

FRIEND OR FOE: SOCIETAL SHIFTS FROM INTENSE PERSECUTION TO ACTIVE CONSERVATION OF TOP PREDATORS

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SUMMARY.—*Friend or foe: Societal shifts from intense persecution to active conservation of top predators.*

The importance of top predators in the functioning of ecosystems is a well-established ecological paradigm; therefore active persecution of top predators is a serious global conservation problem. Here we present the case of a southern European country (Spain) which has moved rapidly from widespread and long-term intense persecution of raptors until the 1970's to occupying a leading place in raptor study and conservation within Europe today. We argue that such a radical change may have a contingent component (the rapid and intensive urban concentration of rural people following economic growth of the country), as well as a more deterministic component (an active role of mass media increasing awareness on a concentrated population). This societal shift could inform future conservation strategies in countries currently undergoing rapid urbanisation.

Key words: raptors, conservation, social attitude, change, mass media, economic growth, persecution.

RESUMEN.—*Amigos o enemigos: un rápido cambio social desde la persecución intensa a la conservación a ultranza de depredadores apicales.*

La relevancia de los depredadores apicales en el funcionamiento de los ecosistemas es un paradigma ecológico bien fundamentado; por lo tanto la persecución activa de los mismos es un serio problema de conservación. Aquí presentamos el caso de un país del sur de Europa (España) que se ha movido velozmente de una intensa persecución de las aves rapaces hasta los años 70 del siglo XX a ocupar un lugar de liderazgo europeo en el estudio y conservación de dicho grupo de aves. Argumentamos que tal cambio radical puede tener una componente contingente (la rápida e intensiva concentración urbana de la gente rural en paralelo con el rápido desarro-

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llo económico del país), así como una componente más determinista (un papel activo de los medios de comunicación que concienciaron a la población urbana). Este cambio social podría resultar informativo de cara a futuras estrategias de conservación en aquellos países que actualmente experimentan una rápida urbanización.

Palabras clave: rapaces, conservación, actitud social, medios de comunicación, crecimiento económico, persecución.

Conservation scientists and managers live in a changing world and are faced with the difficulty of preserving biodiversity under changing social and environmental scenarios. Sometimes however the key to conservation is based upon fostering changes in attitude toward some taxonomic group (Miller, 2005), which could act as a conservation umbrella to protect entire ecosystems (Sergio *et al.*, 2005). Being able to identify such keys for societal shifts in the scale of values is hence crucial. Cues to key identification can come from active social investigation but also from unexpected results in ecological research. Here we demonstrate a bias towards raptor study in a southern European country (Spain), and explore this bias to learn about its causes. Then we move on to suggest that causes producing this bias may be used actively in developing countries to inform conservation policies.

UNEXPECTED RESULTS

In the course of an ongoing systematic review (Pullin and Knight, 2001; Sutherland *et al.*, 2004; Pullin and Stewart, 2006) on the influence of human recreational activities on the breeding success and nest-site fidelity of diurnal raptors, we carried out a literature search designed to be highly specific (see key words used in Appendix 1). The search identified a total of 3,887 papers (4,280 minus 393 duplicates), but after critically reading the abstracts of all the papers only 18 fulfilled our inclusion criteria (i.e. primary studies providing annual monitoring of raptor nests and territories in ar-

reas subjected to recreational activities and areas without these activities or long-term annual monitoring of a sample of raptor nests and territories including information before and after human disturbance; see details at <http://www.cebc.bangor.ac.uk/protocols.htm>). Surprisingly 6 out of 18 papers (33 %) were written by Spanish authors (see references in bold in Appendix 2). To make sure that the search was not biased, by the fact of being performed by a Spanish researcher (A.M), 300 randomly selected search records were reviewed by a second UK researcher (G.S), and a high degree of agreement was found (Kappa index value = 0.664).

This Spanish bias was unexpected taking into account that in Spain predators, and raptors in particular, were actively persecuted until recently (until the late 1970's or even the 80's, well after the return to democracy). For example, in 1953 the Spanish dictatorial government created the provincial councils for the extinction of pest animals and hunting protection (*i.e.* 'Juntas Provinciales de extinción de animales dañinos y protección a la caza'). Between 1955 and 1961 the Spanish government paid for the carcasses of 784 vultures, 1033 eagles, 20228 other raptor types and more than 500,000 other birds (including corvids and non-identified raptors) in 10 provinces of Spain, representing 27 % of the country surface area (Anonym, 1962). On the contrary raptors were protected earlier in central and northern European countries, where they are now so abundant that they are sometimes controlled for conservation purposes (Côte and Sutherland, 1997).

TABLE 1

Ratio between research effort and availability of raptors in six European countries. Availability was calculated as density (no. of breeding pairs / surface area) * no. of species; Research effort was calculated as the mean percentage of studies dealing with raptors (for each country during the period 2002 - 2006) published in the leading ornithological journal of each country. Percentages are shown among parentheses.

[Tasa entre el esfuerzo de investigación y la disponibilidad de rapaces en seis países europeos. La disponibilidad se calculó como la multiplicación entre el número de parejas / área de superficie y el número de especies. El esfuerzo de investigación se calculó como el porcentaje medio de estudios focalizados en rapaces (por país y para el periodo 2002 - 2006) que fueron publicados en las revistas ornitológicas líderes en cada país. Los porcentajes se muestran entre paréntesis.]

	Spain	Sweden	UK	Germany	Netherlands	France
No. of pairs	225517 (19.3)	99281 (8.5)	145421 (12.4)	254848 (21.8)	37655 (3.2)	405269 (34.7)
No. of species	33 (21.3)	27 (17.4)	20 (12.9)	26 (16.8)	16 (10.3)	33 (21.3)
Surface area (km ²)	504645	449964	244820	357021	41526	675417
Availability Index (A)	14.75	5.96	11.88	18.56	14.51	19.80
Research effort (E)	0.154	0.092	0.11	0.088	0.074	0.18
Ratio E / A	1.04	1.54	0.93	0.47	0.51	0.91

POSSIBLE CAUSES TO EXPLAIN RESEARCH BIAS

We can think of three non-mutually exclusive explanations to this unexpected result:

a) Researchers have a higher tendency to study raptors in Spain.

To test this hypothesis, we calculated the percentage of papers dealing with raptors (both diurnal and nocturnal) published in the leading ornithological journals (Journal of Avian Biology, Ibis, Journal of Ornithology, Alauda, and Ardea) of five north and central European countries: United Kingdom, France, Sweden, Germany and the Netherlands, during the period 2002 - 2006, and compared results to the Spanish journal (Ardeola). We used this percentage as a proxy to national research effort, although most of these journals have an international scope. Results showed that France is the leading country in proportional research

effort devoted to raptors, followed by Spain, the United Kingdom, Sweden, Germany and the Netherlands (Table 1).

b) Birds of prey are especially abundant in Spain.

To test this factor we built an index combining raptor density and richness (Availability index, noted by $A = \text{raptor density} * \text{number of species}$, see Table 1) to compare the availability of raptors for researchers in all six European countries considered. Density was calculated by adding up the minimum number of pairs for all raptor species present as breeders in each country, as reported in a comprehensive study by BirdLife International (BirdLife International, 2004), and dividing this figure by country surface area. Results indicated that France has the highest overall raptor density, followed by Germany, Spain, the Netherlands, UK and Sweden (Table 1).

Combining hypotheses a and b

Hence, it turns out that research effort weighted by raptor abundance (i.e. effort in proportion to availability) is much larger in Sweden and Spain than in the other four countries (see Table 1). This is especially outstanding in the case of Spain, if we consider that publications on raptors in the journal *Ardeola* are most likely an underestimate of the real effort devoted to the study of this group by Spanish ornithologists. This is because Spanish ornithologists have published most of their work in foreign journals because of the lack of an ornithological journal (i.e. *Ardeola*) included within the Science Citation Index until very recently. In fact, analyzing a review of articles published by Spanish ornithologists in 35 international scientific journals, during variable time periods spanning from 1995 - 1999 (Copete, 2000), it turned out that 22 % of the papers published abroad by Spanish animal ecologists ($n = 102$) dealt with birds of prey. This in turn means that a substantial percentage of papers published in the central and northern European journals considered in our analyses are most likely written by Spanish researchers, further reinforcing our original idea that Spanish animal ecologists love their raptors. Interestingly, 14 % of papers dealing with raptors accepted for publication in the Swedish Journal of Avian Biology between 2000 and 2006 were written by Spanish ecologists. On the contrary, papers published in *Ardeola* had an almost negligible foreign component. Further evidence supporting that this pattern toward raptor research in Spain is not due to chance comes from the fact that during the period 2000 - 2006 as many as 15 different research teams published papers dealing with raptors in *Ardeola*, whereas only 9 Scandinavian teams (including Finnish, Swedish, Norwegian and Danish) published raptor papers at the Journal of Avian Biology during the same time period. Alternatively, one could argue that rarest zoological groups are those which receive higher attention by researchers in each

country, because of their threatened status. Although that reasoning could apply to Sweden it does not certainly apply to Spain, since this country occupies an intermediate position in relative raptor abundance (availability) within the European framework.

c) There has been a change in attitude of Spanish society towards raptors.

A change in social attitude towards top terrestrial predators (including researchers but also the “average citizen”) may have happened in Spanish society during the last decades owing to two main causes:

1) A recent, intensive and rapid rural exodus with population concentration in large cities

From the 50's to the 70's of the 20th century a rapid and intensive movement of people from villages to cities took place (Fig. 1). This urban concentration meant most people no longer perceived predators as enemies, because their daily problems became rapidly and radically disassociated from things such as predator species abundance (Valkama *et al.*, 2005). Attitudes in favour of predators are typical of urban citizens and rare among rural inhabitants living close to them (Kellert, 1994; Blanco and Cortés, 2002; Karlson and Sjöström, 2007). This change took place previously, and in a more gradual way, in central and northern European countries with older democracies and earlier industrial development.

2) Awareness increase due to mass media influence.

During the 70's, with most of the population already concentrated in a few industrial cities, the Spanish television scheduled nature documentaries by Félix Rodríguez de la Fuente (1928 - 1980). This communicator was especially concerned with vertebrate predators and with birds of prey in particular, being himself a passionate practitioner of falconry. In fact *ca.* 50 % of his most popular TV series (named “The man and the Earth”, with 124 chapters

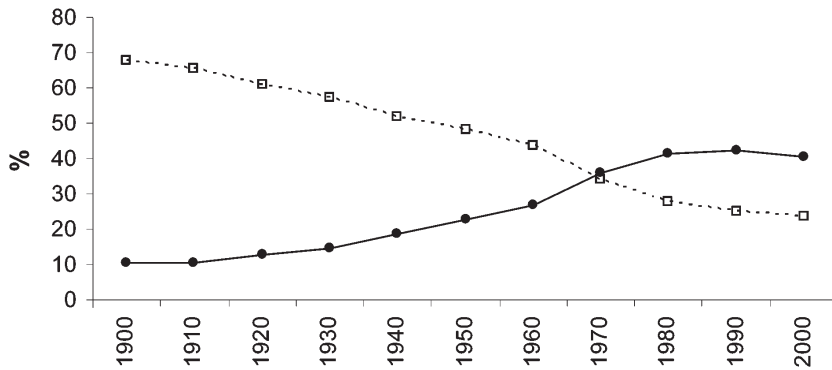


FIG. 1.—Percentage of population (living in villages <10,000 inhabitants; open squares) and population (living in cities >100,000 inhabitants; black dots) present in Spain from 1900 to 2001. Source: Azagra and Chorén (2006).

[Porcentaje de habitantes españoles entre 1900 y 2001 viviendo en poblaciones menores de 10.000 habitantes (cuadrados blancos) y mayores de 100.000 habitantes (círculos negros). Fuente: Azagra y Chorén (2006).]

broadcasted during 1973 - 1980) dealt with birds of prey and terrestrial carnivores. His television shows and encyclopaedias on animal topics marked an emerging generation of naturalists and determined an emphasis on the study of top predators. Many present day Spanish animal ecologists consider themselves intellectual sons and daughters of Félix, as do managers in charge of species protection. In fact, the first Spanish efforts for the legal protection of Iberian predators were addressed to the conservation of the peregrine falcon (1964), owing to the influence of this communicator. In fact it has been already highlighted elsewhere that raptors and carnivorous mammals were present as front pages of the main magazine devoted to nature issues in Spain (*i.e.* Quercus) more often than expected by the diversity and abundance of these groups (Herrera, 1989). A recent update of that analysis indicates that ca. 20 % of the front pages of this conservation magazine ($n = 256$) has a diurnal or nocturnal raptor as a front page picture (Serra, R. *com. pers.*). This is especially striking if we recall that raptors only represent some 9 % (39 / 455 species cited at least once since 1950)

of the Spanish avifauna and that this magazine does not only deal with birds but with all aspects of natural history (Goodness of fit test $\chi^2 = 12.79$, $df = 1$, $P < 0.001$).

The joint influence of rural abandonment and increased awareness most likely affected not only naturalists and wildlife researchers but led to a general concern of Spanish society regarding raptors and large predators such as lynx, wolf or bears. Additionally, a closer proximity to central and northern European countries, following the arrival of democracy and the incorporation of Spain to the EU in 1986, encouraged Spaniards to embrace post-modern attitudes, including birdwatching and nature conservation, with a stronger tradition outside Spain. Hence, hunting and predator persecution were associated with the old practices of the dictatorship period (1939 - 1975) and thus became abandoned to a large extent. Evidence of the social change in attitude in relation to raptors in Spain comes from the decrease in number of raptors admitted, due to shooting or trapping, to a sample of three rehabilitation centres in Eastern Mediterranean Spain during the last decade (Admissions

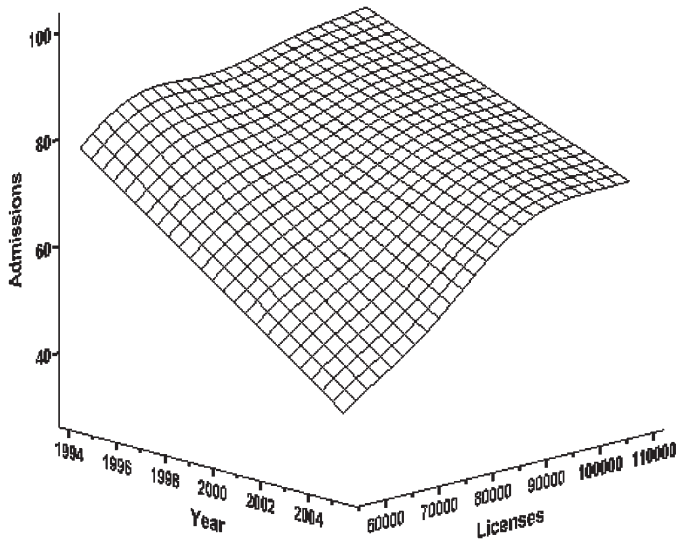


FIG. 2.—Robust locally weighted regression smoothing surface on the number of hunting licences issued annually against the total number of the most common raptor species admitted to rehabilitation centres in the Comunidad Valenciana region (Eastern Spain) from 1994 - 2005. Species: *Buteo buteo*, *Accipiter nisus*, *Falco tinnunculus*, *Athene noctua*, *Tyto alba* and *Bubo bubo*.

[Representación gráfica de la superficie de regresión entre la variación temporal en el número de licencias de caza y el número total de especies de rapaces más comunes admitidas en los centros de rehabilitación de la Comunidad Valencia (años 1994 - 2005). Las especies de rapaces son: *Buteo buteo*, *Accipiter nisus*, *Falco tinnunculus*, *Athene noctua*, *Tyto alba* y *Bubo bubo*.]

Growth Rate or λ for the period 1994 - 2005 = -1.03; lower 95 % CI limit = -1.049 and upper 95 % CI limit = -1.007). The decrease in the number of hunting licences (Licences growth rate λ for the 1991 - 2005 = -1.034; lower 95 % CI limit = -1.034; upper 95 % CI limit = -1.023) issued annually in this region (as a proxy of increased distance of the Spanish population from the rural world) was strongly correlated with the decrease in raptor admissions over time ($r_s = 0.874$; $P < 0.001$; $n = 12$; see Fig. 2), although increased social awareness of urbanized people has probably played a substantial role as well (Fajardo, 2001). An analysis of the Red Data Book on Spanish Vertebrates indicates that illegal hunting occupies the fifth position out of 20 among the main causes of threat; more specifically, for only 18 % of threatened raptor species hunting is still

a major cause of threat, and poisoning seems to be yet a cause of concern for only a few species or subspecies (Madroño *et al.*, 2005).

INFORMING FUTURE CONSERVATION POLICIES IN RAPIDLY URBANIZING COUNTRIES

Summarizing, we think that both, the attitude of researchers and public opinion reflects a rapid and radical change in overall social attitude towards this particular zoological group in Spain. This change was probably marked by one contingent factor (an urbanizing society in rapid economic growth) and a more deterministic one (increased public awareness through mass media). A change with similar velocity and intensity, from intense persecution to conservation, has probably few equivalents

worldwide with any other predator group, except perhaps wolves (Mech, 1995; Karlsson and Sjöström, 2007). Concentration of people in large industrial cities had a double influence here, as people became distanced from predators as a daily problem, and more readily absorbed conservation “doctrines” through their contact with mass media (but see Miller 2005 for a different view on the interaction between biodiversity and conservation and human concentration in urban areas). This societal shift could inform future conservation strategies in countries currently undergoing rapid urbanisation where loss of top predators is of concern (Wright and Muller-Landau, 2006; Laurence, 2007). Basically the Spanish case shows that pressure on top predators is expected to decrease with increasing concentration of rural people in cities and that *ad hoc* educational campaigns broadcasted by the media are not useless.

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APPENDIX 1 [APÉNDICE 1]

List of terms used for our literature search on the effects of recreational activities on breeding diurnal raptors. The search was performed on the following online data bases (ISI Web of knowledge, ISI Web of Science, ISI Proceedings, Science Direct, Scopus, Index to Theses Online, Digital Dissertations Online, CAB Abstracts).

[Listado de términos utilizados en la búsqueda bibliográfica en las bases de datos (ISI Web of knowledge, ISI Web of Science, ISI Proceedings, Science Direct, Scopus, Index to Theses Online, Digital Dissertations Online, CAB Abstracts).]

“Flight initiation distance” AND (raptor* OR “bird of prey”), “Human disturbance” AND (raptor* OR “bird of prey”), “Breeding success” AND (raptor* OR “bird of prey”), “Nest site fidelity” AND (raptor* OR “bird of prey”), Human activit* AND (raptor* or “bird of prey”), Human approach* AND bird*, Escape* AND (raptor OR “bird of prey”), Recreation* AND (raptor* OR “bird of prey”), Disturb* AND (raptor* OR “bird of prey”), Touris* AND (raptor* or “bird of prey”), Urban* AND (raptor* OR “bird of prey”), Impact* AND (raptor* OR “bird of prey”), Road* AND (raptor* OR “bird of prey”), Car AND human AND (raptor* OR “bird of prey”), Hiking AND (raptor* OR “bird of prey”), Research effect* AND (raptor* OR “bird of prey”), “Flushing distance” AND (raptor* OR “bird of prey”), “Nest success” AND (raptor* OR “bird of prey”), Leisure* AND disturbance*.

APPENDIX 2 [APÉNDICE 2]

List of references specifically dealing with the effect of recreational uses on breeding raptors, selected from the inspection of ca. 4,000 abstracts of references dealing with the topic. Studies published by Spanish authors are highlighted in bold.

[Referencias que tratan del efecto de las actividades recreativas sobre la biología reproductiva de las rapaces. Las referencias son una selección entre los 4000 resúmenes revisados sobre el tema. Los artículos publicados por autores españoles se marcan con el texto en negrita.]

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APPENDIX 2 [APÉNDICE 2] cont.

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