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CONTRIBUTION TO THE BIOGEGRAPHICAL ANALYSIS OF THE REPTILE DISTRIBUTION IN THE MEDITERRANEAN ISLANDS.

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RESUMEN: Contribución al análisis biogeográfico de la distribución de los Reptiles en islas mediterráneas.

El estudio de la relación entre el área y el número de especies de Reptiles para diversos archipiélagos de la región mediterránea demostró una concordancia entre ambos valores. Sin embargo, las pendientes encontradas se hallaban en desacuerdo con las predichas por el modelo de MACARTHUR & WILSON (1967).

Tal desacuerdo se halla en cierta medida relacionado con la paleogeografía pero, principalmente, con la ecología y la influencia del Hombre. El intenso impacto humano durante los últimos 5000 años ha alterado la distribución de muchas especies reptilianas. Este hecho debe ser tomado en consideración antes de comenzar cualquier análisis biogeográfico.

La presencia de especies endémicas, que , en general, se halla positivamente relacionada con la paleogeografía de las islas, mostró una regresión Oeste-Este.

SUMMARY: The study of the species-area relationship for the different archipelagos in the Mediterranean region showed a positive relation. But the slopes of the curves usually disagree with the predictions of MACARTHUR & WILSON (1967).

This disagreement is related to a certain degree with paleogegraphy but mainly with the ecology and the influence of man. The intense human impact, for the last 5,000 years has altered the distribution of many reptile species. This, must be taken under consideration before any biogeografical analysis.

The presence of endemic species, which is positively related with the palaeogeography of the islands in general, shows a western - eastern regression.

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INTRODUCTION

The geographical distribution of the reptiles in the Mediterranean region can be considered as well known. Furthermore, if we compare it with the knowledge of other animal groups in this region, we may regard it as more complete, especially after the works of WETTSTEIN (1953), MERTENS & WERMUTH (1960), ARNOLD & BURTON (1978), WELCH (1983), DIESENE & REICHHOL (1985), ENGELMANN (1985), MARTINEZ-RICA (1989) and others.

Though, information concering the paleogeography of the region and the reptiles' distribution are adequate, its amazing that no-one up to now has ever attempted a thorough biogeographical analysis of the whole Mediterranea area. Of course, some analyses of especific island groups , do exist (BEUTLER 1979, MYLONAS & VALAKOS 1988, PARLANTI et al. 1988).

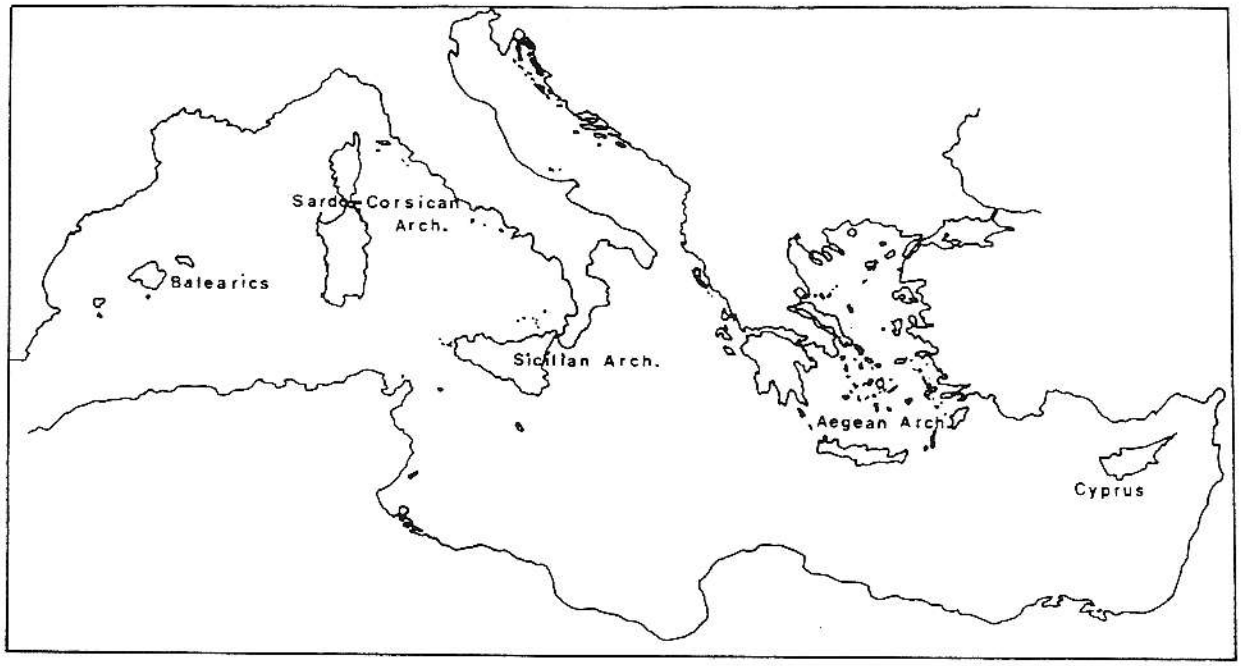

Figure 1. The main mediterranean archipelagos and islands.

In this paper we present our biogeographical observations for the species-area relationship, based on the majority of the Mediterranean islands.

METHODS

We used data from 198 islands whose herpetofauna is well known. These islands are mainly found in 3 archipielagos: the Aegean, the Sicilian and the Sardocorsican. In the two extremes we have the island of Cyprus in the east and the Balearics in the west. Most of these islands (51%) have an area of less than 1 Km^2 and only 5% of them exceed 1000 Km^2 (Fig.2).

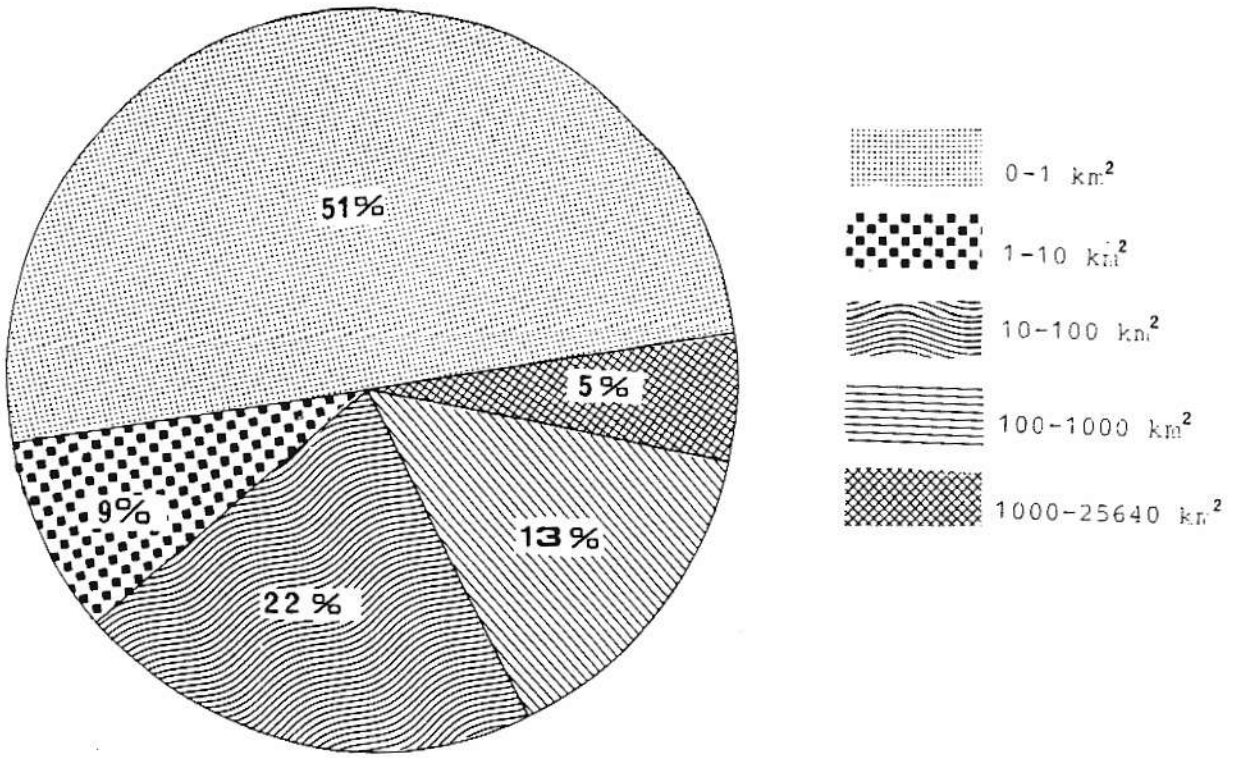

Figure 2. Grouping of the 198 Mediterranean islands studied in this work, according to their area.

The species - area relationship has been studied for: 1. All the Mediterranean islands, 2. The Aegean islands, 3. The Sicilian archipelago, 4. The Sardo- corsican and Toskany archipelago. The data for the Sicilian and Sado-corsican archipelagos are mainly from the work of PARLANTI et al. (1988). Because the range of the island area is quite large, we studied the species-area relationship in two different ways in order to avoid statistical errors. Firstly by excluding the largest islands and secondly by grouping all the islands in 4 classes according to their area : 0.001-0.1 Km^2, 0.100-10 Km^2, 10-1000 Km^2, and 1000-25,460 Km^2. In each class the area is increased a hundred times.

RESULTS - DISCUSSION

The area and the number of the species for all the Mediterranean Islands and also for each of the 3 archipelagos are strongly related (Fig.3). When we excluded the largest islands, these relations remain unchanged. When we grouped the islands the relation is absend for the first class and problematic for the islands with an area less than 1 Km^2.

It is quite interesting to study the slopes (z-value) of the curves. These slopes seem relatively low compared with those given by MAC ARTHUR and WILSON (1967). Especially the slope 0.18 which corresponds to all the Mediterranean islands and 0.15 for the Sicilian archi-

pelago may be considered as being near the lower limit and just above the slopes that refer to isolated continental regions (MAC ARTHUR & WILSON 1967, DIAMOND & MAYR 1976).

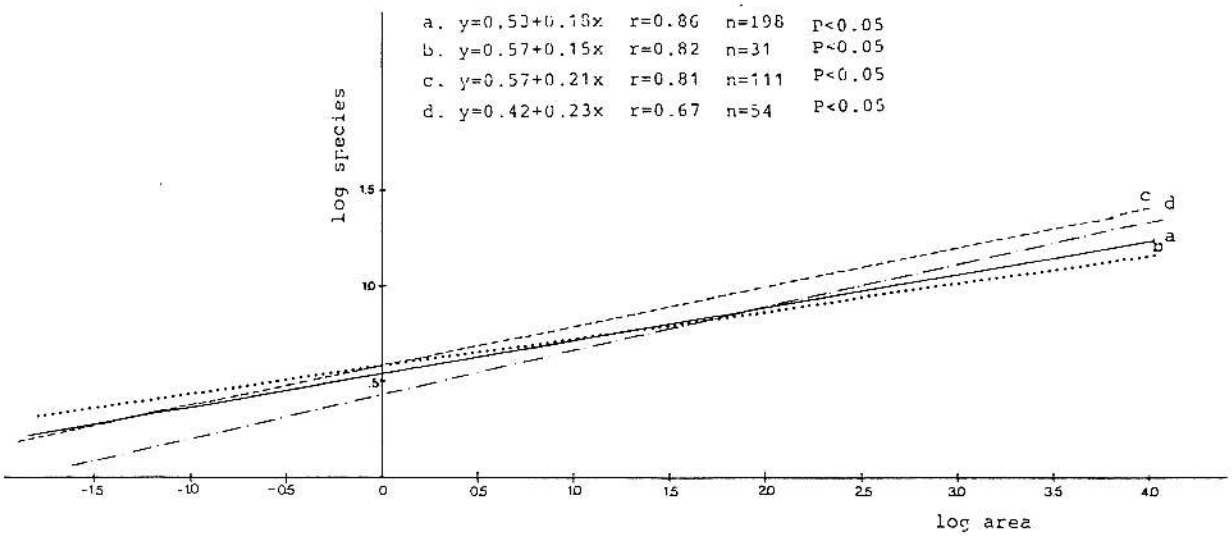

Figure 3. The species-area curves for: a) 198 Mediterranean islands, b) The Sicilian archipelago , c) the Sardo-corsican archipelago and d) the Aegean archipelago.

Therefore, we should either accept that the isolation of the insular herpetofaunas of the Mediterranean is limited or that smaller islands have overdiversified herpetofaunas whilst the large ones have underdiversified.

Searching the factor insularity we studied the endemic reptile species with a restricted insular distribution. We did not take into consideration the endemic subspecies, because there is great confusion in their taxonomy. All these endemic species are lizards, which have pratically no ability to disperse actively over sea barriers. On the contrary snakes that do not have any endemic species in the Mediterranean region are good swimmers (CARLQUIST 1965). In the Aegean we have reports that snakes were found swimming 2-3 Km from the nearest coast (VALAKOS, unpublished data).

Surprisingly diminution of endemism exists from the west to the east (Fig.4). This is a good indication that the factor "insularity" is greater in the western islands than in the eastern ones. This is in agreement with the paleogegraphical data which support the opinion that the Balearics, Corse, Sardinia and even Sicily had an independent island history while in the east the Aegean islands and Cyprus werw connected to the mainland until the last glaciation (Wü rm, 15.000 years ago) (GIUSTI & MANGANELLI 1984).

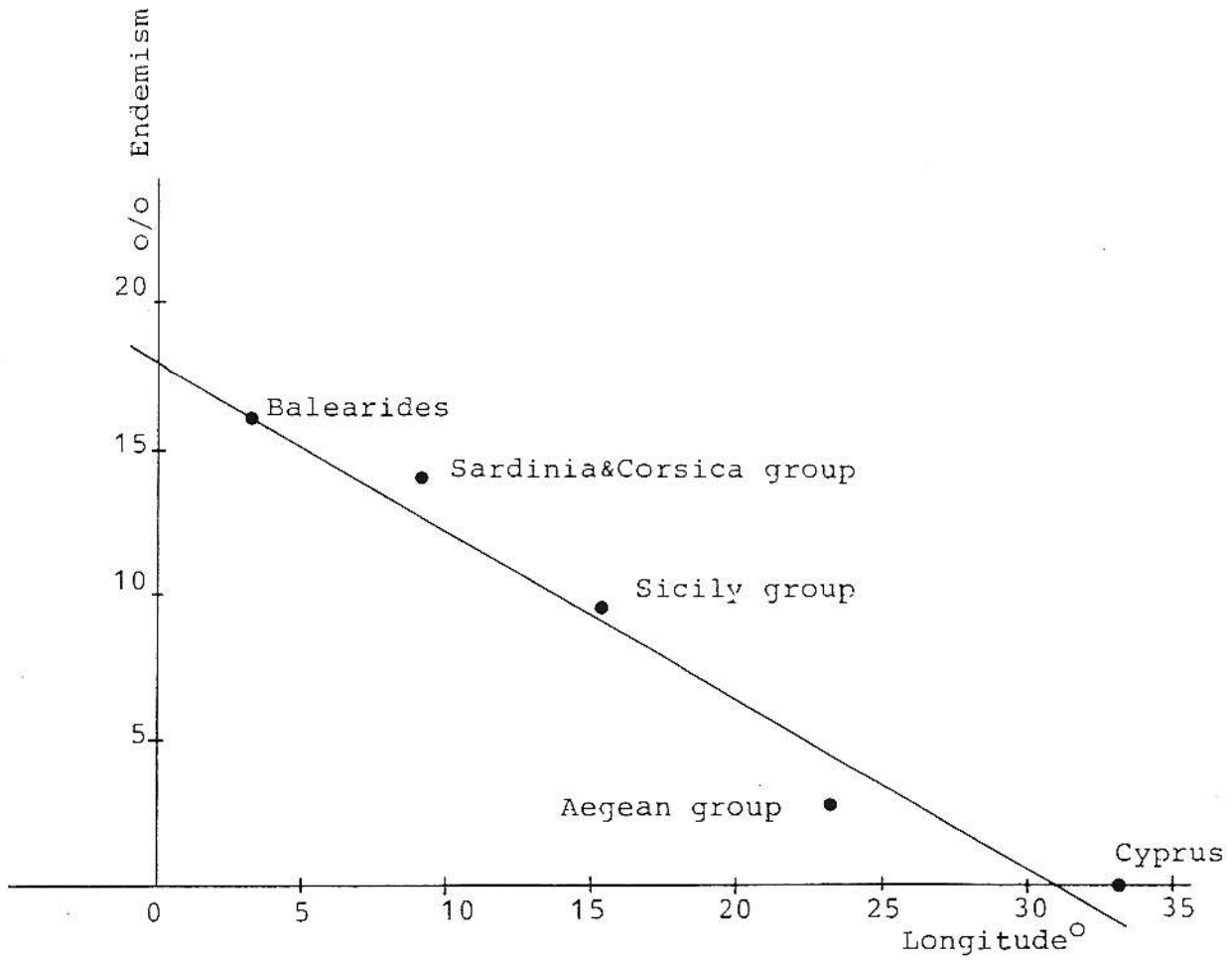

Figure 4. The decrease of the endemism of the reptiles in a western-eastern direction in the mediterranean islands.

Having rejected the limited isolation of the Mediterranean islands we must attribute the low z-values to ecological conditions including the influence of man. MYLONAS (1984) who studied the distribution of land snails in the Aegean, has found that human influence alters significantly the species-area relationship. Island faunas which are strongly influenced by man show a lower slope than the ones less disturbed. Therefore the human influence might be a resonable explanation for the low z-values. Becuse man in small island has increased the number of species, by creating new biotopes, mainly cultivations, and decreased their number on large islands mostly by habitat destruction.

Another reasonable ecological explanation concerning the poorness of the herpetofauna in the larger islands is that they usually have very few predominant types of biotopes, for instance maquis, shrubs and pine forest. The larger islands, seem uniform, not proportionaly to their area.

We believe that a thorough analysis of the differentation of the ecological niche of the reptiles on the small and large islands in relation to paleogeographical and historical data is necessary.

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APPENDIX

Island	Area Km	S	Island	Area Km	S
IONIAN ISLANDS					
Cephalonia	781	18	Psara	40	2
Corfu	592	26	Fourni	30	5
Zante	402	14	Salamis	95	7
Levkas	303	12	Aegina	83	7
Ithaki	96	15	Poros	23	7
Kalamos	25	3	Hydra	50	6
Paxi	25	3	Naxos	428	11
Andros	380	10	Paros	195	12
AEGEAN ISLANDS					
Cythera	278	9	Tinos	194	11
Anticythera	20	4	Milos	151	9
Skyros	209	9	Kea	131	8
Skopelos	95	6	Amorgos	121	7
Alonisos	64	5	Ios	108	7
Euboaea	3,655	20	Kythnos	99	8
Lesvos	1,630	12	Mykonos	85	10
Chios	824	14	Syros	84	10
Samos	476	12	Thira	76	8
Limnos	476	8	Sifnos	73	8
Thasos	379	9	Serifos	73	7
Ikaria	255	9	Anafi	38	4
Samothrace	178	6	Kimolos	36	6
Aghios Eustratios	43	5	Antiparos	35	9
Cret	8,261	11	Gavdos	30	3
Phodes	1,398	21	Kos	290	15
Kalymnos	111	13	Leros	53	9
Nisyros	41	8	Megisti	9	9
CYPRUS	9,251	23			

Area and species number of reptiles (S) in the Greek Islands. The area and the species for the Sicilian and the Sardo- Corsican archipelagos were taken from PARLANTI, C. et al. (1988), and for the Balearics from MARTINEZ-RICA (1989).