13. Herpetofaunal survey of Israel (1950–85), with comments on Sinai and Jordan and on zoogeographical heterogeneity

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Abstract

Methodical collecting, with mapping, has amassed over 30,000 specimens of amphibians and reptiles from Israel (with the Golan plateau and part of Mt. Hermon) at Tel Aviv University and the Hebrew University of Jerusalem. Included are at least 102 species and subspecies: seven amphibians, six marine turtles and 89 land and freshwater reptiles. Taxa described or discovered in Israel since 1950 (review by Haas) comprise 14 desert forms, six Mt. Hermon forms (including the endemic *Cyrtodactylus amictopholis* Hoofien, 1967), one mesic snake and two marine turtles.

A few reptiles once reported from Israel have disappeared, including the Nile crocodile; probably also *Discoglossus nigriventer* Mendelssohn and Steinitz, 1943. A few others are seriously endangered.

Sinai harbours seven additional species. Some comments are also made on the fauna of Jordan.

Zoogeographically the Israeli herpetofauna is heterogeneous, showing at least 12 distribution patterns, but most forms are Mediterranean *(sensu stricto)* or Saharo-Arabian.

Introduction

An updated overview of the herpetofauna of Israel is overdue. The most recent scientific review, 'on the present state of our knowledge of the herpetofauna of Palestine' was completed in 1950 by Haas (1951a). This covered only the reptiles; the amphibians had been dealt with by Mendelssohn and Steinitz (1944). There followed a discussion of the herpetofauna's zoogeographical origins (Haas 1952a). During the time elapsed since, there appeared no general review of the herpetofauna except, on the one hand, name-lists of species (rarely subspecies) by Hoofien (1967a, 1972) lacking details of ge-

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ographical distribution, and, on the other hand, Hebrew texts, mostly addressing the layman (Barash and Hoofien 1956, Dor 1965, 1975; Werner 1966a, 1973; Arbel 1984).

This paucity of written reports misrepresents both the degree of interest in the herpetology of Israel and the actual research activity that has been going on.

Interest in local herpetofauna

The Middle East has always attracted pilgrims travellers, naturalists and collectors. Thus, not only all the marine turtles but also several land and freshwater amphibian and reptilian species occurring in Israel, were already described by Linnaeus (1758), some from the Middle Eastern collections of his disciple F. Hasselquist (1766). The history of the herpetological investigation of Israel before 1950 has been reviewed by Haas (1951a) and need not be elaborated here. His one major omission is the activity of Aharoni, climaxed by a Hebrew text-book (1929) onto the pages of which unfortunately some European reptiles also found their way.

Naturally, visiting collectors emphasized the listing of taxa from the area, with only varying attention to their geographical distribution. With the gradually intensifying research by resident biologists during the 20th century, increasingly more emphasis was placed on distributions within Israel. Coupled with this was realization of the biogeographical complexity of the area (Kosswig 1955; Por 1975). The Mediterranean Sub-region of Wallace (1876), regarded by later zoogeographers as a transition zone (Beaufort 1951: 41) or as unworthy of recognition (Darlington 1957: 442), actually comprises a number of discrete, even contrasting, life zones. In Israel we find, from north to south, the mesic Mediterranean *(sensu stricto),* the (narrow) steppic Irano-Turanian and the desertic Saharo-Arabian sub-regions of the Palearctic region. Originally based on the work of Grisebach (1872), this classification was first applied to Israel by Eig (1931) for plants and by Bodenheimer (1935a, b) for animals. We shall deal with this matter further in the Discussion (Fig. 4).

Local research activity

The biogeographical heterogeneity of the country has intensified the attention to the ecological and geographical distribution of reptiles and other organisms. At the Hebrew University, where I studied since 1950 and have been caring for the herpetological collections since 1953, this attitude generated efforts to document each taxon from as many parts of the country as possible and to note localities in increasing detail and precision (see Methods). By now the collections hold some 16,000 specimens (including tadpoles) from Israel and Sinai.[1]

Work at Tel Aviv University has built up collections of similar scope.

But whereas Israeli researchers have been publishing their studies on morphology, physiology, behaviour etc. of reptiles, publication of the herpetological survey of Israel s.s. has been postponed in expectation of yet greater perfection. Beyond the lists and popular works mentioned above, there only appeared reports on new or problematical taxa (quoted later where relevant) or on collections from adjacent areas: Turkey (Bodenheimer 1944), Iraq (Haas 1952b), Arabia (Haas 1957, 1961; Haas & Battersby 1959), Dahlak archipelago (Hoofien and Yaron 1964), Lebanon (Zinner 1967), SW Asia in general (Haas and Werner 1969), Jordan (Hoofien 1965; Werner 1971), Mt. Hermon (Hoofien 1967b, 1968, 1973, 1980, 1983; Zinner 1972b; Werner and Avital 1980), Sinai (Hoofien 1965; Werner 1973, 1980, 1982a) and NE Egypt (Werner 1983).

Currently work is progressing on a full summary of the herpetological survey of Israel (with the Golan plateau and part of Mt. Hermon) and of Sinai, based in part on collaboration with J.H. Hoofien which involves the manual mapping of locality records (Werner 1977). In parallel there proceeds an extensive computerized study of morphological variation in common squamates throughout the Levant (Kosswig, Lavee and Werner 1976). What follows is a brief interim report on the first project, somewhat encumbered by persisting doubts about the precise taxonomic status of several taxa.

Materials and methods

Material

The material from Israel (with the Golan plateau and part of Mt. Hermon) housed in the Hebrew University of Jerusalem (HUJ) and Tel Aviv University (TAU), comprises over 30,000 specimens. This material results from assorted collecting activities, ranging from single-specimen donations by the public to specialised field trips carefully aimed at sampling from new or ecologically interesting localities. The intensity of sampling varied greatly between sections of the total survey area (Fig. 1). With few exceptions specimens were formalin-fixed, alcohol-preserved and individually catalogued.

Taxonomy and nomenclature

Specimens were identified, when necessary, by standard keys (Barash and Hoofien 1956; Marx 1968) or by specific literature later referred to with respect to various species. The taxonomic names used here sometimes differ from those used by Haas (1951a). They accord with convention, or are referenced

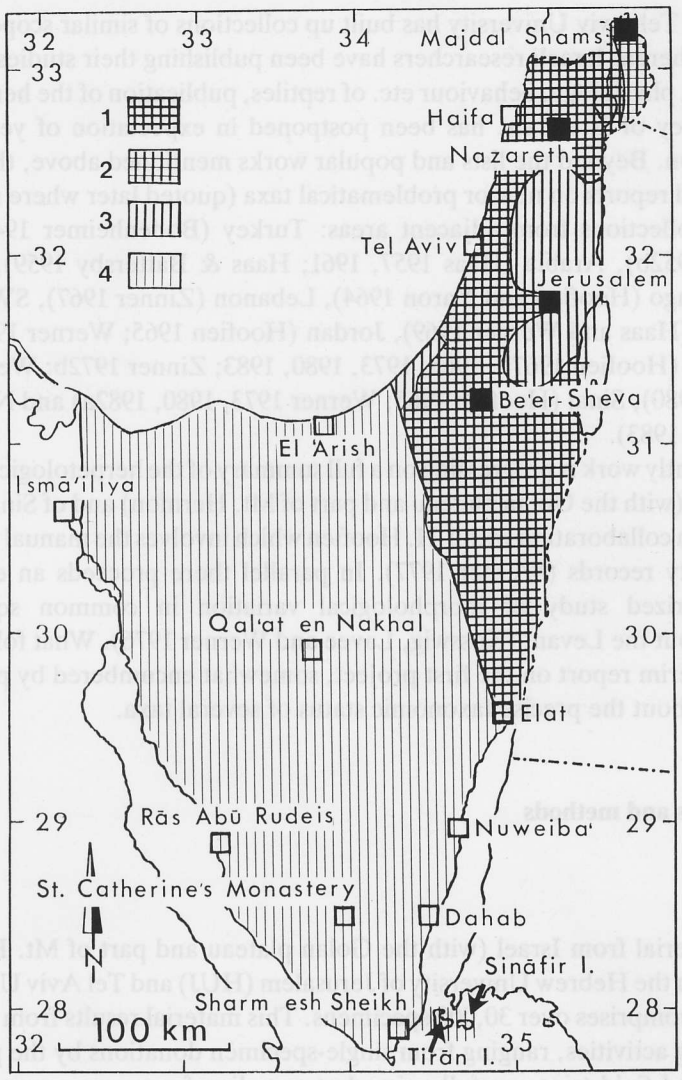

Figure 1. Survey areas and localities for orientation. 1. Israel of 1948, best studied area; 2. Golan plateau, accessible since 1967, fairly well studied; 3. The Samaria, Judea and Gaza areas, accessible since 1967 but poorly studied excepting the Jordan Valley; 4. Sinai, accessible in 1956–57 and 1967–82 (partial reports; Werner 1982a, b). The localities appear on Figs 2–4 without legends.

where relevant, as far as possible only within the Tables (1–3). I endeavoured to refer to all major post-1950 systematic revisions (below the genus level) and faunal reports affecting local populations.

Table 1. The Amphibia of Israel.

Taxa occurring in Israel	References for taxonomy and nomenclature
URODELA	
Salamandridae	
Salamandra salamandra infraimmaculata (Martens, 1885)	Degani 1979
Triturus vittatus vittatus (Jenyns, 1835)	Steinitz 1965
ANURA	
Discoglossidae	
Discoglossus nigriventer Mendelssohn and Steinitz, 1943	Mendelssohn and Steinitz, 1943
Pelobatidae	
Pelobates syriacus syriacus Boettger, 1889	
Bufonidae	
Bufo viridis Laurenti, 1768	
Hylidae	
Hyla savignyi (Audouin, 1827)	Brzoska and Schneider 1982 Schneider *et al.* 1984
Ranidae	
Rana ridibunda ridibunda Pallas, 1771	

Table 2. The marine Reptilia of Israel.

Taxon[a]	Documented from Israeli coasts of	
	Mediterranean[b]	*Red Sea*[b]
TESTUDINES		
Cheloniidae		
Caretta caretta (Linnaeus, 1758)	+ +	+
Chelonia mydas (Linnaeus, 1758)	+ +	+
Eretmochelys imbricata imbricata (Linnaeus, 1766)	+	
Eretmochelys imbricata bissa (Rueppell, 1835)		+
* *Lepidochelys olivacea* (Eschscholtz, 1829)		+
Dermochelyidae		
Dermochelys coriacea (Linnaeus, 1766)	+	+

* Not listed by Haas (1951: p. 95) for Israel.

[a] Taxonomy and nomenclature in this table follow Pritchard and Trebbau (1984).

[b] Symbols: + = present, + + = breeding.

Table 3. The terrestrial Reptilia of Israel.

Taxon*	Occurrence within Israel**				Reference for taxonomy and nomenclature***
	Mediterranean	Mainly Mt. Hermon	Mainly southern deserts	Mainly Wadi 'Arava	
TESTUDINES					
Emydidae					
Mauremys caspica rivulata (Valenciennes, 1833)	+				Busack and Ernst 1980
Testudinidae					
Testudo graeca floweri Bodenheimer, 1935	+				Hoofien 1972
Testudo graeca terrestris (Forskål, 1775)	+	+			Wermuth and Mertens 1961
* *Testudo kleinmanni* Lortet, 1883			+		Wermuth and Mertens 1961
Trionychidae					
Trionyx triunguis (Forskål, 1775)	+				
SAURIA					
Gekkonidae					
Bunopus blanfordii (Strauch, 1887)				+	Anderson 1973
* *Cyrtodactylus amictopholis* Hoofien, 1967		+			Hoofien 1967b
Cyrtodactylus kotschyi orientalis Štěpánek, 1937	+				
Hemidactylus turcicus turcicus (Linnaeus, 1758)	+	+	+	+	
Ptyodactylus hasselquistii guttatus von Heyden, 1827	+		+	+	Werner 1965
* *Ptyodactylus hasselquistii* cf. *hasselquistii* (Donndorff, 1798)			+	+	Werner 1965
Ptyodactylus hasselquistii puiseuxi Boutan, 1893	+	+			Werner 1965
Stenodactylus doriae (Blanford, 1874)				+	Arnold 1980a
* *Stenodactylus petrii* Anderson, 1896			+		Arnold 1980a
Stenodactylus sthenodactylus sthenodactylus (Lichtenstein, 1823)	(+)		+	+	Arnold 1980a
Tropiocolotes nattereri Steindachner, 1901			?	?	Leviton & Anderson 1972
Tropiocolotes steudneri (Peters, 1869)			+	+	Leviton & Anderson 1972
Agamidae					
Agama pallida pallida Reuss, 1833			+	+	Werner 1971
Agama savignii Duméril & Bibron, 1837			+		Flower 1933
Agama sinaita von Heyden, 1827			+	+	
* *Agama stellio brachydactyla* Haas, 1951 *Agama stellio* ssp.	+	+	(+)		
Uromastyx aegyptius (Forskål, 1775)			+	+	
* *Uromastyx ornatus* von Heyden, 1827			+		
Chamaeleonidae					
* *Chamaeleo chamaeleon musae* (Steindachner, 1900)			+		Hoofien 1964
Chamaeleo chamaeleon rectcrista Boettger, 1880	+	+			Hoofien 1964
Scincidae					
Ablepharus kitaibelii kitaibelii (Bibron & Bory, 1833)	+	+			Fuhn 1970
Chalcides guentheri Boulenger, 1887	+	+			
Chalcides ocellatus (Forskål, 1775)	+	+	+	+	Hoofien 1972
Eumeces schneideri pavimentatus (Geoffrey-St. Hilaire, 1827)	+	+			Eiselt 1940
* *Eumeces schneideri schneideri* (Daudin, 1802)			+	+	Eiselt 1940
Mabuya vittata (Olivier, 1804)	+	+			
Ophiomorus latastii Boulenger, 1887	+				Leviton & Anderson 1966
Scincus scincus scincus (Linnaeus, 1758)			+		Arnold & Leviton 1977
Sphenops sepsoides (Audouin, 1829)	(+)		+	+	Pasteur & Boins 1960

Table 3. (Continued).

Taxon*	Occurrence within Israel**				Reference for taxonomy and nomenclature***
	Mediterranean	Mainly Mt. Hermon	Mainly southern deserts	Mainly Wadi 'Arava	
Lacertidae					
Acanthodactylus boskianus (Daudin, 1802)			+	+	Salvador 1982
* *Acanthodactylus opheodurus* Arnold, 1980			+	+	Arnold 1980b, Salvador 1982
Acanthodactylus pardalis (Lichtenstein, 1823)			+		Salvador 1982
Acanthodactylus schreiberi syriacus Boettger, 1879	+				Salvador 1982
Acanthodactylus scutellatus scutellatus (Audouin, 1829)	(+)		+		Salvador 1982
* *Lacerta laevis* cf. *kulzeri* (Mueller & Wettstein 1932)		+			Hoofien & al., in MS, Budak 1976
Lacerta laevis laevis Gray, 1838	+	+			
Lacerta trilineata israelica Peters, 1964	+	+			Peters 1964
Mesalina guttulata guttulata (Lichtenstein, 1823)			+	+	
Mesalina olivieri schmidti (Haas, 1951)			+	+	Haas 1951b
Ophisops elegans ehrenbergii (Wiegmann, 1835)	+	+			Öktem 1963, Werner 1971
Anguidae					
Ophisaurus apodus (Pallas, 1772)	+				Obst 1981
Varanidae					
Varanus griseus griseus (Daudin, 1803)			+	+	Mertens 1954
OPHIDIA					
Leptotyphlopidae					
Leptotyphlops macrorhynchus (Jan, 1864)	(+)		+		Hahn 1968
Typhlopidae					
Typhlops simoni (Boettger, 1879)	+				
Typhlops vermicularis Merrem, 1820	+	+			
Boidae					
Eryx jaculus turcicus (Olivier, 1801)	+	+			Baran 1976
Colubridae ('Aglypha')[2]					
* *Coluber elegantissimus* (Guenther, 1878)				+	
Coluber jugularis asianus (Boettger, 1880)	+	+			Zinner 1972a
Coluber nummifer Reuss, 1834	+				Werner & Avital 1980, Schaetti & Agasian 1985
* *Coluber ravergieri* Ménétriés, 1832		+			Hoofien 1968, Werner & Avital 1980, Schaetti & Agasian 1985
* *Coluber rhodorachis* ssp.	+		(+)		Perry, in MS
Coluber rhodorachis spp.			+	+	Perry, in MS
Coluber rogersi (Anderson, 1893)			+		
Coluber rubriceps (Venzmer, 1919)	+	+			Baran 1976
Eirenis coronella (Schlegel, 1837)	+				Hoofien 1972
Eirenis coronelloides (Jan, 1862)			+		Hoofien 1972
Eirenis decemlineata (Duméril & Bibron, 1854)	+				
* *Eirenis modesta* (Martin, 1838)	(+)	+			Hoofien 1968
Eirenis rothi Jan, 1865	+	+			
* *Elaphe hohenackeri taurica* (Werner, 1898)		+			Hoofien 1973
* *Elaphe quatuorlineata sauromates* (Pallas, 1814)	(+)	+			Zinner 1972b
Lytorhynchus diadema (Duméril & Bibron, 1854)	(+)		+	+	Leviton & Anderson 1970

Table 3. (Continued).

Taxon*	Occurrence within Israel**				Reference for taxonomy and nomenclature***
	Mediterranean	Mainly Mt. Hermon	Mainly southern deserts	Mainly Wadi 'Arava	
Natrix tessellata tessellata (Laurentius, 1768)	+	+			
Rhynchocalamus melanocephalus (Jan, 1862)	+		(+)		
Spalerosophis diadema cliffordi (Schlegel, 1837)			+	+	Lanza 1964
Colubridae ('Opisthoglypha')[2]					
Macroprotodon cucullatus cucullatus (Geoffroy-St. Hilaire, 1827)			+		Lanza 1973
* *Malpolon moilensis* (Reuss, 1834)			+	+	
Malpolon monspessulanus insignitus (Geoffroy-St.-Hilaire, 1827)	+	+			Lanza 1973
Micrelaps muelleri (Boettger, 1880)	+				
* *Psammophis aegyptius* Marx, 1958				+	Marx 1958
Psammophis schokari (Forskål, 1775)	+		+	+	Marx 1958
Telescopus dhara (Forskål, 1775)	(+)		+	+	Hoofien 1972
Telescopus fallax syriacus (Boettger, 1880)	+	+			
* *Telescopus hoogstraali* Schmidt & Marx, 1956			+		
Atractaspididae					
Atractaspis engaddensis Haas, 1950	(+)		+		
Elapidae					
Walterinnesia aegyptia Lataste, 1887	(+)		+	+	Marx 1953
Viperidae					
Cerastes cerastes cerastes (Linnaeus, 1758)			+		Leviton & Anderson 1967
* *Cerastes gasperettii* ssp.				+	Werner & al. in MS
Cerastes vipera (Linnaeus, 1758)			+		
Echis coloratus Guenther, 1878	(+)		+	+	
Pseudocerastes persicus fieldi Schmidt, 1930			+		Joger 1984a
* *Vipera bornmuelleri* Werner, 1898		+			Mertens 1967
Vipera palaestinae Werner, 1938	+	+			Joger 1984a

* Not listed by Haas (1951: p. 95) for Israel.

** Symbols: + = present; (+) = present only rarely or marginally, or due to penetration of desert element along suitable habitat into principally Mediterranean zone; ? = presence doubtful due to doubtful identification.

*** Given only where deemed useful.

Localities and distributions

Locality data preferably included coordinates accurate to the nearest 100 m from a topographical map (Survey of Israel, Ministry of Labour, Israel Grid or UTM); this has been followed especially at the Hebrew University after 1972. Where original locality records lacked grid references, the latter were reconstructed from such topographical maps, and as a precaution coded accordingly. For each species locality records from this material (plus some few personal observations of J.H. Hoofien or myself) were entered on a pre-printed base map, 1:1,000,000 or 1:2,000,000, with an overprinted pale blue Grid of Israel network (Werner 1977). From these maps (Fig. 2) derives the information on distributions (Fig. 3) summarized here.

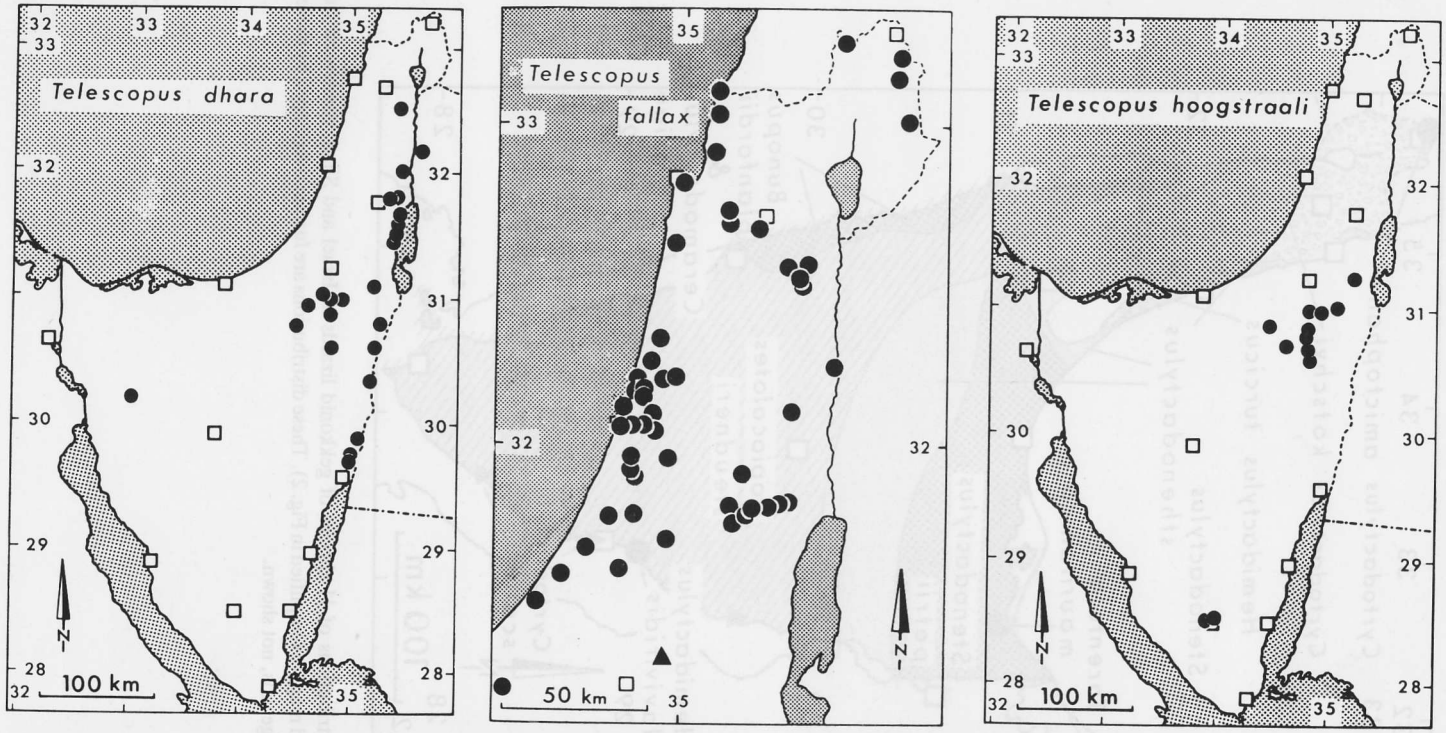

Figure 2. Examples of the locality record maps used for this summary. (a) *Telescopus dhara* occurs throughout the desert with the Jordan Valley, elsewhere in both NE Africa and Arabia; (b) *T. fallax* inhabits N Israel and countries northwards; (c) *T. hoogstraali* is endemic to the desert of Israel and Sinai. (The triangle in the *T. fallax* map marks a possible intermediate between the last two species.)

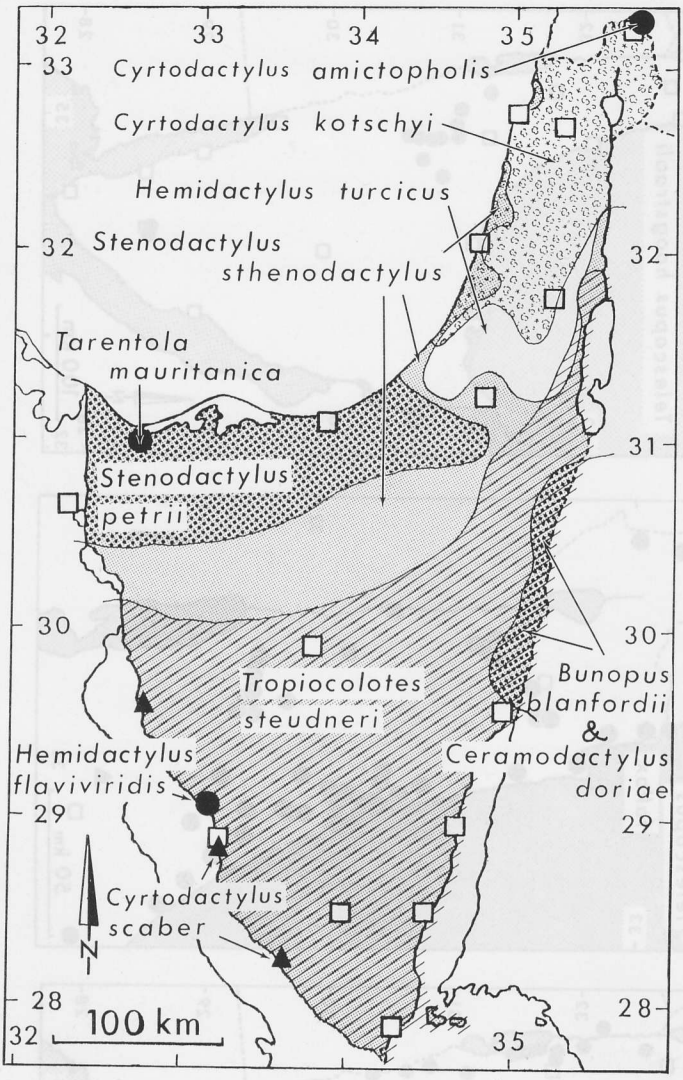

Figure 3. Distributions of 11 species of gekkonid lizards in Israel and Sinai, condensed from locality record maps (exemplified in Fig. 2). These distributions are further overlapped by those of *Ptyodactylus* geckos, not shown.

Results and comments

Species found

The material comprises at least 102 species and subspecies, listed in Tables 1–3 and annotated below where necessary. Subspecies are listed when I felt confident of their being distinct (on at least the subspecific level). On the other hand I have excluded certain subspecies, especially of *Ophisops elegans* (Haas 1951a) and *Uromastyx aegyptius* (Hoofien 1972) which I feel require more thorough validation. Tables 1–3 include 20 taxa which have either been newly described, or at least confirmed for Israel, since the review by Haas (1951a). These are indicated by an asterisk in Tables 1–3.

Amphibia. Seven species (Table 1), all more or less confined to the north of the country (Mendelssohn and Steinitz 1944; Werner 1948, 1949; Wahrman 1970). *Triturus vittatus chuldaensis* Bodenheimer, 1926 has been synonymized by Steinitz (1965) with *T. v. vittatus*. Of *Discoglossus nigriventer* there exist only the type (Mendelssohn and Steinitz 1943, 1944) and one later, much larger individual (Steinitz 1955). The two tadpole paratypes have been lost. The taxonomy of the local *Bufo viridis* (see also Flindt and Hemmer 1968) is currently being studied elsewhere.

Reptilia: Testudines. Five marine turtle species (Table 2) occur (with varying frequency) in the Mediterranean and Red Sea coastal waters of Israel (Ben-Tuvia in MS, Frazier and Salas 1984). However, only *Caretta caretta* and *Chelonia mydas* nest here, in very small numbers, on the Mediterranean shore (Sagi 1984). Of the four land and freshwater species (Table 3), the occurrence of *Testudo kleinmanni* (= *'leithi'*) in the (northern) Negev was rediscovered only in 1963, during a student field trip guided by J.H. Hoofien, the late G. Haas and myself (Werner 1982c). In the SW of the range of *T. graeca* in Israel, the delimitation of *T. g. floweri* remains unclear; in the NE of the country, the taxonomic significance of the morphological distinction of *T. graeca* on the Golan awaits clarification.

Sauria: Gekkonidae. Among the 11 taxa (Table 3 and Fig. 3) one, *Cyrtodactylus amictopholis* is so far only known from Mt. Hermon. *C. kotschyi* has been hypothesized to inhabit mainly that part of the Mediterranean zone, where the day-night temperature difference is moderate (Werner 1966b). Five others are narrow-toed ground dwellers of the desert. That both *Stenodactylus doriae* and *S. petrii* occur in Israel, the former in the Wadi 'Arava, the latter in the western Negev, is only understood thanks to the clarification by Haas (1956). Arnold (1980a) has urged not to use trinomials for the highly variable *S. sthenodacty-*

lus. But Loveridge's (1947) proposal of an eastern *S. s. sthenodactylus* and a western *S. s. mauritanicus* gains some support from geographical variation in vertebral numbers (Werner 1964). The distinction and occurrence within Israel of a sixth terrestrial gecko, *Tropiocolotes nattereri,* await validation. The three *Ptyodactylus* forms are here conservatively listed as subspecies (Werner 1965). Whereas Wermuth (1965) has regarded them as consubspecific, evidence from several directions of research is pilling up towards their recognition as species (Werner and Frankenberg 1981; Werner in preparation).

Agamidae. Of the six species, the commonest presents the most complicated case: despite Daan's (1967) efforts, the local subspecific taxonomy of *Agama stellio* still requires clarification (Nevo 1981). *A. s. brachydactyla* is well defined in the central Negev (and parts of Sinai). But in Mediterranean Israel *A. stellio* is probably distinct from *A. s. stellio,* and a somewhat similar form occurs in the southernmost Negev (and southern Sinai). The other agamids are limited to the desert; *A sinaita* occurs in Israel only in the southern desert, not in northern Israel as interpreted by Wermuth (1967). *Uromastyx aegyptius* is suspected of perhaps including a sibling of smaller dimensions (Bouskila 1984).

Chamaeleonidae. The relations between the quite variable *Chamaeleo chamaeleon recticrista* of Mediterranean Israel, and *C. c. musae* of the Negev (and N Sinai) sands, are complex (Hoofien 1964 pers. obs.). The map presented by Hillenius & Gasperetti (1984) is oversimplified through the omission of *C. c. musae* records from northern Sinai and the western Negev.

Scincidae. The nine taxa are about equally divided over the mesic and desertic regions. The difference between the Mediterranean *Eumeces schneideri pavimentatus* and the desertic *E. s. schneideri* are considerable, in that the former, unlike the latter, shows marked sexual dichromatism. Indeed, Taylor (1935: 552–553) depicted male and female '*pavimentata*', both from 'Haifa, Syria' but labelled the male '*E. schneideri*'.

Lacertidae. Of the 11 taxa, all the *Lacerta* and *Ophisops* are Mediterranean *(sensu lato),* the *Acanthodactylus* and *Mesalina* – desertic. *Acanthodactylus opheodurus* has been mistaken for *boskianus asper* till its recent description from Arabia and recording from Israel (Arnold 1980b; Salvador 1982). We have yet to elucidate the precise distributions and ecological relationships of these two species. There is some argument (Hoofien 1972) whether *A. schreiberi syriacus* is specifically distinct from, or a subspecies of, *A. boskianus* (Daudin 1802). The *Lacerta laevis* cf. *kulzeri* population on Mt. Hermon was previously (Hoofien 1972, Arnold 1973) mistaken for *Lacerta danfordi*

(Guenther, 1876) (Hoofien 1983; Hoofien, Sivan and Werner in MS). The *L. laevis* population on the NW shores of Lake Kinneret, of distinction, may also deserve subspecific recognition. *Mesalina guttulata* and *M. olivieri* have been lumped by some authors (e.g. Marx 1956, 1968) but are quite distinct both morphologically (Haas 1951b; Barash and Hoofien 1956) and ecologically: the former inhabits various terrains including rocky ones but excluding sand-dunes; the latter prefers sandy soils including dunes. Even where the two co-exist one finds few suspected hybrids.

Anguidae. Ophisaurus apodus is characteristic of the Mediterranean maquis and shrub landscapes. It is unknown to what subspecies the local population belongs (Obst 1981).

Varanidae. Varanus griseus inhabits light desert soils and reaches Tel Aviv in the NW and the Jordan Valley in the NE (Stanner 1983).

Ophidia: Leptotyphlopidae. Leptotyphlops macrorhynchus occurs mainly but not only in the desert. According to Hahn (1978) *L. phillipsi* Barbour, 1914 (Barash and Hoofien 1956; Hoofien 1972) is a synonym.

Typhlopidae. Typhlops vermicularis has a wide distribution in the Mediterranean, and *T. simoni* a spotty one.

Boidae. Eryx jaculus occurs in the Mediterranean areas, including the northern Negev, mainly (not exclusively) in light soils.

Colubridae (*'Aglypha'*[2]). Of the 19 taxa, nine range widely in the Mediterranean and five in the desertic areas; four are restricted (or almost so) to Mt. Hermon, and one – to the Wadi 'Arava. Specimens of *Coluber rhodorachis* sspp. were previously all identified as *C. rhodorachis* but two taxa are morphologically distinct (Werner 1985; Perry in MS). They are well defined geographically, occupying northern *vs.* southern parts of the Israeli range previously accorded to *C. rhodorachis*. Unfortunately, *Eirenis coronella* was in recent decades often termed *E. lineomaculata* Schmidt, 1939, whereas *E. coronelloides* was termed *E. fasciatus* Jan, 1863, or, worse, *E. coronella* Schlegel, 1837 (Barash and Hoofien 1956; Hoofien 1972; Baran 1976; Schmidtler and Schmidtler 1978; Arnold 1982).

Colubridae ('Opisthoglypha'). Of the nine taxa, four are Mediterranean, four are desertic, and one, *Macroprotodon,* is known only from the most southern sandy areas near the Mediterranean coast. The presence of *Psammophis aegyptius* in the southernmost Wadi 'Arava (Werner 1973), rather than *P.*

schokari, was detected only upon re-examination of museum material, after the existence of both species in Sinai raised the problem. *Telescopus dhara* (including *guentheri* and *obtusus*) needs revision. *T. hoogstraali* was regarded by Zinner (1977) as a subspecies of *T. fallax* but I regard his evidence as open to more than one interpretation.

Atractaspididae. Since its description from the 'En Gedi oasis on the western shore of the Dead Sea (Haas 1950), *Atractaspis engaddensis* has also been recorded from numerous locations in the southeastern deserts and southern Sinai and from the Jordan Valley, apparently also from nearby Arabia (Joger 1984a).

Elapidae. Since its discovery in Israel (Aharoni 1944), *Walterinnesia aegyptia* has similarly been found throughout the deserts of southern Sinai and southern Israel and in the Jordan Valley.

Viperidae. Four of the six species are desert dwellers, one is Mediterranean and one is restricted to Mt. Hermon (and Lebanon mountains). The *Cerastes cerastes* population of the Wadi 'Arava is unique in that horns never occur, unlike the situation in Sinai to the west (Sochurek 1974) and in Arabia to the east (Leviton and Anderson 1967). The taxonomy of this species in Israel is being reviewed (Werner et al. in MS).

Species not found

In addition to the species listed in Tables 1–3, the occurrence of which in Israel is documented, many others have been mentioned in the literature as also occurring here. Neither those which simply are old synonyms, nor all of those which have been recorded from Israel through errors[3] can be discussed here. But I wish to briefly mention five cases of particular interest.

Bufo regularis Reuss was listed by Tristram (1885) and Steinitz (1957) as restricted, in Israel, to the Negev. Since no specimens from the Negev are known, Steinitz' statement appears to have been an extrapolation from the species' record from Petra, Jordan (SW Transjordan), discussed below under Some Comments on the Herpetofauna of Jordan (Werner, in press.).

Crocodylus niloticus niloticus Laurenti occurred in Israel till the turn of the century, its last stronghold having been the Kabara swamps and Nahal Taninim (River of Crocodiles) on the coastal plain W of Mt. Carmel. It was probably eradicated by hunting, perhaps augmented by later swamp-draining (Haas 1951a). One tooth was discovered in this area in 1961 (Ayalon 1979).

Blanus strauchi aporus Werner is, according to Lortet (1883), 'Assez commun sous les pierres, à Lattakièh et à Tibériade'; according to Tristram (1885),

who may simply be echoing this source, it is 'Not uncommon under stones on the Plain of Gennesaret and on the maritime plains'. The British Museum, which in principle has Tristram's material, has no documenting specimen. Our repeated searches around Lake Kinneret and elsewhere in the north of the country revealed none. Alexander (1966) depicts a locality record at Tiberias, but my inquiry at the Muséum d'Histoire Naturelle, Geneve, which owns the supposedly documenting specimen (MG 603.94) revealed, that the latter really originated from Latakie, and was lent out to Alexander carrying an erroneous (re-copied) label (V. Aellen, pers. comm. 4.IV.1967). Thus we have no proof that the animal really occurred in Israel. Nevertheless I tend to believe this because of the somewhat parallel case of *Vipera lebetina* (see below); the two cases are perhaps explicable by a single hypothesis.

Naja haje haje (Linnaeus) was 'met with . . . near Gaza, on the sandy plain' by Tristram (1885) who believed that 'in the plains and downs beyond Beersheba it is well known'. We could find no additional solid evidence of its occurrence within Israel, nor, for that matter, in Sinai, although we specifically inquired and traced all rumours. Haas (1951a) suggested that perhaps Tristram really saw another elapid which does occur in the Negev, *Walterinnesia aegyptia*. Actually the two are unmistakably different in coloration. At the time (1951) *Malpolon moilensis* was not known from Israel; since this snake assumes a cobra-like defensive posture with spread hood so that observers are often misled (Gasperetti 1974, 1977; Arbel 1984), it could be a more likely source of confusion.

Vipera lebetina obtusa Dwigubsky occurred in northern Israel in the past, according to convincing evidence reviewed by Bodenheimer (1957) and Joger (1984a). During the last half-century, however, no more specimens have been found in Israel. It seems that like *Blanus, V. lebetina* has disappeared from northern Israel sometime around the turn of the century. In other words, their distribution boundaries have receded northwards, since both species survive further to the north – from Lebanon to at least southeastern Turkey (Alexander 1966; Joger 1984).

Recent and imminent status changes

The dynamic aspects of the local distribution of amphibians and reptiles lie beyond the scope of this article and mostly have not been properly documented. A pity, because the rapid development of the country is believed to have changed the ranges of many species (Zinner 1974). Only some salient cases are reviewed below.

Recent range regressions. It is tempting to seek an explanation for the northward retreat of *Blanus* and *V. lebetina*. Although human activity has caused

assorted ecological changes in Israel, I regard the long-term climatic shift as a more likely factor: thus comparison of the average annual rainfall values for the international standard periods 1901–1930 and 1921–1950 shows a decline in rainfall over most of Israel, the differences ranging in the north from ca. 10 mm near Tiberias to ca. 90 mm near Akko (Rosenan & Manné 1957). Conceivably this affected *Blanus* directly but *V. labetina* in some (unknown) indirect way.

Some believe that this decline in rainfall significantly facilitated the artificial draining of the Hula swamps ('land reclamation') during the 1950's. It is generally suspected that this draining annihilated the endemic *Discoglossus nigriventer,* so that the total remaining representation of the species now amounts to two preserved specimens (Mendelssohn and Steinitz 1943; Steinitz 1955). Alternatively, populations may survive in nearby streams, awaiting their detection through more specialized searching methods (L.P. Knoepffler, pers. comm.).

Recent range extensions. The development of agricultural settlements in the Negev, and their application of irrigation (with water from the north), during the past 40 years, is believed to have had two kinds of 'positive' implications. On the one hand, there has occurred a marked southward extension of the ranges of frogs. Gershman and U. Werner (1983) plotted locality records of amphibians (from HUJ and TAU material) separately for the periods before and after 1946. Although collecting activities in the Negev also increased after 1948, the results are quite convincing. *Bufo viridis* extended its range (excepting possible isolated desert-oasis populations) roughly from 31° 30′ S to 30° 36′ S. *Rana ridibunda* and *Hyla savignyi* made smaller but significant advances. In parallel, *Mauremyus caspica rivulata* has extended its range southwards, through successfully populating newly constructed oxidation ponds and other artificial, polluted water bodies (Sidis 1983; Gasith and Sidis 1983). On the other hand, certain desert species have extended their ranges from the severe southeastern Negev to the north and west: notably *Echis coloratus* (Zinner 1974) and perhaps also *Walterinnesia aegyptia* which feeds i.a., on toads, made available as described above (Mendelssohn 1962, 1977, Zinner 1971).

Imminent local extinctions. For several species the proper ecological niches, of tiny extent within Israel, are shrinking dangerously; thus many breeding pools of *Triturus vittatus* and *Salamandra salamandra* have been eliminated. Worst may be the case of *Trionyx triunguis,* now more or less reduced to one coastal stream, Nahal Alexander (Ayal and Gasith 1983). The local breeding populations of the sea turtles are on the verge of extinction (Sagi 1985). The habitat of *Testudo kleinmanni* is also regarded as endangered (Mendelssohn 1982). *Lacerta trilineata israelica* has disappeared from some woodlands,

perhaps due to feral cats. *Natrix tessellata* used to be common, and in 'fish ponds a pest. In 1979 Dr. E. Kramer and I searched for it in vain at the Ma'agan Mikhael fish ponds where it had been particularly abundant, and were informed that it had recently become rare. This has since been confirmed for many, though not all, parts of its Israeli range. The reasons are unknown, though a resurge of *Herpestes ichneumon* is one suspected factor. All the snakes restricted locally to Mt. Hermon (Table 3) are endangered by overzealous amateurs.

Some comments on Sinai

The herpetofauna of Sinai (Werner 1982a) includes at least six species not occurring in Israel (Table 4); their zoogeographical relations have been discussed elsewhere (Werner 1982b).

Table 4. Species of Reptilia occurring in Sinai but not in Israel.

SAURIA
Gekkonidae
Cyrtodactylus scaber (von Heyden, 1827)
Hemidactylus flaviviridis (Rueppell, 1835)
Tarentola mauritanica fascicularis (Daudin, 1802)
Tropiocolotes nattereri Steindachner, 1901 (?)
Lacertidae
Mesalina brevirostris Blanford, 1874
Mesalina rubropunctata (Lichtenstein, 1823)
OPHIDIA
Colubridae
Coluber sinai (Schmidt and Marx, 1956)

I have three new comments:

Joger (1984b, c) in his thorough revision of *Tarentola* maps *T. annularis annularis* (Geoffrey, 1809) in both northwestern and southern Sinai. Actually our specimens from northwestern Sinai are *T. mauritanica fascicularis* (Daudin 1802). The record from the southern Sinai mountains derives only from two pre-1882 specimens in the British Museum, collector unknown, and was never reconfirmed through additional material, although we searched the area repeatedly and thoroughly for rupicolous geckos and obtained many *Ptyodactylus*. There are circumstantial reasons for doubting the correctness of that record (Arnold pers. comm. 8.II.1985).

Previously I had to include *Coluber sinai* among the species whose presence I could not validate from our own material (Werner 1982a). But while that

paper was in press, we obtained a specimen found freshly killed outside the Zuqe Dawid Field School (near Santa Catherine monastery).

The record of *Coluber ventromaculatus* from Sinai, quoted by Gasperetti (1974) could conceivably have been based on a *C. rhodorachis* with ventrolateral blackish dots, as they sometimes occur in this species too.

Some comments on Jordan

Based on the latest (but partial) reviews (Werner 1971; Amr and Amr 1983; Disi 1983, 1985), the herpetofauna of Jordan (Transjordan) includes 15–17 species or subspecies which do not occur in Israel (Cisjordan) (Table 5). The following updating comments appear warranted.

Bufo regularis has been reported from Petra (Barbour 1914) but I reexamined the documenting specimens and they merely are small-spotted and/or pale-spotted (mostly male) *Bufo viridis* (Werner in press.).

Table 5. Species or subspecies of Reptilia occurring in Jordan (Transjordan) but not in Israel (Cisjordan).

SAURIA
Gekkonidae
Pristurus flavipunctatus guweirensis Haas, 1943
Stenodactylus grandiceps Haas, 1952
Agamidae
Agama blanfordi fieldi Haas and Werner, 1969
Agama pallida haasi Werner, 1971
Agama stellio picea Parker, 1935
Scincidae
Eumeces schneideri princeps (Eichwald, 1839)
Scincus scincus meccensis (Wiegmann, 1837)
Lacertidae
Acanthodactylus cantoris schmidti Haas, 1957
Acanthodactylus grandis Boulenger, 1909
Acanthodactylus robustus Werner, 1929
Acanthodactylus tristrami tristrami (Guenther, 1864)
Mesalina brevirostris microlepis (Angel, 1936)
Ophisops elegans blanfordi Schmidt, 1939
OPHIDIA
Colubridae ('Aglypha')
Coluber caspius schmidtii Nickolski, 1909
Colubridae ('Opisthoglypha')
Telescopus nigriceps (Ahl, 1924)

Lacerta danfordi danfordi Guenther was reported from Petra by Barbour (1914) and confirmed by Hoofien (1969) and Arnold (1973), based on keys then available. But with the aid of a more recent revision of the group (Budak 1976) the material is clearly identifiable as *Lacerta laevis* cf. *kulzeri,* resembling the Mt. Hermon population (mentioned above) (Hoofien, Sivan and Werner in MS).

Discussion

Biogeography of Israel

The biogeography of Israel is viewed differently by researchers judging from a distance and those working (or at least visiting) locally, as has already been hinted in the Introduction. Foreign zoogeographers either accept Wallace's (1876) Mediterranean sub-region (of the Palaearctic region) which includes Israel *in toto* (e.g., Bartholomew *et al.* 1911; Swan and Leviton 1962) or else downgrade it (e.g., Beaufort 1951; Darlington 1957) but elaborate no alternative.

On the other hand local zoologists, spearheaded by Bodenheimer (1935a, b) in principle more or less adopt the biogeographical scheme concluded by local botanists in successively refined editions (Eig 1931; Zohary 1957, 1962, 1970, 1973; Gruenberg-Fertig 1966).

This scheme, originally derived from the work of Griesebach (1872), relates to climatically based vegetation types (Gaussen 1960, Linton 1970). Figure 4 shows one recent version compiled after various sources as explained there. Represented are three sub-regions of the Palaearctic region: the Mediterranean (sensu stricto) woodland and scrubland (annual precipitation commonly over 250 mm), the Saharo-Arabian desert (annual precipitation usually much under 150 mm) and the intervening Irano-Turanian steppe (precipitation intermediate and irregular). The latter, within Israel, is phytogeographically a narrow zone and zoogeographically of disputed validity (Saint Girons 1982). These three sub-regions coincide with Koeppen's climatic regions (Geiger and Pohl 1954; Rosenan 1970), respectively: Csa (Mediterranean climate with warmest month over 22° C), BWhs (desert climate with mean annual temperature over 18° C, and dry summer), and BShs (steppe climate, also with mean annual temperature over 18° C, and dry summer). In addition, the dry and hot penetration zone of the Sudanian (Ethiopian), a sub-region of the Palaeotropic region, has been accorded increasing recognition (Gruenberg-Fertig 1966). However, one should remember that zone boundaries may shift depending on how one measures or weighs the representations of the various phytogeographical regions within a given area.

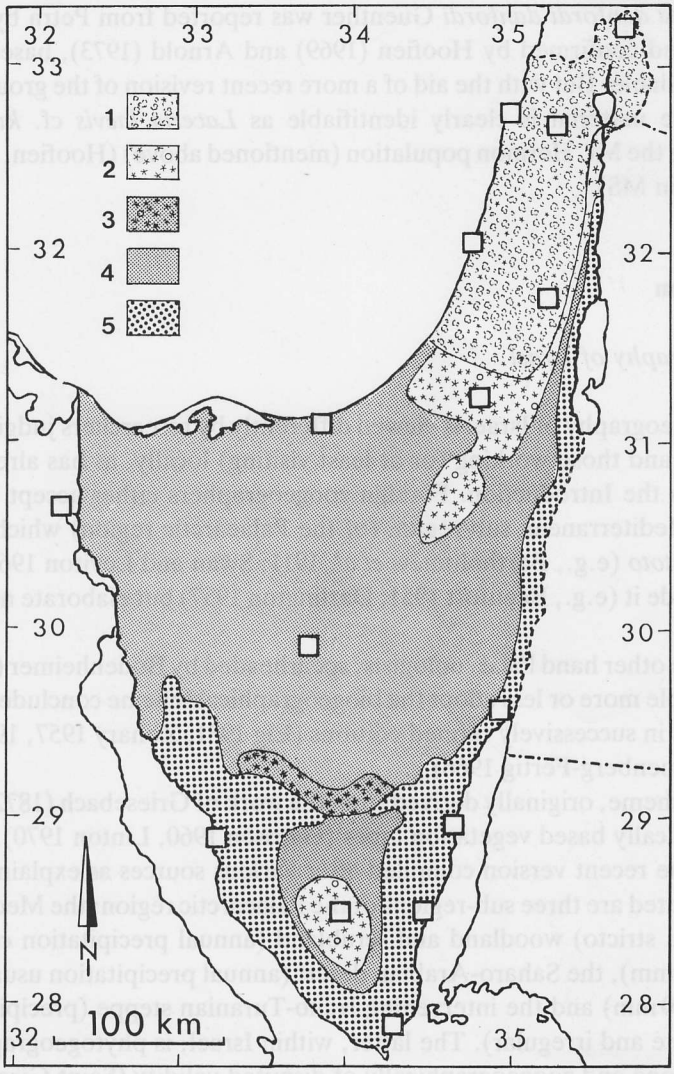

Figure 4. Biogeographical regions of Israel and Sinai, mainly based on Gruenberg-Fertig (1966), Haim (1969) and Zohary (1973).

1. Mediterranean;
2. Irano-Turanian;
3. Irano-Turanian – Saharo-Arabian transition;
4. Saharo-Arabian;
5. Sudanian penetration zone.

As noted elsewhere it is common but not compulsory for the distribution ranges of amphibians and reptiles to be in agreement with sub-region boundaries in the scheme (Bodenheimer 1936; Werner 1969, 1971; Haas and Werner 1969; Saint Girons 1982). Thus the representation of four such sub-regions within Israel provides much of the foundation for great zoogeographical heterogeneity of the herpetofauna.

Difficulties in zoogeographical analysis of the herpetofauna of Israel

Conventional zoogeographical-statistical analysis of an area, as applied for instance by Bodenheimer (1935a, 1937), requires that each kind of animal in the area be classified as an element of a named zoogeographical unit (or sometimes of two). This procedure is often foiled by three difficulties.

First, when deliberating a decision on the zoogeographical belonging of an animal, what taxonomic level should one observe? For example, the subspecies *Chamaeleo chamaeleon musae* lives in small bushes in the desert sands of southwestern Israel, northern Sinai and northeastern Egypt, i.e. completely within the Saharo-Arabian subregion, in sympatry with several Saharo-Arabian reptile species (Werner 1968, 1982a). The species *Chamaeleo chamaeleon,* on the other hand, may be regarded as Mediterranean (or as southwestern Palaearctic). But if one wishes to judge by 'origin', and examines the credentials of the 'group', then at the levels of both the genus *Chamaeleo* and the family Chamaeleonidae we deal with an African, Palaeotropic element (Hillenius 1959).

To be logical one probably would have to consistently adhere to the species level both because it is the smallest unit properly delimited from its relatives and because it is the only taxonomic level which is objectively defined, enabling relative uniformity. In practice it would be very difficult to refrain from blinking at the higher taxon whenever the species level is not informative, as with endemic species.

Second, there are too many cases where the status is doubted or debated (is it a subspecies or a species?), especially in Israel. Only some of these cases have been mentioned under Results and Comments: *Ptyodactylus hasselquistii guttatus, P. h. hasselquistii* and *P. h. puiseuxi,* or *P. hasselquistii, P. guttatus,* and *P. puiseuxi* (explained above)? *Agama pallida* or *A. mutabilis pallida* (Werner 1971; Hoofien 1972)? *Acanthodactylus schreiberi syriacus* (Mediterranean) or *A. boskianus syriacus* (Saharo-Arabian) (Hoofien 1972)? *Coluber ravergieri nummifer* or *C. nummifer* (Werner and Avital 1980)? *Vipera xanthina palaestinae* or *V. palaestinae* (Mendelssohn 1963; Joger 1984a)? Several further examples could be given.

Third, the affinities of the taxon are not always certain or persisting. For example, Haas (1952) regarded *Telescopus nigriceps* in the Negev as of eastern

origin. But after the Negev (and Sinai) population was separated from *T. nigriceps* as *T. hoogstraali* (Schmidt and Marx 1956), Zinner (1977) considered the latter an offshoot of the northern *T. fallax*. (But see my comment above, under Species Found.)

The combined effect of these three difficulties is to render conventional zoogeographical analysis, in terms of elements of sub-regions, very dubious. Hence I prefer to restrict myself to describing the zoogeographical composition of the herpetofauna merely in terms of the diversity of the actual distributions of the species (Saint Girons 1982).

Zoogeographical heterogeneity

Only the more typical patterns of terrestrial distribution, each common to at least a few species, can be discussed here (Fig. 5). In most cases these will be illustrated only with elected salient examples, from different families. Even so

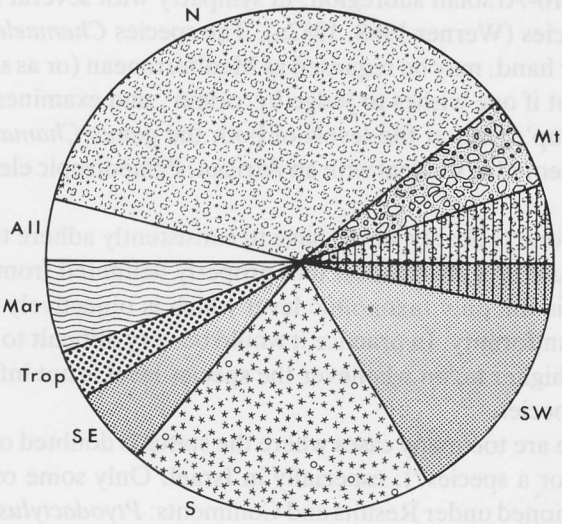

Figure 5. Distributional composition of the reptilian fauna of Israel (from Tables 2 and 3). *All:* species occurring throughout Israel (mainly circum-Mediterranean ones); *N:* species of northern Israel (and further north); *Mt. H:* species restricted, within Israel, to Mt. Hermon; *End. N:* species endemic to northern Israel or Mt. Hermon (and their immediate vicinity); *End. S:* species endemic to southern Israel (and immediate vicinity); *SW:* species of southwestern Israel (and the Sahara); *S:* species occurring throughout southern Israel (and usually in both NE Africa and Arabia); *SE:* species of the Wadi 'Arava (and Arabia); *Trop:* species of clear Sudanian affinities; *Mar:* marine species of any distribution pattern. (The sizes of 'cake slices' are proportional to species numbers.)

it will occasionally be necessary to digress from the species level and refer to those of the subspecies or the genus.

Circum-Mediterranean (all-Israel). Few species merit this term and even their distributions do not fully encircle the Mediterranean sea. *Hemidactylus turcicus* and *Chalcides ocellatus* locally fulfill this status by indeed occurring throughout the whole country. *Testudo graeca,* however, is restricted in Israel to the Mediterranean sub-region.

Mesic (northern Israel). Several species whose world distribution covers Europe or only the countries around the northeastern corner of the Mediterranean sea, roughly centering on Turkey, are limited in Israel, more or less strictly, to the Mediterranean sub-region: all the amphibians (except *Discoglossus*), *Cyrtodactylus kotschyi, L. trilineata, Ophisaurus apodus, Typhlops vermicularis, Coluber rubriceps, Eirenis rothi, Telescopus fallax.*

Mt. Hermon only. Four species whose world distribution resembles the above occur in Israel only or almost only on Mt. Hermon: *Coluber ravergieri, Eirenis modesta, Elaphe hohenackeri,* and *E. quatuorlineata sauromates.* In all these cases it is unclear whether the Mt. Hermon population is continuous with, or disjunct from, the species' general range.

Endemics (northern Israel). Additionally, *Cyrtodactylus amictopholis* (Fig. 6) is so far known only from Mt. Hermon and *Vipera bornmuelleri* occurs only on

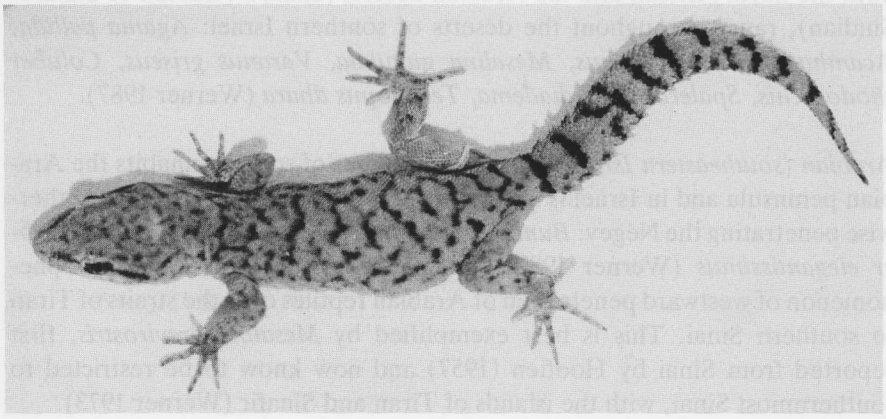

Figure 6. Cyrtodactylus amictopholis, a small gekkonid lizard endemic to Mt. Hermon (gravid female, actual total length approx. 70 mm).

the mountains of Hermon and Lebanon. *Lacerta laevis* cf. *kulzeri* (taxonomy doubtful) is apparently of similarly limited distribution (but see comments on Jordan). *Discoglossus nigriventer* is or was restricted to the Hula Valley. Some reptiles appear to be known only or mainly from northern (Mediterranean) Israel, or also from Lebanon, and the extent of their ranges further to the north is unclear: *Chalcides guentheri, Typhlops simoni, Micrelaps muelleri.*

Endemics (southern Israel). The distributions of two reptiles appear to coincide, roughly, with the Irano-Turanian subregion of Israel. *Telescopus hoogstraali* occurs only in a restricted area south of Be'er-Sheva and quite appropriately also on the central mountains of southern Sinai. *Acanthodactylus pardalis* is restricted in Israel to the loess-soil zone surrounding Be'er-Sheva, and the relationship of this disjunct population to its name-sakes in surrounding countries is dubious (the species is absent from Sinai). *Uromastyx ornatus* is known only or mainly from Sinai, its range extening just a little into Israel, in the granite mountains near Elat.

Saharan (southwestern Israel). Psammophile reptiles of the Sahara (or of northeastern Egypt) which range through northern Sinai and inhabit the sands of the western Negev, but not those of the eastern Negev and Wadi 'Arava, include: *Testudo kleinmanni, Stenodactylus petrii, Agama savignii, Scincus s. scincus, Acanthodactylus s. scutellatus, Macroprotodon cucullatus, Cerastes vipera.* Unlike these, the Saharan *Sphenops sepsoides* and *Stenodactylus sthenodactylus* do reach also the Wadi 'Arava (Werner 1968, 1987; Arnold 1980a).

Desert (southern Israel). Several reptiles whose world distribution includes both the north African and the Arabian deserts (Saharo-Arabian or Saharo-Sindian), range throughout the deserts of southern Israel: *Agama pallida, Acanthodactylus boskianus, Mesalina guttulata, Varanus griseus, Coluber rhodorachis, Spalerosophis diadema, Telescopus dhara* (Werner 1987).

Arabian (southeastern Israel). A smaller number of species inhabits the Arabian peninsula and in Israel is known only from the Wadi 'Arava, not otherwise penetrating the Negev: *Bunopus blanfordii, Stenodactylus doriae, Coluber elegantissimus* (Werner 1987). There appears to exist a parallel phenomenon of westward penetration of Arabian reptiles over the straits of Tiran to southern Sinai. This is best exemplified by *Mesalina brevirostris,* first reported from Sinai by Hoofien (1957) and now know to be restricted to southernmost Sinai, with the islands of Tiran and Sinafir (Werner 1973).

African (tropical). Probably the only reptilian species illustrating the presence of Sudanian (Ethiopian) non-desertic fauna in Israel today is *Trionyx triunguis,* reinforced in the recent past by *Crocodylus niloticus* and on the genus level (!) by *Atractaspis engaddensis* (and *Chamaeleo,* discussed above).

These examples should suffice to demonstrate the extreme zoogeographical heterogeneity of the herpetofauna of Israel (Fig. 5). If we add the marine species, distributed over the Mediterranean Sea (and Atlantic Ocean), the Red Sea (and Indo-Pacific Ocean), or both, we end up with a minimum of 12 distinct distribution patterns being represented in the Israeli herpetofauna. Moreover, not all taxa conform to any pattern at all; notably *Ptyodactylus hasselquistii guttatus* (Werner & Frankenberg 1982).

Conclusions

1. The extant herpetofauna of Israel (with the Golan plateau and part of Mt. Hermon) numbers at least 102 species and subspecies. These include 6–7 amphibians, 6 marine turtles and at least 89 terrestrial and freshwater reptiles.

2. Of the above list, 23 taxa have been added since the review by Haas (1951), having been either newly described or newly reported (or confirmed) for Israel. These comprise 14 desert forms, six Mt. Hermon forms, one mesic snake and two marine turtles.

3. Species which have disappeared from Israel in the recent past include *Crocodylus niloticus, Blanus strauchi, Vipera lebetina* and probably *Discoglossus nigriventer.* Some others are now in danger of local extinction.

4. Species which appear to have been recorded from Israel only through error include *Bufo regularis, Lacerta danfordi,* and *Naja haje.*

5. In Sinai there occurs *Tarentola mauritanica* rather than *T. annularis;* the occurrence of *Coluber sinai* is confirmed.

6. From the herpetofaunal list of Petra, Jordan, both *Bufo regularis* and *Lacerta danfordi* are retracted.

7. Zoogeographically, the herpetofauna of Israel exhibits at least nine terrestrial and three marine patterns of distribution. But 47% of the taxa occur only in northern (mesic) Israel, having their world distribution to the north of Israel; and 39% occur only in part or all of southern (desertic) Israel, having their world distribution in some or all parts of the Saharo-Arabian subregion.

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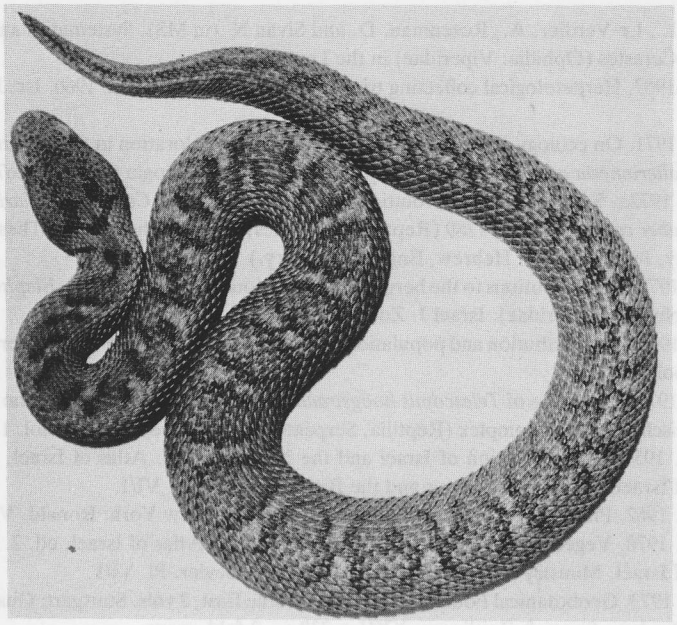
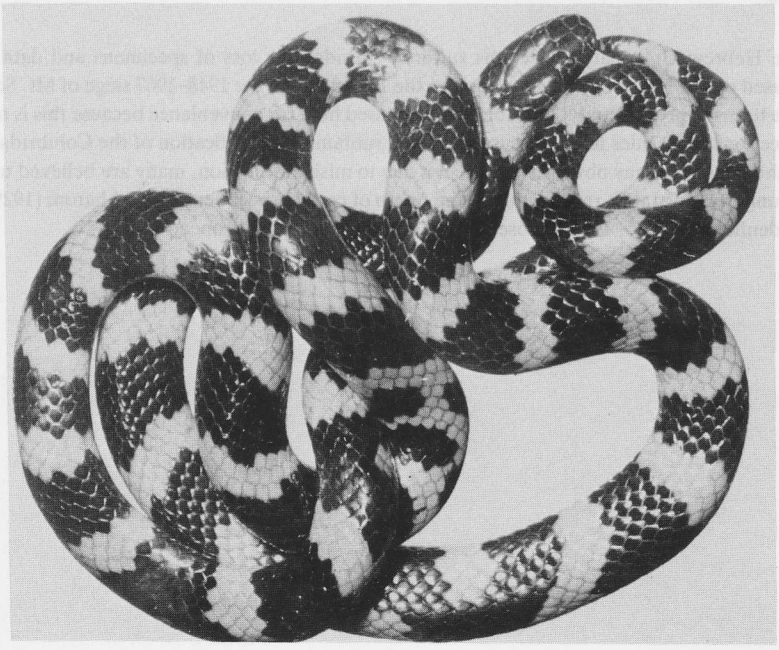
Notes

1. The Hebrew University collections suffered considerable loss of specimens and data while housed on the Mt. Scopus campus during the 1948 war and the 1948–1967 siege of Mt. Scopus.
2. The terms 'Aglypha' and 'Opisthoglypha' are used here for convenience because this is not the place for taking sides in the discussion on the subfamilial classification of the Colubridae.
3. Although errors may obviously have been due to misidentification, many are believed to have sprung from mistaken recollection of the origin of certain specimens; e.g., Aharoni (1929) and Bodenheimer (1935, 1937) whose books contain also some European species.



Vipera bornmuelleri, female seven months old. This species is common on Mount Hermon. (Photoghrapher: Y.L. Werner).



Micrelaps muelleri: an opisthoglyphous snake which apparently is endemic to Israel and Lebanon. (Photographer: Y.L. Werner).