

The Ecofunctional Positions of Palearctic Vultures

W. Baumgart

ABSTRACT

The basis of the ecofunctional differentiation of vultures in general is their social hierarchy at carcasses. Investigations of their food and foraging-range in southern Europe and central Asia showed not only clear division into "waste salvagers" and "carcass utilizers", but also a division within these groups based on actual flight performance. The Ecofunctional Positions (EFP/ÖFP - Ökofunktionelle Position) of Palearctic vultures are in contrast to their taxonomic positions, but makes them more directly comparable to other Old World as well as New World Vultures. The following conclusions are therefore made:

- The New World condors are the intermediate functional equivalent of the large Old World solitary and carcass-using vultures, e.g. Cinereous Vulture and Eurasian Griffon respectively.
- The small New World Turkey and Black Vultures are replaced by kites in the Old World and Australia, respectively *Milvus* and *Haliaeetus* spp.
- The Bearded and Egyptian Vultures hold an EFP, apparently not occupied by vultures or birds of prey in the New World.

INTRODUCTION

The social dominance hierarchy of vultures at carcasses and their feeding on different parts is accepted as the basis of the ecological differentiation of this interesting group of "inactive raptors". Large species such as *Aegypius* or *Torgos* are powerful enough to tear through the skin; *Gyps* vultures eat the inner parts; and smaller species like *Neophron* pick up small leavings. *Gypaetus barbatus* takes bones at the end (Valverde 1959, Kruuk 1967, König 1974).

But this system of "cooperation" cannot be observed everywhere. Outside of Africa and India the vulture community is not complete in this way. Especially on the Mediterranean islands there are only one or two species feeding upon available resources and the ecological differentiation becomes unclear. The vultures are seeking food not only in various habitats but are also consuming rather different food items (Glutz *et al.* 1971, Cramp & Simmons 1980, Mundy *et al.* 1992). This necessitates thinking about other principles and factors of fundamental importance for vulture existence.

PERFORMANCE AND FOOD-SEARCH STRATEGIES

The Palearctic vultures are like other vultures – incapable of active hunting in the manner of

birds of prey, their ancestors. Therefore they are without any active influence on the availability of their food supply as to dispersal, distribution or continuity. Vultures contribute to the maintenance of their existence essentially only in two ways:

- by increase of their ability to fast for weeks (by low metabolic rates and often large fat stores), and
- to travel as excellent gliders over great distances with little energy expenditure, and so to explore wide foraging ranges.

But these two abilities are negatively correlated in a fundamental antagonism!

The ability to survive a long time without food increases with weight and size (The former Pleistocene North American gigantic vulture *Teratornis merriami* can be understood not only as an adaptation to the megafauna of this time but also in high degree to a discontinuity of food supply in this period). But on the other hand, increasing weight reduces the gliding ability.

A "solution" is only possible in that all parts of the body without direct positive influence as stores for energy like muscles, bones, feathers etc., must be minimized in weight. But the minimizing of muscles decreases the active manoeuvrability! Meanwhile the passive gliding ability can be increased mainly by raising the number of secondaries to 27 (Tewes 1996), fixed to a relatively long forearm (ulna). A limitation to this development is provided by the diminishing ability of vultures in landing and taking-off rapidly. Simultaneously this prevents active hunting by vultures. The construction of the vulture's body has to correspond from the very beginning to a strongly fixed type of flight performance according to food size and dispersion. There are two alternatives:

1. Widely distributed smaller pieces sufficient for single individuals.
2. Larger animal carcasses offer plenty of food sufficient for a high number of individuals.

The representatives of these two types differ considerably in their flying abilities and shapes or silhouettes. The first group has relatively narrow and pointed wings with a longer tail, while the second group has wide rounded wings with a shorter tail.

The alternative food supplies require fundamental different search strategies (Baumgart 1998a). In the first case, birds fly low, are virtually independent of thermals (but using microthermals near the ground), and do not show inter-individual cooperation. In the second case, high thermals support the soaring of cooperating individuals.

In the negative correlation of gliding ability and weight is based the occurrence of size categories within one type. Thus the Bearded Vulture *Gypaetus barbatus* and the Egyptian Vulture *Neophron percnopterus* are interpretable in principle as size-differentiated functional "doubles" with a flight performance essentially comparable with that of gulls. They can be categorized as "mainland gulls".

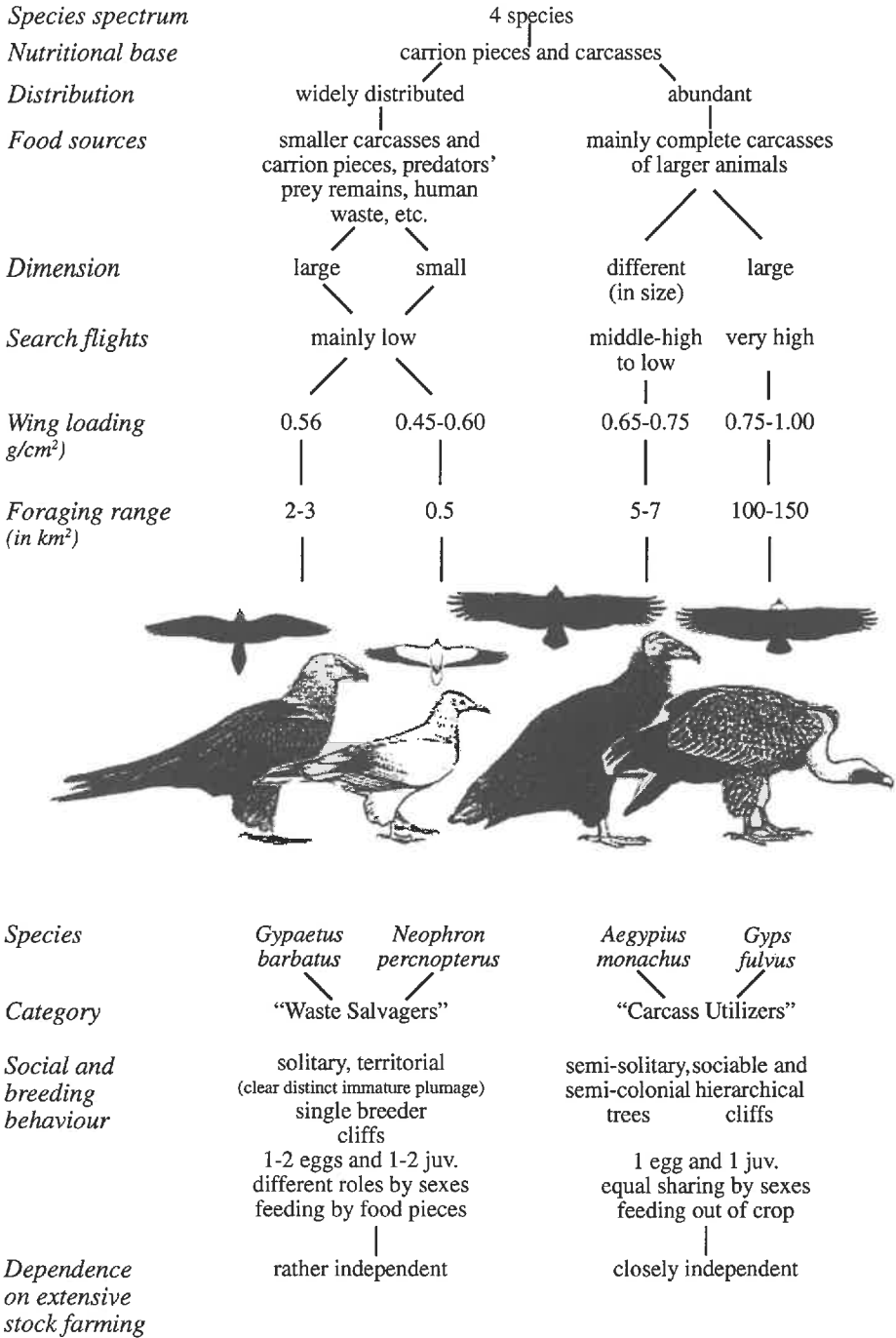
The relation between these basic requisites and the derived morphological, behavioural and other patterns, is shown in Figure 1.

ECOFUNCTIONAL POSITIONS (EFP) OF EUROPEAN VULTURES

The differentiation of European vultures does not follow strict ecological principles, because one species can act in very different habitats. It seems better to speak in this case not of "niche" but of "resource base". More important is the differentiation in flight performance as basic to the Ecofunctional Positions (EFP), including the efficiency and performance criteria in using resources (Baumgart 1991). The different behaviour of vultures at carcasses, especially between "Waste Salvagers" and "Carcass Utilizers" is only the result of these principles. Vultures behave at carcasses not primarily as a functional community but only as a feeding community. Their inclusion in the family Aegypiidae was in spite of their polyphyletic descent; their inferred monophyly was one of the great mistakes of the systematics of the past.

The functional differentiation of Bearded and Egyptian Vultures as a "Double" is easily explained. That of the Cinereous Vulture *Aegypius monachus* and Eurasian Griffon *Gyps fulvus*, ecologically, is not so clear (tree and cliff breeders in more wooded and open landscapes respectively). But they search for food in different ways.

Figure 1. The ecofunctional positions of European Vultures (principles).



The Cinereous Vulture has a smaller foraging range (radius about 15 km, or 700 km²) intensively explored by a limited number of individuals. It has a lower wing loading and higher manoeuvrability in flight than does the Eurasian Griffon. The latter's flight performance is adapted to the exploration of an extensive foraging range (radius of 60-200 km, or up to-125 000 km²).

According to the dispersion and abundance of food sources, these two vultures may occur in different landscapes in various numbers. If there are not enough resources for a sympatric occurrence of the two species with their two types of search strategies, only one species, regularly the Cinereous Vulture, acts in an intermediate way as in Central Asia or in a certain degree on Mallorca.

The principles of sympatric occurrence of two large types of vultures, according to their different EFP (reflecting different strategies in the search for food), is also seen elsewhere in the Old World. Mostly a large solitary and a *Gyps* vulture occur sympatrically. If there are two representatives of one type because the food supply is rich then they are differentiated in size. This is the case with the Rüppell's Griffon *G. rueppellii* and African White-backed Vulture *Pseudogyps africanus* in Africa, Long-billed Griffon *G. indicus* and Indian White-backed Vulture *P. bengalensis* in India, and Laped-faced *Torgos tracheliotus* and White-headed *Trionoceph occipitalis* Vultures in Africa.

Other differences, for example in the breeding behaviour of Rüppell's Griffon and White-backed Vulture (cliff and tree breeder) are of less importance. Cliff breeding is more secure, but tree breeding guarantees a better distribution over an area and less travel distances. Therefore all large solitary vultures are tree breeders.

On this functional basis an objective comparison of Old World accipitrid vultures and New World cathartid vultures is possible. In contrast to the Old World situation, where mostly two sympatric types of very large vultures are found, in the Americas only one large vulture occurs: the Andean Condor *Vultur gryphus* in South America and the Californian Condor *Gymnogyps californianus* in North. Pairs of these two vultures mostly use separate foraging ranges to each other, they are solitary breeders, but can also act and cooperate with any other individuals in food searching and communal roosting (Wallace pers. com.). Their behaviour is similar to that of the Cinereous Vulture in northern Central Asia, which is without the sympatric occurrence of other vultures. This could justify an evaluation of the two condors as vultures of intermediate types under conditions of limited resources. They survived in the post-Pleistocene period perhaps because of this adaptive ability when the food supply decreased; in North America the other vultures and the teratorns disappeared.

If there is not enough food for large vultures their functions are fulfilled in a limited way by large eagles (such as *Aquila audax* in Australia or in Europe by *Haliaeetus albicilla* and *Aquila heliaca*). In these species, the adult birds regularly live like real active preying eagles but the immature birds show vulture-like features in their foraging behaviour.

Among the smaller species we now have in America two vulture groups with similar habits, the more solitary Turkey *Cathartes aura* and Yellow-headed Vultures *C. burrovianus/melambrotus* and in the clearly sociable American Black Vulture *Coragyps atratus*, compared sometimes with the small Old World Vultures like Egyptian and Hooded *Necrosyrtes monachus* Vultures. But it seems that they occupy other EFP.

In the details of food searching, the small New World vultures are in a higher degree similar to the Old World kites such as in Europe the more solitary Black Kite *Milvus migrans* and the more sociable Red Kite *M. milvus*. As smaller "doubles" they show a certain degree of functional correspondence with the Cinereous Vulture and Eurasian Griffon. In Australia the same relation between Whistling kite *Haliastur sphenurus* and *M. migrans affinis* is evident.

Under this aspect it can be explained why there are no *Milvus* kites in America. Their EFP are here occupied by the smaller New World vultures (Baumgart 1998b). But what about the small kite-like American raptors: Swallow-tailed Kite *Elanoides forficatus* and Mississippi Kite *Ictinia mississippiensis*? They can perhaps be best evaluated as seasonal equivalents of the small Old World insect-eating falcons (like *Falco naumanni* and *F. verspertinus*).

CONCLUSIONS

The above examples demonstrate clearly that the system of EFP is not closely related to the phylogenetic system. The EFP appears to be a secondary independent factor in species formation. This factor is reliant on the efficiency and performance criteria of the various species in different environments, and contributes to our understanding of evolution in terms of the searching for resources.

We can now define the ecofunctional positions of western Palaearctic vultures, as follows.

- The Bearded and Egyptian Vultures are the "Large and middle-sized salvagers of dispersed wastes".
- The Cinereous Vulture and Eurasian Griffon occupy the EFP of (respectively):
- Large, solitary, intensively ranging carcass utilizer, and
- Large, sociable, hierarchical, extensively ranging carcass utilizer.

These definitions are not strictly ecological directed. They outline more a "performance-profile" realised in a variety of environmental situations. Therefore the Cinereous Vulture for instance can be found in very different habitats, from open woodlands in mountains to deserts in lowlands. Only when it occurs sympatrically with the Eurasian Griffon, its habits are then in closer correspondence with the above definition.

Nevertheless it is remarkable that the Cinereous Vulture searches especially in wooded areas, not only for carcasses of large Animals but also for rather small food items. In this way it partially resembles the Bearded Vulture (as well as even the Egyptian Vulture). In the parts of central Asia lacking *Gyps* vultures, it demonstrates some traits of the griffon's lifestyle, becoming more gregarious, and more extensive in its searching. Under the conditions of the post-Pleistocene period in North America, but without the competition from the cathartid vultures, a Cinereous Vulture type had maybe the best chances to survive longer and alone among all the large vultures. This expresses the high ecofunctional plasticity of this type, which its substituted in other regions by representatives of other genera (*Torgos*, *Trigonoceps* and *Sarcogyps*). These may not be close generically, but they are always co-functionally related among each other.

REFERENCES

- BAUMGART, W. 1991. Über die Geier Bulgariens. A. Der Schmutzgeier (*Neophron percnopterus*).- Beitr. Vogelkd. 37: 1-48.
- BAUMGART, W. 1998a. Leistungsdifferenzierungen bei Greifvögeln und ihre Bedeutung für artliche Existenz und Artbildung (Aves: Falconiformes) [Performance differentiations in birds of prey and their importance for existence and origin of species].- Zool. Abh. Mus. Tierkd. Dresden 50, Suppl. 125-137.
- BAUMGART, W. 1998b. Probleme und derzeitiger Stand des Kalifornien-Kondor-Projektes (Frühjahr 1997).- Rundbrief WAG 25/26 (1997): 13-18. Reprint: Problems and present situation of the Californian-Condor-Project (Spring 1997).- Bearded Vulture Annual Report 1997: 66-70.
- CRAMP, S. & K. E. L. SIMMONS 1980. Handbook of the Birds of Europe the Middle East and North Africa. The Birds of the Western Palearctic. Vol. II, Hawks to Bustards.- Oxford.
- GLUTZ VON Blotzheim, N. U., K. BAUER & E. BEZZEL 1971. Handbuch der Vögel Mitteleuropas, Bd. 4, *Falconiformes*.- Frankfurt a. M.
- KÖNIG, C. 1974. Zum Verhalten spanischer Geier an Kadavern.- *J. Orn.* 115: 289-320.
- KRUUK, H. 1967. Competition for food between vultures in East Afrika.- *Ardea*. 55: 171-193.
- MUNDY, P., D. BUTCHART, J. LEDGER & S. PIPER 1992. The Vultures of Africa.- London.
- TEWES, E. 1996. The European Black Vulture (*Aegypius monachus* L.), management techniques and habitat requirements.- Ph. Diss. Univ. Vienna.
- VALVERDE, J. A. 1959. Moyens d'expression et hiérarchie sociale chez le vautour fauve *Gyps fulvus* (Hablizl).- *Alauda* 27: 1-15.

Dr. Wolfgang Baumgart
Grumbkowstr. 2a
D-13156 Berlin
Germany

