THE CONTINENTAL AND ISLAND MIGRATION ROUTE OF THE SOUTHEAST MEDITERRANEAN: PROBLEMS AND PROPOSITIONS

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ABSTRACT

Studies on Greek territory, although still limited, have established the existence of preferred corridors used by the majority of species during the palaearctic migration. The geographical and geological formation of the Southern Balkans appears to channel a considerable number of birds through these corridors. The importance of this migration is underestimated, owing to the lack of objective means of measurement.

The concentration of species into relatively narrow corridors makes the stream of migrants vulnerable to human pressures (shooting, and industrial and other development). The birds, probably for geophysical reasons which are discussed, are reluctant to take alternative routes. Greece, the last stage before Africa, possesses a large number of rich and varied biotopes which form indispensable resting and feeding places for the migrants, and wintering places for a smaller number. In order to promote a more effective policy of protection, accurate information is needed on the numbers of raptors passing through Greece.

INTRODUCTION

Studies on Greek territory, although still limited, have enabled us to determine the preferred corridors used by most species migrating from the Palaearctic. The topography of the southern Balkans appears to channel a considerable number of birds into these corridors. The extent of this migration has been underestimated, due to lack of means to measure it objectively.

With regard to the Greek mainland, three points emerge:

1. The concentration of birds into relatively narrow corridors makes the flow of migrants vulnerable to human pressures (hunting, industrial development) directly some obstacle impedes its passage. For apparent geophysical reasons, the birds seem unable to take alternative routes.
2. Greece, the last staging post before Africa, provides many rich and varied biotopes, which form resting and feeding places indispensable to migrants.
3. These same biotopes provide wintering areas for other raptors. Diminution of these areas reduces the populations of such species and may even lead to the disappearance of certain species. In order to promote a more effective policy of protection, we need to acquire objective and irrefutable data. A method of studying the migration which may help towards achieving this is discussed here.

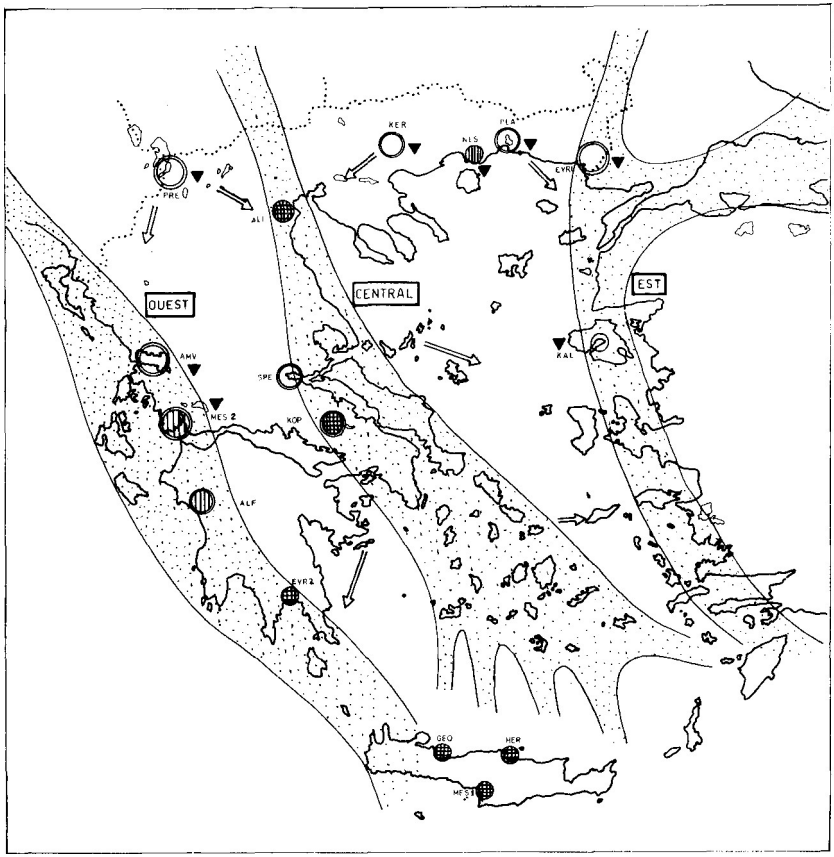

Figure 1: The three main migration flyways across Greece and the Greek islands. Dotted areas = the west, central and east corridors; Open arrows = minor flyways; Circles = resting and wintering places, classified as follows: Double circle = principal resting station; Single circle = secondary resting station; Open circle = preserved habitat; Vertical hatching = modified habitat; Cross-hatching = destroyed habitat; Triangle = nidification. Key to wetlands: ALF = Alfios, ALI = Aliakmon, AMV = Amvrakikos, EVR 1 = Evros, EVR 2 = Evrotas, GEO = Georgoupolis, HER = Heraklion, KAL = Kaloni, KER = Kerkini, KOP = Kopaida, MES 1 = Messara, Mes 2 = Mesolonghi, NES = Nestos, PLA = Porto Lagos, PRE = Prespa, SPE = Sperchios.

SITUATION AND IMPORTANCE OF THE ROUTE

In the extreme south-west, the continent of Europe extends geologically into a set of finger-like prolongations of the mainland together with innumerable islands. This is the Greek peninsula, with its main axis running NW to SE and forming, with its chains of islands, a quadrilateral region with sides of 600–800km. The continent of Africa (Libya, Egypt) lies 350km south of this peninsula. To the north, Europe spreads into a vast triangle, the theoretical base of which lies along the 46th parallel, from Trieste to Odessa. Greece thus finds itself at the extreme south of a continental system which probably drains a major part of the Palaearctic

migration coming from the north, e.g. Eastern Europe, Scandinavia and above all Russia.

Although the observations made on Greek territory are still limited and rarely systematic, this migration route can be recognized as being as important as the one that passes down the western side of Europe. One remarkable fact, which we made known at the Vienna Conference in 1975, is that it splits into three main flyways: western, central and eastern. These in fact represent extensions of the Adriatic, central-European and western Black Sea routes (*Figure 1*).

CONCENTRATION OF MIGRATION ROUTES INTO CORRIDORS

As in some other parts of Europe, the flow of migrants follows preferred courses which often have a very narrow front, in some places only a few hundred metres wide. The length of these corridors varies from a few hundred metres to several tens of kilometres. For certain species, however, the spring migration follows a different route to the autumn one.

Various reasons have been proposed to explain such concentrations in the flow of migrants, in particular the search for rising air currents to facilitate crossings of the sea or high mountain ranges. Coastal flyways, for obvious reasons, are particularly favourable to migrants. Finally, as we shall see from the example analysed below, certain routes, passing through ancient geological formations, may be engraved in the 'genetic memory' of a species.

In certain cases, the migration corridors take particular courses which do not appear wholly to fit the foregoing principles. We therefore decided to study one of these atypical corridors which passes through the centre of Crete.

Atypical corridor in central Crete

Although the length from north to south of this broad and low-altitude region does not exceed 40km, the migrants follow a corridor shaped like an inverted L which extends over 70km (*Figure 2*). The migrants coming from north or south follow the coast for over 50km (depending on their point of arrival) in order to reach the opening of this corridor, instead of using apparently favourable passes in between. The following species are regularly seen on this route: *Milvus milvus, Circaëtus gallicus, Buteo buteo* and *B. vulpinus, Hieraaetus pennatus, Circus aeruginosus* and *C. cyaneus, Falco eleonorae* and, more rarely, *F. columbarius*. Other birds using the route include virtually all waterfowl from cormorants to waders, swallows and passerines.

Study of this corridor has focussed on the geology and geophysics of the region. The lie of the land had no obvious influence on the route taken, nor did the axis of the watercourses. With the help of the metallographer, Constantin Zervantonakis, from the Research Centre of the Cretan Ecosystem, we studied the magnetic fields and barymetry of central Crete, with results which seemed to us singularly revealing. The magnetic fields are shown only schematically, because the maps consulted fell within the domain of national security. The barymetric zones were taken from unpublished maps of Iannis Louis.

Magnetic fields

Recent studies at Cornell University, USA, have shown that magnetic fields of the order of 30γ are perceptible to homing pigeons and young gulls. On *Figure 3* we show that the migration corridor runs through the zone where the magnetic field is weakest. Moreover, many high magnetic fields border this corridor, both to the north and south, forming, so to speak, magnetic barriers.

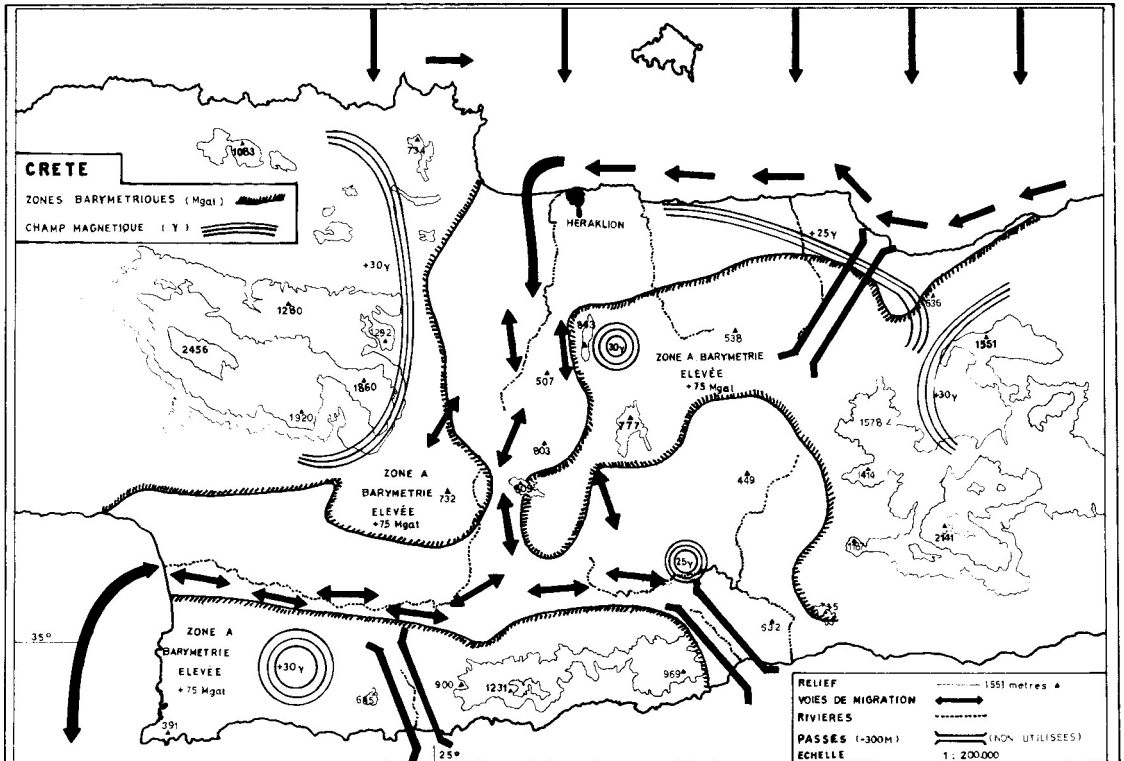

Figure 2: Crete, showing the main migration routes across the island and their relationship to barymetric zones and magnetic fields.

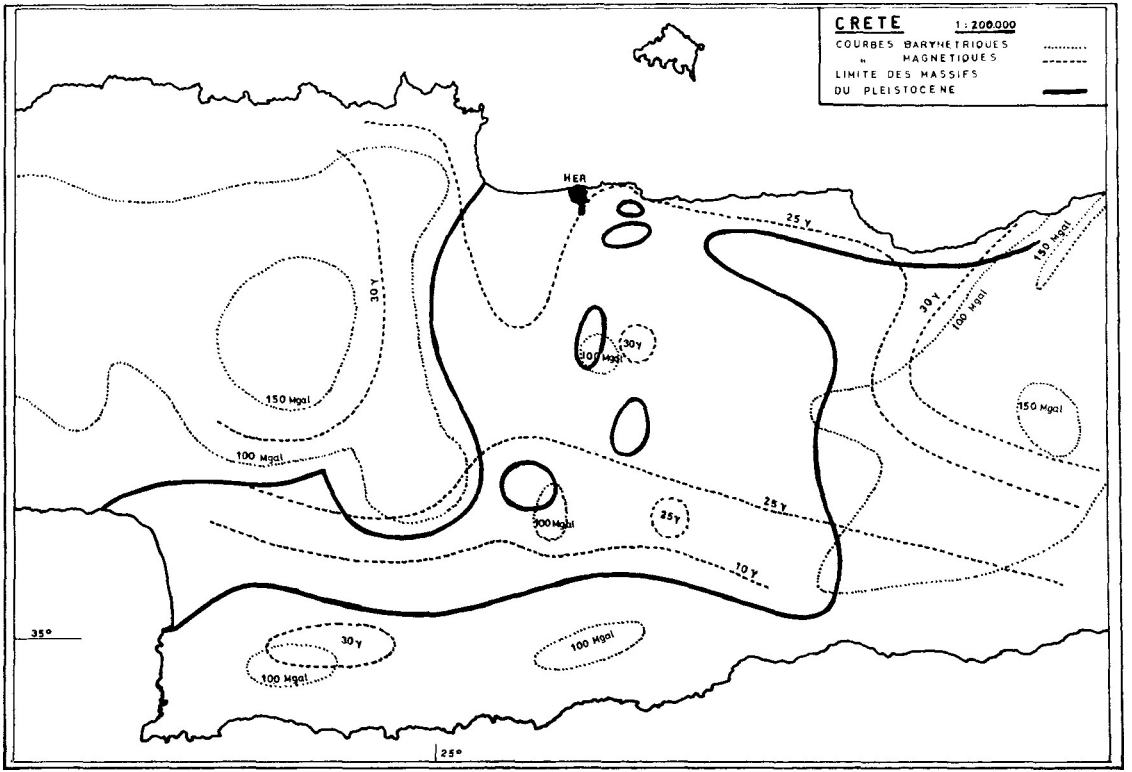

Figure 3: Crete, showing barymetric and magnetic lines, and the limits of the Pleistocene massif.

Barymetry

The normal acceleration of the weight of a given body on the surface of the earth is 980Gal, but this rate may increase in accordance with the nature of the earth's surface, so that a given body weighs heavier in zones of high g. At any given location, the weight diminishes at a rate of 0.386Mgals. per metre of elevation. A bird at 10m will feel its local weight lessened by 3.86Mgal. and at 100m by 38.6Mgal.

Altitude cannot, however, reduce the effects of weight in zones such as central Crete, where the barymetry is complex and at high levels. *Figures 2* and *3* show the zones above 75, 100 and 150Mgal., and here the barymetric fields precisely demarcate the effective limits of the migration corridor.

It is likely, therefore, that the birds have an acute barymetric sense which, during a long flight, leads them to select the routes on which they will weigh least, thereby conserving energy. This is not to say that magnetism and barymetry will be important to all species on migration.

Palaeo-history

The zone studied in Crete consists of high massifs dating from the Miocene, and low-lying regions which, a million years ago, where covered by the sea. The few islands which dotted this channel are today high hills (*Figure 2*). The migration corridor passes in the main along the basin of this ancient sea. It is possible, therefore, that raptors have taken this route for a very long time and continue to do so through 'genetic memory'. Much more recently—up to only 50 years ago—there spread in the north near Heraklion, and in the south, on the edge of the plain of Messara, the two largest wetland biotopes in Crete. Their geographical situation corresponds exactly with the openings of the migration corridor.

RESTING STATIONS FOR MIGRANTS

Along any great migration route, birds use favourable biotopes to rest and feed. In the event of bad weather, these become vital refuges, when countless individuals assemble together. These refuges are thus vital for the normal progress of migration.

Greece, the last staging post before Africa, used to possess many areas of natural habitat rich in potential prey, including wetlands. The drainage operations of 1930–40 and 1950–75 have spared a certain number of these (*Figure 1*). The lagoons of Missolonghi, the largest in Europe, covering 19,000ha, were saved at the last moment from the installation of a petrochemical works, thanks to the intervention of the present Government. And while certain biotopes have degenerated, others may well be evolving, such as the one at the mouth of the Sperchios, studied by the Hellenic Ornithological Society.

The most favoured migration route remains the eastern one, which benefits from numerous still-intact resting places on the Turkish coast. Numerous observations made over many years prove that these resting places are vital points on the axis of the migration, and their protection should be as much a priority as that of the preferred corridors.

WINTERING AND BREEDING PLACES

These same resting places serve in Greece as wintering grounds for a great many migrants, a high proportion of which are immatures. Clearly the destruction of

these places increases the mortality and reduces the numbers of such birds. When it is a question of such rare species as *Pandion haliaetus* or *Haliaeetus albicilla*, destruction of these areas means the disappearance of the species from Greece—a major reason for demanding their total protection. All the resting and wintering biotopes in Greece are also breeding areas. Those in the north are the least spoilt (*Figure 1*).

PROPOSALS ON PROJECTS FOR PROTECTING THE MIGRATION

We believe, first of all, that the World Working Group on Birds of Prey, in collaboration with other competent bodies, should establish a policy for safeguarding the migrants, following preliminary studies which should consist of:

(1) Identification of the most vulnerable stretches of the migration routes.
(2) Counts of the number of birds that use them.
(3) Drawing up an inventory of resting and wintering sites, and calculation of the minimum area necessary for the normal functioning of each biotope.
(4) Drawing up a list of the areas which would justify total protection and promotion of their preservation in the countries concerned, in collaboration with national conservation bodies and with the financial support of international organizations.

More specifically, we propose the inclusion in the programmes of support of the World Working Group and ICBP, of three short-term projects in Greece:

(1) Restoration of the Missolonghi biotope to its natural state. This project is already embodied in the government's programme, but it will also need international backing, given its extent and biological complexity.
(2) Some measure of restoration of certain resting places which lie at the end of long flights. We have in mind the Evros Delta in the Peloponnese and the mouth of the Geropotamos in Messara, Crete.
(3) Logistic support for a study of the Sperchios Delta, which is being developed and which, in addition to ornithologists, needs the participation of other specialists.