

TECHNICAL REPORT 07/2017

Wild Fauna mortality
in the Valencian Community.
Causes and significance.



Servei de Vida Silvestre (Wildlife Services)
General Management of Natural Environment and Environmental Assessment
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GENERALITAT VALENCIANA

CONSELLERIA D'AGRICULTURA, MEDI AMBIENT, CANVI CLIMÀTIC I DESENVOLUPAMENT RURAL

WILD FAUNA MORTALITY IN THE VALENCIAN COMMUNITY. CAUSES AND SIGNIFICANCE.

BACKGROUND INFORMATION

The Servicio de Vida Silvestre (Wildlife Service) maintains different databases upon wild fauna mortality in the Valencian Community since the end of the 1990s, corresponding to the main known mortality causes. For each of these causes, annual balances that describe the scope of the problem, the impact on endangered species and displaying the performed action to reduce the accident rate are prepared.

In order to elaborate the current report, all the available mortality registers within these databases have been reviewed. The aim is to describe the impact of each of the different causes over wild fauna, carrying out a thorough analysis for each group of fauna. The list of the analysed mortality causes is ordered as follows:

Table 1. Relation of the mortality causes.

Mortality cause	Beginning of database
Road Accidents	1986
Shots	1990
Drownings	1992
Collisions with power lines	1994
Electrocutions	1995
Fishing gear interactions	1998
Poisoning	2000
Wind turbine collisions	2006

Lastly, a general overlook of the mortality causes from the available registers is displayed, pointing out the causes with the greatest impacts over the wild fauna and also those that affect more to endangered species.

Bearing this in mind, we may carefully consider the obtained results, as in most cases the finding of these specimens is casual, so the registered mortality may be deemed as a biased display of the actual mortality. Only in the case of wind turbine collisions, the register of cases belongs to a permanent tracking programme, so it would be closer to the real mortality. In the rest of cases, the number of specimens recorded annually greatly oscillates depending on the performance of communicative campaigns with the responsible sector (for example professional fishermen for sea turtles).

MORTALITY IN WIND TURBINES

The Valencian Community counts with 10 wind power functioning areas, 4 in the province of Castellón and 6 in Valencia's. Excluding the 9th zone (Buñol), which started functioning in 1999, the rest started operating from 2006 onwards (Table 2).

Table 2. Operational wind power zones and parks in the Valencian Community.

Province	Wind power zone	Starting year
Castellón	1	2006
	2	2006
	3	2006
	6	2008
Valencia	7	2010
	8	2010
	9	1999
	10	2009
	11	2009
	12	2011

Overall death rates

Until the 31st December 2016, a total of 1.722 wind turbine collision casualties has been recorded, bearing in mind that the number of wind parks has been gradually increasing along the reviewed period. The average of death cases in the last 5 years (2012-2016), period in which all parks were already operational, resulted in **171 ex/year**. The distribution (cumulative) in wind zones is exhibited in the following graph:

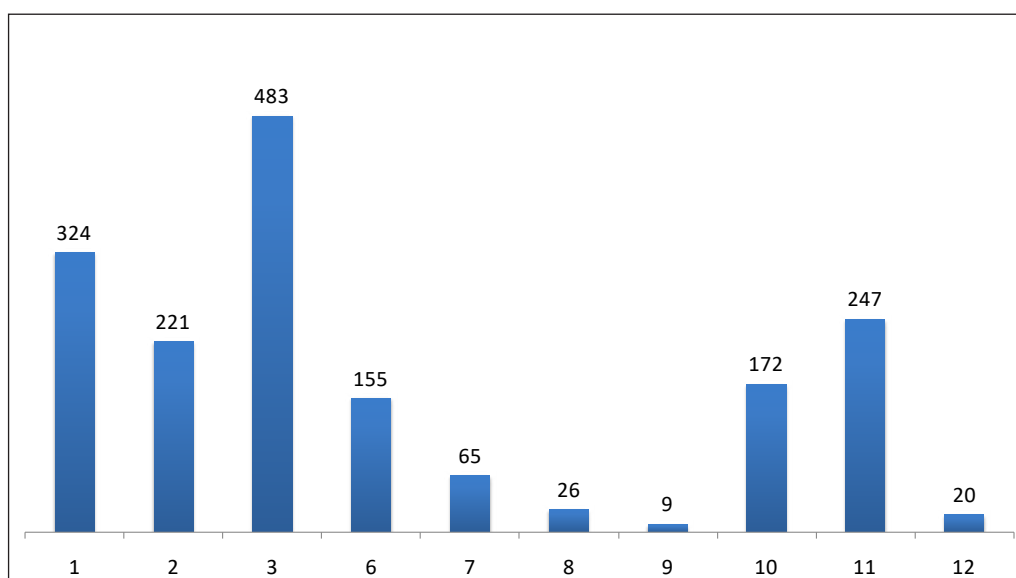


Figure 1. Cumulated mortality (death records) in wind zones until 31st December 2016.

The most affected group of fauna was that of the griffon vultures, with more of the 45% of the registers, closely followed by Other Birds (mainly passeriforms; Table 3).

Table 3. Abstract of the death rates by collision with wind turbines in wind zones of the Valencian Community.

Griffon Vultures	Other Birds	Otras predatorias	Undetermined birds	Bats
785 (46%)	575 (33%)	111 (6%)	14 (1%)	237 (14%)

Recorded mortality in wind zones

The existence of normalised tracking programmes in every wind zones, allows a comparison between them:

Table 4. Comparison of the death rates in wind zones.

Province	Wind Zone	Starting year	Number of wind turbines*	Specimens number	Specimen/wind turbine/year
Castellón	1	2006	66	324	0,45
	2	2006	77	221	0,26
	3	2006	120	483	0,37
	6	2008	115	155	0,15
Valencia	7	2010	54	65	0,17
	8	2010	66	26	0,06
	9	1999	24	9	0,02
	10	2009	68	172	0,32
	11	2009	134	247	0,23
	12	2011	61	20	0,05

* Information on the number of wind turbines in each wind zone taken from <http://www.thewindpower.net/>

Death rate of endangered species

During these years, 12 mortality cases of listed specimens have been registered: 8 birds of prey and 4 bats. The allocation of the species and their respective wind zones is displayed below.

Table 5. Mortality records of endangered species in wind zones.

Species (Degree of protection)	1	2	3	6	7	8	9	10	11	12	Total
Cave bat (V)								1	2		3
Marsh harrier (E)	1				1						2
Red kite (E)	1										1
Black vulture (V)					1						1
Montagu's harrier (V)				1							1
Lesser kestrel (V)			1								1
Egyptian vulture (V)		1									1
Great noctulus (V)									1		1
Osprey (V)				1							1
Total	2	1	1	2	2	0	0	1	3	0	12

(V) Vulnerable; (E) Endangered.

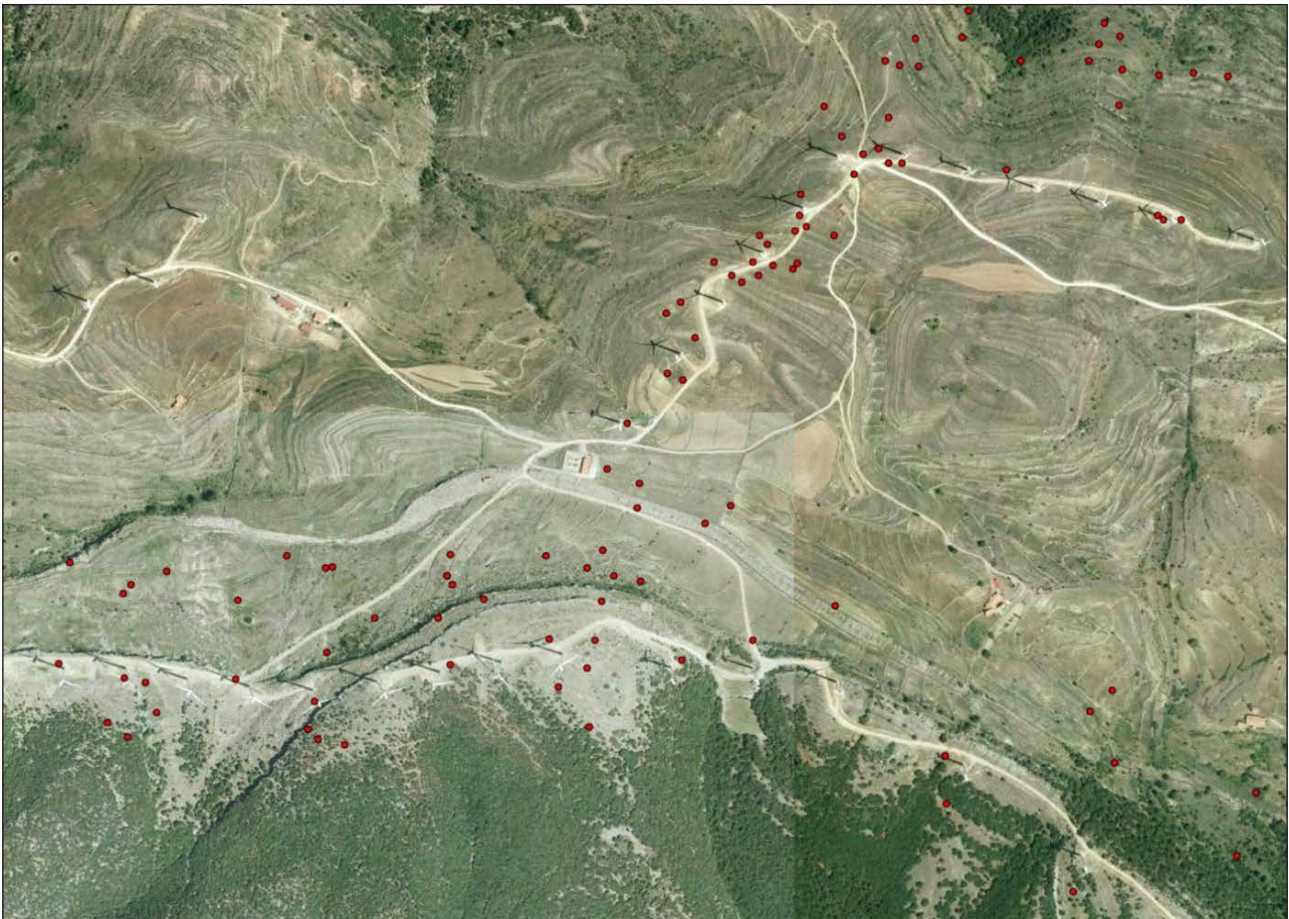


Figure 2. Location of the corpses detected in a stretch in Parque Eólico Torre Miró I (Wind Power Park Torre Miró I), Morella (1st wind power zone; 2006-2016).

ELECTROCUTIONS

The wild fauna electrocutions database in the Valencian Community has been maintaining records since 1995. The coverage and the effort put in the search and communication of the electrocutions, has been variable during the starting years (Figure 3) but it may be considered uniform since 2009, first year in which a balance of the recorded electrocutions is devised in Wild Fauna Recovery Centres¹. The subsequent development of a protocol for the reception and communication of electrocuted animal cases (October 2011) served to reinforce this project.

General mortality

The total of the fauna electrocutions recorded until 31st December 2016 is 3.459. Considering the above mentioned year-to-year variability, only the last five years (2012-2016) have been taken into account when calculating the annual average, that has proved to be of **210 electrocutions per year**.

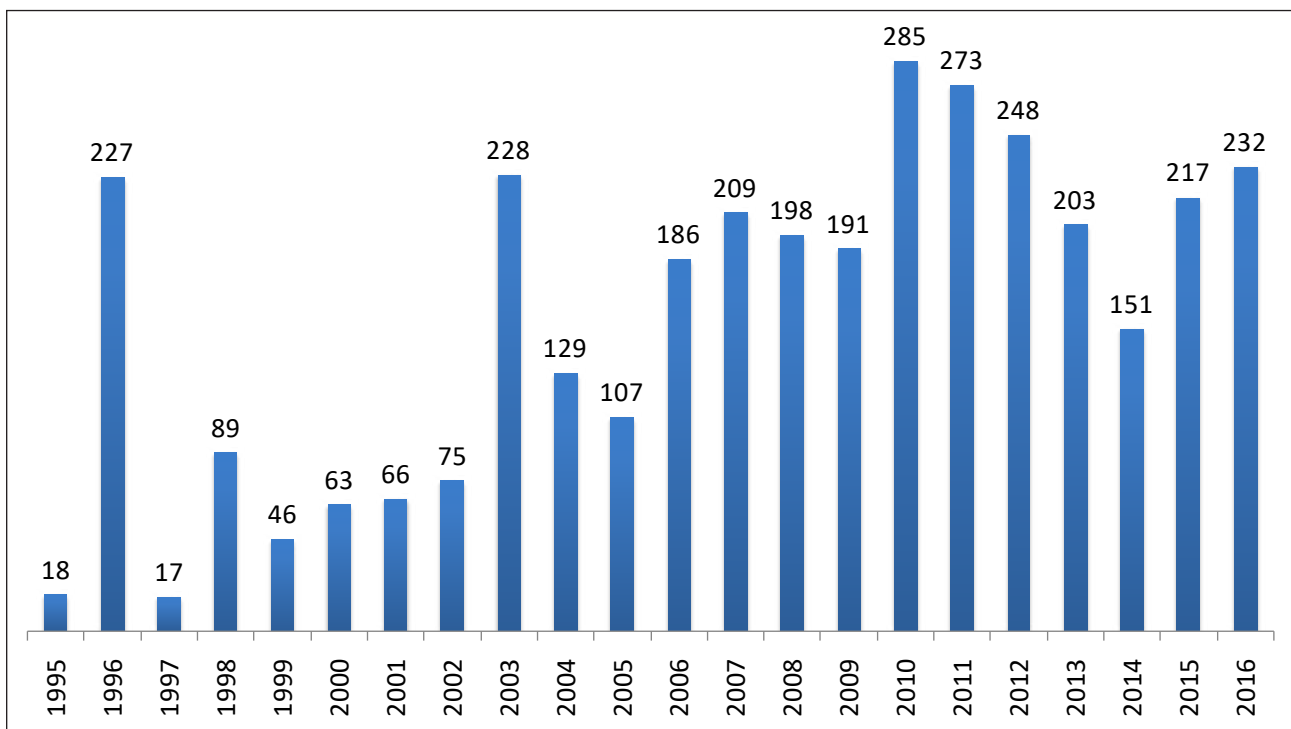


Figure 3. Historical register of the electrocution recorded in the Valencian Community.

The most affected fauna group by this cause was that of the birds of prey (diurnal and nocturnal), with a cumulated total of 2.833 specimens. The rest of the reviewed groups are nowhere near of them (Table 6).

¹ *Identificación de las Áreas Prioritarias para la protección contra la colisión y electrocución de la avifauna en la Comunidad Valenciana*. Juan Manuel Pérez-García. Universidad Miguel Hernández. Generalitat Valenciana. 2009.

Table 6. Fauna electrocutions registered in the Valencian Community, classified by fauna group, during 1995-2016.

Group	Registers	%
Diurnal birds of prey	1.841	53,2
Nocturne birds of prey	992	28,7
Other birds	342	9,9
Water birds	124	3,6
Reptiles	58	1,7
Mammals	56	1,6
Undetermined	46	1,3
Total	3.459	100%

The two most affected species were the Common Kestrel, standing for half of the diurnal birds of prey registers (919), and the Eagle Owl, which almost corresponded to all the nocturne birds of prey registers (909). The rest of the species is far away, as exhibited in the Table 7.

Table 7. Species with 50 or more records for electrocutions during 1995-2016.

Species	Records
Common Kestrel	919
Eagle Owl	909
Common Buzzard	283
Booted Eagle	168
Short-Toed Eagle	94
Bonelli's Eagle	88
Griffon Vulture	83
Jackdaw	56
Stork	50

Endangered species mortality

During the reviewed period, 108 electrocutions of endangered species have been recorded (Table 8), among them it is worth mentioning the Bonelli's Eagle with 88 cases. The electrocution is the more relevant mortality cause for this species, that is gradually decreasing in Spain.

Table 8. Records of electrocuted endangered species in the Valencian Community during 1995-2016.

Species (Degree of protection)	Castellón	Valencia	Alicante	Total
Bonelli's Eagle (V)	11	12	65	88
Osprey (V)	0	5	4	9
Montagu's Harrier (V)	1	2	0	3
Purple Heron (V)	0	2	1	3
Marsh Harrier (EP)	0	2	0	2
Black Vulture (V)	1	0	0	1
Eleonora's falcon (V)	1	0	0	1
Lesser Kestrel (V)	0	0	1	1
Total	14	23	71	108

(V) Vulnerable; (E) Endangered.

The electrocutions average of this species in the Valencian Community (1995-2016) has been of 4.2 ex/year, highlighting the number of cases recorded in the province of Alicante (n=65), that represents 74% of the total records (Figure 4).

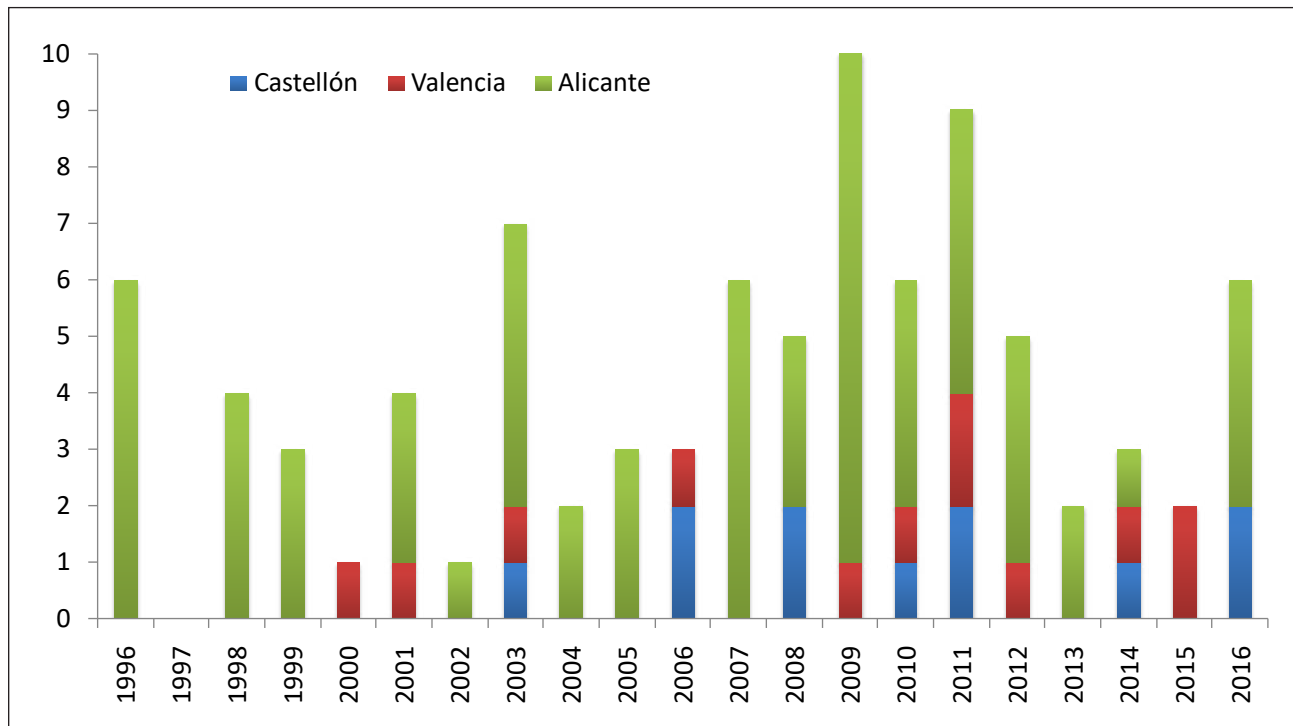


Figure 4. Number of recorded Bonelli's Eagles' electrocutions during the reviewed period, ordered in provinces.

In the figure 5, the municipalities where electrocutions of this species have been recorded during recent years are exhibited. We should highlight the high mortality in the southern part of Alicante, with maximum rates in Pilar de la Horadada (31 cases) and Orihuela (14 cases), having to point out that these data come from specific search studies in the power lines of Sierra de Escalona and its surroundings^{2,3}, a well-known area of concentration of large dispersing juvenile eagles.

In the Table 9, the record of the electrocuted Bonelli's Eagles from 2000 onwards is displayed, from whom we have information upon their age. For a total of 39 species that could have been recorded, it can be observed that adult (n=12) and young (n=12) specimens of the year stood for more of the 60% of the registers. Regarding the specimens sexed in this same period (n=30), a 57% of the cases were female and a 43% of male.

Table 9. Records of electrocuted Bonelli's Eagles that could have been registered, ordered in ages and provinces, during 2000-2016.

	Young	2 nd Year	3 rd year	Subadult	Adult
Castellón	3	0	1	0	5
Valencia	1	2	1	2	5
Alicante	8	4	1	4	2
Total (n=39)	12	6	3	6	12

² Izquierdo, A., Seva E., Martín C. y López, G. 1996. *Informe preliminar sobre la Electrocuación en Tendidos eléctricos de fauna silvestre en el área de la Sierra de Escalona y la Sierra del Puerto*. Alicante. Conselleria de Agricultura y Medio Ambiente. Unpublished.

³ TRAGSA, 2003. *Caracterización de líneas eléctricas en la Sierra de Escalona y Dehesa de Campoamor (Alicante) y de su incidencia en la avifauna*. Unpublished.

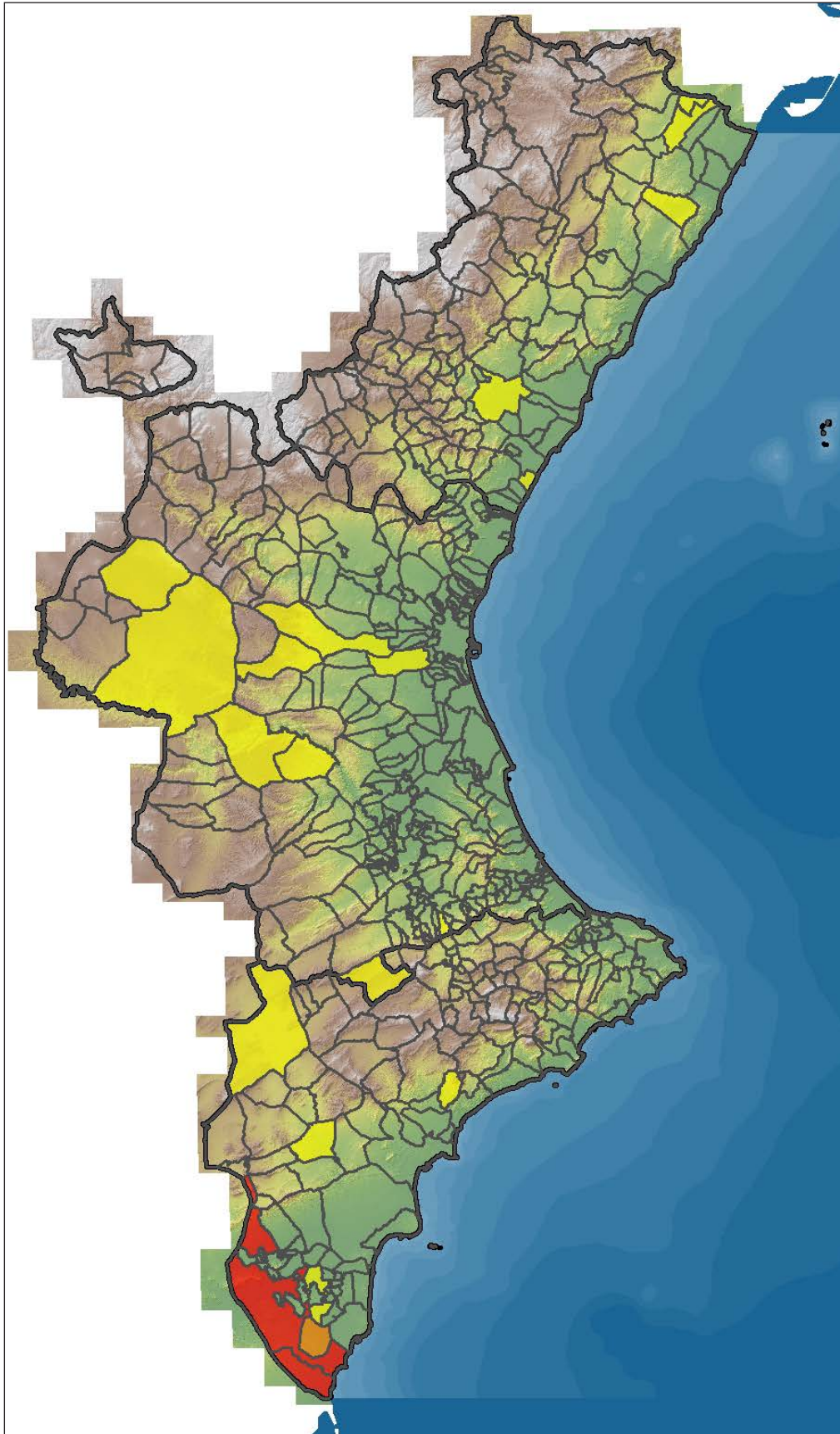


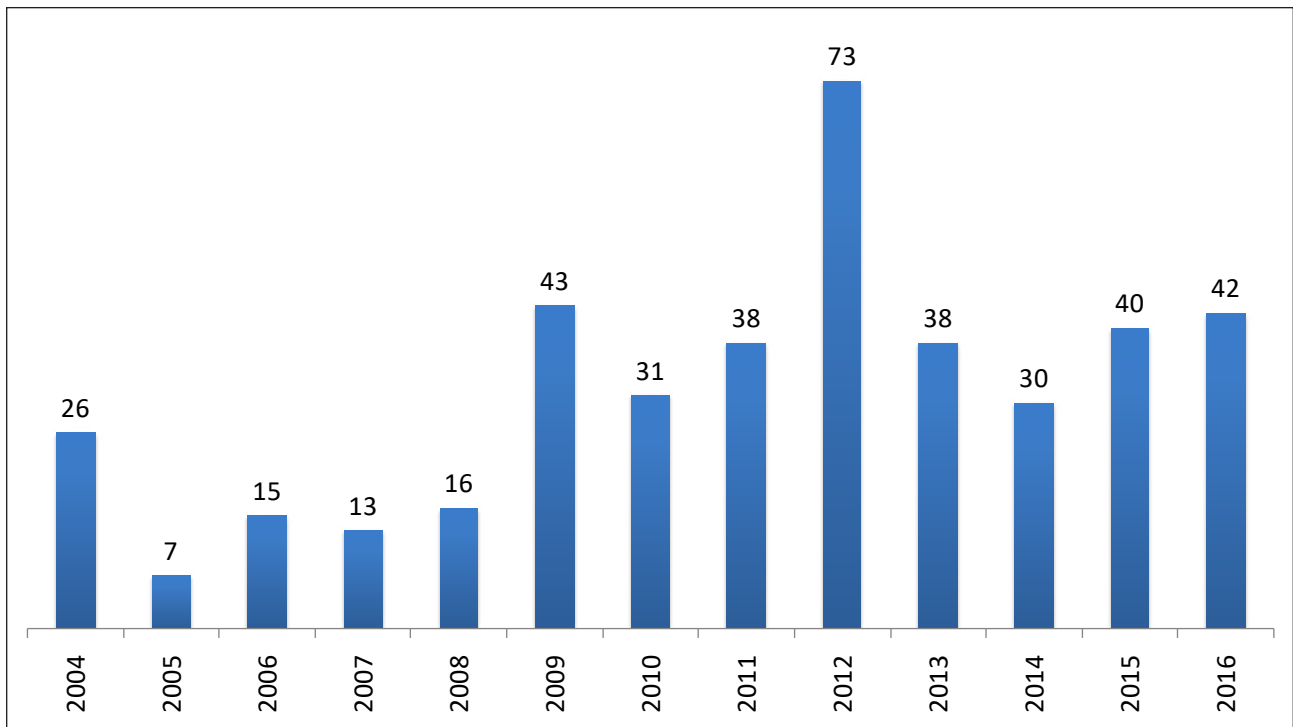
Figure 5. Municipalities where Bonelli's Eagle electrocutions have been recorded during the reviewed period. Yellow 1-2 records; Orange: 6 records; Red: 14-31 records.

COLLISIONS WITH POWER LINES

The database of wild fauna collisions in power lines similarly operates to that of electrocutions, feeding from the Fauna Recovery Centres' incomes, but also including death rates for collision with the evacuation lines in wind power parks, obtained from the environmental monitoring programmes of these facilities.

General mortality

The total of bird collisions registered until 31 December 2016 is 418. Records since 1994 are maintained in the database, but as in the previous case, the information begins to be compiled in a more or less regular form around 2009⁴. For the last 5 years (2012-2016), it results in an average of **45 collisions per year**.



Figur6 6. Historical register of the collisions recorded in the Valencian Community. It is shown from 2004 onwards due to the shortage of data (n=7)..

Regarding the affected species, most of the records correspond to small birds (warblers, thrushes, starlings, etc.), compiled together with the evacuation lines of wind power parks. Nevertheless, the number of some collided water birds and birds of prey specimens is also highlighted (Tables 10 and 11).

⁴ Pérez-García J.M. y Botella F. 2012. *Modelo de zonas de riesgo para la colisión de la avifauna en líneas eléctricas de transporte en la Comunidad Valenciana*. Red Eléctrica de España. Unpublished.

Table 10. Collisions of recorded birds in the Valencian Community between 1994-2016, ordered in groups.

Group	Records	%
Water birds	117	28
Diurnal birds of prey	50	12
Nocturne birds of prey	36	8,6
Other birds	215	51,4
Total	418	100%

Table 11. Species with ten or more records for collisions with power lines between 1994-2016.

Specimen	Records
Blackcap	35
Grey Heron	23
Eagle Owl	19
Common Kestrel	19
Song Thrush	19
White Stork	14
Pink Flamingo	11
Spotless Starling	11
Cattle Egret	10

Death rates of endangered specimens

Along the reviewed period, 20 collisions of endangered specimens have been recorded (Table 12). The impact upon the Bonelli's Eagle is underscored once again, in this instance with four cases (2 in Orihuela, 1 in Finestrat and 1 in Vall d'Uixó).

Table 12. Records of endangered species collisions in the Valencian Community between 1994-2016. No cases of endangered species were recorded in 2008, 2009 and 2016.

Specimen (Degree of protection)	1994	1997	2004	2005	2006	2007	2010	2011	2012	2013	2014	2015	Total
Common Tern (V)			1	1		1					1	1	5
Bonelli's Eagle (V)				1	1				1			1	4
Audoin Gull (V)									3				3
Purple Heron (V)										1	1		2
Squacco Heron (V)			1				1						2
Bittern (E)		1											1
Lesser Kestrel (V)								1					1
Osprey (V)	1												1
Little Tern (V)			1										1
Total	1	1	3	2	1	1	1	1	4	1	2	2	20

(V) Vulnerable; (E) Endangered.

ROAD ACCIDENTS

In 2012, an estimate of accidents upon wild fauna in the Valencian Community was performed⁵. In order to accomplish this analysis, all the previous available information about this type of accidents was compiled, moulding a data table of approximately 9.000 records. Hitherto this data base of wild fauna accidents in roads of the Valencian Community is maintained, whose main sources are: 1) periodic data of environmental agents, 2) Biodiversity Data Bank of the Valencian Community, 3) entries in Fauna Recovery Centres and 4) various occasional appointments: Brigadas de Red Natura 2000 (Natura 2000 Network Brigades), Natural Parks' staff, etc..

General mortality

The total of recorded accidents up to 31st December 2016 is 14.205, with an average of **1.183 accidents per year** for the past 5 seasons.

In the figure 7, the distribution of the data obtained annually is displayed. It can be appreciated a maximum in 2011-2012, when the research process and the above mentioned data collection (including specific samples) were conducted, and also a gradual decrease in the compiled amount of data henceforth. The increased number of records in the early 90s is also highlighted, as a result of the mortality monitoring programme in roads conducted during these years.

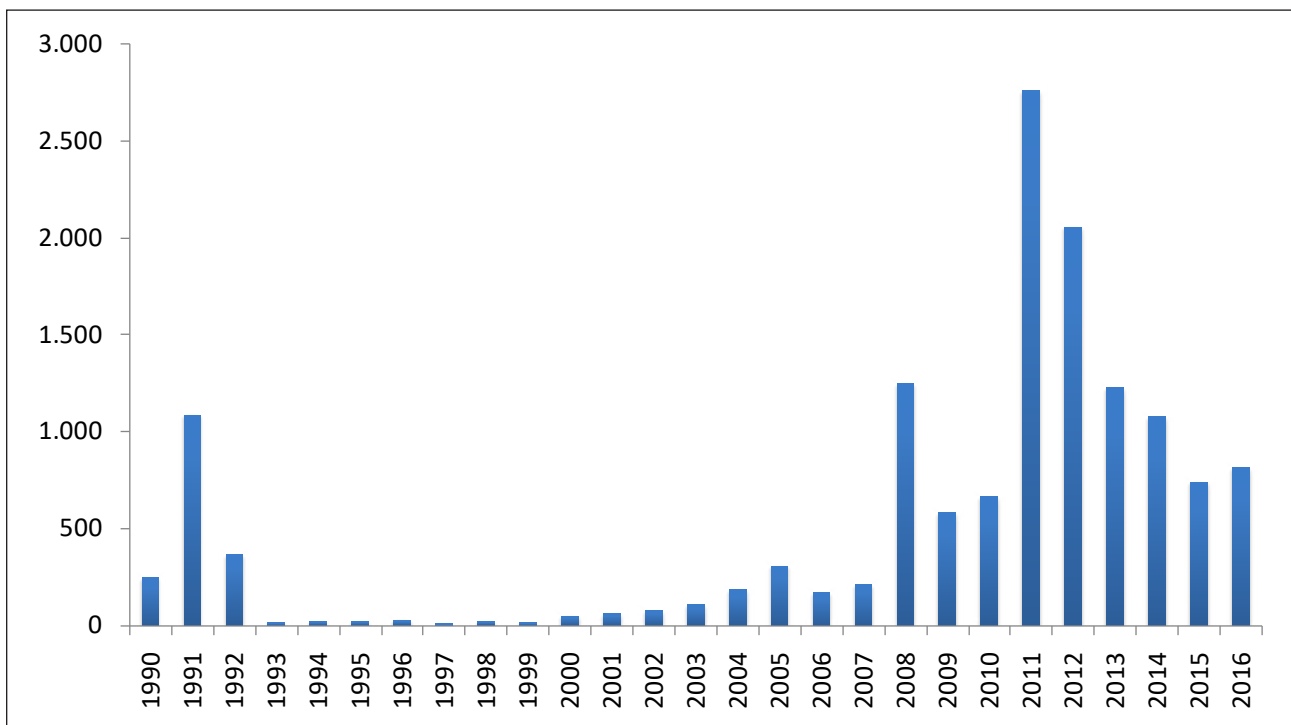


Figure 7. Historic record of recorded fauna accidents in the Valencian Community.

⁵ *Evaluación de los atropellos de vertebrados en la red de carreteras de la Comunitat Valenciana*. Natural Areas and Biodiversity Service. May 2012.

Altogether, mammals are the fauna group most affected by this mortality cause with a 50% of the records, followed by birds (26%), and leaving reptiles (14%) and amphibians (10%) in the last position. In the Table 13 and figure 8, the distribution of accidents, ordered in fauna groups, is displayed pointing out in each case the specimen with a higher number of registers.

Table 13. Percentage of accidents ordered in fauna groups/subgroups.

Group	Subgroup	% over the total	Most representative species	% sub-group
Mammals	Lagomorphs	18	Rabbit	91
	Rodents	10	Squirrel	43
	Insectivores	8	Hedgehog (both species)	96
	Carnivores	7	Fox	43
	Ungulates	5	Boar	94
	Chiropters	2	Pipistrellus Bat	92
Birds	Other birds (mostly Passerines)	18	House Sparrow	15
	Waterbirds	5	Moorhen	56
	Birds of prey	3	Little Owl	60
Reptiles		13	Bastard/Montpellier Snake	35
Amphibians		10	Common Toad	46

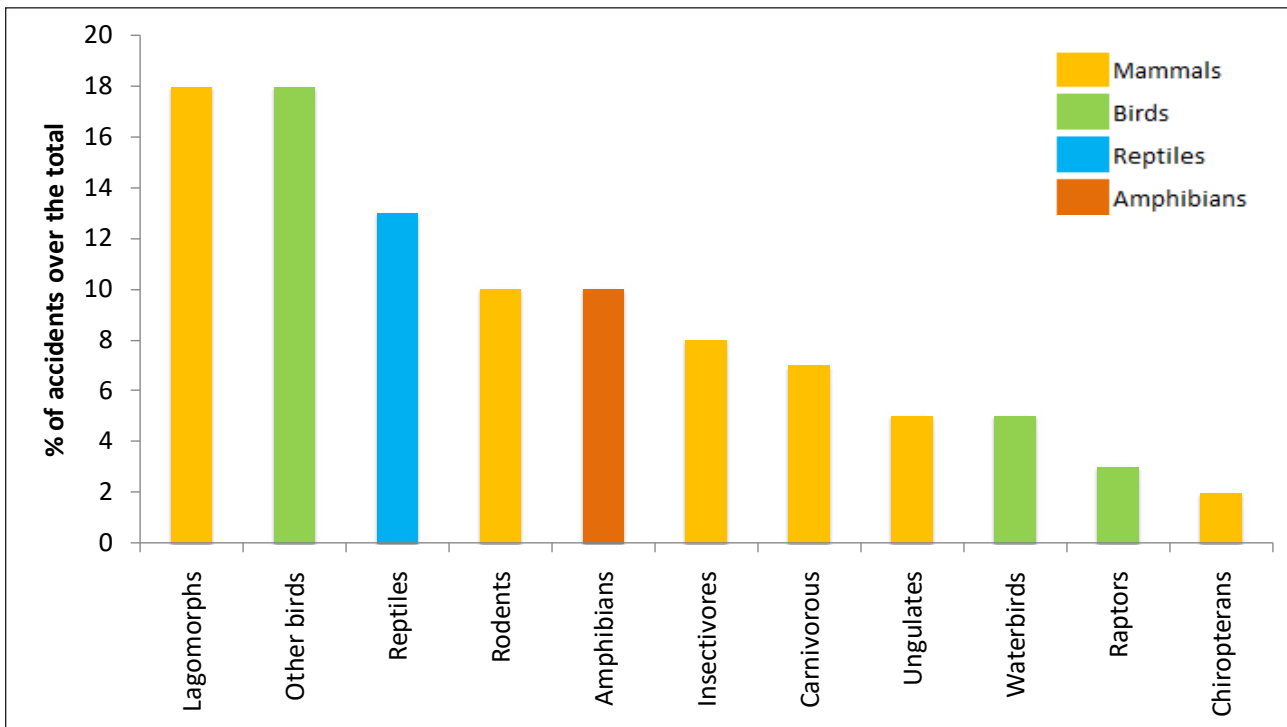


Figure 8. Total distribution of accidents ordered by fauna group/subgroup.

Endangered species mortality

In the 14th table, the endangered species accidents recorded for each year are displayed. The most prominent case is that of the Iberian Ribbed Newt, specimen classified as Vulnerable, for which dozens of accidents are recorded every year in Alto Vinalopó, Alicante (Figure 9). For the rest of endangered species affected by this mortality cause, the number of records is much less, but the number of Kentish Plover accidents in the early 90s in Santa Pola, as a result of thorough trackings in the road N-330, and the cases of accidented otters in the provinces of Castellón and Valencia, are highlighted.

Table 14. Accidents of endangered species in the Valencian Community between 1988-2016.

Species (Degree of protection)	88	91	92	96	97	0	2	3	7	8	9	10	11	12	13	14	15	16	Total
Iberian Ribbed Newt (V)										1			2	56	29	50	17	68	223
Kentish Plover (V)		14																	14
Otter (V)					1	1		1	1		1	2			1			1	9
Little Terns (V)		4																	4
Squacco Heron (V)										1				1	1				3
Common Redstart (V)		3																	3
Black Stork (V)														2					2
Audoin's Gulls (V)			1							1									2
Cabrera Vole (V)							2												2
Lesser Horseshoe Bat (V)														1			1		2
Hermann/Mediterranean Tortoise (V)												1	1						2
Black Tern (E)		1																	1
Montagu's Harrier (V)																		1	1
European Pond Turtle (V)														1					1
Collared pratincole (V)										1									1
Common bent-wing bat (V)	1			5										1					7
Mediterranean Horseshoe Bat (V)					1														1
Greater mouse-eared bat (V)																	1		1
Total	1	22	1	5	2	1	2	1	1	4	1	3	3	62	31	50	19	70	279

(V) Vulnerable; (E) Endangered.

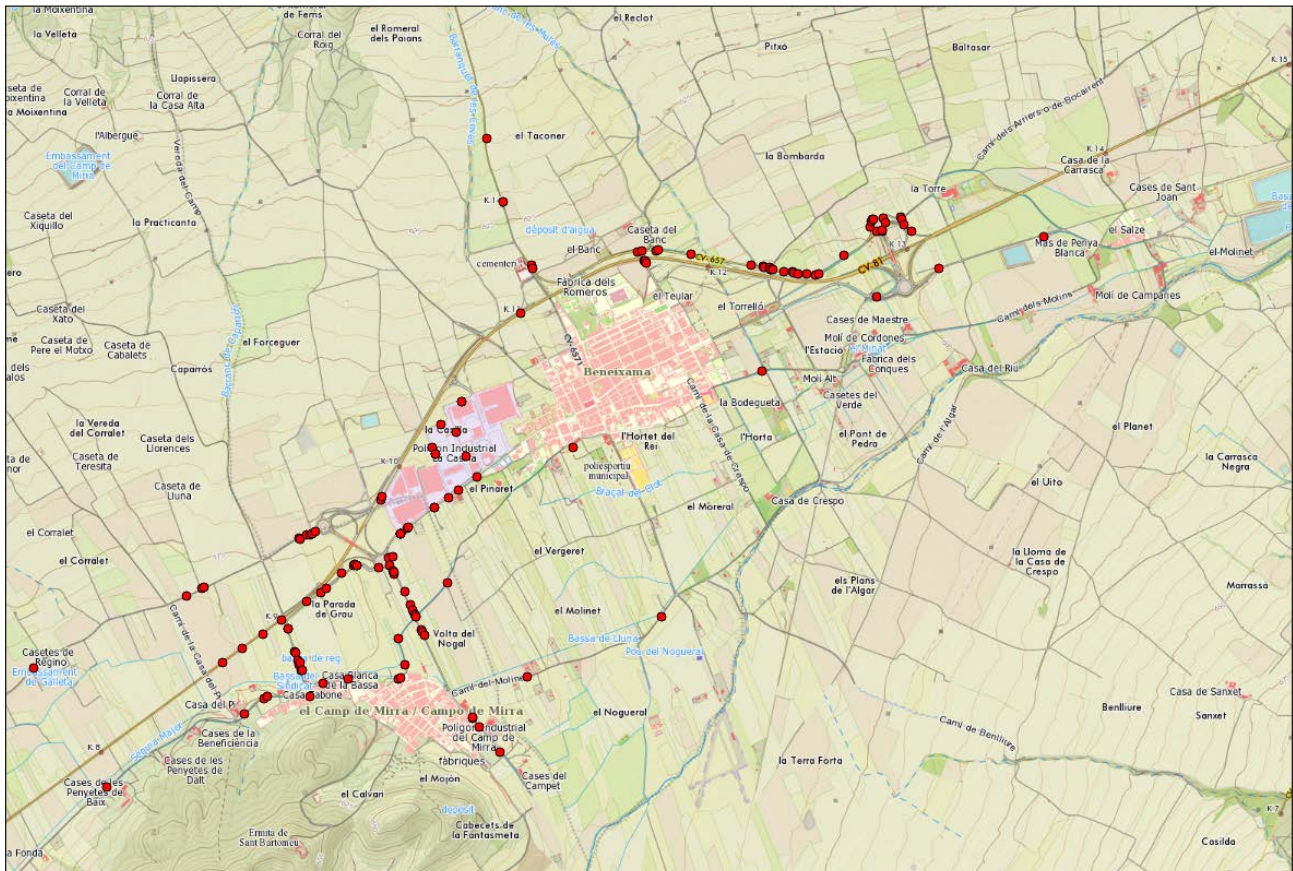


Figure 9. Detail of some of the recorded Iberian Ribbed Newt accidents in the region of Alt Vinalopó (2011-2016).

SHOTS

The mortality records of gunshots to non-hunting wild fauna come from the Valencian Community Fauna Recovery Centres database, having available information since the early 90s.

Furthermore, in 2013 an internal communication protocol for shot non-hunting fauna entered in the CRF was established, with particular emphasis on endangered species and the use of lead shots in wet areas.

General mortality

Between 1991 and 2016, 2.124 non-hunting specimens (all birds) have entered the Valencian Community CRF (Fauna Recovery Centres), distributed as follows:

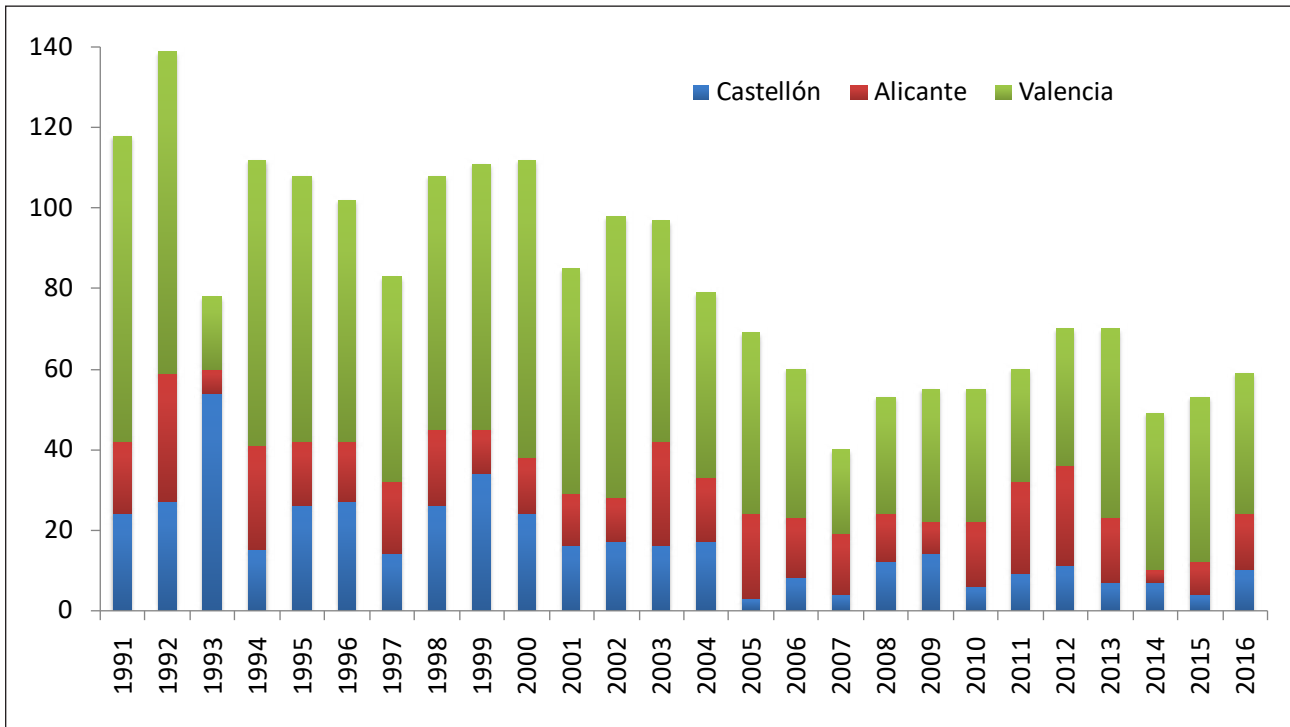


Figure 10. Admissions for shots to non-hunting wild fauna in the Valencian Community CRF between 1991-2016.

A gradual decrease in the number of admissions for this cause can be appreciated, with annual averages diminishing between decades (Table 15).

Table 15. Average of admissions for shot to non-hunting fauna in the Valencian Community CRF, ordered in decades.

	1991-2000	2001-2010	2011-2016
Average of admissions per year	107	69	60
Total admissions for shots	1.071	691	361

The most affected group, by far, for this cause are the diurnal birds of prey, with 65% of the records for this cause (Table 16), followed by waterbirds, nocturnal birds of prey and other birds to a lesser extent.

Table 16. Admissions for shot to non-hunting birds between 1991-2016, ordered in groups.

Group	Records	%
Diurnal birds of prey	1.363	64,2
Water birds	353	16,6
Nocturne birds of prey	232	10,9
Other birds	175	8,2
Total	2.123	100

Subsequently, the five specimens with the highest number of admissions for shot cumulated for the three most affected groups, are displayed:

Table 17. Relation between the five specimens with highest rate of admissions by shot for the three most affected groups.

Diurnal birds of prey		Water birds		Nocturne birds of prey	
Species	Total	Species	Total	Species	Total
Common Kestrel	487	Grey Heron	95	Eagle-owl	103
Eurasian Sparrowhawk	333	Cattle Egret	90	Little Owl	54
Common Buzzard	184	Great Cormoran	52	Short-eared Owl	29
Booted Eagle	94	Pink Flamingo	26	Barn Owl	28
Peregrine Falcon	58	Little Egret	25	Long-eared Owl	14

Endangered species mortality rates

The total by shot registered species amounts to 115 (between 1991-2016), from which 68% corresponds to diurnal birds of prey, and 31% water birds. The species breakdown is displayed in the table 18.

In parallel to the total of admissions, the number of shot endangered species have also been reduced over the years (Figure 11), although nowadays mortality cases for this cause are still occurring, especially in the birds of prey group (Bonelli's Eagle and Marsh Harrier; Table 18).

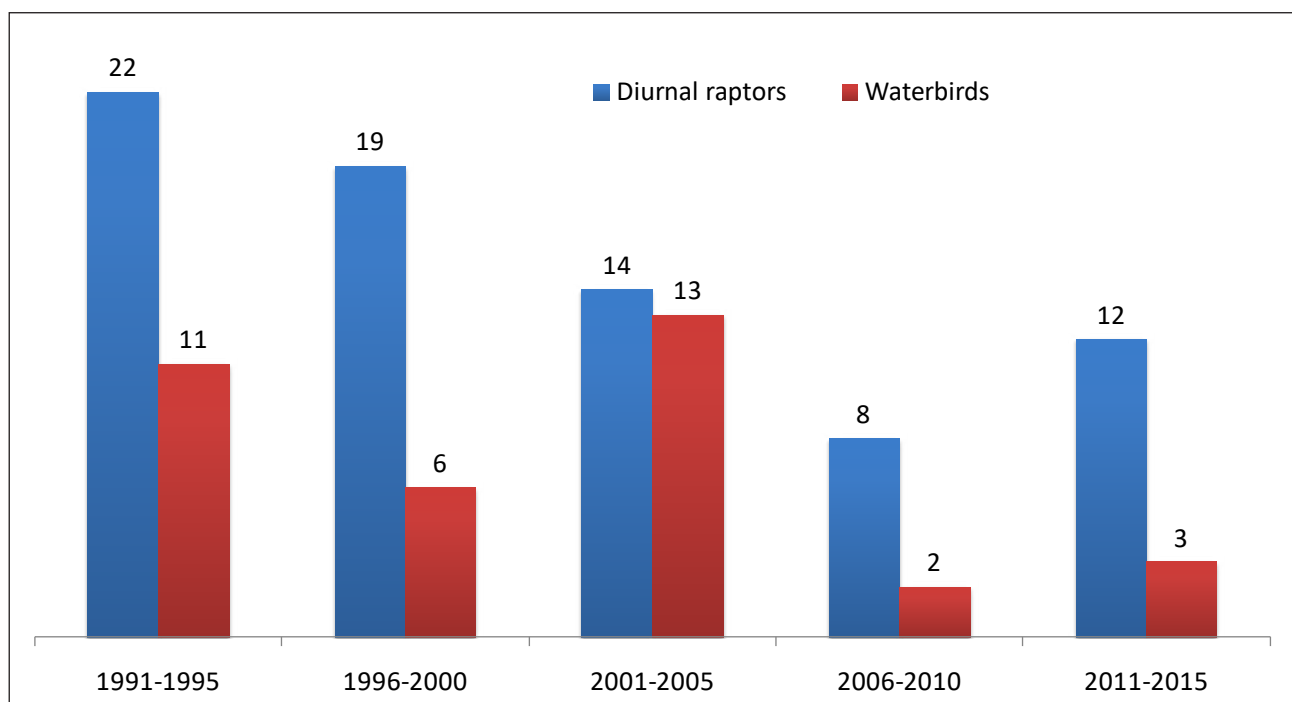


Figure 11. Admissions by shot to endangered specimens belonging to the two reviewed groups, ordered in five year periods (1991-2015).

Table 18. Records of endangered species by shot, group and year.

		91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	Total
Diurnal birds of prey	Bonelli's Eagle (V)			3	1			6	2	2	2	1			2	2	1		1	1		1		2	1			28
	Marsh Harrier (E)	1	6	1	1	2				2	3	3	3		1		1	1	1		1	2			2	2	1	34
	Montagu's Harrier (V)					1							1		1							1					1	5
	Eleonora's Falcon (V)	1		1																				2				4
	Red Kite (E)	1	1								1																	3
	Osprey (V)	1										1							1									3
	Lesser Kestrel (V)	1																										1
Water Birds	Audouin's Gull (V)	1	1				1		2	1		6			1								1		2			16
	Purple Heron (V)	3	2			2	1																					8
	Marbled duck (E)					1				1					2													4
	White-headed Duck (E)		1																1									2
	Bittern (E)																					1						1
	Collared pratincole (V)														1													1
	European Shag (V)											1																1
	Common tern (V)												1															1
	Crested Coot (E)													1														1
Other Birds			1	1																								2
Total	9	11	6	3	6	2	6	4	7	6	11	5	1	8	2	2	3	2	1	2	4	1	4	5	2	2	115	

(V) Vulnerable; (E) Endangered.

DROWNINGS

The wild fauna drowning cases in water points started to be systematically compiled as from 2010, year during which a first memory related to this mortality cause in the Valencian Community was written, after including the existing prior data⁶. Since then, the database is kept permanently updated, mainly nourishing from: 1) admissions in Fauna Recovery Centres, 2) direct communications of Environmental Agents and Biodiversity Squads, and 3) validated appointments of the Biodiversity Data Base (reported by individuals). Additionally, some specific works dealing with the impact of this mortality cause have contributed to the enhancement of the available information, take for instance the mortality tracking of vertebrate in irrigation ponds and fire tanks conducted in 2009, or the research on drowning risk spots for Bonelli's Eagle in the environment of the National Park Sierra de Espadán carried out in 2016.

General mortality

The total of the recorded wild fauna drownings between 1991-2016 amounts to 406, with an average of **28 cases per year** for the last 5 seasons. Despite as of 2016 we could deem the compiled information as quite uniform, the existence of specific campaigns of body search -abovementioned- allows the existence of a great year-to-year variability (Figure 12).

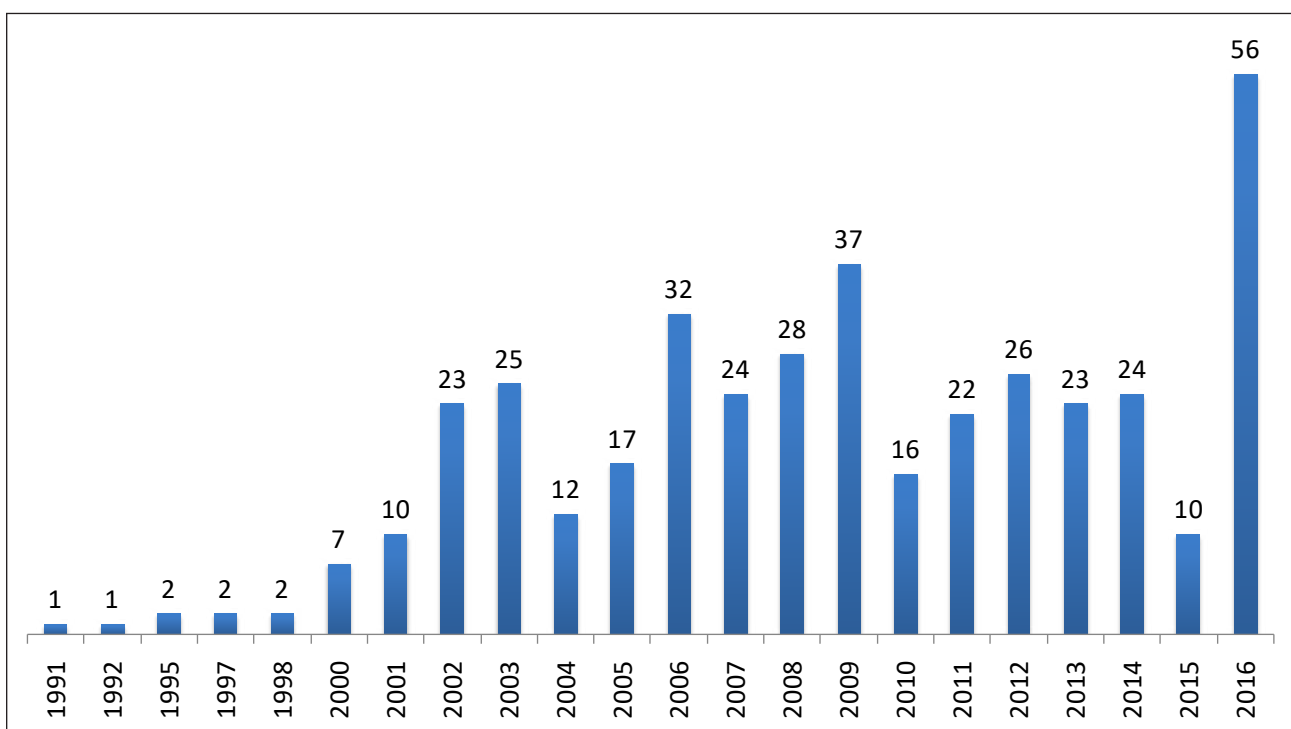


Figure 12. Historic record of registered drownings in the Valencian Community.

⁶ Seguimiento de mortalidad de vertebrados en balsas de riego y depósitos de incendios en la Comunitat Valenciana. Biodiversity Services. 2010.Unpublished report.

Most of the species affected by this cause were birds and mammals (Table 19), even though there are few cases of reptiles (snakes and ocellated lizards) and amphibians (toads) accidentally trapped in these facilities.

Table 19. Recorded drownings in the Valencian Community between 1991-2016, ordered by groups.

Fauna group	Records	%
Birds	241	59,4
Mammals	140	34,5
Reptiles	20	4,9
Amphibians	5	1,2
Total	406	100%

The breakdown for the two most affected fauna groups is as follows:

Table 20. Breakdown of the records for the two most affected fauna groups.

Mammals		Birds	
Carnivorous	67	Diurnal birds of prey	96
Rodents	32	Nocturne birds of prey	82
Hoofed mammals	14	Water birds	15
Lagomorphs	14	Other birds	48
Insectivorous	11		
Bats	2		
Total	140	Total	241

Endangered species mortality

Regarding the endangered species, there is an old datum (1995) of a great buzzard bat (*Myotis myotis*) in Ibi, and there is evidence of two Cabrera voles (*Microtus cabreræ*) drowning episodes in ponds (5 specimens in Ayora, 2000; and 1 specimen in Requena, 2003), although as a mortality cause, it is significantly relevant for the Bonelli's Eagle, with 11 compiled cases along these years, being 7 of them compiled during the first and second year (Table 21).

Table 21. Bonelli's Eagle recorded drownings in the Valencian Community between 1991-2016.

Date	Sex	Age	Municipality	Province	Pond type
Year 2003	-	1 st year	Alcoy	Alicante	Pond against fires
20/07/2003	Female	1 st year	Jarafuel	Valencia	Pond against fires
25/03/2008	-	-	Requena	Valencia	Unspecified
24/07/2006	-	2 nd year	Benissa	Alicante	Unspecified
12/01/2011	Female	3 rd year	Chiva	Valencia	Pond against fires
31/05/2012	Female	2 nd year	Casinos	Valencia	Canal
25/07/2012	-	1 st year	Domeño	Valencia	Canal
08/07/2015	Male	1 st year	Santa Magdalena de Pulpis	Castellón	Pond against fires
30/06/2016	Female	Subadult (3 years)	Artana	Castellón	Irrigation pond
30/06/2016	Male	Adult	Artana	Castellón	Irrigation pond
07/07/2016	-	1 st year	Benissa	Alicante	Pond against fires

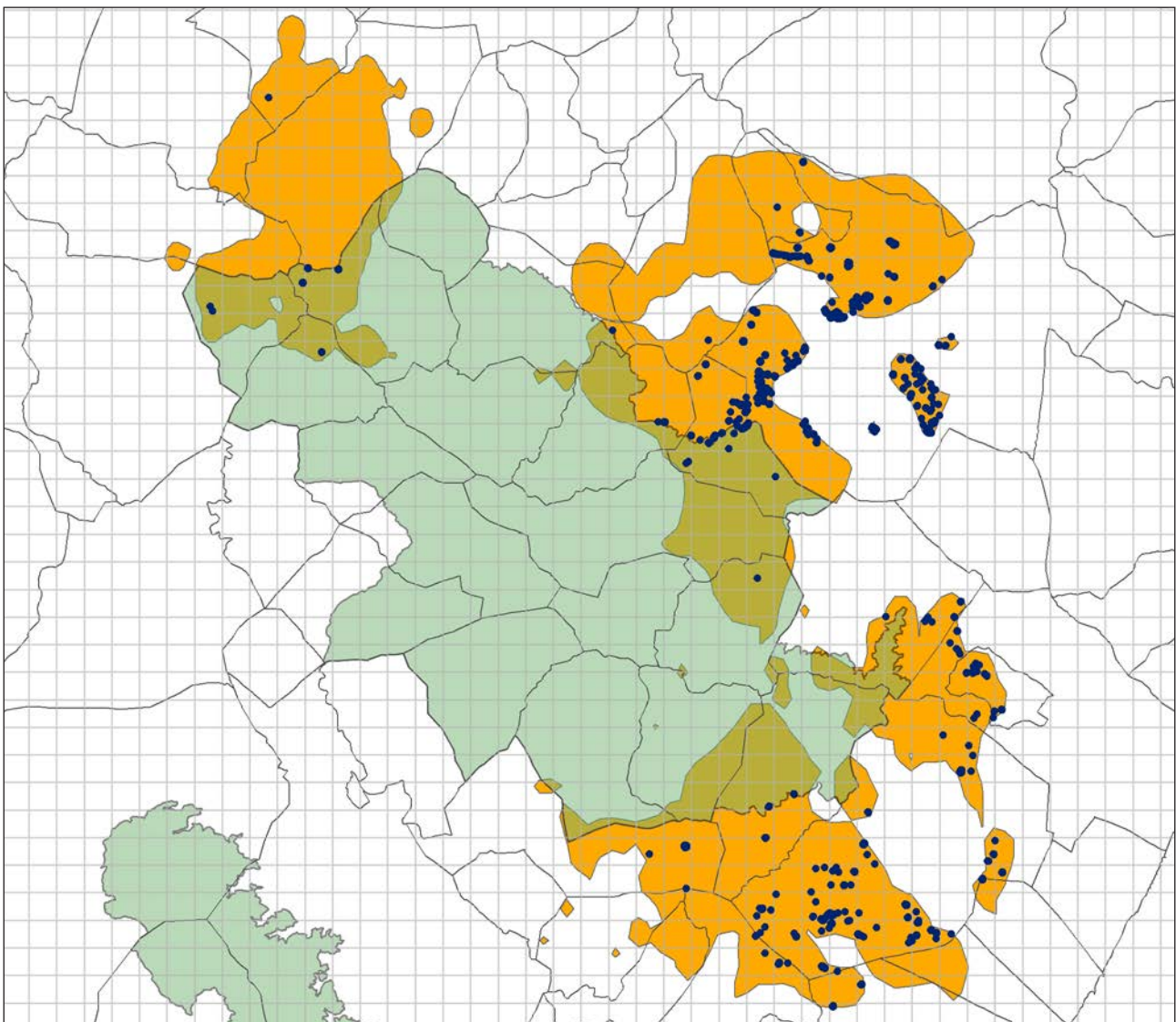


Figure 13. Disposition of water spots with drowning risks for the Bonelli's Eagle in the environment of the National Park Sierra de Espadán.

POISONS

Since its inception, the Fauna Recovery Centres function as a receiving point for animals likely to have suffered poisoning. After being necropsied, some samples are sent to the Department of Toxicology of the Faculty of Veterinary in Murcia, where the relevant analyses are carried out.

Conversely, the Plan against the illegal use of poisoned baits in the Valencian Community⁷ was passed in 2012, thereafter conducting annual assessments related to the impact of this mortality cause over the fauna.

General mortality

121 verified poisoning cases in the Valencian Community have been recorded since 2000, corresponding nearly 80% of them to the province of Alicante. The average of cases for the last five seasons is of **14 cases per year**, having to point out that for this mortality cause (and far more than any other), includes both records of domestic species and baits. Taking into account only the wild fauna, the total of affected specimens is 63.

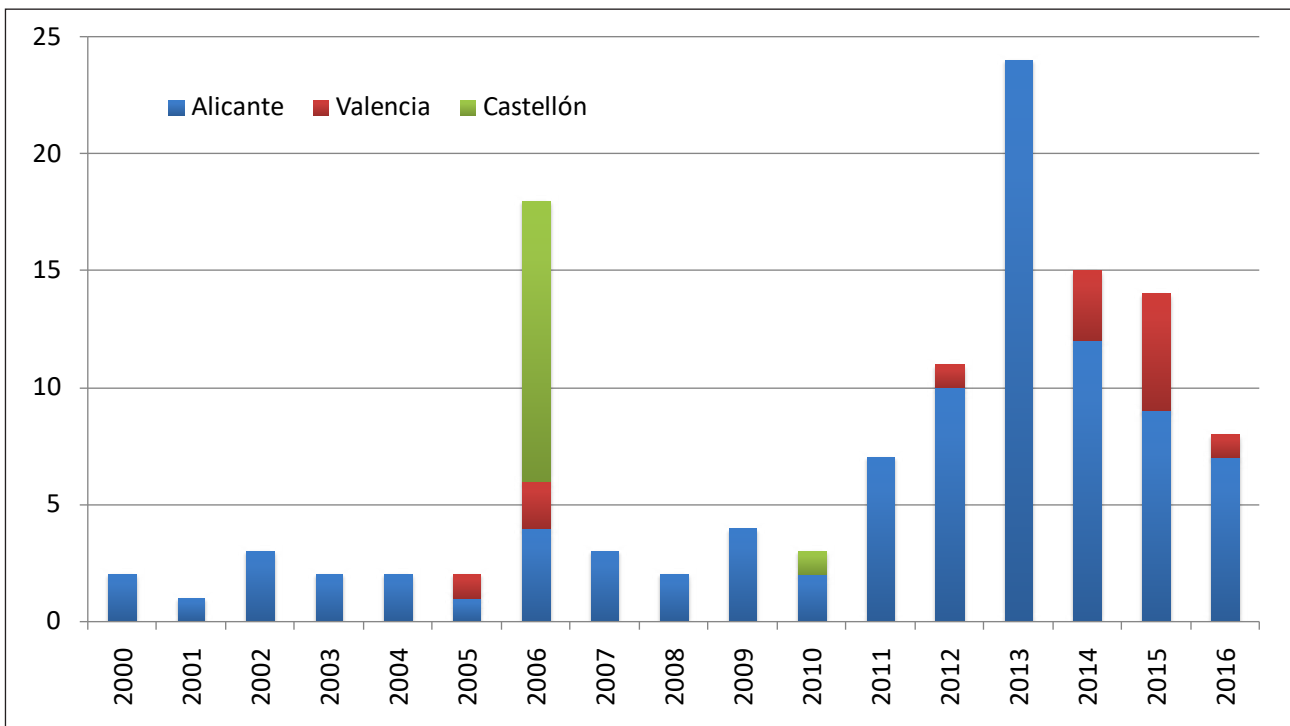


Figure 14. Poisoning cases recorded in the Valencian Community, ordered in provinces.

⁷ INSTRUCTION, by General Directorate for the Natural Environment on 26 March 2012, against the illegal use of poison in the Valencian Community.

Roughly a 60% of the recorded poisonings affected mammals and a 26% to birds. A remaining 2% of the cases concerned reptiles (lizards). On the other hand, a 14% of the cases was concerned with baits encountered in the natural milieu (Figure 15).

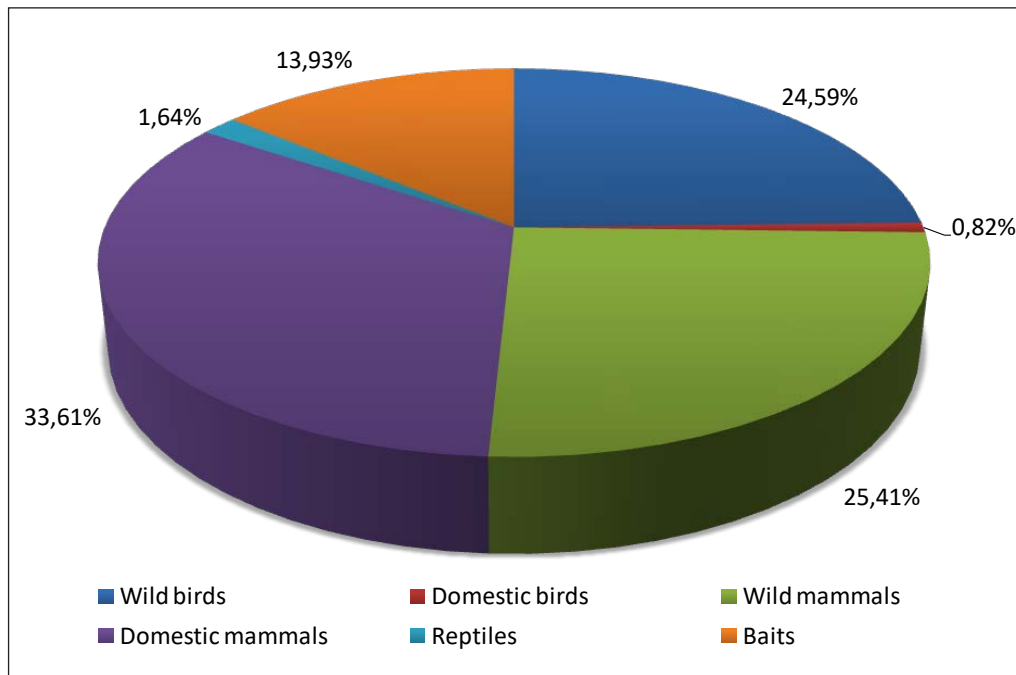


Figure 15. Poisoning cases' allocation.

The recorded cases ordered in subgroups (for mammals and birds) are detailed below, allowing the confirmation that most poisonings are directed at predators: birds of prey and wild carnivorous, as well as dogs and cats:

Table 22. Itemisation of poisoning records, ordered in fauna subgroups.

Mammals		Birds	
Dogs	35	Birds of prey	22
Carnivores	23	Other birds	9
Lagomorphs	8		
Cats	6		
Rodents	2		
Total	74	Total	31

Endangered species mortality rates

The Bonelli's Eagle is the sole endangered species which has been recorded for poisoning, with 4 specimens affected by this cause, being in all cases chicks found dead in the nest: 2 in Tibi (April 2003) and 2 in Villajoyosa (April 2012). The particular toxin found in both incidents was *Aldicarb*, being likewise found in the pidgeon used as a lure in one of the cases (Tibi).



Figure 16. Poisoned lure: Chicken gizzard with *Aldicarb* granules

INTERACTION WITH FISHING GEAR

In 2011, a database was built based on the admissions of birds and marine turtles affected by fishing gear in the Fauna Recovery Centres, collecting data between 1998-2011⁸. This information was gradually broadening with cetaceans and marine turtles stranded on Valencian Community shores, compiled by the Marine Zoology Unit (Universitat de València).

General mortality

The total of the mortality records for interaction with fishing gear between 1998-2016 amounts to 915. The average for the last five years is **68 specimens per year**.

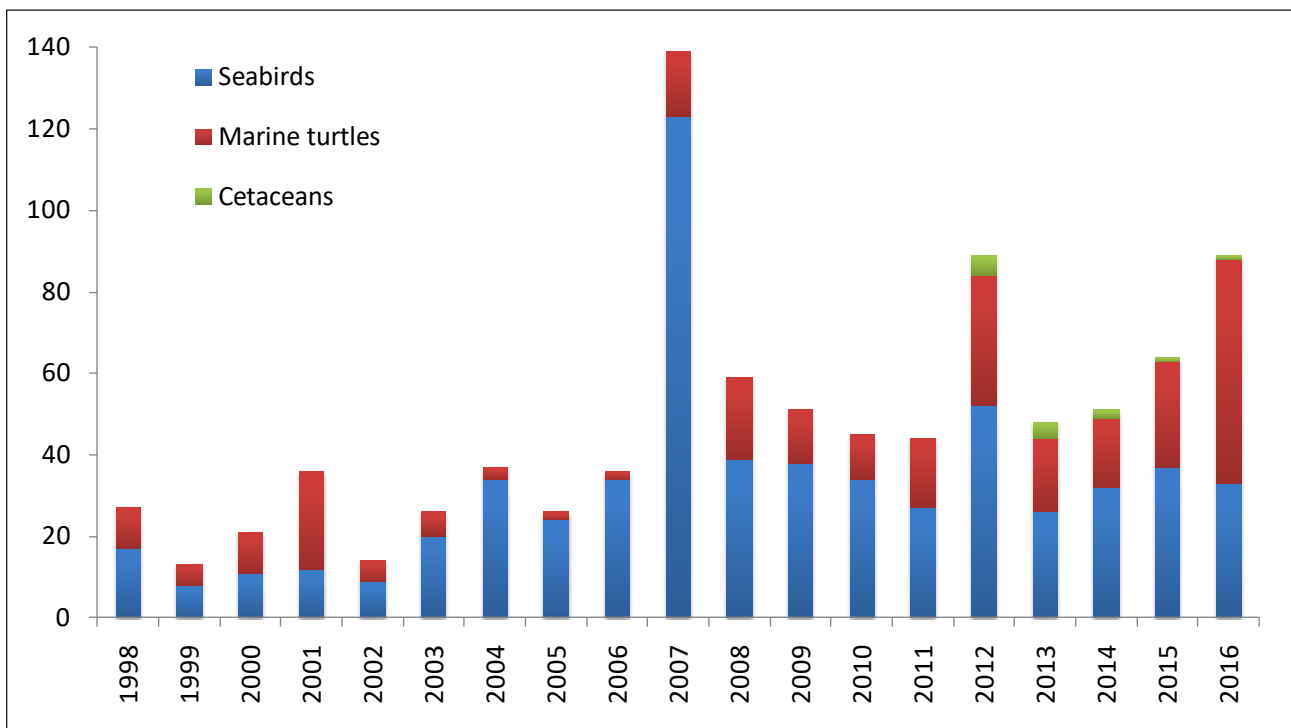


Figure 17. Mortality records for interaction with fishing gear, ordered in fauna groups.

Sea birds are the most affected fauna group by this cause with a 67% of the total of records, that was mostly dealt with specimens hooked on sport hooks (88% of the birds' total in 2016).

Marine turtles stand for a 32% of the total and, differing from the previous group, most of the records are due to the interaction with professional fishing gear, mainly in trammels and trawling. The

⁸ Informe sobre las causas de entrada en Centros de Recuperación de tortugas y aves marinas por artes de pesca. 2011. Natural Areas and Biodiversity Service. January 2012.

influence on this group has been gradually increasing along recent years, especially because of the awareness and consciousness-raising campaigns carried out with the fishermen in order to have the accidentally caught specimens delivered⁹.

In the last place we found cetaceans, with a 1% of mortality records related to this cause.

Endangered species mortality

The Loggerhead Turtle is the listed species most affected by this mortality cause. On average, about thirty marine turtles annual cases with injuries for fishing gear were recorded during the past five years, fundamentally trawling (52% of the cases between 2012-2016) and trammel (41% of the cases between 2012-2016) nets. On the other hand, some of the cetaceans and seabird specimens are also considered among the most threatened (Table 23).

Table 23. Mortality records of endangered species for interaction with fishing gear between 1998-2016.

Specimen (Degree of protection)	Total
Loggerhead sea turtle (V)	289
Auduin's Gull (V)	121
Balearic Shearwater (E)	32
European Shag (V)	24
Cory's Shearwater (E)	19
Common Bottlenose Dolphin (V)	4
Common Tern (V)	3
Kentish Plovers (V)	2
Whiskered Tern (V)	1
Storm Petrel (V)	1
Common Dolphin (V)	1
Total	497

(V) Vulnerable; (E) Endangered.

⁹ *Memoria de Gestión ARCA del Mar. 2015.* Generalitat Valenciana/Ciudad de las Artes y las Ciencias. Febrero, 2016.

GENERAL SUMMARY

Taking the recorded data into consideration, the leading mortality cause upon wild fauna would be road accidents with more than 1.000 annually recorded affected specimens, at a reasonable distance from the rest of causes (Table 24). With regards to the condition over classified species, we can appreciate the allocation of the cases for the type of cause in the table 25, emphasising the fishing gear impact (upon sea birds and marine turtles), electrocutions (birds of prey) and shots (water birds and birds of prey), as well as accidents over endangered amphibians (Iberian Ribbed Newt).

Table 24. Total of recorded and average cases ordered in mortality causes during the past five years.

	Reviewed periods	Total of records	Average (2012-2016)
Accidents	1988-2016	14.205	1.183 specimens per year
Electrocutions	1995-2016	3.459	210 specimens per year
Wind turbines	1999-2016	1.722	171 specimens per year
Fishing gears	1998-2016	915	68 specimens per year
Shots	1991-2016	2.124	60 specimens per year
Collisions with power lines	2004-2016	418	45 specimens per year
Drownings	1991-2016	406	28 specimens per year
Poisonings	2000-2016	63	8 specimens per year

Table 25. Mortality rates for fauna groups and total of threatened species (TS), ordered in mortality cause.

	Birds	TS	Mammals	TS	Reptiles	TS	Amphibians	TS
Accidents	26%	31	51%	22	13%	3	10%	223
Electrocutions	96%	108	2%	0	2%	0	0%	-
Wind turbines	86%	8	14%	4	0%	-	0%	-
Fishing gears	67%	203	1%	5	32%	289	0%	-
Shots	100%	115	0%	-	0%	-	0%	-
Collisions with power lines	100%	20	0%	-	0%	-	0%	-
Drownings	59%	11	35%	7	5%	0	1%	0
Poisonings	48%	4	49%	0	3%	0	0%	-

Endangered species mortality

It should be noted that in specific cases the species are affected by a unique factor, take for instance the Iberian Ribbed Newt and accidents, being usual that the mortality is due to more than a cause, existing endangered species affected by up to five different cause, for example the Bonelli's Eagle (Figure 18).

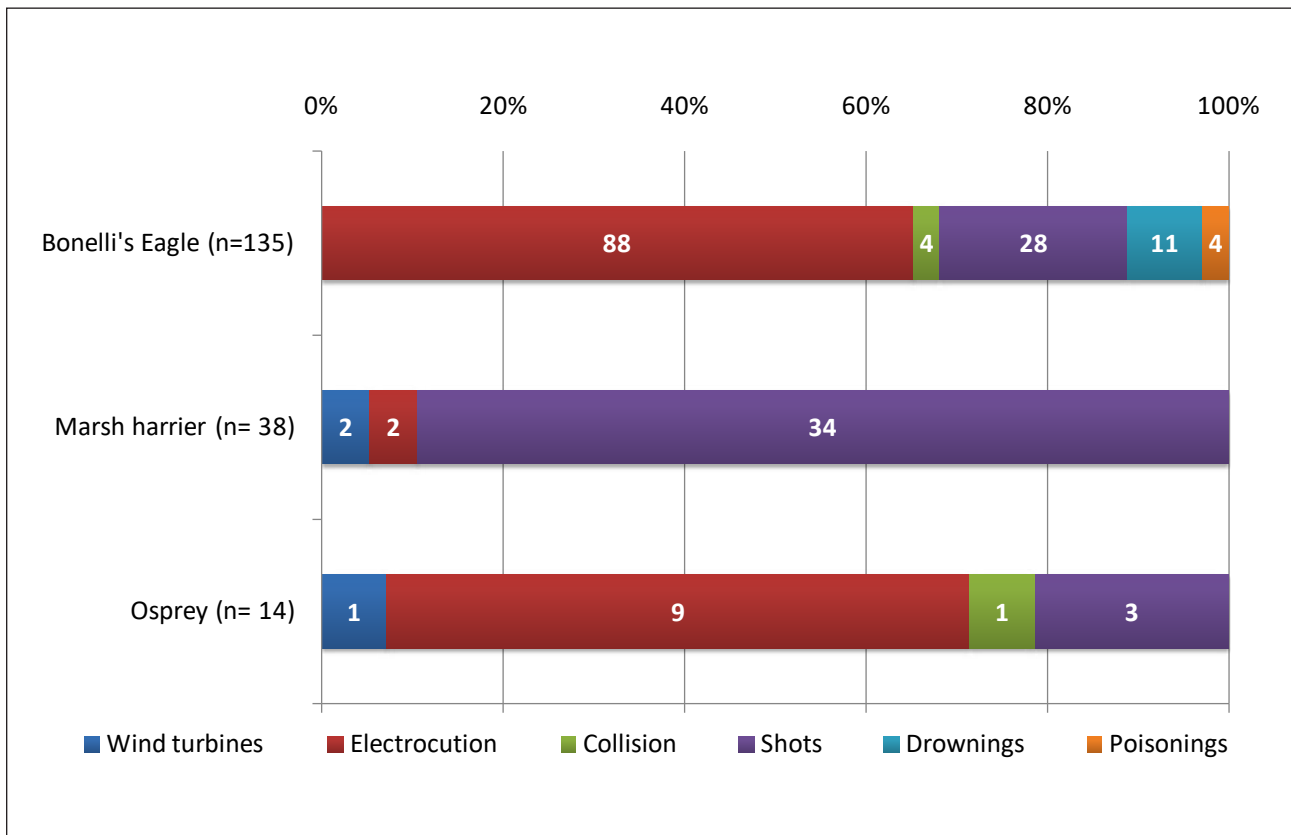


Figure 18. Mortality ordered in type of cause for three bird threatened species. The total of the recorded cases for each species is shown in brackets, that is displayed broken-down in the corresponding bar.

An annual risk rate could be developed by solely taking into account the condition to classified species, calculating their percentage over the total of affected specimens and weighing in relation to the number of admissions that year. As an example, the rates obtained for each cause in 2016 is displayed below. The final percentage allows the assessment of the relative significance of each of the mortality causes over the endangered fauna.

Table 24. Calculation of the risk rate weighed for classified species, 2016.

2016	Number of admissions (A)	Number of classified species admissions (B)	B/A	Total % of species
Fishery	89	73	0,82	5,04
Road Accidents	812	70	0,09	4,83
Electrocutions	232	8	0,03	0,55
Drownings	55	3	0,05	0,21
Shot	59	2	0,03	0,14
Wind	158	2	0,01	0,14
Collisions	42	0	0,00	0,00
Poison	2	0	0,00	0,00
Total admissions	1.449	158		10,90

Therefore, the analysis of the mortality records during the past 11 years offers the following results:

Table 25. Weighed risk rate (%) for threatened species between 2006-2016.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average 2006-2016*
Fisheries	1,66	3,66	1,73	2,48	1,80	0,77	2,67	1,40	2,11	3,17	5,04	2,8
Road Accidents	0,00	0,12	0,29	0,09	0,23	0,09	2,21	1,74	3,29	1,47	4,83	1,38
Electrocutions	0,92	1,10	0,35	0,89	0,55	0,29	0,28	0,22	0,20	0,23	0,55	0,41
Shot	0,37	0,37	0,12	0,09	0,16	0,12	0,04	0,22	0,26	0,15	0,14	0,15
Collisions	0,18	0,12	0,00	0,00	0,08	0,03	0,14	0,06	0,13	0,15	0,00	<0,1
Drownings	0,18	0,00	0,06	0,00	0,00	0,03	0,07	0,00	0,00	0,08	0,21	<0,1
Wind	0,00	0,00	0,12	0,00	0,08	0,06	0,04	0,06	0,13	0,08	0,14	<0,1
Poison	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,00	0,00	0,00	0,00	<0,1

*The average for 2006-2016 is obtained from the total of endangered species for each cause over the total of entries for the reviewed period (n= 17.748).

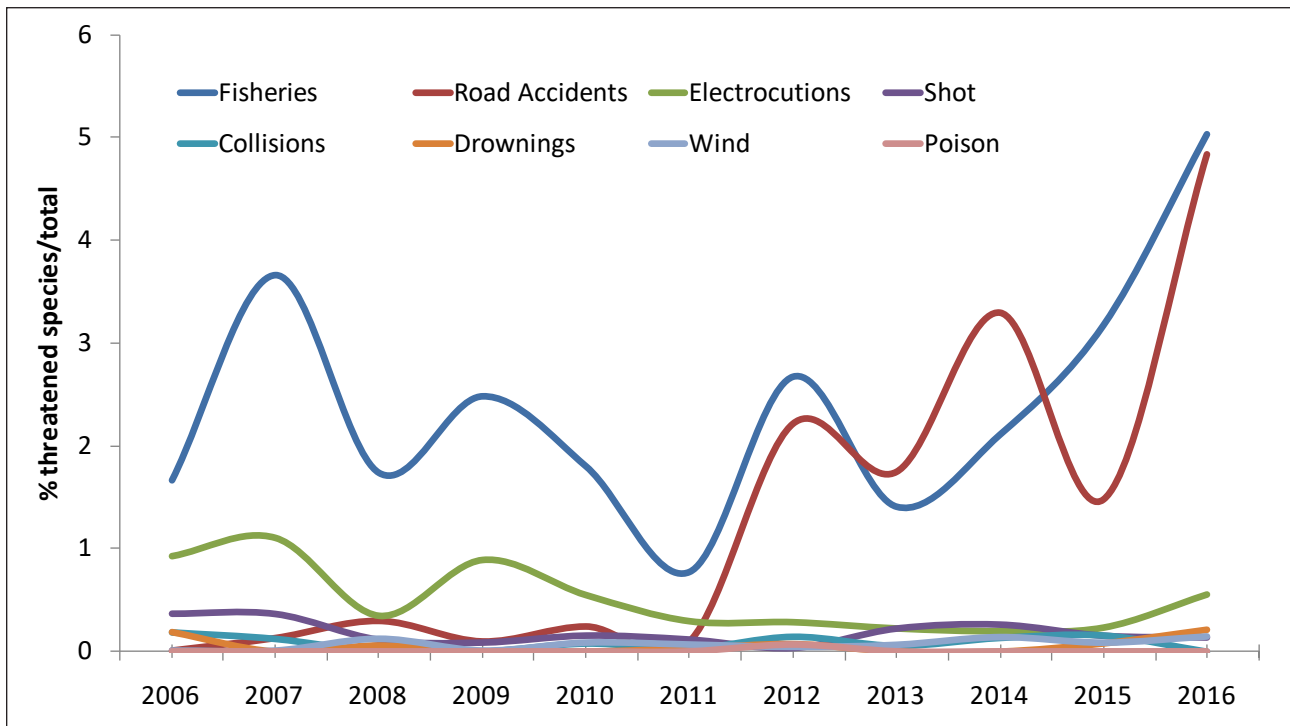


Figure 19. Risk rate development for **threatened** species between 2006-2016, ordered in mortality causes.

CONCLUSIONS

- The data presented are the greatest wild fauna mortality review driven by human activities ever conducted in the Valencian Community. Altogether, the death cause of more than 23.000 specimens has been determined:

Table 26. Summary of the fauna mortality records in the Valencian Community.

Cause	Specimens number	Endangered specimens number
Accidents	14.205	279
Electrocution	3.459	108
Shots	2.124	115
Collisions with wind turbines	1.722	12
Fishery	915	497
Collision with power lines	418	20
Drownings	406	18
Poisonings	63*	4
Total	23.312	1.053

*Solely wild fauna specimens are considered.

- These data are unquestionably a small and biased sample of reality, since most of the animals that die in the field, roads or in the sea, are neither encountered or communicated. By comparison, the initial study focused on electrocutions estimated that a mortality average of **983 ± 384 birds of prey per year** occurred between 1997-2008. On its behalf, the survey on accidents, estimated an annual mortality of **552.919 animals/year**, solely in the main road network.
- The bias is lesser in those cases where special surveillance programmes, take for instance wind turbine collisions and poisoning cases; though an underestimate is surely taking place, specifically of small and not threatened species.
- The detection of mortality causes increases when the cooperation of the causative sector is achieved. This is particularly remarkable in the marine turtles case, by having achieved an increase of the fishermen's submissions of those specimens caught accidentally. Furthermore, this is also being achieved with electrical distribution companies.
- The vast majority of the deaths occur accidentally, solely being the shots and poisonings deliberate actions to cause the death of the specimens, which stands for a 9,4% of the cases. The accidental character of most deaths is not a hindrance to communicate the circumstance, when it can be identified, to the responsible and to adopt corrective measures.
- The death of so many wild animals, being an undesirable circumstance, usually has no impact in their populations, obviously considering that it is focused on more plentiful specimens. For example, in the road accidents' case, the most frequent ones are of common species, being

some of them occasionally considered as pests. In the wind turbine cases, the vultures' increased mortality does not hinder the development of their populations¹⁰.

- The mortality problem becomes more serious when it affects endangered species, since their populations are small, they are altered for other habitat variations and, in some cases, the incidental mortality may well be the main cause for their precarious demographic condition.
- In order to calculate this mortality impact upon endangered species, one also needs to be familiar with their natural populations, movements and breeding parameters. Thus, there is a greater concern upon the mortality causes of rare, resident and low-breeding species rather than locally abundant, migratory and high-breeding species. In this sense, the mortality of Iberian Ribbed Newt within roads may be acceptable provided that the ponds where they reproduce and spend most of their life are preserved. On the contrary, electrocutions of nesting and scarce birds of prey, especially adults, may suppose an effective reduction of their population, consequently there is an urgent need for corrective actions.
- Thus, the imperative conduct carried out in the Valencian Community would be the correction of power lines (support and power lines), given their influence upon the Bonelli's Eagle population. Additionally, it is important to maintain the ongoing programmes, like the one conducted with the professional fishermen, whose cooperation has proved to be successful in terms of submission and recovery of marine turtles affected by this cause. Ultimately, it is worth remembering that this monitoring of the wild fauna mortality causes permits specific actions in concrete cases (black dots), take for instance the repair of dangerous ponds, additional surveillance in troublesome hunting grounds or the installation of barriers in stretches with a high accident rate.

¹⁰ *Evolución de la población de aves necrófagas en la Comunitat Valenciana. Censo 2016.* Wildlife Service. September 2016.