MUNIBE (Ciencias Naturales - Natur Zientziak) | Nº 49 | 117-127 | SAN SEBASTIAN | 1997 | ISSN 0214-7688

Intensive census of nocturnal raptors in Biscay

Censo intensivo de rapaces nocturnas en Bizkaia

KEY WORDS: Broadcasting methods, censusing methods, distribution, owls, population status, Strigiformes.
PALABRAS CLAVE: Distribución, métodos de censo, rapaces nocturnas, reclamos, status poblacional, Strigiformes.
GAKO-HITZAK: Banaketa, zentsu-metodoak, harrapari gautarrak, populazio-egoera, Strigiformeak.

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SUMMARY

Intensive census of nocturnal raptors in Biscay. We made an intensive census of nocturnal raptors in Biscay (Northern of Spain) that took us four years (1992-1996). In this time we used three different methods: 1- searching for suitable owl nest sites, 2- enquiries to rural people and colleagues, 3- broadcasting methods.

We located 1,704 Tawny Owl (*Strix* aluco) territories, 407 Barn Owl (*Tyto alba*) territories, 272 Little Owl (*Athene* noctua) territories, 26 Scops Owl (*Otus scop*) territories, 6 Long-eared Owl (*Asio otus*) territories and 3 Eagle Owl (*Bubo bubo*) territories with the three methods. Moreover we proved, by enquiries and occasional observations, the wintering of Long-eared Owl and Short-eared Owl (*Asio flammeus*).

These results allowed us to establish a baseline of owl abundance and, they also proved the inconvenience of the results obtained by non-intensive census.

RESUMEN

Censo intensivo de rapaces nocturnas en Bizkaia. Hemos realizado un censo intensivo de las rapaces nocturnas en Bizkaia (Norte de España) a lo largo de 4 años (1992-1996). Durante este tiempo utilizamos tres métodos para censar: 1- búsqueda directa de nidos, 2- cuestionarios a las gentes de los pueblos y ornitólogos, 3- reclamos.

Mediante la combinación de los tres métodos localizamos 1.704 territorios de cárabo (*Strix* aluco), 407 de Lechuza (*Tyto alba*), 272 de Mochuelo (*Athene* noctua), 26 de Autillo(*Otus scop*), 6 de Búho Chico (*Asio otus*) y 3 de Búho Real (*Bubo bubo*). Además, pudimos comprobar, mediante cuestionarios y observaciones ocasionales, la invernada del Búho Chico y la Lechuza Campestre (*Asio flammeus*).

Estos resultados nos permitieron establecer la base del conocimiento sobre la abundancia de las rapaces nocturnas y, además, prueban la inconveniencia de los resultados obtenidos mediante censos no intensivos.

LABURPENA

Bizkaiko (Estatu espainiarreko iparraldea) harrapari gautarren zentsu sakona burutu dugu lau urtetan zehar (1992-1996). Hiru metodologia desberdin erabili dira tarte horretan: 1- habien bilakera zuzena, 2- herrietako biztanleei eta ornitologoei egindako galdetegia, 3- errekla-moak.

Hiru metodoen erabileraren bidez, urubiaren (*Strix aluco*) 1.704 lurralde aurkitu genuen, 407 hontza zuriarena (*Tyto alba*), 272 mozoloarena (*Athene noctua*), 26 apohontzarena (*Otus scop*) eta 3 hontza haundiarena (*Bubo bubo*). Gainera hainbat galdetegi eta noizbehinkako behaketen ondorioz, hontza ertainaren eta zingira-hontzaren (*Asio flammeus*) negupasa baieztatu ahal izan genuen.

Emaitza hauek harrapari gautarren ugaritasunaren inguruko ezagupenaren oinarriak ezartzea baimendu ziguten, intentsiboak ez diren zentsuen bidez lortutako emaitzen ezegokitasuna frogatzen duten aldi berean.

INTRODUCTION

The owls are one of the most difficult groups of birds to study; most of them are secretive and difficult to observe (PROUDFOOT AND BEASOM, 1996). Their life is being increasingly studied and many scientists have made great efforts to get to know the ecology and ethology of different species. However, little is known about their population and conservation status.

In the last few years, speciphic owl census techniques have been developed, and one of them, the broadcasting method, seems to be the most used (see SARA & ZANCA, 1989; MORELL *et al.*, 1991; PERCIVAL, 1992; GALEOTTI & PAVAN, 1993; REDPATH, 1994; PROUDFOOT & BEASOM, 1996; RINKEVICH & GUTIÉRREZ, 1996). Nevertheless, this method has some drawbacks, such as sensitiveness to weather (REDPATH, 1994) and detectability of some species (SARA & ZARA, 1989). So the use of several other censusing methods can offer better results (see TELLERIA, 1986).

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Little is known about the distribution and abundance of nocturnal raptors in Biscay. Seven nocturnal raptors have been reported in Biscay: Barn Owl (*Tyto alba*), Scops Owl (*Otus scops*), Eagle Owl (*Bubo bubo*), Little Owl (*Athene noctua*), Tawny Owl (*Strix aluco*), Long-eared Owl (*Asio otus*) and Short-eared Owl (*Asio flammeus*) (ZUBEROGOITIA & TORRES, 1997). The Short-eared Owl is the only one that is not a breeding species in the study area. Up to 1994 there were no reports about stablished eagle owls in Biscay (ZUBEROGOITIA & TORRES, 1997).

In 1985 ALVAREZ *et al* carried out the first Atlas of Continental Vertebrates of Araba, Biscay and Gipuzkoa, where some data about the distribution of the nocturnal raptors in the Basque Country appeared. In fact, they did not complete the distribution of owls due to a poor methodological scheme. In the same way, there is no intensive census effort in Spain to our knowledge. The different intensive methods for owl research have never been applied in Spain in a wide scale, as we can see in other atlas and ornitological studies that have been published in many Spanish areas: La Rioja (DE JUANA, 1980), Galicia (LOPEZ & GUITIAN, 1980), Cataluña (MUNTANER *et al*, 1983), Navarra (ELOSEGUI, 1985), Asturias (NOVAL, 1986), Salamanca, (CARNERO & PERIS, 1988), Ávila (SAN SEGUNDO, 1990), Cordoba (CARPINTERO *et al.*, 1991), Cádiz (CEBALLOS & GUIMERA, 1992), Madrid (MARTI *et al.*, 1994), Burgos (ROMAN *et al*, 1997), Almería (MANRRIQUE, in press) and Aragon (DIPUTACIÓN GENERAL DE ARAGÓN, in press). Apart from this, the National Atlas which has been supported in the regional Atlas has been finished recently (PURROY, 1997).

The aims of the present paper are determine the distribution and the numerical status of the owls in Biscay and the establishment of a baseline of owl abundance and population performance for the future monitoring of owl populations.

METHODS

Study Area:

The study area covers the whole of Biscay (2,384 km²). It is a province located in the Western Basque Country (Northen Spain). Its territory is hilly and densely populated with extensive urban and industrialised areas. For a description of landscape and climate see LOIDI (1987).

Methods

We began this study in December 1992 and finished it in December 1996. Throughout these years we searched for all species of owls continuosly (Barn Owl, Scops Owl, Eagle Owl, Little Owl, Tawny Owl, Long-eared Owl and Short-eared Owl), two days per week, every month, using three diferent methods:

1- Nesting sites search. We searched 325 churchs, 834 houses and barns, 16 derelicted buildings, 2 castles, 3 towers, all the country quarries, cemeteries, schools, caves, walls, bridges, cliffs, tree holes, old stick nests and 150 nest boxes that we set up in 1995. According to TAYLOR (1992) the nest sites were examined each year to determine the number available to owls, the number used for breeding, and other breeding data, of all species, althought mainly of Barn Owl.

2- Enquiries to rural people and colleagues. We assesed the validity of each enquirie (713) by visiting the different places in which the presence of an owl was suspected. This method was mainly used for Barn Owl, Litle Owl and Scop Owl. We did not use this method for Tawny Owl because were very common but the nest sites were difficult to find. Nevertheless we noted all the information for contrasting with the rest of methods. Also we used the enquiries for searching the wintering species, Long-Eared Owl and Short-Eared Owl.

3- Broadcasting methods to provoke the territorial vocalization (See SARA & ZANCA, 1989; GALEOTTI, 1990; REDPATH, 1994). We used this method in 2,056 different points for all species. Each tape had male, female and owlet voices in continuous form. Moreover, we used the broadcasting methods in the forests of the highest mountains for seeking Tengmalm's Owl (*Aegolius funereus*).

Taped vocalizations were broadcasted according to the size of the owl, from the smallest to the bigest. Thus we tried to avoid inducing predatory and/or competitive behaviour between species (see MIKKOLA, 1983).

Playback of each species was broadcasted for 5 minutes and, later, reaction was waited for in silence for about 10 minutes. REDPATH (1994) suggested 30 min.; however we was proving the method during one year and resolved that during 10 min. was possible to detect mostly of territories.

The census activity began at dusk. We played the tape at intervals, in different sites that were close to each other, so that the cry of owls demarking territories could be heard. These points were separated 200 m in flat fields for censusing little owls and scops owls, and 500 m for censusing the rest of the species in flat lands, and between 500 and 1,000 m for censusing in mountains. We

usually played the tape in the highest sites of mountains and hills for hearing the answer of owls better.

Censusing was generally performed on all kind of weather conditions except for very windy and very stormy nights. When owls did not respond to the playback as expected, we came back to the same place as many times as needed (2-3 times more, in some occasions 4 times) to ascertain the presence/absence of owls.

Owl locations were plotted on 1:25,000 topographic maps to the nearest UTM (Universal Transverse Mercator) coordinator (approximately 50 m). Each pair was considered as a territory, although in many occasions only one owl responded, which could have or not have a mate. For this reason we did not consider the pair as a unit, and we noted the territory as a unit. Situational points of each territory were the sites in which owls responded to tape vocalizations first and the nest sites if we used the other methods.

According to BRUIJN (1994) Squares of 5 km were considered to estimate densities of Tawny Owl and Barn Owl. However, densities of little owls were considered by the number of territories per available habitat in which the species survive. The available habitats for little owls were fields with hedges, and the unavailable habitats were the wooded areas.

RESULTS

Tawny Owl

Tawny owl was the most abundant raptor in the study area. We located 1,704 territories well distributed along the study area (Figure 1). Each territory belonged to a pair, although some owls were unpaired. In the 29% of the territories both members of the pair responded, while in the rest of the territories only one of them did. Nevertheless we proved, going back to the same points in different days, that the majority of these owls had a mate (in 25 of 31 controled pairs one owl respondeed the first time, in the other six cases both, male and female, responded). We noticed that a great number of young owls without territories exists. These owls did not defend territories; sometimes we heard their hoots before the arrival of the territory owner. They could probably be a pool of birds which could fill in vacancies in stablished territories.

Although the Tawny Owl was present in the whole Biscay, different densities existed according to habitat types. It was rare in urban areas, where it had the lowest densities (0.12-0.50 territories/km²), and where it occupied the little and isolated urban parks. It was not very frequent in deforested fields and in continuos pine or eucaliptus forests (about 0.5 territories/km²). It was also

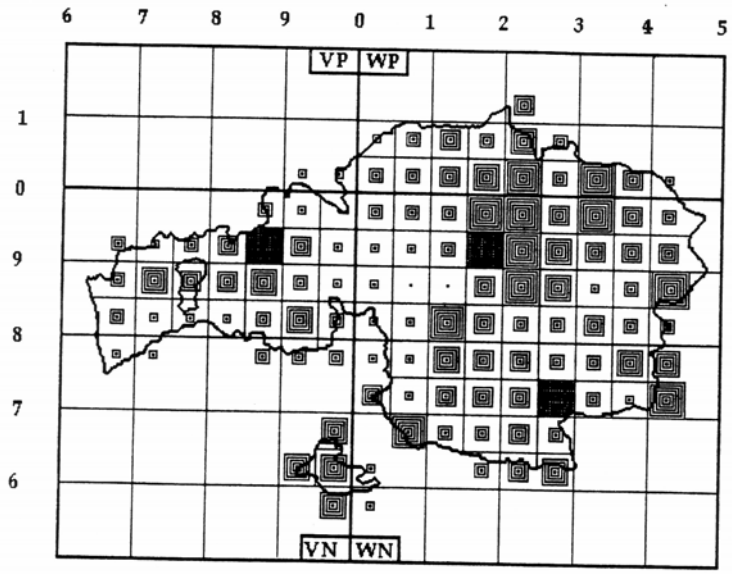

Fig. 1. Densities of Tawny Owl considering squares of 5 km.
< 0.25 territories/km²
0.25-0,50 ter./km²
0.50-0.75 ter./km²
0.75-1 ter./km²
1-1.25 ter./km²
1.25-1.5 ter./km²
1.5-1.75 ter./km².

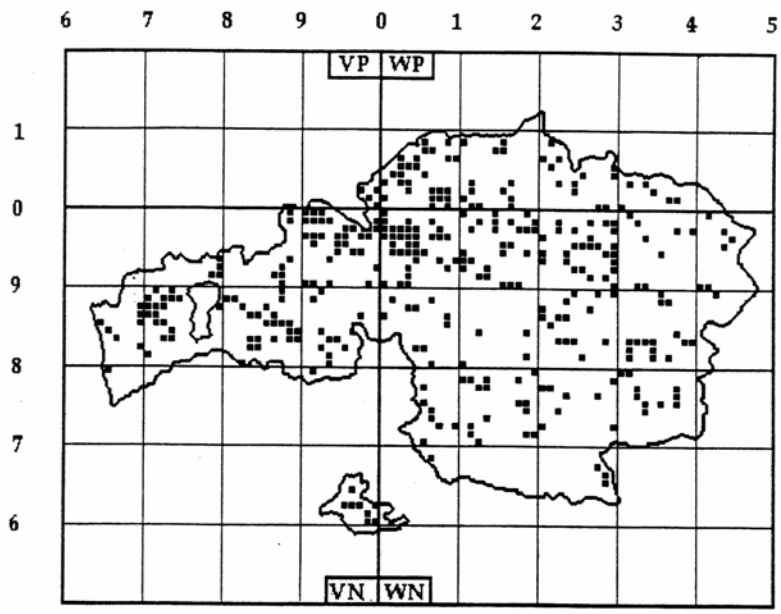

Fig. 2. Barn Owl distribution. The black points are equivalent to a square of 1 km². In some of these points there are more than one territory of Barn Owl.

less frequent in continuous beech forests (about 0.75 territories/km²). However, tawny owls reached high densities in patched forests mixed with meadows; for example, in such habitats of the Biosfere Reserve of Urdaibai we found 1.32-1.64 territories/km², 1.67 territories/km² in the low forests of the Urkiola Natural Park, and 1.57 territories/km² in mixed forests of Sopuerta.

Barn Owl

Barn Owl was the second most abundant Strigiform. We located 407 barn owl territories and their nests distributed all through the study area (Figure 2). In some of these territories (1.7%) females were located around the nesting area all year round but males moved away from the nesting areas in winter, after the breeding season (data obtained monitoring these pairs during the study period, and ringing some of them). A few territories (1%) were occupied only by one owl in the four years that the study period lasted. All the territories seemed to be stable during the study period, except for 30 that were abandoned after destruction of the nest by different causes. Only in 17 of them did the barn owls change the nest sites.

Using ringing data, we saw a great replace rate; shortly after barn owl deaths (within 6 months), another owl replaced the empty places. This allows us to presuppose the existence of a great number of barn owls without a breeding territory of their own that are waiting for some occasion to fill these unoccupied spaces.

The highest densities of barn owls were found to occur in towns and big villages, with densities of 0.62-0.84 territories/km² in the Nervion Estuary, the most populous area in Biscay. Lower densities were found in the rest of the country, between 0.1 and 0.3 territories/km², where barn owls were present in almost all little villages and were rare in semi-natural landscapes. Some barn owls bred in pasture woodlands, although densities were very low in these situations (less than 0.1 territories/km²).

Little Owl

We located 272 little owl territories that belonged to the same number of pairs. This species was common in hedged open fields. In fact there were seven areas where little owls exhibited high productivity and density (Figure 3). Little owls were uncommon in the rest of the habitats; likewise, we did not find little owls in forested habitats.

This species densities were diferent in each area. Thus, in a hilly field in the Karrantza Valley, there were 51 pairs in 39 km² of available habitat

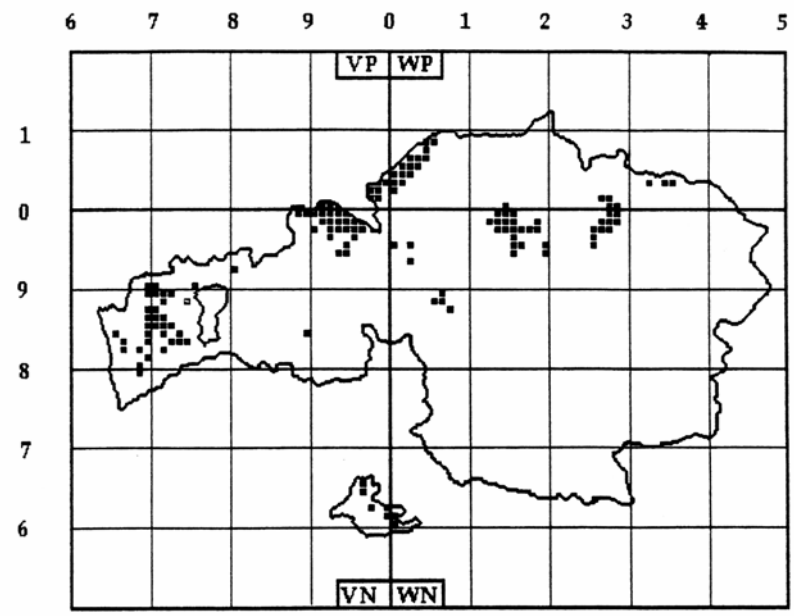

Fig. 3. Little Owl distribution. The black points are equivalent to a square of 1 km². In some of these points there are more than one territory of Little Owl.

(1,31 pairs/km²); in a densely populated coast field in the left side of the Nervion Estuary, there were 60 pairs in 29 km² of available habitat (2,07 pairs/km²); in a densely populated coast field too in the right side of the Nervion Estuary, there were 49 pairs in 20 km² of available habitat (2,45 pairs/km²); in a flat field in the Mungia Valley, there were 47 pairs in 21 km² of available habitat (2,24 pairs/km²); in a coast flat field in the Urdaibai Biosfere Reserve, there were 28 pairs in 15 km² of available habitat (1,87 pairs/km²); and in a mediterranean field in the Orduña Valley, there were 10 pairs in 8 km² of available habitat (1,25 pairs/km²). In many of these sites, little owls appeared in high densities; we found up to 5-6 pairs/km² in some sites of Santurtzi (left side of the Nervion Estuary) and in the Urdaibai Biosfere Reserve, up to 7 pairs/km² in the Mungia Valley and up to 8 pairs/km² in Barrika (right side of the Nervion Estuary).

During the study period six little owl territories disappeared due to road building and increasing urbanisation of field areas.

Scops Owl

Scops Owl was a rare breeding species in the study area. We only located 26 territories in the lowland fields, near the coast (Figure 4).

Eagle Owl

The eagle owls were the least abundant residents. Three eagle owl territories were found in the western mountains (Figure 5); two ocurred in the same area of the Karrantza Valley and the other one in a mountain near Bilbao. We did not test the breeding of the species during the study period, although the owls displayed territorial behaviour and were stablished in the areas during this period. Apart from this, we located five lonely eagle owls in other areas.

Long-Eared Owl

Long-eared owls appeared as breeding birds only in a few sites. In fact, we only located six breeding territories along the four years of research. Two of the territories were in the coast field, and the other four were in the mountains of the Gorbea Natural Park and the Urkiola Natural Park (Figure 6). Indeed, we did not obtain territorial answers to playback records in the wintertime, so we did not control winter population. Nevertheless, casualties produced by hunters and owls found dead on round sides, plus some occasional observations allowed us to stablish that the Long-eared Owl is a frequent wintering species throughout the country.

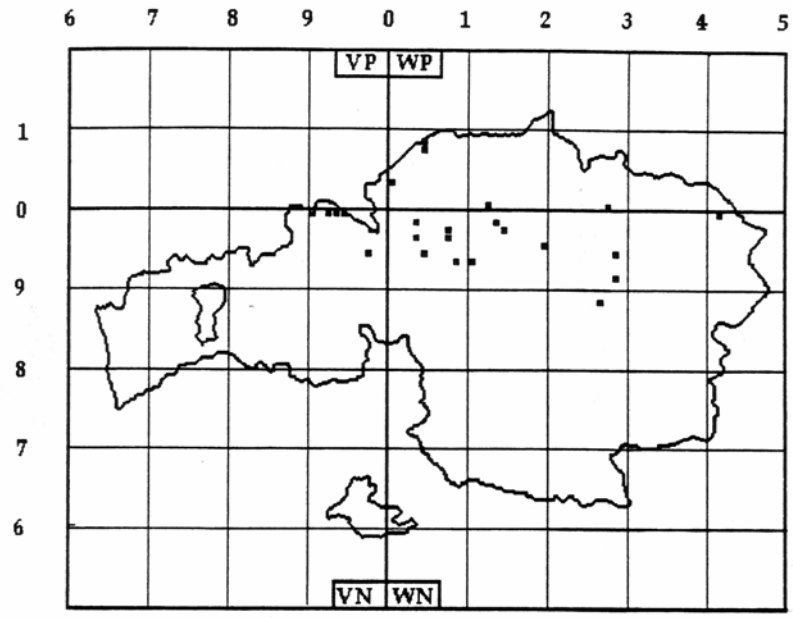

Fig. 4. Scops Owl distribution. The black points are equivalent to a square of 1 km². In some of these points there are more than one territory of Scops Owl.

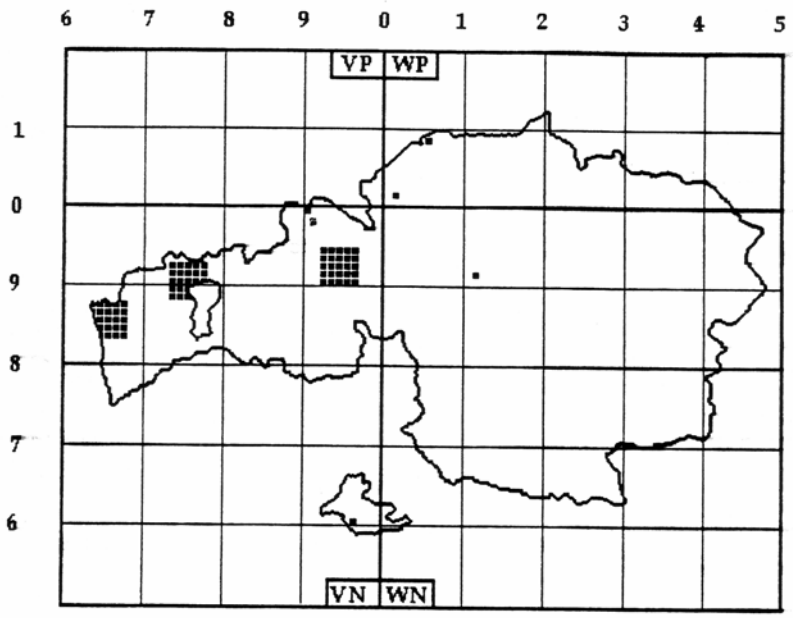

Fig. 5. Eagle Owl distribution. The big squares show the Eagle Owl territories. The little squares show the sites where were found isolated owls.

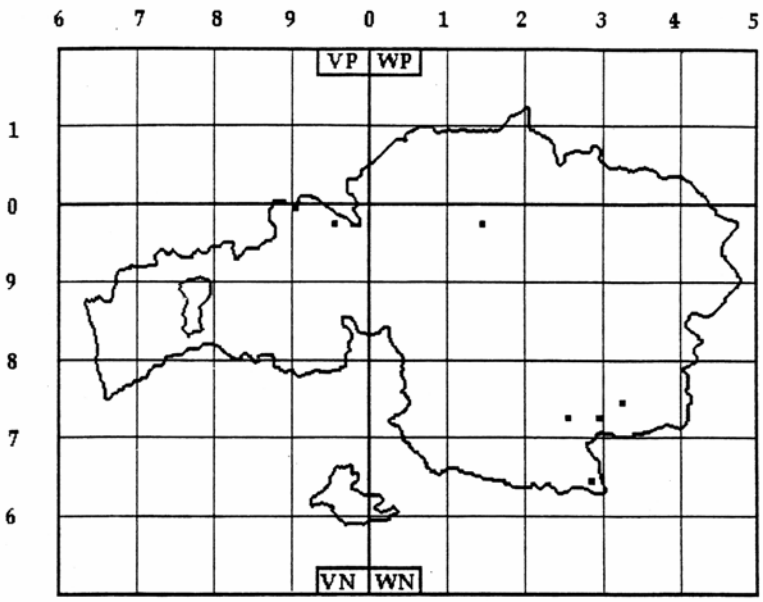

Fig. 6. Long-eared Owl distribution. The black points are equivalent to a square of 1 km².

Short-Eared Owl

The Short-eared Owl was a winter resident in the coast fields. This species did not answer to the territorial calls during the study period, hence we located only a few wintering owls by occasional observations and casualities produced by hunters.

DISCUSSION

Our results on Tawny Owl's population showed that it is the most abundant raptor in the study area. In 1985 ALVAREZ *et al.* supposed that this species was the most abundant one in the Basque Country, and other authors argued the same idea for many Spanish provinces (see DE JUANA, 1980; LOPEZ & GUITIAN, 1980; MUNTANER *et al*, 1983; ELOSEGUI, 1985; NOVAL, 1986; CARNERO & PERIS, 1988; SAN SEGUNDO, 1990; MARTI *et al.*, 1994; ROMAN *et al*, 1997; DIPUTACIÓN GENERAL DE ARAGÓN, in press.). However, there is no published reference about the real situation of this species in Spain. Likewise, the Tawny Owl is the commonest and most widespread owl in Europe (MIKKOLA, 1983), although, the great density found in Biscay, 1,704 territories in 2,384 km² (0,71 territories/km², considering all the habitats) can only be found in a few countries (see ULSTRAND & HÖGSTEDT, 1976; MIKKOLA, 1983; SAUROLA, 1995). However, tawny owls do not occupy all the habitats. REDPATH (1995) located 30 pairs in 400 km² of Cambrigeshire. The species selected only the forested areas and their limits in Cambrigeshire. So REDPATH (1995) concluded that the 30 pairs of tawny owls occupied an equivalent of 3.9 ha of woodland in fendlands and 14.8 ha of woodland in Monks wood. Likewise, GALEOTTI (1994) found 22 pairs in 20 km² of an urban area and 17 pairs in 16 km² of a rural area in Pavia. However, in the study of Galeotti, the mean territory size was smaller than the available area; in fact, in the urban areas the mean territory size was 17.6 (12.1 ha (range 5.6 - 50.5 ha) and in the rural areas the mean territory size was 22 (12.6 ha (range 5 - 43.7). If we consider only the wooded areas (estimating the number of territories per wooded areas), our results could be similar to REDPATH's or GALEOTTI's results, although we saw that tawny owls used to perch in lonely trees that were situated far from the forests. In fact we located some tawny owls in deforested areas of the coast, where owls tended to use shrubs, isolated trees, power lines and roofs.

Barn owls were not as abundant as tawny owls although they were quite frequent in Biscay. Following BRUIJN (1994) we calculated barn owl densities from the number of records within 5-km square. The smallest densities of barn owls in

Biscay were equivalent to the highest densities reported by BRUIJN (1994) in the Netherlands. In some densely populated areas of Biscay there were 0.5-1 pair/km². Similar data were obtained in Central Europe (GEROUDET, 1965), in Southern Spain (VARGAS & ANTUNEZ, 1981), and in favourable habitats in lowland Scotland (READ & ALLSOP, 1994). In middle populated areas there were 0.1-0.33 pairs/km², and in low populated areas we only found a pair each 10 km² (0.1 pairs/km²), similar to upland areas densities in Scotland (READ & ALLSOP, 1994).

Little Owl was the third species in abundance in Biscay. We located 272 pairs which depended strongly on fields. Comparing the distribution and the ecology of little owls and tawny owls, we could make a hypothesis: the distribution of the little owl would be limited by the distribution of tawny owls, since little distribution overlap between both species ocurred. Suitable but unoccupied breeding habitat for the Little Owl occurred within tawny owls' distribution area. In fact we saw tawny owls attacking little owls in three occasions and MIKKOLA (1983) reported the presence of little owls in tawny owls diet. This could be the reason why the species did not ocuppy some meadows and fields in woodland areas. Likewise, in the rest of the Eurosiberian region of the Basque Country, the species was distributed in fields, where ALVAREZ *et al.* (1985) considered it as a rare species, while in the mediterranean region the Little Owl seemed to be common and well distributed in the flat lands and in the Ebro Valley. Actually, it is a species common in nearly all Iberian Peninsule (see DE JUANA, 1980; LOPEZ & GUITIAN, 1980; MUNTANER *et al*, 1983; ELOSEGUI, 1985; NOVAL, 1986; CARNERO & PERIS, 1988; SAN SEGUNDO, 1990; CARPINTERO *et al.*, 1991; CEBALLOS & GUIMERA, 1992; MARTI *et al.*, 1994; ROMAN *et al*, 1997), although it does not exist any data about its status.

Local densities of little owls varied greatly within the study area. Using radio telemetry techniques FINCK (1988) proved that the home ranges of 19 Little Owl males varied from 2 to 107 ha in Lower Rhine, one of the most densely Little Owl populated areas in Central Europe. In the same locality EXO (1992) monitored 6 pairs that had home ranges from 1 to 50 ha. The recorded territory sizes corresponded well with population density in optimal habitats of central Europe, where clumps of between 4 and 6 pairs/km² were found (EXO, 1992). In the study area we found some areas with similar densities; moreover, in some localities (such as Mungia Valley, with patch of 7 pairs/km², or Barrika, with sites of 8 pairs/km²) densities are higher. Hence, we can say that the Little Owl population in Biscay could be compared to the best European population per available habitat.

Scops owls population was small in regard with other spanish countries. In fact, Scops Owl seemed to be more frequent in other Eurosiberian regions such as the east of Gipuzkoa coast (ALVAREZ *et al.*, 1985). This species is more abundant in the neighbouring countries with Mediterranean climate (see DE JUANA, 1980; ELOSEGUI, 1985; ALVAREZ *et al.*, 1985; ROMAN *et al*, 1997). This is why, we suppose that this species is influenced by climate and vegetation in Biscay. In the same way, scops owls are rare in other eurosiberian regions of Europe and common in Mediterranean regions (MIKKOLA, 1983).

According to ALVAREZ *et al.* (1985), the Long-eared Owl was a rare breeding species in Biscay. It seems that some pairs bred in our forests and fields, although we did not see a continuous presence of them in the breeding areas. More breeding pairs existed in some neighbouring countries like La Rioja (GONZALEZ-PERUJO, 1996), Burgos (ROMAN *et al*, 1997), or Alava (ALVAREZ *et al.*, 1985; GAINZARAIN, J. per.com. 1997). Long-eared Owl abundance could be conditioned by climate up to a certain extend. It seemed to be more abundant in the mediterranean regions of Spain and less abundant in the eurosiberian regions; however, this is a common species in the Eurosiberian regions of Europe (see MIKKOLA, 1983). During 1993-94 a vole peak occurred in nearly all the mediterranean regions of Spain; then an increase of breeding pairs and breeding success was observed (MARTINEZ & ZUBEROGOITIA, 1997). Nevertheless, this situation did not occur in Biscay, where voles did not show evident population fluctuations (own observations).

MIKKOLA (1983) argued that the Long-eared Owl population declined in central and south-west England coincides with the timing of the Tawny Owl increase, as long-eared and tawny owls have similar ecological requirements, competition between the two owls is probable. This may be the reason why the Long-eared Owl is rare in Biscay.

Our surveys revealed the existence of at least three stablished pairs of eagle owls in the study area. This is the first time that the existence of the species is revealed in Biscay. We may conclude that this population is not isolated because there have been several recent observations of eagle owls in the proximity of the study area. A pair was seen at the east frontier of Cantabria (SOCIEDAD ORNITOLÓGICA LANIUS, Per. com.) and other

pair was located in Oriñon mountains, near the northern limit of Karrantza Valley. This records would indicate that the Eagle Owl occupied a larger range than previously recognized. The absence of the species reported in Eurosiberian regions of the Iberian Peninsula could be due to the inexistence of rabbits (see ALVAREZ *et al.*, 1985; GRANDE & HIRALDO, 1993; FAJARDO, 1995). However, an hypothetical expanding of Eagle Owl is due to its adaptation to rat and other rodent diet, as well as it occurred in other european countries (see SAUROLA, 1995).

Short-eared Owl is a wintering species in Biscay, as well as in the majority of the Iberian Peninsule (FAJARDO *et al*, 1994). Up to now, breeding records have not been confirmed in the study area. However the Short-eared Owl has been reported to breed in neighbouring areas (ONRUBIA & JUBETE, 1995; ROMAN *et al*, 1997).

CONCLUSIONS

Once we have finished this work, the situation of owl populations and their status is known. Hence we can begin to research the changes on their populations and the causes of decreasing or increasing. Usually, in many of the owl research, that first step is not taken; thus the conclusions and management implications are misleaded. The majority of Strigiformes management works made in the Iberian Peninsule are supported by density esteems based upon non-intensive census that can be far from the real situation. In fact, according to DIAZ *et al* (1996), except for some eagle owl census (see PAZ DE LA ROCHA, 1987; MARTINEZ *et al*, 1987; FERNANDEZ, 1993) there is no real data about the situation of the night raptors. However, some authors like ALVAREZ *et al.* (1985) and FAJARDO (1995) published references regarding the conservation status of the night raptor population in Basque Country without any real data on populations supporting conclussions. These references are not valid while serious works, supported by censuses, are not done with some years gap, as other authors have made before in some european countries (see KESTELOOT, 1976; JUILLARD, 1989; BUNN *et al*, 1982; EXO, 1992; READ & ALLSHOP, 1994; BRUIJN, 1994; SAUROLA, 1995).

ACKNOWLEDGEMENTS

We thank JOSE ANTONIO GONZALEZ-OREJA, JOSE ANTONIO MARTINEZ and RICARD GUTIÉRREZ for their valuable comments. We also wish to thank everybody that took part in the field work, especially JULEN ZUBEROGOITIA, GORKA OCIO, TAMARA CRESPO, GORKA DURALDE, LANDER ASTORKIA, UDIARRAGA ABRISKETA, FERNANDO GARITAGOITIA, JOSE ANTONIO GONZALEZ-OREJA, FERNANDO RUIZ-MONEO and other people who have aported valious data, such as JOSERRA AIHARTZA, MARI JOSE TOTORIKA, ENEKO IMAZ, ESTHER BERNEDO, JAVIER FRANCO, PEDRO VALENCIANO, XABIER BUENETXEA, PEDRO ABAD. We are also indebted to Udiarraga Abrisketa for improving the English.

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