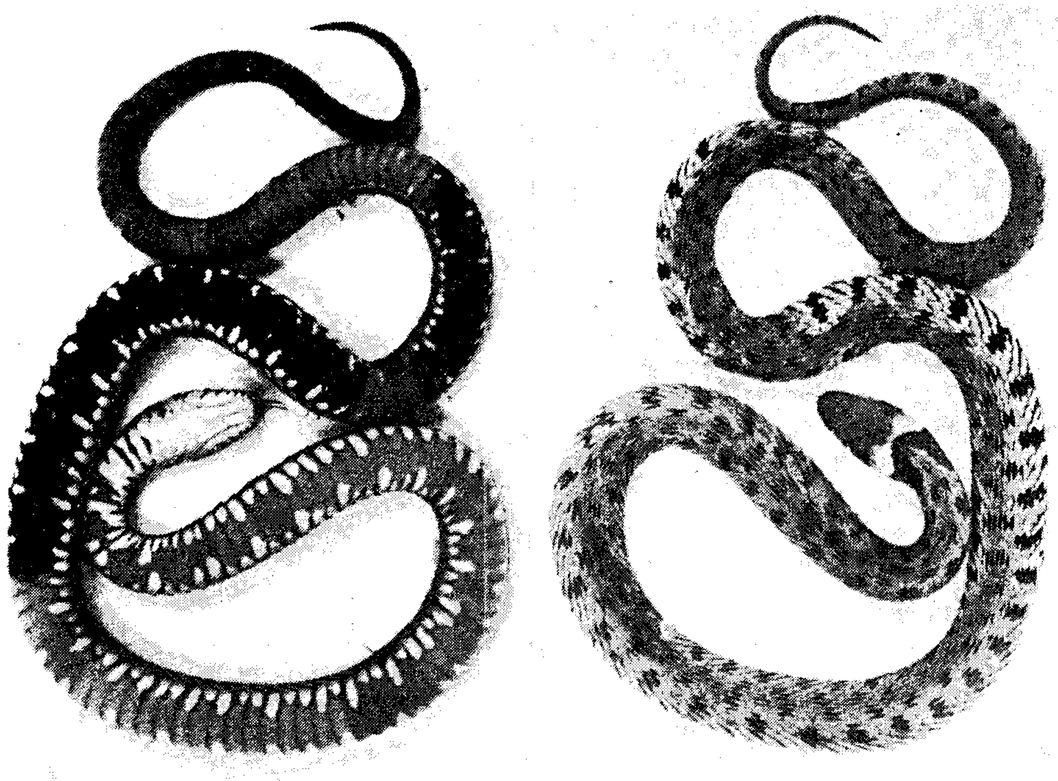


FIG. 63. Ringed Snake. Barren variety. From Gotland. Photo by H. Gräns.

more varied. It might be tentatively asked whether the increased variation may be caused in any way by the climate of the eastern part of Sweden, which is warmer, drier and has a greater radiation than the western areas.

There is no doubt that the strongly deviating colour variations are much more common on Gotland than they are in other Swedish areas. All types of grass-snake variations seem to occur on Gotland. BRINCK and GISLÉN (in 1950), dealing with problems of immigration to this island, have made some remarks regarding the Gotlandian grass-snakes. In early post-glacial times there seem to have been possibilities of immigration to Gotland directly from Germany over an island chain that made the water stretches to be conquered fairly short (cf. LINDROTH 1949, pp. 305–311). SMITH (1954) writes "There is a record of a Ringed Snake caught in the Bay of Biscay many miles from the land, carried out, no doubt, on some river current. It was none the worse for its immersion in salt water."

By this means Gotland may have been recruited by a genetically more complex stock of snakes than the Swedish mainland. On this island the fairly small and perhaps isolated populations, through endogamy, may have caused otherwise hidden recessive characters to appear. The dry and warm climate is still more pronounced on Gotland than in the eastern part of the mainland. Therefore there is a possibility that conditions similar to southern Europe may occur on Gotland, where the highly insolated limestone rocks create unusually southerly

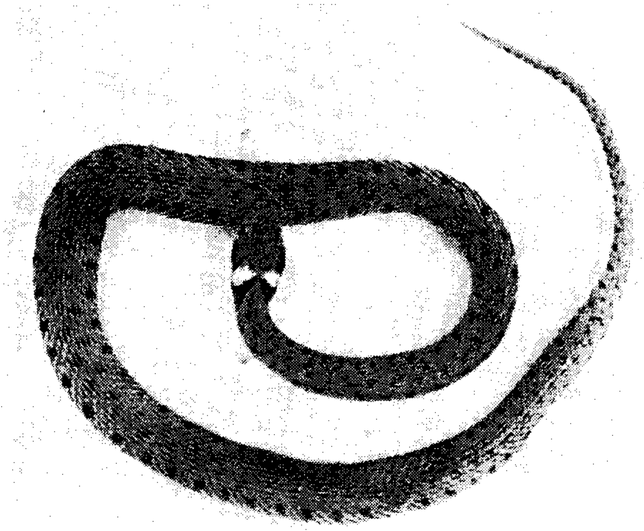


FIG. 64. Ringed Snake. Barren variety. From Gotland. Photo by H. Gräns.

surroundings. We may perhaps imagine that in such areas rare characters, like the barren variety, may have had some advantage in competition and therefore could be perpetuated.

The mating occurs at the end of May or maybe at the beginning of June. The eggs are deposited after a varying time of brooding within the body of the mother. The hatching occurs at the end of August or the beginning of September. The

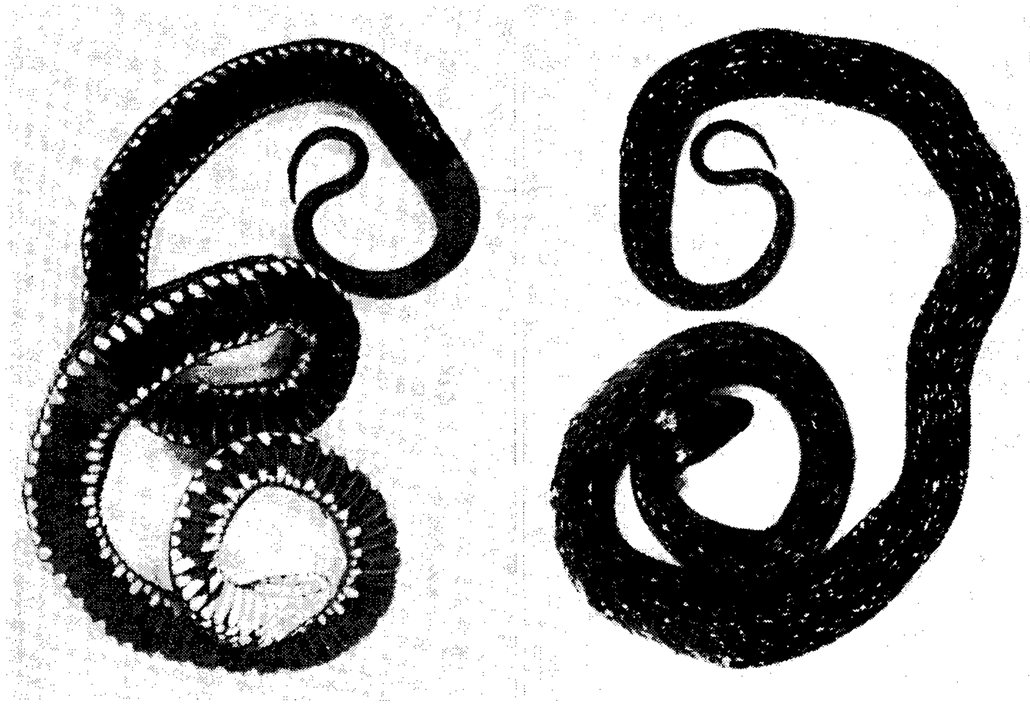


FIG. 65. Ringed Snake. Melanic variety. From Gotland. Photo by H. Gräns.

FIG. 66. Ringed Snake, copulating. From Hornborgasjön, Vg. Photo by K. G. Wingstrand.

eggs are grey-white or white-yellow with a size of 18–27 mm. The shell is like parchment. When fresh they are sticky and coherent in a lump of 10 or more. The newly hatched young measure 16–19 cm. During the second year they apparently reach a length of 21–30 cm. CARL EDELSTAM (SMITH 1954) has given an account of the growth of a marked male caught and measured by him through five successive years. The measurements of length are as follows: 70, 72, 75, 76.5, 78 cm.

OCCURRENCE:

Skåne. Anderslöv s:n, Markiehage, C.C. — Bromma, S.S. — Löderup s:n, S.S. — Malmö, NILSSON 1860. — Mölleberga s:n, LANG 1926. — Skabersjö s:n, S.S. — Torup, P.H.-A. — Yddingen, southern shore, P.H.-A. — Yddingen, L.Z.M., LANG 1926. — Bökeberg, L.Z.M., V.E. — Hyby s:n, S.S. — Lyngby s:n, LANG 1926, S.S. — Fjällfotasjön, M.M., LANG 1926. — Börringe, L.B.-F. — Gustaf, S.S. — Genarp, LANG 1926, S.S. — Gödelöv, S.S. — Björkesåkrasjön, LANG 1926. — Häckeberga, LANG 1926, K.A. — Everlöv, S.S. — Blentarp, S.S. — Sövde s:n, S.S. — Sövdeborg, K.C.-L. — Snogeholmssjön, Ellesta, L.Z.M. — Snogeholmssjön, northern part, Exc. — Sövestad s:n, S.S. — Baldringe, S.S. — Röddinge s:n, S.S. — Vanstad s:n, S.S. — Ramsåsa s:n, S.S. — Smedstorp s:n, S.S. — Tungbyholm, J.B. — Tottarp s:n, LANG 1926. — Lund, NILSSON 1860. — Dalby crown forest, K.A. — Dalby, L.Z.M., S.S. — Torna Hällestad L.Z.M. — Hällestad, S.S. — Veberöd s:n, S.S. — Harlösa, S.S. — Vomb s:n, S.S. — Björka, S.S. — Öved s:n, S.S. — Södra Åsum s:n, Åsumsgården, G.R. — Södra Åsum s:n, S.S. — Fränninge, S.S. — Kristinehov, Exc. — Andrarum, Exc. — Kronovall, M.M. — St. Olof s:n, S.S. — Södra Mellby s:n, Killeberg, P.Å.O. — Kivik, J.B. — Barsebäckshamn, L.Z.M. — Barsebäck, L.Z.M. — Between Eslöv and Ringsjön, SAHLIN 1929. — Gudmundtorp, S.S. — Hörby s:n, S.S. — Östraby s:n, S.S. — Långaröd s:n, S.S. — Huaröd s:n, S.S. — Degeberga, K.E., S.S. — Vittskövle s:n, S.S. — Maglehem s:n, S.S. — Kvistofta, S.A. — Kvistofta valley, SAHLIN 1929. — Fjärestad, S.S. — Ottarp, S.S. — Halmstad, S.S — Svalöv s:n, Norra Svalöv, S.S. — Trolleholm Castle, K.A. — Röstånga s:n, S.S. — Stehag s:n, S.S. — Bosjökloster, L.Z.M., K.C.-L., L.B.-B. — Höör, L.Z.M. — Östra Sönnarslöv s:n, L.L.I., S.S. — Allerum mire, GISLÉN 1946, E.B-n. — Allerum, S.S. — To the north of Hälsingborg, Pålsjöskogen, MUCHARDT 1912. — Hälsingborg, S.S. — Hälsingborg plain, SAHLIN 1929. — Råå meadows, S.S. — Raus, S.S. — Kropp s:n, S.S. — Frillestad, S.S. — Risekatslösa s:n, S.S. — Åstorp, Tingvalla, U.S. — Åstorp, A.S. — Kvidinge, Kärreberga, U.S. — Kågeröd s:n, L.Z.M., S.S. — Ljungbyhed, L.Z.M. — Ljungbyhed area, C.H.P. — Sösdala, Lillsjödal, U.S. — Brönnestad, L.Z.M. — Hässleholm, L.Z.M. — Attarp s:n, S.S. — Between Bjärlöv and Hanaskog, Exc. — Hanaskog, the bog, Exc. Österlöv s:n, Gårrö, Å.U. — Oppmanna s:n, Allarp, Spegelvik, O.B.S. — Oppmanna s:n, S.S. — Kiaby s:n, Barum, Å.U. — Kiaby s:n, S.S. — Trolle-Ljungby, Å.U. — Gualöv s:n, S.S. — Ivetofta s:n, S.S. — Mölle, H.B-m. — Mölle, Vattenmöllan, NILSSON 1954. — Kullaberg, to the east of Mölle, G.N.M., BEHRENS & MALMBERG 1950. — Kullaberg, near the lighthouse, G.N.M. — Brunnby, S.S. — Brunnby s:n, Skäret, N.R.M. — Jonstorp s:n, Svanshall, A.N-n. — Strövelstorp s:n, Vegeholm, A.N-n. — Välinge s:n, Rögle and Utvälinge, A.N-n. Välinge s:n, S.S. — Oderljunga, Bälingesjön, L.L.I. — Stoby s:n, A.K. — Hjärsås s:n, S.S. — Vånga s:n, S.S. — Näsum s:n, R.J., S.S. — Hallands Väderö, L.Z.M., B.H., VALLIN 1947, 1949. — Torekov, H.B-m. — Örkelljunga, Gudebygget, L.L.I. — Värsjö, P.M.L. — Vittsjö, L.Z.M. — Lursjö, A.K. — Hästveda s:n, A.K. — Osby s:n, S.S. — Osby area, HALL 1950.

Blekinge. Mjöllby s:n, Hällevik, L.L.I. — Torhamn s:n, Torhamnslandet, E.D-l. — Mörrum s:n, between Pukavik and Sandbäck, T.G. — Mörrum s:n, Björkenäs, L.Z.M., T.G. — Hjortsberga s:n, Johannishus, L.Z.M., GISLÉN 1940. — Karlskrona, H.A.L. Karlskrona. — Karlskrona area, T.S. — Ronneby, Persborg, WESTERLUND 1890. — Nättraby s:n, Skärva, O.T. — Rosenholm, H.A.L. Karlskrona, A.L.-m. — Augerum s:n, Bastasjö, A.L.-m. — Rödeby, T.G. — Jämshög s:n, R.J. — Åkeholm, G.W.

Halland. Halmstad, H.A.L. Halmstad. — Skedala, K.E. — Harplinge s:n, E.D-l. — Enslöv, P.H.-A. — Steninge s:n, HANSTRÖM 1950, E.D-l. — Getinge s:n, A.K., E.D-l. — Eftra s:n, E.D-l. — Skrea s:n, Heberg, Ringsjön, T.G. — Slättåkra s:n, Stämhult, Möllesjön, T.H-g. — Varberg, Varberg samrealskola. — Ullared s:n, Skinnarlyngen, G.N.M. — Ullared, H.A.L. Halmstad. — On the southernmost point of Onsala peninsula, E.D-l. — Särö G.N.M.

Småland except Kalmar län. Markaryd area, E-y B-n. — Älmhult, A.L-g. — Liatorp, T.G. — Ljuder s:n, Fläddingsmåla, L.L.I. — Ljuder s:n, Slätthult, H.L. — Annerstad s:n, Piksborg, J.B. — Angelstad s:n, between Stavsjö and Kvämslöv, H.L. — Tutaryd, L.L.I. — Ryssby, K.-E.J. — Vislanda, T.G. — Räppe, N.R.M. — Växjö, Teleborg, J.B. — Aringsås, H.L. — Lenhovda, Möcklehultsmåla, H.L. — Hyltebruk, R.F. — Södra Unnaryd, A.N-n. — Skeppshult, J.P. — Villstad s:n, H.H. — Reftele s:n, Segerstad, Å.H. — Växtorp s:n, to the south of Ulås, H.L. — Växtorp s:n, Ed, Trollklippan, H.L. — Värnamo, Apladalen, G.A. — Smålands Rydaholm, Slättebrohult, L.L.I. — Gällaryd s:n, Os, L.L.I. — Moheda s:n the southern part of Fiolen; Kopparås mire, L.L.I. — Aneboda s:n: Eskås; several localities, L.L.I. — Aneboda, L.Z.M., LANG 1928, A.R. — Lamhult, L.L.I. — Berg, Vinninge, S.A-n. — Dädesjö bog, L.L.I. — Klavreström, N.R.M. — Näshult, M.M. — Åker s:n, to the west of Klevshult, H.L. — Sävsjö, H.E.P. —Södra Solberga, H.L. — Myresjö s:n, Österkorsberga, C.B.G. — Mulseryd s:n, Jära, H.L. — Bottnaryd s:n, Älgaryd, H.L. — Bankeryd s:n, near the mouth of Dummeå, BJURULF 1944. — Eksjö, N.R.M., H.A.L. Umeå. — Karlstorp, Kolsjön, CYRÉN 1946.

— Karlstorp, G.N.M., — CYRÉN 1910. — Hässleby, A.D. — Vireda s:n, G.N.M., H.L., Bunn, G.N.M.

Kalmar län. Påboda, T.G. — Söderåkra, near the river, T.G. — Värnanäs, T.G. — Dörby s:n, Ulfsborg, L.Z.M. — Kalmar, U.Z.M., WESTERLUND 1855. — Kläckeberga s:n, Wesslö, the marshy ground, Exc. — Madesjö, H.L. — Kläckeberga s:n, Wesslö, L.Z.M. — Åby s:n, Björnö, Exc. — Skägganäs, A.D. — Kristvalla, H.L. — Strömserum, Exc. — To the west of Algunnen, Kleven, T.G. — Algunnen, GISLÉN 1935, T.G. — Mönsterås, T.H. — Mönsterås s:n, Våldö, T.H. — Mönsterås area, Å.D. — Emsfors, Exc. — Virserum, Triabo, H.L. — Oskarshamn, J.B. — Jungfrun, L.Z.M., BERNSTRÖM 1939, CURRY-LINDAHL 1950 B, DU RIETZ & CURRY-LINDAHL 1950, GISLÉN 1949. — Tveta s:n, Lilla Sinnerstad, L.Z.M., H.S-n. — Mörlunda s:n, Rosenfors, L.Z.M., H.L. — Tuna s:n, Flohult, T.G. — Västervik, Idö, M.M. — Västervik, Gränsö, Å.H. — Överum, M.M., E.M-m.

Öland. Ottenby lund, K.C.-L. — Resmo, Exc. — Möckelmossen, HORN AF RANTZIEN 1955, C.E., N.B. — Vickleby, HAGBERG 1950. — Beijershamn, D.C., K.C.-L., C.E., EDELSTAM 1944. — Torslunda s:n, KULLENBERG 1953. — Glömminge, H.L. — Högsrum s:n, Österskog; Halltorps hage, K.C.-L. — Repplinge s:n, Borgehage, L.Z.M., JOHANSSON 1955, Exc. — Borgholm, P.H.A. — Köping s:n, Hörninge, N.R.M. — Löt s:n, Petgärde, C.E. — Föra s:n, Östra Wässby, D.C. — Föra s:n, Marsjö, C.E. — Föra s:n, between Marsjö and Lofta, LANG 1919. — Persnäs s:n, Knisa, C.E. — Hornsjön, D.C. — Böda s:n, Svartvik, H.A.L. Kalmar, HANSON 1950, JOHANSSON 1955 A, D.C.

Gotland. Hoburgen, L.Z.M., K.C.-L. — Öja s:n, G.N.M. — Fide s:n, Fidenäs, K.C.-L. Havdhem, K.C.-L. — Stora Karlsö, LOVÉN 1918, FRÖMAN 1947, B.W-n. — Eksta, K.C.-L. — Lilla Karlsö, CURRY-LINDAHL 1946 B, G.H., K.C.-L. — Lojsta, K.C.-L. — Klinte s:n: Stormyr; Prästängen; Långskogsväten, K.C.-L. — Klintehamn, Varvsholmen, S.E-n. — Torsburgen, L.Z.M. — Vestergarn, Skansudde, CURRY-LINDAHL 1946 B, D.C. — Kräklingbo s:n, Kärrmans, G.N.M. — Roma mire, K.C.-L. — Högklint, Fridhemsbukten, K.C.-L. — Högklint, G.N.M., K.C.-L. — Follingbo s:n, Rosendal mire, D.C., K.C.-L. — Follingbo s:n, K.C.-L., N.N. — Lina mire, K.C.-L., N.L. — Gothem s:n, K.C.-L. — Vallstena s:n, K.C.-L. — Visborgsslätt, Kristiania, K.C.-L. — Terra Nova, D.C. — Hejdeby s:n, Tjutet, K.C.-L. — Hejdeby, K.C.-L. — To the east of Visby, Svejde, K.C.-L. — Visby, Snäckgärdsbaden, K.C.-L. — Near Snäckgärdsbaden, N.N. — To the north of Visby, Skansudd, K.C.-L. — Vestkinde s:n, Skälsö fishing hamlet, K.C.-L., T.W. — Vestkinde s:n, Kronovik mire, CYRÉN 1946, D.C., K.C.-L., O.C. — Tingstäde, M.M., K.C.-L. — 4 km to the north of Tingstäde mire, D.C. — Othem s:n, K.C.-L. — Lummelunda s:n, L.Z.M. — Stenkyrka s:n, Sudergårda, L.Z.M. — Hellvi s:n, Stora Ire, U.S. — Fardume fen, K.C.-L. — Hangvar, G.N.M., H.L. — Häftings Klint, D.C. — Bunge s:n: Hultungs; Bungenäs; Fårösund, BRATTSTRÖM 1945. — Fårö, Norra Gattet, K.C.-L. — Fårö, Verkegårds, D.C. — Fårö, the church, E.B. — Fårö, Norrsunda mire, D.C. — Fårö; Kalbjerga mire; Eketräsket; Kangul vät; Ekeviken, K.C.-L. — Fårö, Eketräsket, DURANGO 1946, 1953. — Fårö, Tälleviken, K.C.-L., DURANGO 1946, N.N. — Fårö, Långhammars hammar, DURANGO 1946, CURRY-LINDAHL 1955 B. — Between Holmudden and Skärsände, L.Z.M. — Fårö, CURRY-LINDAHL 1946 B, K.C.-L. — Gotska Sandön, STUXBERG 1868, K.C.-L.

Göteborg. Slottsskogen, G.N.M. — Landala, G.N.M. — Ryaskog, G.N.M. — Hisingen, Arendal, A.R. — Göteborg, G.N.M. — Göteborg area, G.N.M.

Bohuslän. Kareby, G.N.M. — Tjörn, EKSTRÖM 1850. — Morlanda s:n, S. E-n. — Morlanda s:n, Malö, H.O.B. — Kristineberg, Near Gåsevik, L.S. — Kristineberg, L.S. — Uddevalla, Kuröd, O.B.S. — Skredsvik s:n, Smörkullen, K.G.W. — Munkedal, G.N.M. — Naverstad, N.R.M., S. E-n. — Strömstad, Dynekilen, S.E-n. — Strömstad, N.R.M. — Strömstad area, A.B-s.

Västergötland. Tostared, K.C.-L. — Mölndal, G.N.M. — Häryda s:n, Härsjösand,

G.N.M. — Viared area, HALL 1942. — Borås, G.N.M., C.B. — Partille, G.N.M. — Agnesberg, G.N.M. — Angered s:n, to the northwest of Gunnilse, H.L. — Lerum s:n, on the northwestern shore of Öxsjön, G.N.M. — Lerum, G.N.M. — Ulricehamn, S.E-n. — Floda, G.N.M. — Nödinge s:n, Bohus, G.N.M. — Hemsjö s:n, Västra Bodarne, G.N.M. — Nol, G.N.M. — Mjörnsjö, G.N.M. — Långared s:n, Frishulan, Å.H-l. — Hökensås, Alvasjön, VON POST 1950. — Mösseberg, H.A.H. — Åsle bog, S.E-n. — Halleberg, N.-G.K. — Hunneberg, N.-G.K. — Karaby, N.-G.K. — Broddetorp s:n, Bolum, T.S. — Axwall, Högetomt, L.Z.M., A.D. — Norra Lundby s:n, Rökstorp, A.D. — On the western side of Billingen, Skärvlången, H.A.L., Skara. Råda, G.N.M. — Lidköping, N.-G.K. — Kinnekulle, G.N.M., KARVIK 1953, MALM 1877, N.-G.K. — Forshem, E.S. — Undenäs s:n, to the northeast of Hanefjäll, H.L. — Ullervad s:n, Jula Stn., L.Z.M. — Undenäs, N.-G.K. — Otterstad s:n, Billingsö, N.-G.K. — Mariestad, B.F. — Hassle, Hj.S.

Östergötland. Tidersrum s:n, Skolen, U.Z.M. — Tjärstad s:n, Ämmern, HANNERZ 1910. — Opphem, E.W-n. — Gryt s:n, Harstena, T.G. — Gryt s:n, L.S. — Ödeshög, S.E-n. — Västra Tollstad s:n, to the north of Alvastra, T.G. — Väversunda s:n, S.E-n. — Sjögesta, L.Z.M. — Skeda s:n, Röby, N.R.M. — Vist s:n, Stångån, K.E-n. — Gusum, N.R.M. — Börrum s:n, Passdal, G.N.M. — Rogslösa, T.G. — Vadstena, G.N.M. — Linköping, S.E-n. — Rystad s:n, Luestad and Fröstad, F.O. — Asplången, H.B. — Söderköping, G.N.M., H.A.L. Sundsvall, T.G. — Mogata s:n, Slatorp, U.S. — Kristberg, to the east of the church, H.L. — Stjärnorp, K.E-n. — Östra Skrukeby, H.B. — Vånga s:n: Grensholmen; Restad; Ljusfors, H.L. — Ensjön, H.B. — Borg s:n, Herrebro fen, H.B. — Norrköping, K.E. — Norrköping area, H.B. — Tjällmo s:n, Brotorpet, H.L. — Risinge s:n, Ormlången, H.B. — Risinge s:n, H.L. — To the north of Svärtinge, Risten, H.B. — Kvillinge s:n, Ågelsjön, H.B. — Kvillinge s:n, Nedre Glottern, H.a.R. — Getå, C.M. — Krokek s:n, Svinstaskär, H.B. — Kolmården, N.R.M. — Hällestad s:n, to the west of Skönnarbo, H.L. — Simonstorp s:n, Svängbågen, H.B.

Dalsland. Färgelanda, G.N.M. — Ödeborg, Ellenö, N.-G.K. — Sundals-Ryr, N.-G.K. — Järbo, N.-G.K. — Holm s:n, C.M. — Ed, N.-G.K. — Steneby s:n, C.M. — Ärtemark, N.-G.K. — Laxarby, N.-G.K. — Nössemark, N.-G.K.

Värmland. Kilsviken, K.C.-L. — Visnum s:n, L.L.I. — Långserud s:n, H.L. — 7 km to the south of Degerfors, C.E. — Kristinehamn area, E.W. — Hammarö, H.A.L., Halmstad. — Karlstad, J.G.W. — Karlanda s:n, to the east of Vännacka, H.L. — Stora Kil s:n, Norra Hyen, A.K. — Lungsund s:n, Lundsberg, E.W-n., J.B. — Älgå s:n, Gränssjön, A.E. — Järnskog s:n, Beted, H.L. — Filipstad, E.D-l. — Near Filipstad, S.E. — Gunnarskog s:n, Berga, L.L.I. — Sunne, J.B. — Gåsborn s:n, Mögreven, K.-H.F. — Sunnemo, E.D-l. — Hagfors area, E.W. — Lekvattnet, V.N. — Ekshärad s:n, Östra Tönnet, D.H.

Närke. Askersund, T.A-t. — Lerbäck s:n, BÄCKGREN 1911. — Lerbäck; Rönneshytta; Asbrohammar, H.W.W. — Hallsberg s:n, Tisaretorp, G.Ö. — Asker s:n, Breven, Karol. H.A.L., Örebro. — Lännäs, Segersjö, H.W.W. — Skagershult s:n, at the southern point of Teen, H.L. — Skagershult s:n, Hasselfors, G.N.M., N.R.M. — Skagershult s:n, Hasselfors works, MALM 1877. — Skagershult s:n, Herrefall meadow, A.D. — Svartå, A.D. — Ekeby s:n, Sjötorp, L.Z.M. — Norrbyås s:n, Kvismaren, A.D., K.C.-L., WESSLÉN 1930, — Knista s:n, to the north of Kinkhyttan, H.L. — Örebro, A.D. — Örebro, Oset, H.W.W. — Hidinge s:n, Garphyttan National Park, H.L. — Latorp, H.L. — Kil s:n, Frösvidal, L.L.I. — Kil s:n, Lockhyttan, A.D., H.L. — Hovsta s:n, A.D. — Ödeby s:n, Ödeby, A.D.

Södermanland. Stavsjö s:n, Stavsjön, H.B. — Halla s:n, Ekeby, ROSENBERG 1952, K.C.-L. — Nyköping, S.E-n. — Bogsta s:n, Näsby, J.B. — Trosa, N.R.M. — Nynäshamn, J.B. — Mörkö, N.R.M. — Ösmo s:n: Himmelsö; Vidbynäs; Lund; Herrö, J.B. — Marsjö, T.W. — Vingåker, T.W. — Katrineholm, T.W. — Trosa, K.C.-L. — Helgesta s:n, Sund, C.F. — Biörnlunda, K.C.-L. — Sparreholm, VON

Wiad and Kagghamra H.a.R. — Grödinge, Grindsjön, P.P. — Västerhanninge, H.W.W. — Österhanninge, Handen, H.W.W. — Dalarö, Marsskär, EDIN 1941. — Dalarö, N.R.M., C.E., J.B. — Salem s:n, A.A. — Nämdö, L.L.I. — Öja, Stora Sundby, H.W.W. — Länna, Näsbytorp, H.W.W. — Mariefred, Hedlanda, A.L-t. — Mariefred, Gripsholm, Hjorthagen, U.Z.M. — Mariefred, U.Z.M. — Södertälje, K.C.-L. — Huddinge s:n, Balingsholm, K.C.-L. — Huddinge s:n, Vårby, C.E. — Nacka, Damtorpssjön, H.a.R. — Eskilstuna area, SJÖSTEDT 1920. — Strängnäs, Karol. H.A.L., Örebro. — Torshälla, Mälarbaden, J.B. — Fiholm, L.B.-F. — Sundbyholm, J.B. — Tosterön, A.L-t. — Aspö, Edeby, H.W.W.

Stockholm. Nacka, EDELSTAM 1954. — Saltsjöbaden, Observatoriet, H.L. — Lännersta, T.W. — Drottningholm, L.S. — Nockeby, S.E-n. — Etnografiska Museet, N.R.M. — Djurgården, J.B. — Åkeshov, L.L.I. — Bromma, S.E-n. — Lidingö, Kottlasjön, O.D. — Naturhistoriska Riksmuseet, N.R.M. — Djursholm, Ekebysjön, K.-H.F. — Stockholm, N.R.M. — Stockholm area, N.R.M.

Västmanland. Näsby s:n, Frövi, A.D. — Fellingsbro, H.W.W. — Vedevåg works, J.B. — Strömsholm, J.B. — Rytterne, J.B. — Ridön, J.B. — Irsta s:n, Gäddeholm, J.B. — Badelunda s:n, Hässlö, J.B. — Ängsö, J.B. — Västerås-Barkarö, J.B. — Munktorp, J.B. — Dingtuna, J.B. — Kolsva works, J.B. — Lundby, J.B. — Västerås, Nordanby, L.Z.M., H.A.L. Västerås. — Västerås, Vallby, O.H-g. — Västerås, WALLDÉN 1955, G.D-l., J.B. — Skultuna, L.L.I. — Hällefors, K.-H.F. — Skinnskatteberg s:n, Riddarhyttan, Norra Holmsjön, K.-H.F. — Skinnskatteberg, K.-H.F. — Ljusnarsberg s:n, Mårtenstorp, L.L.I. — Sala, J.B. — Norra Hörken, N.R.M.

Uppland. Ekerön, Stavsund, LÖNNBERG 1908. — Ekerön, I.H. — Ingarö, Skenorasjön, N.R.M. — Ingarö, M.M. — Adelsö s:n, Björkö, S.E-n. — Bo s:n, Kummelnäs, N.R.M. — Djurö s:n, Vindö, N.R.M. — Hässelby, E.P. — Spånga s:n, Rocksta mire, E.P. — Järfälla s:n, Hägerstalund, N.R.M. — Danderyd s:n, Kevinge, F.O. — Bogesund, L.S. — Görväln, C.E. — Säbysjön, C.E., N.L. — Möja, Långviksnäs, J.R. — Möja, A.L-m. — Täby s:n, Hagby, N.R.M. — Österåker s:n, Täljö, K.-H.F. — Österåker s:n, Österskär, C.E. — Österåker s:n; Lervik; Brevik; Valsjön; Träsksjön, H.a.R. — Össeby Garn s:n, Lövsättra, N.R.M. — Sigtuna, K.C.-L., L.S. — Hjälstaviken, K.C.-L., N.L. — Vallentuna; Hackstabäcken; Angarnsjöängen, FORSHEDEN 1952. — Angarn, N.R.M. — Balingsta, U.Z.M. — Norrtälje, N.R.M. — Estuna s:n, Uddboö, A.L-t. — Vätö s:n, Lidö, K.-H.F. — Uppsala-Näs s:n, U.Z.M. — Uppsala, Gottsunda, U.Z.M., O.B.S. — Danmark s:n, Nåntuna, O.B.S. — Uppsala, L.Z.M., J.B. — Almunge, U.Z.M. — Järlåsa, U.Z.M. — Järlåsa, U.Z.M., K.-E.J. — Bälinge, L.Z.M., U.Z.M. — Rasbo s:n, U.Z.M. — Gimo, S.E-n. — Singö s:n, Fogdö, K.C.-L. — Gräsö, U.Z.M.

Dalarna. Malingsbo s:n, Djurlången, K.-H.F. — Malingsbo, H-s.L. — Sävsnäs, EKMAN 1922. — Ludvika, K.-H.F. — By s:n, Storbyn, E.D. — By s:n, B.W. — Brunnsvik, K.-H.F. — Grangärde, K.-H.F. — Ulvshyttan, E.B. — Stora Tuna s:n, Norån, E.D. — Stora Tuna s:n, Tägt, E.D., E.F-k. — Mockfjärd, E.K. — Borlänge, T.G. — Floda s:n, Mosselbodarna, E.D. — Aspeboda s:n, Vallsfors, E.D. — Djura, N.L. — Falun, KLEFBECK 1927, 1949. — Malung, KLEFBECK 1927. — Ål s:n, on the shore of Insjön, N.R.M. — Grycksbo, E.K. — Leksand s:n, Grytnäs, K.-H.F. — Leksand, EKMAN 1922. — Ål s:n, near Sörskog, M.K. — Bjursås, KLEFBECK 1927, E.K. — Svärdsjö, KLEFBECK 1927. — Bingsjö, E-s.M. — Älvdalen, KLEFBECK 1927.

Gästrikland. Grönsinka crown forest, HOLM 1934. — Hedesunda, J.W. — Högbo, EKMAN 1922. — Mackmyra crown forest, HOLM 1934. — Gävle area, G.K. — Harnäs, L.Z.M., N.R.M., C.O. — Hille, HOLM 1934, K.F. — Oslättfors, HOLM 1934.

Hälsingland. Skog s:n, Stråtjära, N.R.M. — Ljusne, L.Z.M. — Bergvik, HOLM 1934. — Söderhamn, N.A. — Norrala s:n, the northern part, N.A. — Norrala, HOLM 1934. — Idenor s:n, Saltvik, K.-H.F. — Idenor s:n, H.A.L. Hudiksvall. — Järvsö, Piparvallen, HOLM 1934. — Helsingtuna s:n, H.A.L. Hudiksvall. — Delsbo s:n, 5 km to the east of the church, S.E. — Delsbo s:n, Överälve, K.-H.F. — Ljusdal, BODÉN & WITT-STRÖMER 1951, L.S. — Ljusdal s:n, Sjöbo village, L.S. — Harmånger s:n, Strömsbruk, H.A.L. Hudiksvall. — Gnarp s:n, N.A.

Härjedalen. Lillhärdal s:n, eastern part HOLM 1934. — Storsjö kapell, P.D.

Medelpad. Attmar s:n, Bölessjön, H.A.L. Sundsvall, O.H. — Attmar s:n, Norrböle, N.A. — Njurunda s:n: Vikarbodarna; Björköfjärden; Brämö; Skrängstasjön; Skottsund, HOLM 1934. — Njurunda, O.H. — Njurunda s:n, Juniskär, H.A.L. Sundsvall, O.H. — Njurunda s:n, Nyhamn, HOLM 1934. — Njurunda, O.H. — Njurunda s:n, H.A.L. Sundsvall, O.H. — Tuna s:n, Sommartjärn, HOLM 1934. — Sundsvall, Norra Stadsberget, Medelpads Hembygdsmuseum, O.H. — Sundsvall, Svartvik, G.N.M. — Skön, HOLM 1934. — Alnön, Spikarna, HOLM 1934. — Alnön, Ripsandsviken, HOLM 1934. — Alnön, O.H. — Sättna s:n, Rösåsen, HOLM 1934. — Tynderö, HOLM 1934. — Hässjö s:n, Tjäl, HOLM 1934.

Ångermanland. Säbrå s:n, Bondsjö, HOLM 1934. — Nora, HOLM 1934. — Södra Ulvön, HOLM 1934. — Vibyggerå s:n, Skule forest, K.C.-L. — Multrå s:n, Strinne village, MODIN 1916. — Örnsköldsvik area, BARTLER 1953 A. — Gideå, K.-H.F. — Täsjö, MODIN 1916.

Västerbotten. Nordmaling s:n, Ava, HOLM 1934. — Hörnefors s:n, Sörmjöle, T.L-d. — Ängesön, HOLM 1934. — Umeå s:n, Piparbölesjön, HOLM 1937. — Umeå s:n, Nyliden, Säboberget, HOLM 1937. — Holmön, Svartisören, HOLM 1934. — Holmön, HÖGBOM 1887, EKMAN 1922, HOLM 1934. — Vännäs s:n, Sunnanå, HOLM 1934. — Degerfors s:n, Kulbäcksliden, HOLM 1934, K.-H.F. — Degerfors s:n, Aggberget, HOLM 1934. — Robertsfors, T.L-d. — Nysätra s:n, Gumboda, T.L-d. — Lövånger, HOLM 1934, 1940. — Gammalbyn, HOLM 1940. — Broträsk, HOLM 1940. — Between Stora and Lilla Lövvattnet, HOLM 1940. — Bjuröklubb, HOLM 1940, O.H. — Lövånger, Storö, Ryssböle, HOLM 1940, D.H.

Norrbotten. 2 km northwest of Edefors church, FRENNESSON 1952. — Överkalix s:n, Kalvjärv, HOLM 1934. — Överkalix s:n, Västra Tallberget, HOLM 1934.

Lappland. Ume river, Lycksele-Stensele bound, HOLM 1934. — Sorsele s:n, O.H. — Arvidsjaur s:n, Trollforsen, HOLM 1934. — Arvidsjaur s:n, 12 km to the north of Moskosel, near the mouth of Abmorälven, HOLM 1934. — Kvikkjokk, Gaskaivo, LÖWENHJELM 1843. — Kvikkjokk, EKMAN 1907. — Muorjevare, HOLM 1934. — Gällivare, Leipipir crown forest, HOLM 1934. — Gällivare, Vettäsjärvi, HOLM 1934. — Between Aborrträsk and Porjus, HOLM 1934.

Vipera berus berus (LINNAEUS). **Adder. Huggorm**

The western border of *Vipera berus berus* in Europe comprises Great Britain, Holland, Belgium, and France. In Russia the European distribution reaches northern Italy and Bulgaria. In the north it comprises Norway, part of Finland to the south of the Kola Peninsula. In Russia the border lies at 65° N, sloping to 60° N at Ural and from there to 60 or 61° N in Siberia. In the far east it reaches to Vladivostok and includes Sakhalin. From the East Asiatic coast it reaches southwards to about 47° N. Then the southern border crosses Mongolia, Altai and Ukraina and reaches the Balkan peninsula at about 40° N. In north-western Spain and north Portugal it is represented by *V. b. seoanei* LATASTE and in Yugoslavia and Bosnia by *V. b. bosniensis* BOETTG. The Swedish distribution of the adder covers practically the whole country. It is found even on islands fairly

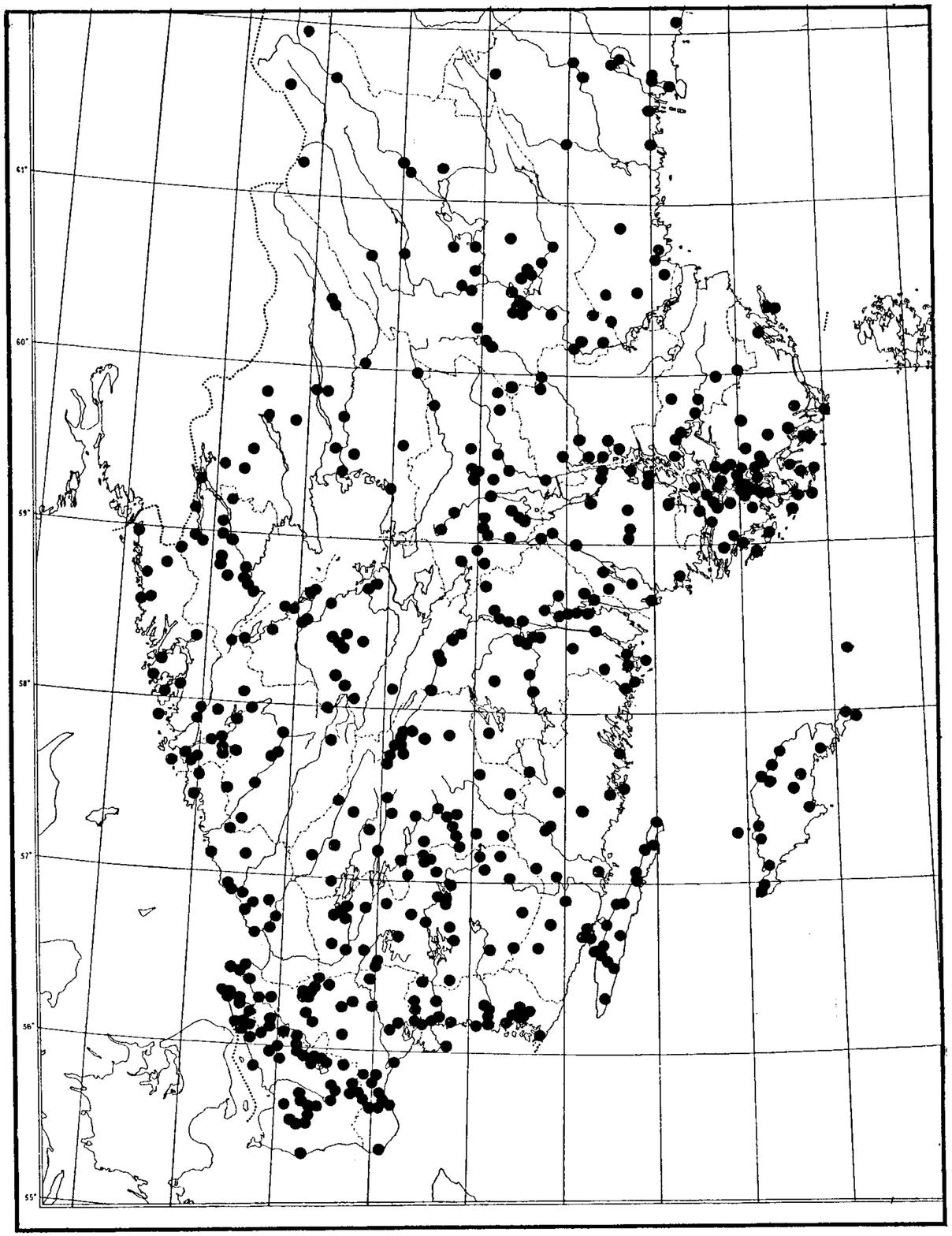


FIG. 67, 68. Distribution in Sweden of *Vipera berus berus*.

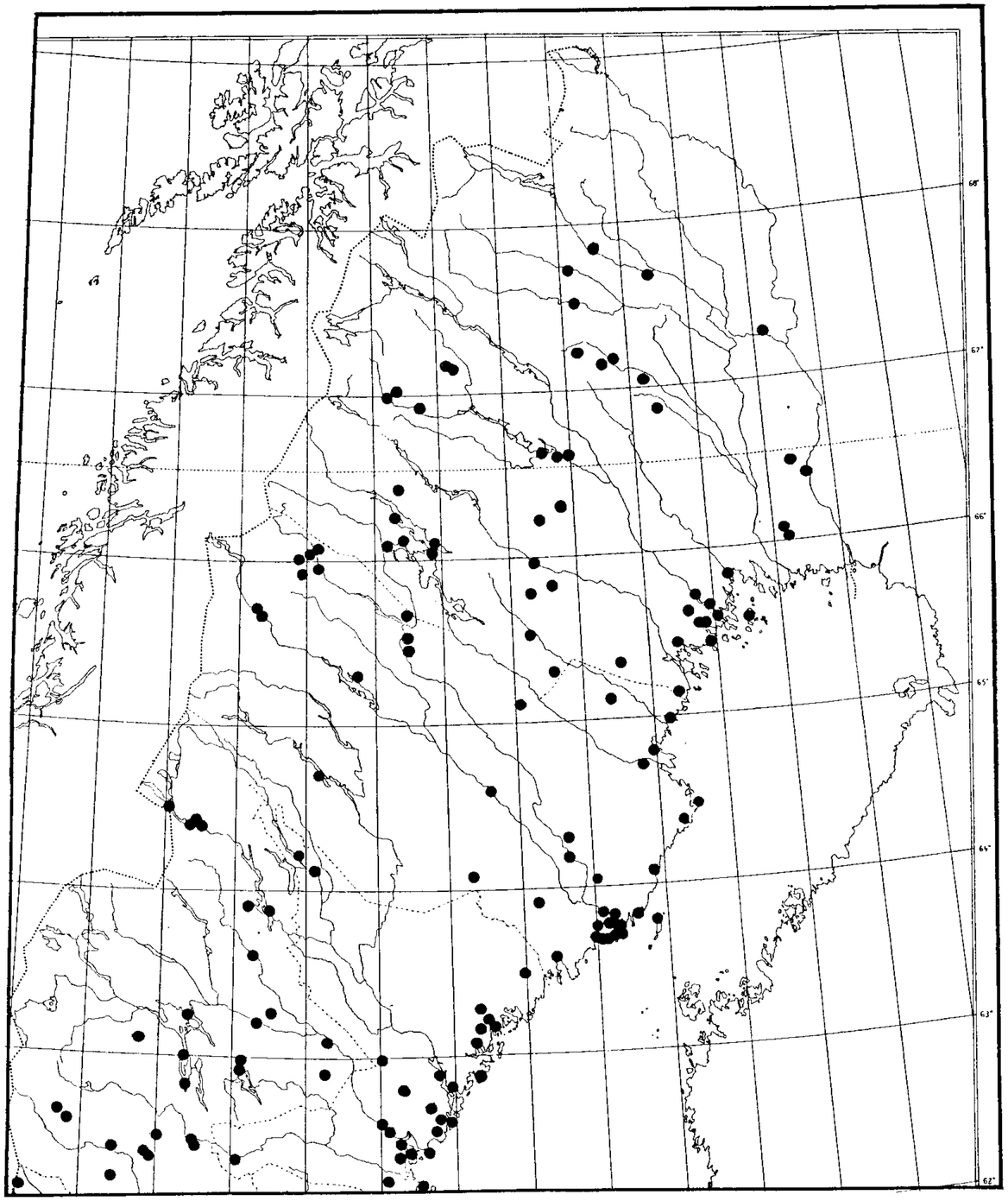


FIG. 68.

TABLE 25. Size of new-born *Vipera berus* according to VOLSØE and SMITH.

Numb. in Brood	Min. mm	Length		Length of Mother	Author
		Max. mm	Average mm		
15	143	169	159.2	—	VOLSØE
14	153	174	163.4	—	,,
13	144	153	150.0	—	,,
6	130	162	146.7	—	SMITH
8	141	155	147.0	510	,,

distant from the shore, such as Stora Karlsö, Gotska Sandön, and Holmön. The northernmost locality lies at about 68° N at Jukkasjärvi.

The vertical distribution extends from sea level up to about 800–1600 m.

The length rarely surpasses 75 cm but there are records, though unverified by preserved specimens, of adders which have been reported to reach greater lengths. VAINIO 1931 has from Finland (68° N) a record of a 94 cm specimen and for Sweden H. SMITH 1919 has from a south slope mountain in Härjedalen at 950 m measured a giant which reached 104 cm. This is the largest specimen ever recorded. Probably it may be the very rich access to lemmings and voles in the Swedish mountains, together with strong radiation, that creates the favorable conditions for a growth to over normal size (GISLÉN 1946 A).

VAINIO investigated Finnish adders 1931, BERNSTRÖM made a study of the central Swedish adders 1943 and VOLSØE 1944 has investigated the Danish adders.

Normally the male, according to BERNSTRÖM, has a black zig-zag dorsal marking on a grey ground-colour and a black belly. The grown female is brown on a dark brown ground-colour and a leaden grey or red-grey belly. But otherwise practically all shades of ground-colour may occur in the adders, though the males have always clearer colours and the females show more dusky combinations. I have noticed black specimens from practically all landscapes in Sweden. We have them thus from Skåne, Småland, Kalmar län, Västergötland, Östergötland, Närke, Södermanland, Stockholm, Västmanland, Uppland, Dalecarlia, Hälsingland, Ångermanland and Lapland.

BERNSTRÖM found that the females usually have a more light-coloured throat than the males. The pair of ventral tail plates behind the anal opening seems, as already stated by BOULENGER 1913, to be a good distinguishing mark between the males and the females. The males always have a longer tail. The tail contains the two hemipenis at the base. BOULENGER reported some overlapping to occur as to the numbers of ventral and subcaudal plates in males and females, but BERNSTRÖM found in his material that there was no overlapping and that the subcaudal plates varied between 37 and 48 in males, while in the females

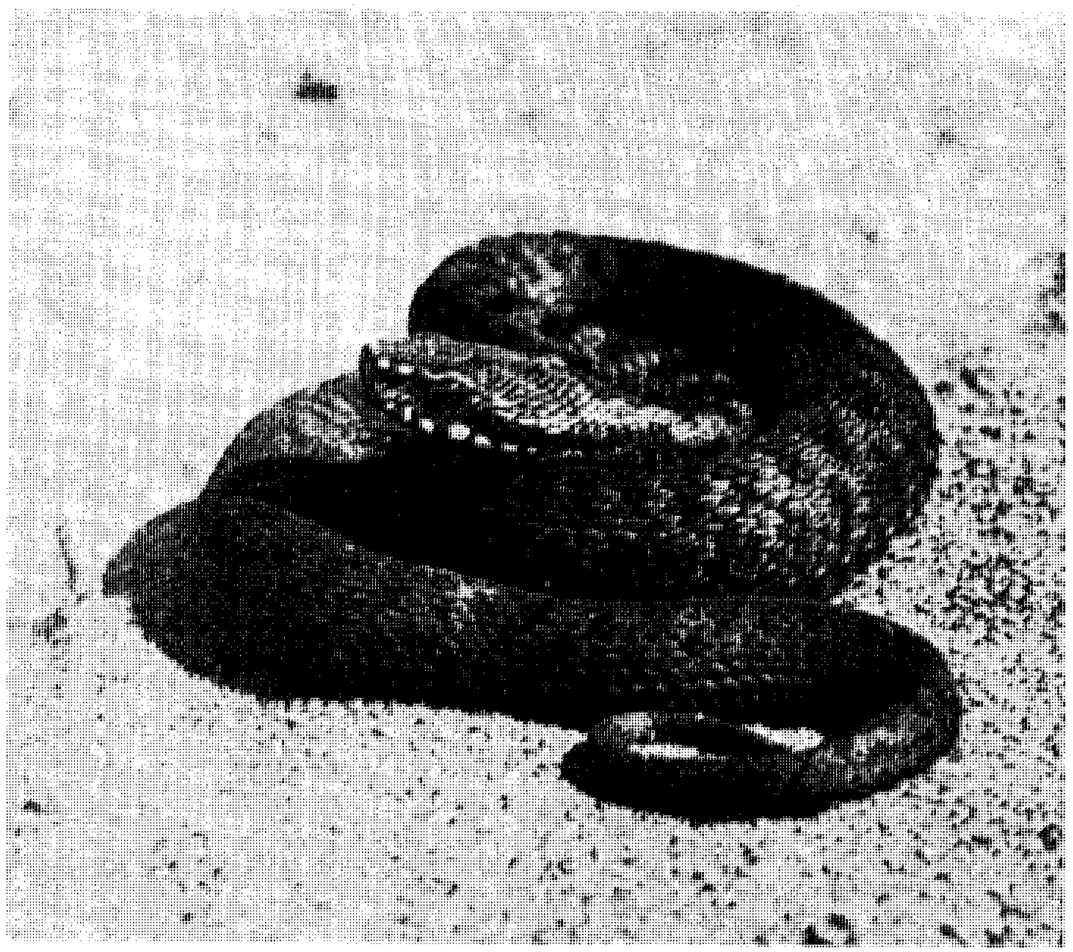


FIG. 69. Adder. Skansudden, Gtl. Photo by G. Håkansson.

these plates were between 29 and 36. According to SMITH (1954), there are 32–40 in males and 27–35 in females.

VOLSØE found, when investigating Jutland specimens, that the prey of the adders was usually lizards. In 20 investigated cases BERNSTRÖM found that 12 of the adders contained remnants of voles, one contained a mouse, three had young yellowhammers, three contained slow-worms and one had remnants of a lizard. Certainly, at least along the coast of Sweden, voles and mice form the most common prey. The adders abound in certain parts of the eastern archipelago where the voles occur in great quantities.

According to VOLSØE (1944) the normal close of the hibernation occurs in Denmark during the first days of April. At that time an average maximum temperature of 8°C is reached. In Scania the first observations of adders in the open are made also in April. According to BERNSTRÖM (1943) the adders change skin at the beginning of May and mate immediately afterwards (according to CURRY-LINDAHL (1955 A) in April). Ovulation according to him occurs at the beginning or in the middle of June. VOLSØE (loc. c.) gives the period of ovulation from 20th

TABLE 26. Growth of *Vipera berus* in central Sweden according to BERNSTRÖM.

Age in years ...		1	2	3	4	5	6
Length in mm	♂♂ min.	175	260	370	440	480	515
	max.	240	330	440	510	565	600
	♀♀ min.	175	300	440	520	550	570
	max.	210	405	530	590	635	665

May to 8th June. From the 30th June I have some embryos from the central part of Sweden which measure 5.5 cm long. The young are born at the end of August, when the female has lost a good deal of her fat. VAINIO and BERNSTRÖM thought that the females were pregnant only once every second year, but, as VOLSØE has shown, this supposition requires proof by means of a more comprehensive material.

The new-born young as a rule are light brown or brightly red-brown. In August 1938 I got 15 dark-greyish young from one black female from Nynäshamn (Central Sweden) measuring 705 mm.*

As the female was unusually large, the young were consequently of unusual size, being 19–20 cm (measured after preserving in alcohol). Otherwise the new-born young usually measure 15–18 cm. According to size of the new-born adders, VOLSØE (1944) and SMITH (1954) give some figures. (Table 25.)

The mean length of the young Danish adders during the first hibernation was 174.4±4 mm. The material was collected during the winters of 1936–37 to 1939–40. (VOLSØE loc. c.)

BERNSTRÖM (1958) reports on the growth of adders, as shown in the table above. At the beginning of the fourth year the males seem to become ripe at about the size of 440–510 mm. The females should become ripe about one year later at a length of 550–635 mm. (Table 26.)

According to VOLSØE, the males of the 1st winter were 170 mm, of the 2nd winter about 250, the 3rd 305 and of the 4th 360 mm. They were ripe after the 5th winter at 400 mm. The females grow more quickly and therefore in the second winter were 260 mm, in the 3rd 350, and in the 4th 470 mm. Next spring they seem to lay eggs for the first time.

In Scania the hibernation begins in the second half of October or the first days of November.

OCCURRENCE:

Skåne. Östra Torp, NILSSON 1842. — Sandhammaren, Å.H-l. — Fjällfotasjön, L.Z.M., M.M. — Bökeberg, LANG 1926, T.G., L.A. — Björkesåkrasjön, SAHLIN 1929. — Yddingen, SAHLIN 1929. — Häckeberga, LANG 1926. — Görslöv, LANG 1926. — Romelcklint.

* Measured after preserving in alcohol. According to VAINIO a snake specimen of that size would shrink about 4–5 cm in such a medium.

L.Z.M. — Veberöd, SAHLIN 1929. — St. Olof, Exc., H.B-m., S.S. — Kronovall, M.M. — Between Tomelilla and Våmbsjön, SAHLIN 1929. — Dalby s:n, S.S. — Stenshuvud, L.Z.M., O.B.S. — Vitaby, L.Z.M. — Öved s:n, L.Z.M. — Fågelsång, NILSSON 1842. — Andrarum s:n, Djurröd, L.Z.M., S.S. — Brösarp, Björstorp, L.L.I. — Frenninge s:n, S.S. — Kristinehov, Exc. — Bjärsjölagård, Exc. — Östraby s:n, S.S. — Hörröd s:n, S.S. — Långaröd s:n, S.S. — Huaröd s:n, S.S. — Degeberga, K.E. — Äspinge, Satserup, H.L. — Ringsjön, NILSSON 1842. — Landskrona, L.Z.M. — Stehag, L.Z.M. — Stehag s:n, S.S. — Torrlösa s:n, S.S. — Svalöv s:n, S.S. — Norregård, Ludvigsborg, L.Z.M. — Åhus, Espet, K.A., O.B.S. — Höör, L.Z.M., M.M. — Munkarp s:n, S.S. — Halmstad s:n, S.S. — Ask, L.Z.M. — Billinge, L.Z.M. — Kågeröd, L.Z.M. — Röstånga, L.Z.M., T.G. — Tjörnarp s:n, Lillsjödal, L.Z.M., G.B-d. Välluf s:n, S.S. — Skäralid, L.Z.M. — Hälsingborg, N.R.M. — Risekatslösa s:n, S.S. — Balsberget, Å.U. — Stenestad, L.Z.M. — Kropp s:n, S.S. — Norra Vram s:n, S.S. — Allerum s:n, Kulla Gunnarstorp, L.L.I., N.R.M., H.L-m, H.M., S.S. — Allerum s:n, Allerum mire, MUCHARDT 1912. — Åstorp, A.S. — Perstorp, L.Z.M. — Oppmanna, G.N.M. — Oppmannasjön, Spegelvik, O.B.S. — Näsum s:n, Ivösjön, R.J. — Näsum s:n, R.J. — Välinge s:n, Rögle, A.N-n. — Oderljunga, Bälingesjön, L.L.I. — Mala, L.Z.M. — Brunnby s:n, L.Z.M. — Jonstorp s:n, Svanshall, L.Z.M., A.N-n. — Jonstorp s:n, S.S. — Ängelholm, L.Z.M., L.L.I., H.M., N.T-W. — Munka-Ljungby, L.L.I. — Lursjö area, A.K. — Between Sibbhult and Broby, L.Z.M., LAGERLUND 1951. — Kullaberg, SAHLIN 1929, BEHRENS & MALMBERG 1950. — Arild, A.N-n. — Örkelljunga: Prästsjön; 0.4 km to the east of Månstorp; Vemmentorpssjön, L.L.I. — Örkelljunga s:n, Lärkholmssjön, A.N-n. — Örkelljunga; Harbeckshult; Skogen; Gudebygget; Åsljungasjön; Åsljunga, L.L.I. — Röke s:n, Värsjön, L.L.I. — Hjärnarp s:n, S.S. — Värsjö, P.M.L. — Vittsjö, L.Z.M., PERSSON 1946. — Grevie s:n, Segelstorp, L.Z.M. — Skånes Fagerhult: Fedingesjön; Sandhult, L.L.I. — Torekov, H.B-m. — Hallands Väderö, L.Z.M., VALLIN 1947, 1949, H.V. — Hofs hallar, L.Z.M. — Osby area, HALL 1950. — Killeberg, G.A-t., P.Å.O. — Loshult, N.N.

Blekinge. Hanö, J.B., R.F-e, B.H. — Torhamn, K.C.-L., P.B. — Ryssberget, Ensjön, T.G. — Mörrum s:n, Björkenäs, T.G. — Mörrum, T.G. — Karlshamn, L.Z.M. — Yttre Stekö, WESTERLUND 1890. — Ronneby, Karön, WESTERLUND 1890. — Järnavik, Gyön, J.F.P. — Vambåsa, A.L-m. — Härstorpssjön, WESTERLUND 1890. — Skärva, O.T. — Rosenholm, A.L-m. — Bubbetorp, A.L-m. — Bastasjö, A.L-m. — Torskors, A.L-m. — Djupadal, GOSSELMAN 1863, WESTERLUND 1890. — Jämshög s:n, CARLSSON 1917, R.J. — Bredåkra, WESTERLUND 1890. — Rödeby, Rödebyskogen, G.N.M. — Olofström, M.M. — Åkeholm, G.W. — Kyrkhult; Ulvaboda, H.L.

Halland. Tönnersjö s:n, K.C.-L. — Tylösand, A.L-u. — Skedala, K.E. — Steninge s:n, L.Z.M., K.C.-L., HANSTRÖM 1946, 1950, B.H. — Enslöv, H.A. — Getinge s:n, A.K. — Slättåkra s:n, T.H-g. — Skrea, MUCHARDT 1912. — Falkenberg, Varbergs samrealskola. — Stafsinge s:n, Ramsjöholm, Varbergs samrealskola. — Svartrå s:n, Skinnarlyngen, G.N.M. — Varberg, Varbergs Samrealskola. — Onsala, KULLENBERG 1942. — Lindome, G.N.M.

Småland except Kalmar län. Mien, CURRY-LINDAHL 1951 B. — Möckeln, K.C.-L. — Hinneryd, H.L. — Traryd, K.C.-L., H.L. — Göteryd, Ry, H.L. — Liatorp, T.G. — Väckelsång s:n, C.B.G. — Älmeboda, T.G. — Annerstad, at the mire, L.L.I. — Annerstad s:n, Skeen, F.O. — Annerstad s:n, Högön, J.B. — Skatelöv s:n, C.B.G. — Östra Torsås s:n, Ingelstad, H.A.L. Hudiksvall. — Angelstad s:n, J.B. — Ljungby, K.C.-L., L.L.I. — Ryssby s:n, L.Z.M., I.G.E. — Vislanda, H.L. — Växjö, Teleborg, J.B. — Växjö, N.R.M. — Räppe, L.Z.M., F.v.S. — Algutsboda, Östra Stamphult, H.L. — Södra Unnaryd, C.M. — Gårdsby s:n, Stojby, M.M. — Mistelås s:n, Tagel, L.L.I. — Moheda, Fiolen, L.L.I. — Moheda, Åkhult mire, L.L.I., A.R. — Berg s:n, Vinninge, S.A-n. — Älghult, Älgasjön, L.L.I. — Nottebäck s:n, Granhult, C.B.G. — Åseda, H.L. — Aneboda: Stråken;

Ugglehult; Eskås; Skärshultsjön, L.L.I. — Lamen, L.L.I., LANG 1928. — Aneboda, L.Z.M., K.C.-L., A.R. — Klavreström, C.B.G. — Badebodaån, T.G. — Södra Hestra, H.L. — Skeppshult, J.P. — Kärda s:n, between Åminne and Vallerstad, H.L. — Gällaryd, L.L.I. — Reftele, H.L., Å.H. — Värnamo, Prostskogen, G.A. — Värnamo area, G.N.M., K.C.-L. — Ramkvilla, L.L.I. — Allgunnen, L.Z.M. — Hjelmseryd, L.L.I. — Bäckaby s:n, Åskog fen, L.L.I. — Näshult, M.M. — Kävsjö bog, K.C.-L., H.L. — Fröderyd, L.L.I. — Österkorsberga, C.B.G. — Lannaskede, G.N.M. — Vrigstad, G.N.M. — Myresjö s:n, C.B.G. — Åsenhöga, H.L. — Tofteryd, H.L. — Sävsjö, H.E. — Norra Hestra, L.L.I. — Vaggeryd, K.-E.J. — Karlstorp s:n, Kolsjön, CYRÉN 1946, 1948. — Karlstorp, CYRÉN 1910. — Hult s:n, Granshult, J.B. — Månsarp s:n, G.B. — Taberg, BJURULF 1944, K.C.-L. — Rogberga s:n, Tenhult, K.C.-L., L.L.I. — Jönköping, Hagaberg, RÖSIÖ 1927. — Jönköping area, BJURULF 1944. — Huskvarna, Bråneryd, U.S. — Bälaryd, near Nosjön, H.L. — Aneby, Å.H. — Skärstad, Vista kulle, H.L. — Älmstad s:n, Sandvik, J.B. — Skärstad, Fingalstorp, H.L.

Kalmar län. Between Karlslunda and Vissefjärda, T.G. — Emmaboda, G.N.M. — Oskar, Folkehyttan, H.L. — Dörby, Ulfsborg, L.Z.M. — Kalmar, Oxhagen, L.Z.M. — Kalmar, WESTERLUND 1855. — Berga udd, HEINTZE 1909. — Nybro, L.Z.M. — Vesslö, Exc., T.G. — Bäckebo, Hälleskulla, H.L. — Algunnen, GISLÉN 1935, T.G. — Kråkemåla, H.L. — Mönsterås; K.-E.J., T.H., Å.D. — Mörlunda s:n: to the east of Ryningsnäs; to the north of Wombsjön, H.L. — Mörlunda s:n, Lilla Sinnerstad, N.R.M. — Kristdala s:n, Skinshult, G.N.M. — Misterhult s:n, Örö, S.S. — Misterhult s:n, Tjustgöl, G.N.M. — Vena, Å.H. — Hässleby, A.D. — Västervik, Gränsö, through H.A.L. Härnösand.

Öland. Gräsgård s:n, ENDERLEIN 1949. — Stenåsa Alvar, N.B. — Stora Alvaret on the west side of Möckel mire, K.A.— Vickleby Alvar, K.A. — Beijershamn, EDELSTAM 1944, C.E., Exc. — Torslunda s:n, KULLENBERG 1953. — Ölands Skogsby, C.E. — Ölands Bäck, L.Z.M. — Stora Rör, G.N.M. — Räpplinge s:n, Borga hage, JOHANSSON 1955. — Borgholm, E.W-n. — Köpingsvik, D.C. — Föra s:n, Vässby, C.E. — Petgärde, CURRY-LINDAHL 1955 A. — Persnäs s:n, Knisa fen, K.C.-L. — Södvik, K.C.-L. — Hornsjön, D.C. — Högby s:n, Vedborm-lake, A.L-t. — Northern point of the island of Öland, KOLTHOFF 1920.

Gotland. Sundre s:n, Muskmyr, H.K. — Vamlingbo, BRATTSTRÖM 1945. — Fidenäs, K.C.-L. — Mästermyr, E.W-n. — Stora Karlsö, L.Z.M., BREHM & EKMAN 1946, B.W-n. — Fröjel, K.C.-L. — Kräklingbo s:n, Hejdeby, K.C.-L. — Hörsne s:n, S.B-g. — Lina mire, N.L., C.E. — Vallstena, Norrgårda, G.N.M. — Storvide mire, D.C. — Visby, Bingerskvarn, BRATTSTRÖM 1945. — Västkinde s:n, Skälsö, BRATTSTRÖM 1945. — Lummelunda, N.R.M. — Hellvi s:n, Malms, BRATTSTRÖM 1945. — Fårö s:n: Ava; Tälleviken, K.C.-L. — Gotska Sandön, EISEN & STUXBERG 1868.

Göteborg. Känsö, G.N.M., MALM 1877. — Stora Delsjön, G.N.M. — Margreteberg, G.N.M. — Slottsskogen, G.N.M. — Gibraltar, G.N.M. — Majorna, G.N.M. — Landala, G.N.M. — Ramberget, G.N.M. — Lagklarebäck, G.N.M. — Hisingen, Arendal, A.R. — Hisingen: Hökälla; Bräckö, G.N.M.

Bohuslän. Marstrand, G.N.M. — Kungälv, G.N.M. — Romelanda s:n, G.N.M. — Tjörn, EKSTRÖM 1850. — Stenungsund, G.N.M. — Orust, Edshultshall, S.E-n. — Orust, Torebo, SUNDEVALL 1849. — Orust, E.K. — Uddevalla: Samneröd; Bräcke; Kuröd, O.B.S. — Hamburgsund: G.N.M. — Kville s:n, C.M. — Tanum, H.B-t. — Naverstad, S.E-n. — Strömstad area, A.B-s.

Västergötland. Glimmared, G.N.M. — Kungsäter, G.N.M. — Tostared, K.C.-L. — Kinna, H.A.L. Skara. — Frölunda, G.N.M. — Fässberg s:n, G.N.M. — Mölndal, G.N.M. — Gunnebo, G.N.M. — Härryda, G.N.M. — Hindås, G.N.M. — Viared area, K. HALL 1942. — Borås, C.B., S.D. — Jonsered, G.N.M. — Härryda s:n, Härsjösand, O.J-n. — Aspen, G.N.M. — Lerum, G.N.M. — Fristad, Tubbekulla, G.N.M. — Hössna s:n, S.E-n. — Västerbodarna, Bergsjödal, G.N.M. — Kilanda, H.L. — Bälinge s:n, Torp, L.L.I. — Börstig, H.A.L. Skara. — Långared s:n, Å.H-l. — Yllestad, H.L. — Yllestad s:n, Kättilstorp, S.E-n. — Alvasjö, v. POST 1949. — Ålleberg, H.A.H. — Mösseberg, H.A.H. — Stenum s:n, Hornborgasjön, E.S. — Broddetorp s:n, Bolum, T.S. — Vassända-Naglum s:n, U.Z.M. — Halleberg, N.-G.K., E.M. — Friel, N.-G.K. — Skara, H.A.L. — Skara, Kar.H.A.L. Örebro. — Höjentorp, E.S. — Skövde area, C.B.G. — Kållands-Mellby, N.-G.K. — Lidköping, N.-G.K. — Skalunda s:n, Hindersrev, N.-G.K., Rackeby, N.-G.K. — Läckö, N.R.M. — Otterstad, Ekebo, N.-G.K. — Kinnekulle, KARVIK 1953, K.C.-L., N.-G.K. — Mariestad, B.F. — Hassle, Hj.S.

Östergötland. 2 km to the north of Sund church, J.B. — Holaveden, BJÖRNSSON 1949. — Tjärstad s:n, Emmern, HANNERZ 1910. — Opphem, E.W-n. — Gryt s:n, Syltvik, C.M. — Gryt s:n, Kettilö, Gruvlagholmen, N.R.M. — In the Skärgård off Gryt, N.I. — Stora Haddebo, A.L-u. — Vårdnäs s:n, K.E-n. — Ödeshög s:n, Stava, T.G. — Västra Tollstad s:n, Forsby, A.M. — Gusum, N.R.M. — Omberg, HEDBERG & ÖHRN 1950, K.C.-L. — Alvastra, G.P. — S:t Anna s:n, Engelholm, Djurudden, T.G. — S:t Anna s:n, Brevik, U.S. — S:t Anna s:n, Stickelskär, T.G. — Tåkern, R.F-e. — Herrestad, H.B. — Vadstena, S.E-n. — Kärna s:n, the bog, H.L. — Linköping, N.R.M. — Linköping area, S.T. — Rystad, Fröstad, F.O. — Linghem, Törnevalla, F.O. — Östra Ryd s:n, Boda, N.R.M. — Söderköping, Ramunderberget, H.B. — Ljung s:n, H.A.L. Linköping. — Stjärnorp s:n, K.E-n. — Kristberg s:n: to the north of Borensberg; Olivehult, H.L. — Okna, H.B. — Borg s:n, H.B. — Eksund, H.B. — Norrköping area, H.B. — Dagsberg, H.B. — Vånga s:n, the mortar of Glan, H.B. — Risten, H.B. — Krokek s:n, Stora mossen, H.B. — Krokek, N.R.M. — Godegård, H.L.

Dalsland. Sundals-Ryr, N.-G.K. — Järn, C.M. — Holm s:n, C.M. — Gunnarsnäs, C.M. — Dalskog s:n, C.M. — Skållerud s:n, Björkön, G.N.M. — Bäcke, N.-G.K. — Ödsköld, C.M. — Ed, Skottan, N.-G.K. — Ed, Klevmarken, N.-G.K. — Ed, G.N.M., G.R. — Tisselskog, C.M. — Steneby, N.-G.K. — Ärtemark, N.-G.K. — Nössemark, N.-G.K. — Vårvik, Kasen, H.L., N.-G.K.

Värmland. Trankil, Orrtjärn, H.L. — Sillerud, Hälgebyn, H.L. — Kristinehamn area, E.W. — Silbodal, H.L. — Karlstad, P.H.-A., J.G.W. — Alster, C.B.G., K.-E.J. — Övre Gla, Buvattnet, O.N. — Stora Kil s:n, Norra Hyen, A.K. — Lungsund s:n, Lundsberg, E.W-n, J.B. — Arvika, N.R.M., A.E. — Brunskog, C.B.G. — Övre Ullerud, T.S. — Gunnarskog, Berga, L.L.I. — Sunne, S.A. — Sunne s:n, Rävkullen, J.B. — Gåsborn, Älvsjöhyttan, K.-H.F. — Hagfors area, LARSSON 1947, E.W. — Norra Ny s:n, Stöllet, K.-E.J. — Norra Ny s:n, Värnäs, C.M.

Närke. Mariedamm, SUNDEVALL 1849. — Askersund, G.N.M. — Lerbäck s:n, AF ROBSON 1911. — Tisaretorp, G.Ö-t. — Svennevad s:n, Skogaholm, N.R.M. — Hallsberg, J.B. — Hallsberg, Marka, A.D. — Hasselfors, MAGNUSSON 1935. — Kumla s:n, Brånsta, Kar. H.A.L. Örebro. — Asker s:n, Sandvad, H.B. — Asker s:n, Stakbäcken, H.W.W. — Kvistbro s:n, Mullhyttemo, A.D. — Kvismaren, ROSENBERG 1937, VON ROSEN 1951. — Västra Kvismaren, Kar. H.A.L. Örebro. — Örebro, Oset, H.W.W. — Örebro, Kränglan, Kar.H.A.L. Örebro. — Örebro, Kar. H.A.L. Örebro, A.D. — Hovsta s:n, A.D. — Kil s:n, Frösvidal, L.L.I. — Kil s:n: Hammarboda; Lockhyttan; Ramsjön, A.D. — Ödeby s:n, L.Z.M., A.D.

Södermanland. Oxelösund, Jogersö, J.B. — Kila s:n, Rösäng, H.a.R. — Tuna, Svehälla, U.Z.M. — Björkvik s:n, L.Z.M. — Nynäs s:n, O.B.S. — Utö s:n, J.B. — Ösmo s:n, J.B. — Muskö, G.P. — Vagnhärad, K.C.-L. — Björnlunda, K.C.-L. — Hellgesta s:n, Sund, C.F. — Sparreholm, T.L-d., VON ROSEN 1951. — Näshulta, H.W.W. — Dunker, H.W.W. — Västerhaninge s:n, Sotholmen, T.G. — Katrineholm, T.W. — Marsjö, T.W. — Vingåker, T.W. — Ornö, Kymmendögård, G.N.M. — Ornö, N.L. — Grödinge s:n, H.a.R. — Södertälje, N.R.M., K.C.-L. — Tumba, N.R.M. — Salem, A.A. — Hedlandet,

A.L-t. — Huddinge s:n, Balingsholm, CURRY-LINDAHL 1944 B, 1952, K.C.-L. — Huddinge s:n, Stensätra mire, K.C.-L. — Vendelsö, Gudö, N.R.M. — Nämdö, L.L.I., CYRÉN 1941. — Enskede, N.R.M. — Saltsjöbaden, the Observatory, N.L. — Nacka, Dammtorpsjön, H.a.R. — Hasseludden, SMITH 1919. — Arboga, Storängstorp, H.W.W. — To the south of Eskilstuna, E.A. — Eskilstuna, U.Z.M., SJÖSTEDT 1920. — Strängnäs, L.L.I., N.R.M. — Helgarö, K.E. — Tosterön, A.L-g. — Torshälla, J.B.

Stockholm. Nacka, EDELSTAM 1954. — Skarpnäck, H.W.W. — Lidingö, N.R.M., LÖNNBERG 1909, O.D. — Frescati, N.R.M. — Ulriksdal, N.R.M. — Stockholm, L.Z.M., U.Z.M., N.R.M.

Västmanland. Näsby s:n, Frövi, A.D. — Näsby, Hult, H.W.W. — Köping, H.A.L. Västerås. — Rytterne s:n, Lagersberg, BERNSTRÖM 1943, J.B. — Tidö, J.B. — Hallstahammar, J.B. — Västerås, H.A.L. Västerås, G.D-l. — Västerås area, WALLDÉN 1955, O.H-g. — Irsta s:n, Gäddeholm, H.A.L. Västerås. — Hällefors, K.-H.F. — Ramsberg, K.-H.F. — Kärrbo, FLODERUS 1925. — Kloten, K.-H.F. — Ombenning, L.L.I.

Uppland. Björkö, S.E-n, G.Ar-n. — Ekerö, I.H. — Lovö, S.E-n. — Lännersta, T.W. — Bo, N.R.M. — Ingarö, M.M. — Runmarö, N.R.M. — Sandhamn, N.R.M. — Hässelby, E.P. — Danderyd, N.R.M., K.-H.F. — Näsby, N.R.M. — Bogesund, S.E-n. — Karlsvreta, Hästängsudd, H.B. — Österåker s:n: Brevik; Lervik; Södra Träsksjön, H.a.R. — Träskö, N.R.M. — Österåker s:n, Träsksjön, ENDERLEIN 1949. — Lökaö, Tistronskär, J.R. — In the Skärgård off Nassa, N.R.M., LÖNNBERG 1909. — Kallhäll, L.Z.M. — Sollentuna, L.L.I. — Täby s:n, Froden, N.R.M. — Angarnsjöängen, Hackstabäcken, FROSTHEDEN 1952. — Svartsö, N.L. — Veckholm s:n, U.Z.M. — Angarnsjön, N.R.M. — Ekolsund, S.E-n. — Hjälstaviken, U.Z.M., N.L. — Yxlö, N.R.M. — Blidö, N.R.M. — Penningby, G.P. — Husby, Långhundra, N.R.M. — Bondkyrka s:n, Graneberg, F.O. — Sigtuna, K.C.-L. — Bondkyrka s:n, Vårdsätra, O.B.S. — Bondkyrka s:n, U.Z.M. — Estuna s:n, Uddboö, A.L-t. — Lidö, K.-H.F. — Åland s:n, U.Z.M. — Uppsala, U.Z.M. — Rasbokil s:n: Edeby; Ragvaldsbol, U.Z.M. — Tuna s:n, U.Z.M. — Fogdö, K.C.-L. — Östhammar area, T.S. — Gräsö channel, U.Z.M. — Gräsö: Måsskär; Söderskäret: Tollingen; Norra Vidgrundet; Digelskär, U.Z.M.

Dalarna. Malingsbo, K.-H.F., H.S.L. — Ludvika, K.-H.F. — Brunnsvik, K.-H.F. — Avesta area, T.S. — Grytnäs, K.-H.F. — By, B.W. — Grangärde, K.-H.F. — Hedemora, Norshyttan, T.W. — Silvberg, Björkljustern, E.L-d. — Silvberg, Sandvik, E.D. — Silvberg, Grängshammar, J.E.D. — Knutshyttan, J.E.D. — Byvalla, E.D. — Gustafs, Dammsjön, J.E.D. — Stora Tuna, eight localities, E.D., J.E.D. — Mockfjärd, E.K. — Borlänge, T.G. — Floda, T.T. — Aspeboda, E.K. — Källviken, Falu-Kuriren 14.4.1937. — Djura, N.L. — Falun, Britsarvet, B.T. — Falun, L.Z.M., K.-H.F. — Falu area, KLEFBECK 1949, E.K., K.-H.F. — Kopparberg, Hökviken, B.T. — Sundborn, E.K., B.T. — Malung s:n, I.G. — Brintbodarne, H.B-m. — Siljansnäs, Brahammar, Falu-Kuriren 25.4.1939. — Leksand, T.T. — Bjursås, Djäkenstugan, Falu-Kuriren 12.4.1939. — Svärdsjö, KLEFBECK 1927, E.K. — Between Bingsjö and Rättvik, E-s.M. — Lima, Lilla Moberget, E.D. — Orsa, Fryksåsen, B.T. — Älvdalen s:n, Blyberg, S.E-n. — Älvdalen, U.Z.M., EKMAN 1922., H.E., Hj.S., E.K. — Hamra crown forest, LÖNNBERG 1906. — Särna, Fulufjället, FORSSLUND 1949, K.-H.F. — Särna: Njupeskär, EKMAN 1922. — Särna, EKMAN 1922, E.D. — To the north of Idre, EKMAN 1922. — Idre, Nipfjället, SAMUELSSON 1917, FORSSLUND 1949, K.-H.F. — Idre, Grövelsjöhöjden, EKMAN 1922.

Gästrikland. — Grönsinka, Hj.S. — Främlingshem, Västermyr, SMITH 1919. — Torsåker, ERIKSSON 1950. — Torsåker, Kratte forge, L.Z.M. — Valbo s:n, Kubbo, SMITH 1919. — Gävle, L.Z.M., G.K. — Hille, K.F. — Ockelbo s:n, Yklaren, CURRY-LINDAHL 1951.

Hälsingland. Alfta, K.-E.J. — Norrala s:n, T.G. — Enånger, T.H-g. — Loos, N.R.M. — Järvsö, between the church and Järvsöklack, T.H-g. — Hudiksvall, Hudiksvall Museum, H.A.L. Hudiksvall. — Hälsingtuna s:n, Fors, H.A.L. Hudiksvall. — Gackerön, H.A.L. Hudiksvall. — Ljusdal, BODIN & WITT-STRÖMER 1951, L.S., T.H-g. — Delsbo, K.-H.F., T.H-g. — Norrbo, T.H-g. — Gnarp, K.-E.J.

Medelpad. Njurunda s:n, Björkön, through H.A.L. Härnösand. — Attmar s:n, Norrböke, through H.A.L. Härnösand. — Fågelberget 10 km to the south of Sundsvall, H.A.L. Sundsvall. — Haverö s:n, ALLEGÅRD 1953. — Haverö s:n, Viken, T.A. — Sundsvall, H.A.L. Sundsvall. — Medelpads Hembygdsmuseum, N.R.M., S.B-t. — Rosberget 2 km to the north of Sundsvall, H.A.L. Sundsvall. — Alnön, H.A.L. Sundsvall. — Timrå, H.A.L. Sundsvall. — Tynderö s:n, Åstön, E.B. — Indal, O.H. — Indal s:n, Hallsta, N.R.M.

Jämtland. Klövsjöfjällen, CURRY-LINDAHL 1951 B. — Rätansbyn, T.S. — Rätan, OLSSON 1882. — Berg, OLSSON 1876. — Revsund, OLSSON 1876. — Hällesjö, OLSSON 1876. — Oviken, OLSSON 1876. — Sundsjö, OLSSON 1896. — Ragunda, OLSSON 1876. — Bydalen, ANDERSSON & BIRGER 1912. — Between Bydalen and Stofallet, ANDERSSON & BIRGER 1912. — Rödön, OLSSON 1876. — Stugun s:n, Näverede, G.N.M. — Stugun s:n, Mårdsjön, OLSSON 1896. — Hammerdal, OLSSON 1876. — Ström s:n, Öjarn, HINRICSSON 1954. — Ström, OLSSON 1896. — Fågelberget, Håkafot, HOLM 1934. — Fågelberget, ANDERSSON & BIRGER 1912. — Karlberget, KLINCKOWSTRÖM 1909. — Frostviken, HOLM 1934, KLINCKOWSTRÖM 1909, OLSSON 1882.

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SOME GENERAL REMARKS CONCERNING THE ECOLOGY OF INVASIONS AND THE DISTRIBUTION OF THE SWEDISH AMPHIBIANS AND REPTILES

When the glacial period ended and the southern part of the Baltic area was freed from the heavy pressure of the ice sheet, this area was subjected to a very rapid rising of the land. Consequently, quite soon Scania came in contact with the Danish islands and a land connection was established between Germany and Scania via Danish territory. Later, the water of the so-called ice-blocked Baltic lake was turned over to the south and the southern shores became partly drowned. Therefore, the water found its way northwards, via the Dana Älv in Öresund. Already before that time, evidently, the amphibians and reptiles must have had the opportunity to invade southern Sweden. We can conclude this from the presence of the sand-lizard on Ven.* The sand-lizard seems to be the only specimen which is otherwise greatly hampered by invasion of islands where there has been no stable connection with the mainland (cf. later Öland and Gotland).

For a long time there was a slow and undisturbed continued distribution northwards in Sweden. In fact, the breaking of the post-glacial warmth period, which lasted from the boreal to the sub-boreal time, i.e. from about 7000–500 years B.C., must have increased the areas of distribution considerably over the occurrence nowadays. We had, for example, during this time the pond terrapin occurring as far northwards as Östergötland and it was fairly common in Scania (ISBERG 1929). Even nowadays we have or had remnants of relictary nature of the Grass-snake in Norrland, of both newts at Stensele, a Smooth Snake in the coastal land area of southern Norrland, the Sand-lizard in Mora (Dalecarlia), the Tree-frog of southern Gotland, the Edible Frog in Uppland, the Variegated Toad in Östergötland and Gotland, the Long-legged Frog in south-eastern Sweden and finally of the Fire Toad in Scania.**

That the climate has become more severe is illustrated e.g. by the fact that *Lacerta viridis* has now become extinct from Rügen where it occurred till in the 1860's. That the same is also true in Sweden can be concluded from the gradual

* The sand-lizard is common on Bornholm and likewise on Anholt, the island in Kattegatt. This seems to be due to the fact that this island was in broad connection with Jutland from the time of the Ancylus-lake (cf MUNTHE 1935, pl. X).

** When comparing the 190 localities of the smooth snake in southern (eastern) Sweden with the 8 finds of this form in Denmark, we can conclude how much better the conditions in this part of Sweden seem to be in comparison with the more Atlantic climate characterizing Denmark, and even western Scania, where the smooth snake is not found nowadays.

disappearance of *Trapa natans* in south-eastern Sweden, where it became extinct about 1913 (MALMSTRÖM 1920).

The retreat of the amphibians and reptiles probably set in as early as the beginning of the iron age. Still, there were for a long time good possibilities for survival in Sweden. As long as there were undrained and unditched pools, the clayey lowlands in the south especially were very wet. We can see remains of such areas even nowadays, e.g. at Linnebjär or at Örup's elm forest in Scania. Even as recently as about 70 years ago ENBOM found large areas in the district north of Lund, which were water-sick and formed vast bogs or fens; this is now well-drained arable land (1941, fig. 1, ZACHRISSON 1922).

As the ground-water sank, swamps dried up more and more, especially in sandy areas. This is especially important in an area which is already poorly provided with lowland lakes. So, for example, when the last lake in the lowland area of the Listerland round Gammalstorp (Blekinge) was totally drained about 25 years ago, it must have meant the disappearance of a lot of frog species from these surroundings. All these areas with low-lying good and fertile soil were presupposed to be drained and cultivated and to become, from a herpetological point of view, sterile culture steppe. This concerns, inter alia, the good areas in Blekinge and Kalmar län, which in this way must have been depleted of localities suitable for frogs. The coast meadows were also in this way partly cultivated and destroyed.

In more recent times, such an area as the forward penetration of the spruce forest at Johanneshus in Blekinge must have created a great obstacle for the east-west communication of more subtle frog forms, e.g. *Bufo calamita*, *B. viridis* and *Rana dalmatina*. Plantation of fir forest on sandy areas such as between Bäckaskog and Bromölla and the spruce forest between Bromölla and Valje must have meant the disappearance of *Bufo calamita* and *Lacerta agilis* from these areas.

M. SJÖBECK (1950, p. 316) says that fir and spruce forest was favoured before the beech forest and that the oak forest and the hazel meadow to a great extent disappeared, which no doubt meant the destruction of many localities for e.g. *R. dalmatina* in the south.

Frogs rarely spawn in lakes and rivers. If they do, it is generally along the borders, where there is placid water or where the border is hidden by a screen of reeds or water plants and thus protected from intrusion by fish or water-birds. The normal spawning places occur in ponds or small waters without fish. *Rana arvalis* or the *Triturus* species may appear also in acid, boggy places. Larvae of *Triturus cristatus* seem to prefer shallow pools or rocky depressions filled with water.

In Sweden there are 12 species of amphibians and 6 species of reptiles represented. This in fact means all Scandinavian species except three which, in addition, are found in Denmark or have been represented in Sweden.

They are

1. *Triturus alpestris*, recently found in southern Jutland (BISGAARD 1949).

2. *Coluber longissimus*, formerly found in Zealand, but extinct there since 1863 (HVASS 1942) and

3. the Pond Terrapin (*Emys orbicularis* (LINNAEUS)). During post-glacial time it occurred both in Sweden (ISBERG 1929) and Denmark (DEGERBØL & KROGH 1951) from boreal to sub-boreal time, i.e. from stone age to bronze age. It seems to have become extinct when the cold winters of the iron age began, about the year 500 B.C.

No less than 15 species have their northerly distributional limits within the borders of Sweden.

Few species are so strongly locally bound and so absolutely unable to be spread by the aid of the wind. The Sand-Lizard seems to have had no ability to spread via water-ways, as it does not occur on our Baltic islands. Also the crested newt seems to be very much hampered in its distribution over brackish water as it is not found on Gotland.

Two species are restricted to Scania.

The Fire Toad *Bombina bombina* seems never to have had a very wide distribution. It was earlier distributed to the northwestern and southern parts of Scania and seemed to remain so till the 19th century. After this, like in Denmark, it became very much rarer. In Scania it is nowadays restricted to a single locality at Kullen. Besides the climatically restricting factors, as pointed out by ALLAN NILSSON, the disappearing fälads* have contributed to its dying out. There is no sign of the Fire Toad being introduced to the county, as it forms quite a normal continuation of its area of distribution and the old name "bomtudse" goes back to mediaeval times. The Fire Toad seems to be dying out and is a rest from the post-glacial warmth period.

Pelobates fuscus. This species seems likewise never to have appeared outside Scania. It was originally found in Sweden by the baron v. DÜBEN in 1835. Restricted to the SW corner of the county and bound to sandy and mouldy areas, it is a species that burrows in light soils.

The Natterjack (*Bufo calamita*) is the only species which has a westerly distribution. It occurs from Bohuslän along the coast southwards to Scania, where it is fairly common in sandy areas in the south and central parts. In the east it continues along the coast through Blekinge to Kristianopel.

The Variegated toad (*Bufo viridis*) has a decidedly eastern distribution, occurring from Hälsingborg in the west and then almost exclusively coast-bound in Scania, through Blekinge, though there very rarely, along the coast. In Kalmar, Kalmar län, it is nowadays rare. It has been found in some other places in the same county, in a single place in the Östergötland archipelago, and is most common on Öland, where it seems to thrive best in the heated pools of the alvar area. In Gotland it has been found in two places, in Visby old harbour, where it is pro-

* With "fälads" is meant open grass-grown meadows used for pasture. Often they are very wet in spring. Nowadays they are generally densely covered with stones and junipers and restricted to higher levels.

bably nowadays extinct, and in the southern part of the island. Though the larvae may have been transported via the Baltic in brackish water, this find may be connected with that of *Hyla* and may point to a transport route via a southern Baltic island chain.

As the metamorphosis of the Natterjack is finished as early as the beginning of August, it seems to have ample time for its development during the summer. Probably, therefore, its distribution is regulated by the mild Atlantic winters which make it possible for the fullgrown toads to survive.

On the other hand, the Variegated Toad, which has its chief distribution in the continental east of Europe, can sustain very cold winters, but needs exceedingly warm summers. This means that it is restricted to the warm and continental parts of Sweden, where this toad can get sufficient time for the development of its larvae. They do not become metamorphosed before September.

The Tree frog (*Hyla arborea*) is found in south and central Scania (and may also occur in one or two localities in the NW part). Further it is reported from the western part of Blekinge. There are rumours too from the eastern part of this county. In older times it has been reported from Kalmar county and recently it has repeatedly been mentioned from the same county. A larva was found most unexpectedly on southern Gotland some few years ago. This is very interesting, as the find may show that the species invaded the island in post-glacial times via a chain of islands from the continent.

The Long-legged frog (*Rana dalmatina*) is the most pronouncedly relictary species of Sweden. The normal northernmost extension of its distribution stops at about 51° N. From there is a big gap northwards. In northernmost Germany—at Hamburg and at Rügen—there are two finds again. Then it reappears in S Scandinavia, on the islands of Bornholm, Zealand, Møen, and some of the smaller Danish islands. In Sweden it is found in the eastern part of Scania, in Blekinge, Kalmar county, on Öland and in N Halland. On Öland it occurs to the southern Alvar and to the northern part of the island. It is generally bound to hazel and sloe meadows, oak forest, more rarely appearing in beech forests.

The Edible Frog (*Rana esculenta*), on the other hand, is rather common in a certain district of western Scania and has been reported from one locality of eastern Scania too. Otherwise it has been met with in 4 places in Kalmar county, in 2 cases in Östergötland and in several localities in Uppland. In the northernmost localities of Uppland it was found in several places on the coast and island areas. It is reported there in a pronounced form of *lessonae*.

The Sand Lizard (*Lacerta agilis*) is tolerably common in Scania, otherwise rare and local everywhere. On the west coast it is found as far northwards as to N Bohuslän, near the Norwegian border. A dusk-coloured form has been met with in Västergötland, near the N Småland border. Along the coast it occurs here and there in Kalmar län and Östergötland. It is rare in Södermanland and Uppland. One clearly relictary occurrence remains from more than 100 years ago, from Dalarna. It does not occur on Öland or Gotland, which seems to show

that there were never dry land-bridges or such, with suitable ecological conditions, from the islands to the mainland (cf. the island of Anholt above).

The Smooth Snake (*Coronella austriaca*) is fairly common from the eastern part of Scania to the continental eastern part of S and central Sweden. Furthermore, it is found sparsely from the central Swedish west coast to the southern part of Norway. From the vicinity of Gothenburg, it extends inland to Alingsås and Trollhättan. Otherwise it is rare or lacking in the central Swedish inland. Northwards it extends along the east coast in the southern part of Norrland. It is rather common on Öland and Gotland, which seems to demonstrate the great swimming abilities of this snake (N.B. it also occurs on Åland which has never been in land connection with the mainland).

The Warty Newt (*Triturus cristatus*) is fairly rare in south and middle Sweden. It seems to be more common in the western part of this area. The larvae are generally found in forest pools. It does not occur on Gotland, but is found on Öland and may have invaded this island during a land connection in the *Ancylus*-time.

From Stensele (S Lapland) there is a relictary find of a larva which did not metamorphose in aquaria during the first year, but retained its gills till the second year at a size of 94 mm. In several northern localities there is a completely black variety.

The Smooth Newt (*Triturus vulgaris*) is common everywhere in south and central Sweden and also on Öland and Gotland. It occurs still along the eastern coast of S Norrland. From there in Jämtland and in the central Norrland coastland it is substituted by a race with a low crest in the males. From Stensele come also neotenous larvae.

The Slow Worm (*Anguis fragilis*) is common in S and central Sweden and occurs along the Norrland coast at least to Lövånger (64° N). It is common on Öland, but it is rather doubtful if it is really indigenous on Gotland.

The Grass-snake (*Natrix natrix*) is common in S and central Sweden, on the Baltic islands and along the coast-land of S Norrland. The variability of the colour is fairly wide, especially in eastern Sweden and on Gotland, where several colour varieties occur which are not found or are very rare in the rest of the country. There are in Norrland and in the inner part of Lapland a number of finds of relictary nature from warm south mountain slopes. Many of them seem, because of unfavourable climatical development and ecologically unsuitable conditions, to have a tendency to become extinct nowadays.

Rana arvalis is common in S and central Sweden with a northern border in central Värmland, S Dalarna and in the east coast district up to about Sundsvall (62° N). It is the single *Rana* species occurring on Gotland, in large parts of S Västergötland, W Småland, in the major part of Blekinge, the eastern part of Småland, and on Öland it is also the only *Rana* species, except in the rich parts of the leafy forests of southern type, where it is substituted by *Rana dalmatina*. It is not easy to find a common ecological rule for this appearance. In the

rainy west it prefers the vast boggy areas, where the sun is baking on the lags, in the dry east it occurs in small swamps, generally characterized by *Cyperaceae* grasses, and on the Baltic islands it even occurs in fens.

Far up in the high north, 200 km north of the otherwise most northerly appearance, the species reappears between 64° and 67° N. (A. Dahm 1953; K. Curry-Lindahl 1956). This is a form characterized by a proportionally larger toetubercle and a shorter tibia.

The Common Frog (*Rana temporaria*) occurs from Scania up to the northernmost part of Sweden. There is, however, an important exception: it does not occur in W Småland and S Västergötland and in the east it is lacking in eastern Småland and Blekinge and on the Baltic islands. It is also absent from Bornholm, Falster, Langeland and Lolland in Denmark. There is a strip of occurrence along our Swedish west coast and also up through the central part of Småland which joins the area of occurrence between Scania and central Sweden. The central Småland area seems to be characterized by lakes with meadowy shores.

The three remaining species: the Common Toad (*Bufo bufo*), the Common Lizard (*Lacerta vivipara*) and the Adder (*Vipera berus*), are distributed over practically the whole of Sweden, the northern border being situated at about 67° N. It is probable that the common frog and the common lizard reach the Arctic Ocean.

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Junior author's address: Zoologiska Institutionen, Lund, Sweden.