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segovia2019

PROGRAM and ABSTRACTS

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CHOUGH
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Abstracts | Resúmenes

Population size and conservation status of the urban population of red-billed choughs in Segovia city, Spain.

José L. González del Barrio (jgonzalezdelbarrio@gmail.com).

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain.

The city of Segovia is unique because it holds an urban population of red-billed choughs, including breeding pairs and individuals that use the city as a daytime and night-time roosting site. This singularity represents a unique opportunity to reconcile the conservation of artistic historical heritage and the protection of endangered wildlife.During the 2019 breeding season we conducted a complete census of nesting pairs in Segovia's urban centre. The main motivation was to determine the exact location of the nesting sites and evaluate their present and future conservation problems derived from the construction work and other disturbances in the buildings used. The results show that the choughs nest in historic buildings of great artistic and cultural value, concentrating on churches in the historic centre and the wall that surrounds the city, but also in modern inhabited buildings, including residential buildings, bridges and other artificial structures. A total of 94 breeding pairs were located, which represents one of the highest concentrations of breeding pairs in Spain, and the only city with a high number of breeding pairs in Europe. With this information, a document was prepared for the City Council of Segovia, in order to avoid the destruction of the nesting and roosting sites as a result of maintenance and renovation of the buildings. Additional measures are proposed to enhance nesting, thus promoting the conservation of this threatened species, as well as to value the species as a tourist attraction for the city of Segovia and the towns of the province where a good number of pairs are also nesting. The chough is proposed as an emblematic symbol of respect for nature and the conservation of the historical-artistic heritage in the city of Segovia.

Tamaño de la población y estatus de conservación de la población urbana de chova piquirroja en la ciudad de Segovia, España.

José L. González del Barrio (jgonzalezdelbarrio@gmail.com).

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain.

La ciudad de Segovia es única por presentar una población urbana de chova piquirroja, tanto de parejas reproductoras como de aves que usan la ciudad como zona de descanso diurno y dormidero. Esta singularidad representa una oportunidad única para compatibilizar la conservación del patrimonio histórico artístico y la protección de la fauna salvaje amenazada. Durante la temporada de cría de 2019 realizamos un censo completo de parejas nidificantes en el núcleo urbano de la ciudad de Segovia. La principal motivación para la realización de este censo fue la de determinar la situación exacta de los lugares de nidificación y evaluar su problemática de conservación presente y futura derivada de la realización de obras y otro tipo de alteraciones y molestias en los edificios utilizados. Los resultados muestran que la chova nidifica en edificios históricos de gran valor artístico y cultural, concentrándose en iglesias del centro histórico y la muralla que rodea la ciudad, pero también en construcciones modernas habitadas, incluyendo edificios de viviendas, puentes y otras estructuras artificiales. Un total de 94 parejas reproductoras fue localizado, lo que representa una de las mayores concentraciones de parejas reproductoras de España, y la única ciudad con un número elevado de parejas de chova piquirroja en Europa. Con esta información se elaboró un documento para el Ayuntamiento de Segovia, con el objeto de evitar la destrucción de los nidos de chovas como consecuencia de obras de mantenimiento y remodelación de los edificios. Se proponen medidas adicionales para potenciar la nidificación, promoviendo así la conservación de esta especie amenazada, así como para poner en valor la especie como un atractivo turístico para la ciudad de Segovia y los pueblos de la provincia donde se localizan también un buen número de parejas nidificantes. La imagen y la historia natural de la chova piquirroja se proponen como símbolo emblemático del respeto por la naturaleza y la conservación del patrimonio histórico-artístico en la ciudad de Segovia.

Abstracts | Resúmenes

Long-term population changes and conservation management of red-billed choughs: insights into behavioural and social plasticity.

Guillermo Blanco[1], Óscar Frías[1], José L. González del Barrio[1], Félix Martínez[2] & Jesús A. Cuevas[3].

1National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; 2 Sociedad para la Conservación de los Vertebrados, Madrid, Spain; 3 University of Alcalá, Alcalá de Henares, Madrid, Spain; g.blanco@csic.es.

Ecological or phenotypic plasticity refers to changes in organism's behaviour, morphology and physiology in response to environmental variation. The ability of a genotype to produce multiple behavioural phenotypes to adaptively respond to changes in the environment may include nest-site selection to reduce predation, parasitism or energetic costs. Social plasticity also allows shifts in breeding systems (colonial or territorial), roosting (communal or family) and coordinated seasonal movements and flock dynamics leading to sedentary, nomadic, migratory or irruptive lifestyle. We show the results of a long-term study (1990-2019) on red-billed choughs in south-eastern Madrid, central Spain, specifically focusing on population trends and the plasticity associated to the progressive change from the use of cliffs to buildings and other artificial structures as nesting and roosting sites, and its implications on the population structure and dynamics. Behavioural and social plasticity derived in changes in the distribution, density, size and trends of the population through expansion and colonization processes.The potential underlying environmental factors influencing chough plasticity were explored to gain insight into population functioning, and to propose conservation management measures for declining populations.

Ecology and responses of Alpine Chough to human activities at high altitude.

C. Vallino[1], E. Caprio1, C. Palestrini[1], A. Roggero[1], A. Delestrade[2], N. Yoccoz[2-3], A. Galimberti[4], A. Franzoi[5], N. Tommasi[4], L. Bontempo[6], D. Chamberlain[1], G. Brotto[1], F. Genco[1], M. Bocc[7], A. Rolando[1].

1University of Turin, Turin, Italy; 2Centre de Recherches sur les Ecosystèmes d'Altitude, Chamonix, France; 3UiT the Arctic University of Norway, Norway; 4University of Milano Bicocca, Italy; 5MUSE, Science Museum, Vertebrate Zoology Unit, Italy; 6Edmund Mach Foundation, Italy; 7Mont Avic Natural Park, Italy; cristina.vallino@unito.it; enrico.caprio@unito.it

Human presence at high altitude modifies alpine ecosystems. Recreational activities influence species through habitat degradation or loss, but human presence means also food provisioning, thus modifying the availability of resources. We aim here to highlight trophic ecology and responses of the Alpine chough to human activities. Regarding the species responses, the first study was realized in two Alpine areas differing in human disturbance; human presence led to shorter stay times and reduced intake rates, thus potentially negatively influencing foraging behavior. However, habituation in the tourist site could enhance feeding success. The second study analyzes the factors affecting flock movements during winter in three tourist sites in the Alps; temperature and people may influence bird activities, with lower temperature and higher number of people resulting in higher presence and larger flock size. However, these relationships differed among sites, with the site with the largest flock size showing much weaker relationships. Regarding Alpine Chough trophic ecology, the first study aimed to verify whether the spatio-temporal distribution of birds was similar to the one of grasshoppers (i.e. their key prey in the Alps during the summer); results showed that flock size can respond to prey abundance and biomass, and this result indicates that choughs can follow large scale fluctuation of the most abundant food item despite being generalists. Finally, the diet of the Alpine chough in two study areas is analyzed with DNA barcoding (to identify fruit from seeds in winter diet) and DNA metabarcoding (to characterize summer diet), while stable isotope ratios analysis can indicate which population has the most diverse diet. Preliminary results show a higher diet variability in the tourist site population, where

discarded food is available. In conclusion, the first part of the project demonstrates that Alpine choughs can potentially develop habituation to human presence enhancing the foraging success. However, when habituation is not present human presence is immediately perceived as disturbance and the foraging efficiency decreases. The second part of the project confirmed that grasshoppers can be all important during the summer for chough diet. However, the high variability found in the diet of the population belonging to the tourist site, demonstrates that they can exploit other food items. The Alpine chough results being an extremely adaptive species, however, populations which live in undisturbed sites can be negatively impacted, and some gaps relative to the effect of human food on the species are present. Future studies could be oriented to evaluate individual conditions in populations which exploit anthropogenic food, and to consequently propose tourist area management guidelines.

Marked genetic structure of red-billed choughs in Iberia: the role of social barriers in restricting gene flow among populations.

Francisco Morinha, Guillermo Blanco, Borja Milá.

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; franciscomorinha@hotmail.com.

Social barriers have been shown to reduce gene flow and contribute to genetic structure among populations in species with high cognitive capacity and complex societies, such as cetaceans, apes and humans. In birds, high dispersal capacity is thought to prevent population divergence unless major geographic or habitat barriers induce isolation patterns by dispersal, colonization or adaptation limitation. We report that Iberian populations of the red-billed chough, a social, gregarious corvid with high dispersal capacity, show a striking degree of genetic structure composed of at least 15 distinct genetic units. Monitoring of marked individuals over 30 years revealed that long-distance movements over hundreds of kilometres are common, yet recruitment into breeding populations is infrequent and highly phylopatric. Genetic differentiation is weakly related to geographic distance or habitat type, and thus genetic structure is unlikely to be due solely to isolation by distance or isolation by adaptation. Moreover, most population nuclei showed relatively high levels of genetic diversity, suggesting a limited role for genetic drift in significantly differentiating populations. We propose that social mechanisms may underlie this unprecedented level of genetic structure in birds through a pattern of isolation by social barriers not yet described, which may have driven this remarkable population divergence in the absence of geographic and environmental barriers.

Genetic analyses reveal a role for mainland vicariance in the isolation of a population of the red-billed chough on La Palma, Canary Islands.

Borja Milá[1], Francisco Morinha[1], José A. Dávila[2], Guillermo Blanco[1].

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; franciscomorinha@hotmail.com.

Oceanic islands have often been colonized by small founding groups of individuals dispersing from the nearest mainland, giving rise to insular populations characterized by locally adapted phenotypes and low genetic diversity. Alternatively, due to past geo-climatic changes, the present-day distribution of the species may not correspond to that found at the time of the original colonization, so that the current mainland distribution may not include the original source area, leading to erroneous assumptions regarding colonization history. Here, we use current patterns of genetic variation to evaluate alternative colonization scenarios and infer the geographic origin of the insular red-billed chough (*P. pyrrhocorax*) population in the Canary Islands. Using phylogeographic and coalescence analyses

of mitochondrial DNA sequence and nuclear microsatellite loci, together with available paleoclimatic information, we test whether choughs on the island of La Palma originate from (i) present-day populations in Iberia, (ii) present-day populations in the mountains of Morocco, or (iii) former populations in coastal Morocco, where the species used to occur before the Last Glacial Maximum. Our genetic results show that the population of La Palma is genetically well differentiated from those in Iberia and Morocco, yet it is more closely related to the former than to the latter. The relatively high genetic diversity on La Palma and the existence of fossil remains on other islands suggest that the Canary Islands choughs are unlikely to descend from a small founder event following a long trans-oceanic flight from Iberia, and were instead connected by gene flow to populations on the Moroccan coast and Iberia when suitable habitat was found along the African coast. We propose that climate change and desertification of coastal areas led to local extinctions that restricted gene flow between Iberia and the islands, promoting genetic differentiation. Our results provide a counterintuitive solution to a biogeographic enigma, and could help resolve the colonization history of other systems with similarly complex climatic pasts.

Seeking solutions to a conservation crisis for red-billed choughs in Scotland.

Sarah Fenn[1], Amanda Trask[1,2], Eric Bignal[3], Sue Bignal[3], Davy McCracken[4], Pat Monaghan[5], and Jane Reid[1].

1School of Biological Sciences, University of Aberdeen, UK; 2Institute of Zoology, Zoological Society of London, UK; 3Scottish Chough Study Group, Isle of Islay, UK; 4Research Division, Scotland's Rural College, UK; 5College of Medical, Veterinary & Life Sciences, University of Glasgow, UK; s.fenn.17@abdn.ac.uk.

The Scottish population of red-billed chough is of major conservation concern, with less than 50 breeding pairs in 2019. Multiple consecutive years of low first-year survival, driven by food shortages at a critical time of year, in combination with increasing levels of inbreeding, threatened the long-term persistence of this small and isolated population. Therefore, to ensure the persistence of the Scottish population, both ecological and genetic issues need to be considered. In response to very low first-year survival rates between 2007 and 2009, a supplementary feeding programme was introduced on Islay between 2010 and 2018, with the primary aim of increasing first year survival, and thereby population persistence. Using a long-term colour-ring resighting and demographic dataset of the Islay chough population, we show that supplementary feeding substantially increased first-year survival. However, supplementary feeding did not fully counteract the ecological constraints on first-year survival, and feeding was only beneficial in some years. Colour-ring resightings from supplementary feeding sites also demonstrated that a large proportion of adult chough utilised the supplementary food. Analyses indicated that supplementary feeding stabilised breeding success against a background decline, and increased adult annual survival probability; therefore, the supplementary feeding programme has likely had a substantial positive effect at the population level. While the supplementary feeding was a highly beneficial conservation intervention, the feeding programme may ultimately be ineffective for population recovery in the long term if inbreeding is limiting the population growth. Inbreeding could be reduced through translocations of chough from other UK populations into the Islay population. However, translocations to alleviate the negative effects of inbreeding may be ineffective if food availability is still the primary limiting factor in the short term. Model simulations showed that with no supplementary feeding or translocations, or translocations only, the Scottish population was projected to rapidly decline. Continued supplementary feeding saw a slower population decline, but the population was still projected to decline. Only with simultaneous supplementary feeding and translocations was the population projected to remain stable, and therefore persist in the long term. Therefore, both ecological and genetic management is crucial to ensure the persistence of the Scottish chough population. Together, these analyses provide an excellent case study demonstrating that supplementary feeding, a widely used conservation tool populations, can have strongly beneficial conservation effects, and illustrate the substantial value that genetic and long-term demographic data can provide to inform population management and conservation.

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Food, feeding habitat and livestock management of red-billed chough in Scotland.

Gillian Gilbert[1], Fiona MacGillivray[1], Nicholas Jonsson[2].

1Centre for Conservation Science, Royal Society for the Protection of Birds, UK; 2Institute of Biodiversity Animal Health & Comparative Medicine, University of Glasgow, UK; gillian.gilbert@rspb.org.uk.

The declining Scottish population is restricted to the islands of Islay, Colonsay and Oronsay of the Inner Hebrides, and is in danger of extinction. This contrasts with other British Isles populations, which are stable or increasing. Other studies revealed a sudden increase in first-year mortality in 2007 and that food availability in the post-fledging period may be contributing to higher mortality and to the population decline. Our research recorded the abundance of dung and soil invertebrates on Islay in the post-fledging period, the diet of the Islay population and the main sources of food and where data allowed, whether these had changed. We found that dung invertebrates formed the majority of prey biomass in dune pasture and Tipulid larvae in mixed pasture but Aphodius larvae were scarce in the diet, whereas they had been a major component in the 1980s. Sources of invertebrate food and feeding behaviour had not changed significantly, with a mixture of dung and soil-based sources being exploited. We did not find a reduction in the abundance of soil associated invertebrate larvae, but we did find a significant reduction in dung associated invertebrates. Subsequent large -scale experiments on Islay, revealed significant negative effects of commonly used veterinary pharmaceutical treatments on invertebrate larvae, these were treatments not previously highlighted as of environmental concern. A questionnaire survey of farmers across four Chough feeding areas of Great Britain showed clear differences in the farm grazing management, in the priority given to animal health problems and in the frequency of application of veterinary parasiticides. We do not make claims that livestock management changes have caused the decline of Scottish Chough, but our results provide one route to improve sustainable food availability.

The natural recolonisation of Cornwall, England, by red-billed choughs.

Claire Mucklow.

Cornish Chough Conservation Program, Cornwall, UK; mkcladi@gmail.com.

The natural recolonisation of Cornwall by choughs in 2001 was significant for Cornish conservation and culture. The chough's story since then has been remarkable with the population now around 100 birds. A supporting cast of volunteers, farmers and conservation organisations work behind the scenes to help the choughs continue to thrive. We will look at the land management measures and monitoring undertaken, how the choughs have brought communities together and some of the challenges ahead.

Can Red-billed Choughs come back to Eastern Alps?.

Johannes Denkinger[1], Helmut Mägdefrau[2].

1Monticola, International Working Group for Alpine Ornithology, Switzerland; 2Nuremberg Zoological Garden, Germany; aj.denkinger@bluewin.ch, Helmut.Maegdefrau@stadt.nurenberg.de.

The occurrence of Red-billed Choughs in the eastern alpine region has shown a dramatic decline during the last century and the species is therefore listed as extinct east of the Valais Mountains (Switzerland) in the eastern Alps. The non-profit bird organisation MONTICOLA, specialized in Ornithology of the alpine region, and a group of Zoolo-

gical Gardens formed a project for reintroduction of the species in the eastern alps (start 2013). A first study on habtat modelling took place, showing thta in eastern Switzerland (Grison, Engadin, Swiss National Park) the habitat for Red-billed Choughs is larger than in Valais for summer and winter. Further research is needed to understand the loss of the species in Eastern Alps. Lack of invertebrates as food, maybe combined with the negative influence of anthelmintics (used in domestic livestock) on invertebrates and on the choughs is discussed. During a conference with MONTICOLA in Slovenia 2019, BirdLife Slovenia (DOPPS), has offered help to examine the possibilities of realisation of a reintroduction project in their country, similar to the successful reintroduction project on Jersey Island (UK). Cooperation with Italian conservationists looks fruitful as they work successfully together on Griffon vultures. Using the time needed for research and preparation of release stations in suitable habitats, a group of zoos are working on building up a good population of *Pyrrhocorax pyrrhocorax erythroramphus*. Seven zoos from Germany, Austria and Switzerland are cooperating. They look for a genetic test, whether the birds derive from the adequate subspecies.

Red-billed Chough on Colonsay and Oronsay, Scotland.

David Jardine.

Argyll, Scotland, UK; dcjardine@btinternet.com.

The Chough on Colonsay are now the northern limit of the world range of this species. This presentation will provide information on the history of this population, which became extinct there in the early 20th century, then was re-established on these islands in the 1960s. It increased to 25 occupied territories 2004, but is now in serious decline. Drawing also on the more detailed studies on the nearby island of Islay, the reasons for this population decline, which includes habitat change (through reduced grazing), changes in agricultural practices and in-breeding.

The Return of red-billed choughs to Jersey: lessons learnt.

Elizabeth Corry.

Durrell Wildlife Conservation Trust, Jersey, UK; elizabeth.corry@durrell.org.

Red-billed choughs had been absent from the Channel Islands since the early 1900s. Their demise is thought to be due to habitat loss and, to a lesser degree, persecution through egg collecting. Other farmland bird species in Jersey have suffered a similar fate. In 2009, Birds On The Edge, a multi-partner project, was established with the aim of restoring habitat and conserving Jersey's bird populations. The choughs were viewed as a flagship species for the project; their reintroduction would drive forward habitat restoration. A captive-breeding programme began at Jersey Zoo in 2010 using birds from Paradise Park, Cornwall. Juveniles were released into the wild from a purpose-built aviary on the north coast using soft-release techniques. Forty-one individuals were released between 2013 and 2018 in small, social cohorts. Provision of supplemental feed, post-release monitoring and veterinary care has resulted in a high survival rate. In 2015, the released birds began breeding in the wild. Today Jersey has a resident chough population of which a little over 50% are wild-hatched. We will discuss the methods used for the release, lessons learnt, how these lessons are being utilised by other projects, and what the future holds for Jersey's chough.

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Population size and trends of the red-billed chough population at Hoces del Rio Riaza Natural Park, Segovia: 20 years of monitoring .

Félix Martínez Olivas.

Sociedad para la Conservación de los Vertebrados (SCV), Madrid, Spain; femolivas@gmail.com.

We have conducted five full censuses of the nesting red-billed choughs at Hoces del Riaza and surrounding áreas, mostly within the Hoces del Riaza Natural Park, in the province of Segovia, Spain, between 1999 and 2019. Results from the counts show that there were at least 70 nestinga pairs in 1999, 66 in 2008, 61 in 2010, 65 in 2012 and 53 in 2019. We observe a declining trend in the species, with about 25% of the population being lost in the last 20 years. All known nesting sites are located on rocky cliffs, common in this area, and no other nesting substrates are known. These results are troubling and reflect the slow and persistent decline of the species in the greater Duero valley.

Censos y tendencia poblacional en las Chovas piquirrojas de las Hoces del Riaza (Segovia, España): veinte años de seguimiento.

Félix Martínez Olivas.

Sociedad para la Conservación de los Vertebrados (SCV), Madrid, Spain; femolivas@gmail.com.

Se han realizado cinco censos completos de las chovas piquirrojas nidificantes en las Hoces del Riaza e inmediaciones (en buena parte la zona está incluida en el Parque Natural del mismo nombre en la provincia de Segovia, España), entre 1999 y 2019. Los resultados de los conteos aportan las siguientes cifras: Al menos 70 parejas reproductoras en 1999, 66 en 2008, 61 en 2010, 65 en 2012 y 53 en 2019. Se observa una tendencia regresiva de la especie, con aproximadamente un 25 % de efectivos desaparecidos en los 20 años de estudio. Todas las ubicaciones de nidos conocidas se encuentran en los cortados rocosos calizos abundantes en éste área, no conociéndose hasta el momento otros emplazamientos diferentes para las plataformas de cría. Se considera este espacio y estos resultados como indicativos de la situación preocupante de la especie en el valle del Duero con pérdida de efectivos de forma lenta y continua.

Choughs in the Pembrokeshire Coast National Park, Wales, UK.

Jane Hodges, Bob Haycock .

Pembrokeshire, Wales, UK; bob.haycock@btinternet.com; hodges.jeh1@gmail.com.

During the 3rd international workshop on the conservation of the chough held in La Palma, Canary Islands in October 2010, we presented a brief introduction to the ecology and conservation of the red-billed chough, Pyrrhocorax pyrrhocorax in the Pembrokeshire Coast National Park, Wales, UK. We looked at emerging population trends and discussed some of the key natural and human-related factors that may have been influencing those trends. In October 2013, we took the opportunity to bring the story up-to-date in a presentation at the 4th international workshop in Vila Real, Portugal. In this presentation, we will re-cap on the methods used and present the results of the annual surveillance of breeding and non-breeding choughs in the Pembrokeshire Coast National Park from 1992 to 2019. This will include some findings from a recent review of choughs in the Castlemartin Coast Special Protection Area. We will consider what the data may be suggesting in terms of population trends and demographics, and we will review some of the key natural and human-related factors that are likely to be influencing population trends in the Pembrokeshire Coast National Park. We will conclude our presentation by describing some of the work on data analysis and review that we are currently undertaking, and by asking the question: "what does the future hold for the chough in this part of Wales?".

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Notes on the breeding population of alpine and red-billed choughs at the Eastern Coastal Mountains of Cantabria IBA, northern Spain.

Óscar Prada, Javier López, David González.

SEO-Castro, Grupo Local de SEO/BirdLife, Cantabria, Spain; montecandina@gmail.com, glseocastro@gmail.com.

The Cantabrian Eastern Coastal Range covers 29,000 hectares and includes a narrow strip of the Basque Country in northern Spain. Spain's Breeding Bird Atlas reveals that this region sustains the highest diversity of breeding species in Cantabria's Atlantic side thanks to the complex habitat mosaic present. The area hosts important populations of scavengers, raptors, and seabirds, which share the place with a red-billed chough (*Pyrrhocorax pyrrhocorax*) population of more than 100 breeding pairs that occupies most limestone cliffs within the IBA. Exceptionally for Europe, the region also hosts a breeding population of Alpine chough (*Pyrrhocorax graculus*) of over 50 pairs, some of them sharing coastal cliffs with seabirds, griffon vultures, Egyptian vultures and red-billed choughs. Both chough species nest in cliffs and forage in nearby meadows and grassy areas. More than 30 years of continued observations suggest overall population stability, though this is not based on specific censuses at specific nesting locations. Habitat conservation has been threatened by large quarry projects that have been stopped by conservationist organizations, and currently with the increase in eucalypt plantations at the expense of grassy meadows, and the proliferation of wind turbines. To protect and restore the habitat, SEO-Castro signs land stewardship agreements with municipal governments and engages in alliances with other stakeholders like cattle ranchers, the main organization of the primary sector in the Cantabrian mountains.

Apuntes sobre la población reproductora de chova piquigualda y chova piquirroja en la IBA Montaña Oriental Costera, Cantabria, España.

Óscar Prada, Javier López, David González.

SEO-Castro, Grupo Local de SEO/BirdLife, Cantabria, Spain; montecandina@gmail.com, glseocastro@gmail.com.

La Montaña Oriental Costera de Cantabria abarca 29.000 hectáreas situadas en la cuña oriental de Cantabria e incorpora una estrecha franja del País Vasco, norte de España. Los resultados del Atlas de Aves Reproductoras en España revelan que esta región sostiene la mayor diversidad de aves reproductoras de la fachada atlántica de Cantabria gracias al apretado mosaico de hábitats que caracteriza el espacio. La zona alberga destacadas poblaciones de aves carroñeras, otras rapaces y aves marinas, todas conviviendo con una población de chova piquirroja (*Pyrrhocorax pyrrhocorax*), estimada en más de 100 parejas reproductoras distribuidas por prácticamente todos los macizos calizos de la IBA. De forma excepcional en Europa, esta región alberga una población reproductora de chova piquigualda (*Pyrrhocorax graculus*) que supera las 50 parejas, dándose la extraordinaria circunstancia de que algunas de ellas ubican sus territorios en el mismo litoral acantilado que lo hacen aves marinas además de buitres, alimoches y chovas piquirrojas. Ambas especies de chovas utilizan los abundantes cortados y torcas para situar sus áreas de cría, mientras que los pastizales y lapiaces son empleados para búsqueda de alimento. Durante más de 30 años de observaciones continuadas se aprecia estabilidad en sus poblaciones, aunque esta apreciación no está basada en censos específicos que incluyan la localización detallada de cada uno de los lugares de nidificación. La conservación del hábitat se ha visto amenazada por grandes proyectos de canteras que fueron frenados por campañas conservacionistas y actualmente con la creciente expansión de plantaciones de eucalipto -en detrimento de los pastizales- y la proliferación de proyectos de industria eólica. Para contribuir a proteger y restaurar el hábitat SEO-Castro emplea los acuerdos de custodia del territorio con ayuntamientos y pedanías titulares de los montes, así como las alianzas con otros agentes clave como son las asociaciones de ganaderos criadores de raza monchina vacuna y caballar, principal fuerza asociativa del sector primario en la montaña cántabra.

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Low-cost housing, a good tool for red-billed chough conservation.

A. Artazcoz[1], S. González[2], P. Azkona[2], L. Goni[2], D. Arranz[2], D. Villanúa[2].

1C/ Navarro Villoslada 23, 31003 Pamplona, Spain;2 Departamento de Ornitología, Sociedad de Ciencias Aranzadi, Zorroagagaina 11, E-20014 Donostia-San Sebastián, Spain; dvillani@gan-nik.es.

The Cantabrian Eastern Coastal Range covers 29,000 hectares and includes a narrow strip of the Basque Country in northern Spain. Spain's Breeding Bird Atlas reveals that this region sustains the highest diversity of breeding species in Cantabria's Atlantic side thanks to the complex habitat mosaic present. The area hosts important populations of scavengers, raptors, and seabirds, which share the place with a red-billed chough (*Pyrrhocorax pyrrhocorax*) population of more than 100 breeding pairs that occupies most limestone cliffs within the IBA. Exceptionally for Europe, the region also hosts a breeding population of Alpine chough (*Pyrrhocorax graculus*) of over 50 pairs, some of them sharing coastal cliffs with seabirds, griffon vultures, Egyptian vultures and red-billed choughs. Both chough species nest in cliffs and forage in nearby meadows and grassy areas. More than 30 years of continued observations suggest overall population stability, though this is not based on specific censuses at specific nesting locations. Habitat conservation has been threatened by large quarry projects that have been stopped by conservationist organizations, and currently with the increase in eucalypt plantations at the expense of grassy meadows, and the proliferation of wind turbines. To protect and restore the habitat, SEO-Castro signs land stewardship agreements with municipal governments and engages in alliances with other stakeholders like cattle ranchers, the main organization of the primary sector in the Cantabrian mountains.

Bidones y barquillas recicladas: una buena herramienta para reducir la depredación de nidos en chova piquirroja.

A. Artazcoz[1], S. González[2], P. Azkona[2], L. Goni[2], D. Arranz[2], D. Villanúa[2].

1C/ Navarro Villoslada 23, 31003 Pamplona, Spain;2 Departamento de Ornitología, Sociedad de Ciencias Aranzadi, Zorroagagaina 11, E-20014 Donostia-San Sebastián, Spain; dvillani@gan-nik.es.

La chova piquirroja (*Pyrrhocorax pyrrhocorax*) es una especie que en las zonas pseudo esteparias de la Península ibérica acostumbra a ubicar sus nidos en corrales. En la actualidad, este tipo de edificios están muy deteriorados y están siendo derruidos o sustituidos por nuevas construcciones que carecen de los huecos necesarios para la ubicación del nido de las chovas u otras especies. Esta limitación obliga a las chovas a ubicar sus nidos en puntos subóptimos, con lo que la depredación de nidos podría ser muy alta. Ante esta situación, la colocación de nidales artificiales a prueba de depredación se plantea como una alternativa a considerar dentro de la conservación de esta especie. Desde el año 2007, se viene desarrollando una monitorización de 69 corrales con nidos de chova piquirroja, que se ha completado con la colocación de nidales artificiales para las chovas. Se han usado dos modelos de nidal, barquillas de fruta de plástico y bidones de pintura ambos reciclados y fijados a la pared de los corrales de manera que resultasen inaccesibles a los depredadores terrestres. En estos 12 años de seguimiento se han podido valorar un total de 367 intentos de reproducción, de los cuales en 289 ha volado algún pollo y al menos en 78 se ha producido depredación. Todos los casos de depredación se produjeron en nidos naturales, mientras que los bidones y barquillas se mostraron aparentemente inaccesibles a los depredadores. Los resultados encontrados muestran como la reutilización de barquillas y bidones como nidales artificiales puede ser una medida muy barata y eficaz para reducir la depredación y por lo tanto favorecer la conservación de la especie.

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Warm winters negatively affect female spring survival of the alpine chough.

Jules Chiffard[1], Anne Delestrade[2-3], Nigel Gilles Yoccoz[2,4], Anne Loison[3], Aurélien Besnard[1].

1Centre d'Ecologie Fonctionnelle et Evolutive, UMR 5175, Montpellier, France; 2Centre de Recherches sur les Ecosystèmes d'Altitude, Chamonix, France; 3Laboratoire d'Ecologie Alpine, Université Savoie Mont-Blanc, France; 4UiT The Arctic University of Norway, Tromsø, Norway; anne.delestrade@gmail.-com.

Seasonality is a strong constraint on lifecycles in alpine environment. Using data from a 27-year study of individually marked alpine choughs in the Northern French Alps, we investigated seasonal variations of survival rates. We hypothesized, based on previous studies on alpine and arctic species, that cold season and more specifically the end of cold season (spring) is a critical period for choughs, and that weather and individual covariates would explain survival variation during this critical period. We found that survival was higher in winter than in summer in adults of both sexes. High survival during the first months of winter may be a general pattern found in alpine and arctic vertebrate species, explained by behavioural and physiological adaptations to climate harshness. Spring, however, was a critical season for female survival, but not for males, and was negatively related to high temperatures during the preceding cold season. Females, which are dominated by males at feeding sites during snowy season, and which additionally need to invest energy in egg production, probably reached their physiological limits in spring. This first robust analysis of survival over a full seasonal cycle in a sedentary bird inhabiting an alpine biome revealed that intrinsic and extrinsic factors interact with seasonality to impact survival of individuals. Investigations of seasonal variation of survival are necessary to better understand the potential impacts of climate change.

Status, population trends and conservation of red-billed choughs in Granada, southern Spain.

Jesús M. Zúñiga .

Centro de Instrumentación Científica, Universidad de Granada, Granada, Spain; jmartinz@ugr.es.

A comparative analysis is made between data from 1980-84 and 2017-2019 on the size of the populations of red-billed choughs in the Sierra Nevada National Park (SNP), and peripheral areas in a perimeter between 60-30 linear km, especially the Guadix Depression, Granada, in southern Spain. Long-term monitoring of population numbers is an essential factor to assess the conservation status and threats to chough populations. The number of birds in stable roosts is accounted for by monthly roosting samples, within the pre-reproductive period (December-February) and post-reproductive period (July to November). Three types of roosts are differentiated according to the type and number of birds that occupy them: (i) macro-roosts: they group a large number of birds in enclaves such as large caves, cracks, natural chimneys or simas; (ii) individual roostsl: the couples or family groups post-reproduction are distributed individually, in holes, cracks or cornices, in wide spaces such as slopes, pits, cliffs, abandoned sheep-farms, which can coincide with the territory of subsequent nest sites; and (iii) mixed roosts: the two types of groupings coexist within a radius of less than 1-2 km. We observed a global decrease, around 60% of the population in 35 years, with total disappearance of some stable roosts within SNP. The population decline seems to be generalized at other sites (sub-areas) near Sierra Nevada National Park. This is the case of the Tajo de las Palomas (Moclín, 1300 m) with a 100% reduction (125-130 birds 1980-1984, 0 birds 2017-19) or the main roost of the Sierra de Alhama-Loja (600-1400 m), with a decrease of 75% (180-190 birds 1981-1984 vs. 45-55 in 2017-2019). There is an increase in the occupation of buildings and/or human constructions as roosts (more than 80%) of comparative occupancy, unusual in the period 1980-1984. The more important roosting is the Minas de Alquife (Cerro Minero),

with censuses of more than 450-500 birds in 1980-82 and currently a maximum of 560 birds (September) to 170 (May). With respect to cultural change, we observed the use of a large semi-abandoned building (Cortijo del Administrador), for a stable colony of 280-290 choughs and the location of 13 nests inside, with a linear distance between them of 2.5-20 m. Breeding success is analysed considering changes in nest sites and reduction of predators to understand their impact on population dynamics. 123 nest sites (2018-2019) are located and compared with 382 (1980-1983), with an increase compared to sites in human constructions (only 4.3% in 1980-83, 60.2% in 2017-19). One factor to consider in the stability of the populations is the low productivity in the study area in 1980-1984, with an average value of 1.22 fledging success, much lower than the average value of other areas of the rest of Europe (3.70-2.38, different authors). It is necessary to repeat in a detailed study the effect of the large reduction in populations of raven (Corvus corax) as a main predator, especially in the pre-fledging phase. In 2017 we recorded only three raven pairs in the study area, when in 1980-84 we observed 250-300 pairs in forest roosts. The causes of the reduction of their populations, the change in the use of space (anthropophylic plasticity) and the modifications of the habitat of the species as a consequence of human activity are analysed. A series of actions are proposed in the medium and long term, together with possible lines of research to guarantee their conservation.

Comparative genomics of red-billed choughs in Iberia and the Canary Islands.

María Recuerda, Guillermo Blanco, Borja Milá.

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; m.recuerda@csic.es.

Understanding the genetic basis of traits that allow individuals to adapt to local conditions is important to help us understand how evolution works and how species are formed. Island colonization exposes birds to new ecological conditions, leading to rapid morphological, physiological and behavioural adaptations, often related to diet shifts. The red-billed chough (*Pyrrhocorax pyrrhocorax*) inhabits the oceanic island of La Palma (Canary Islands), where available food resources are different from those in the continent. In La Palma, choughs have shifted their diet to include fleshy fruits due to the low abundance of insects, and this can lead to morphological and physiological differences relative to mainland populations. To study the genomic basis of the differentiation among island and mainland individuals and to identify the genes under selection, we obtained single nucleotide polymorphism (SNP) loci across the genome using genotyping by sequencing (GBS) data from three populations, two from Iberia (Los Monegros and Madrid) and one from La Palma. We ran a STRUCTURE analysis and constructed a phylogeny to study the genetic structure, which shows clear differentiation between insular and continental populations. We then generated resequencing data of 12 genomes per treatment (mainland vs island), to detect the genomic regions showing signs of selection. Two different approaches were implemented based on FST as an index measuring population differentiation due to genetic structure. To date, we have obtained hundreds of SNP loci putatively under selection and have mapped them onto the zebra finch annotated genome to identify the candidate genes potentially involved in the differentiation. As expected, we found some genes involved in morphogenesis (FGF20) and in metabolism (PPID). Comparison of results from this study on choughs will be compared to those from other three passerine species with island and mainland populations, so that we can see if the same or different genes are modified when birds colonize oceanic islands.

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Conservation status of the red-billed chough in the Isle of Man, UK .

Allen Moore.

Manx Chough Project, Isle of Man, UK; allen.gobbag@manx.net .

The Isle of Man is a 560 square kilometres island in the Irish Sea between Britain and Ireland. Politically, it is a Crown Dependency of the UK, which means that we have our own parliament and do not have a vote in Westminster elections. Neither did we have a vote in the farcical Brexit referendum. There is archaeological evidence of Choughs in the Isle of Man from almost 1900 years ago. In common with many other places, Choughs numbers decreased markedly during the second half of the 19th century, but numbers gradually built up during the 20th century. Chough surveys in 2002 and 2014-15 showed further increases, albeit slight after 2002. A geographically distinct part of the Isle of Man was recolonised by Choughs more than 10 years ago, and the recolonization of the area made up the majority of the slight increase since 2002. The main grazing mammals which benefit Choughs in the Isle of Man are cattle, sheep and rabbits. However, the future is more doubtful, with calls for the planting of many trees and the reduction of the production of meat, especially beef, as means of reversing Climate Change. Manx agriculture has always been minimally profitable, and I see the battle against such over-simplistic thinking to be my next battle personally.

Vocal differences vs. genetic segregation between two populations of choughs in Portugal: Cause or Consequence?.

Vanessa Rodrigues[1], João Alexandre Cabral[2], António Luís[1], Paulo Travassos[2], Francisco Morinha[2,3], Diogo Carvalho[2], Paulo G. Mota[4].

1 Laboratório de Ecologia Marinha e Estuarina (LEME), Departamento de Biologia, Universidade de Aveiro, Portugal; 2Laboratório de Ecologia Aplicada, Centro de Investigação e de Tecnologias Agro-Ambientais e Biológicas (CITAB), Universidade de Trás-os-Montes e Alto Douro, Portugal; 3National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; 4Departamento de Ciências da Vida, Universidade de Coimbra. CIBIO, Portugal; 93.rodrigues.vanessa@gmail.com.

Ecological changes due to anthropogenic effects have had enormous consequences causing populations fragmentation and species extinctions. The two last populations of Red-billed Chough (*Pyrrhocorax pyrrhocorax*) resident in Portugal (in Serra d'Aire e Candeeiros and Sagres) have an apparent gene-flow restriction, suggesting an isolation that is not exclusively explained by geographical barriers, since the species has a high dispersion capacity. Being a social corvid, we hypothesized that this isolation could have behavioural causes, through vocal group recognition and inter-group segregation. The aim of this study was to describe the calls used in both populations and to test whether there were differences between the two populations so that individual calls origin could be identifiable. Results showed that populations have different repertoires, with calls that are different between populations, and no calls appear to be shared between the two. Most calls from Sagres are shorter and have a higher final frequency. We also attempted to determine individual differences in the Serra D'Aire population, and found some traits that can account for individual identity, namely at peak frequency and ascending time in calls. Our results revealed an enigmatic cause-effect pattern that is still far from being resolved because either the genetic isolation of these populations can be partially attributed to communication/social barriers or the vocal differences may result from the fragmentation of these populations.

Predation of golden eagles (*Aquila chrysaetos*) on the red-billed chough in Iberia.

Enrique Navarro.

Grupo Tagonius, Madrid, Spain; enrique.navarro@aequilibrium-project.org.

The impact of predation on red-billed chough populations has been studied in the context of the breeding season (predation on eggs and nestlings), but there is an information gap regarding predation on adults or fledglings. Here, I analyze the impact of mediterranean golden eagle (*Aquila chrysaetos homeyeri*) predation on choughs during the eagle's nestling period, in the context of the project "AEQUILIBRIUM" (ACE-TAGONIUS). Data were collected by installing camera-trap stations on breeding platforms and by direct recording of prey provisioning to golden eagle nests during a study of golden eagle diet during the breeding season across Iberia. Corvid prey (up to 6 species recorded) are common, and red-billed choughs stand out in quantity across the region. I discuss the patterns of eagle predation on chough chicks and adults relative to the location of eagle territories in different habitats. I show other types of relationship between both species in areas where they both breed.

Depredación del águila real (*Aquila chrysaetos*) sobre la chova piquirroja en Iberia.

Enrique Navarro.

Grupo Tagonius, Madrid, Spain; enrique.navarro@aequilibrium-project.org.

El impacto de la depredación sobre las poblaciones de chova piquirroja ha sido estudiado en el contexto de la reproducción (depredación sobre huevos y pollos en nidos), pero existe un vacío de información sobre este aspecto en lo que se refiere a individuos adultos o juveniles independizados. En esta comunicación se analiza el impacto de la depredación sobre chovas piquirrojas por parte del águila real mediterránea (*Aquila chrysaetos homeyeri*) durante el periodo de crianza de los pollos, en el contexto del Proyecto "AEQUILIBRIUM" (ACE-TAGONIUS). La información fue obtenida mediante la instalación de estaciones de foto-trampeo en las plataformas de cría y el registro directo de aportes de presas, en el marco de un estudio sobre la dieta del águila real durante el periodo reproductor realizado en una amplia zona de la Península Ibérica. Los aportes de córvidos (hasta 6 especies registradas) son muy frecuentes en cuanto a su proporción como presas, destacando numéricamente la depredación sobre chovas piquirrrojas en diferentes territorios a lo largo de la geografía peninsular. Se discuten los patrones de depredación sobre pollos y adultos en relación con la localización de los territorios de águila real en distintos ambientes. Se muestran otros tipos de relación entre ambas especies en las áreas comunes de reproducción.

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Natal recruitment and dispersal of red-billed choughs: influence of sexual differences on social organization.

Óscar Frías, Guillermo Blanco.

National Museum of Natural Sciences, Spanish National Research Council (CSIC), Madrid 28006, Spain; milvusmigrans@gmail.com.

Dispersal is a key process in the life-history of organisms, and it has a primary influence on the regulation, spatial distribution and genetic structure of populations. The distance moved by individuals from its natal place to the site of reproduction, referred to as natal dispersal, implies cost and benefits in terms of energy consumption, survival prospects and familiarity with resources, predators and conspecifics influencing fitness. We examined long-term factors influencing natal dispersal distances in a population of red-billed choughs over a large area in southeastern Madrid, Spain. A total of 1528 chicks were banded with metal and alfa-numeric-coloured PVC rings allowing individual identification from a distance. We searched for banded breeding individuals by visiting nest-sites, and obtained data on the natal dispersal distance from 61 choughs (26 males and 35 females). The results indicate that breeding choughs show a great fidelity to their natal area in a region where this species nest on cliffs and buildings. Dispersal distance shows differences between sexes, with larger distances in females than in males. The previous knowledge of the area to settle as breeding individuals could be an advantage for males that disperse less from their natal area if they obtain in this way some benefit or if they reduce the costs regarding competition face to other males to obtain mates and to acquire and defend their nest sites and other resources. This mechanism could be much more efficient if dispersal differ between sexes, by reducing the possibility of pairings between closely related individuals, such as siblings. The lesser dispersal distance of males could imply their settlement next to their parents and brothers, which can imply social facilitation based on the kinship due to the spatial aggregation of relatives due to the great fidelity to their nesting sites throughout their lives. We discussed whether high philopatry to birth area and sex differences in natal dispersal might have an influence on the structure and dynamics of the chough metapopulation

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The 26-year decline of the central Apennines population of the red-billed chough from 1994 to 2019.

Augusto De Sanctis[1], C. Artese[1], R. Caldoni[1], S. Inzaghi[2], Ms. Pellegrini[1], F. La Civita[3], G. Opramolla[3], S. Spacca[3], F. Ricci[2].

1Stazione Ornitologica Abruzzese Onlus; 2Riserva Naturale Regionale Oasi WWF "Gole del Sagittario"; 3Centro Ricerche Ambienti Montani, Reparto Carabinieri Biodiversità Castel di Sangro; augustodesanctis@gmail.com.

The central Apennines population of Red-billed Chough represents the stronghold of the species in Italy, with hundreds of pairs breeding both within colonies or solitary along the calcareous/marl cliffs of the principal massifs of Central-southern Italy. First data on the Red-billed Chough in 1976 referred exclusively to the Abruzzo National Park and only from 1994 to 1997 a more comprehensive surveys resulted in a first estimate of Abruzzi population. Other monitoring programs for some massifs in the region were carried out in the mid-2000. In 2013-2014 other breeding data were also collected in the same areas for the management plan of Natura2000 sites. During the 2019 breeding season we monitored 31 sites in the main Abruzzi massifs using standard methods for nest mapping. These breeding sites were chosen prioritizing the ones that had previous data from 1994-1997, but also taking into account elevation, distribution and type of breeding organization (colonial vs. solitary; colony size). Overall, the comparison between the 90's and 2019 data suggested that the red-billed chough breeding population underwent a severe decline as a whole, with several breeding sites being deserted. This holds true for medium size colonies

too (4-8 pairs, such as the Frattura and the San Venanzio gorge colonies). In other large colonies, as that of the Anversa-Sagittario Gorge, we observed a strong decrease in breeding pairs (from 15 to 7). In the most numerous one in the region, that of the Celano Gorge, we observed a drastic decrease in breeding pair numbers between 1994 and 2008 (from 45-55 to 5-10) and only a partial recovery in 2019 (18-25). Generally, it seemed that for most massifs the decline in a twenty-five year span it was 40-50% and that the population underwent a sharp decrease in the first part of the period, followed by a period of stability or a less dramatic decline in the second part. Only in the Majella massif the species appears to be stable according to Majella National Park's data. The reasons for such a pronounced decline are unclear. However, large scale habitat change is occurring in the Apennine range due to recolonization of forests in mountain areas and to the abandonment of agriculture in surrounding areas which are used for foraging by the choughs also outside the breeding period. Moreover, it should be addressed the question about a potential effect of climatic factors on the species reproduction, such as a more intense variability during the breeding season.

The evolution of vocalizations of choughs, rook, crows and ravens.

Paola Laiolo.

Research Unit of Biodiversity (CSIC, UO, PA), Oviedo University – Mieres Campus, Mieres, Spain; paola.laiolo@csic.es.

Corvidae are known for their amazingly diverse and flexible behaviours, the result of superior cognitive skills evolved in constantly variable environments and complex societies. Other phenotypic traits of these species, such as voice and morphometry, display much lower levels of variability, an unusual conservatism for birds inhabiting all habitats and latitudes, including the harshness extremes on earth. Some genus display marked morphological and voice similarities that have been hypothesised to originate from mutual interactions, as a case of non-aposematic mimicry. In this talk I will discuss the level of interspecific variability in the calls of raven, rooks, crows and choughs, and compare this variability with that of the habitat and the biotic contexts (presence of congeners).

Looking into the past: red-billed chough population size and colony/roost site selection in the Cantabrian Mountains 25 years ago.

Vittorio Baglione.

Universidad de León, León, Spain; vittorio.baglione@gmail.com.

In 1993 and 1994 I carried out a census of the red-billed chough population in the Cantabrian Mountains. The study area (1500 km2 approximately) included four river basins and comprised the potentially most suitable habitats for the species in the province of León (northern Spain). Birds were counted at roost sites in winter, providing an estimation of the whole population, whereas the breeding population was estimated with transects along the limestone cliffs. The average density of choughs in the whole study area was 0.42 pairs/Km2, increasing to 0.75 pairs/km2 in the central part. In spite of the large availability of suitable cliffs, about 50% of the breeding pairs concentrated in colonies of variable size (12-20 pairs), while 26-7-30.6% of the population did not breed. Choughs preferred the highest and linearly longest cliffs to roost and breed. Colonies and roosts clumped in areas with large availability of pastureland and small extension of woods and shrub land. Data on the current status of the population are urgently needed to assess the trend of the species in this important part of its Iberian distribution range.

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Inventory and census of chough colonies in the Ordesa and Monte Perdido National Park, Aragón, Spain: first experiences of tracking alpine choughs with GPS-GPRS devices.

José Luis Rivas, Javier Sanz, Juan Carlos Albero, Fernando Carmena, Nacho Gómez, Ramón Antor.

SARGA-Gobierno de Aragón, Aragón, Spain; igomez@sarga.es.

In the last few years, wildlife managers at the Monte Perdido National Park hired the services of the public company SARGA, dependent of the Aragón regional government, to inventory and monitor the Alpine and red-billed chough populations within the park and areas nearby. After gathering available information on the presence of suitable localities for these species through surveys of park personnel (park staff, naturalists, ornithologists, etc.), in 2014 we visited a total of seven chough colonies. Colonies were visited during the breeding season and data on presence and abundance of both chough species were collected during dusk counts. The two largest colonies were selected for long-term monitoring, the Sestrales chough colony (Añisclo valley) and the Chough Chasm (Sima de las Grajas, Escuaín valley). These colonies were censused in 2015, 2017 and 2018 to study temporal trends. In addition, in order to obtain more information on chough presence, abundance and spatial use (location of roosts, foraging areas, seasonal movements), in the early summer of 2018 we marked an Alpine chough individual with a GPS-GPRS emitter (Ornitela Ornitrack 10-3G model) around the Góriz refuge (Ordesa valley). Here we present available results from the different counts and the data obtained from the GPS-GPRS emitter.

Inventariado y censo de "gralleras" en el Parque Nacional de Ordesa y Monte Perdido, Aragón, España: Primeras experiencias de marcaje de chova piquigualda mediante emisor GPS-GPRS.

José Luis Rivas, Javier Sanz, Juan Carlos Albero, Fernando Carmena, Nacho Gómez, Ramón Antor.

SARGA-Gobierno de Aragón, Aragón, Spain; igomez@sarga.es.

En los últimos años los gestores del Parque Nacional de Monte Perdido encargaron a personal de la empresa pública Sarga, dependiente del Gobierno de Aragón una serie de trabajos de inventariado y monitorización de los núcleos poblacionales de chova piquigualda (*Pyrrhocorax graculus*) y piquirroja (*Pyrrhocorax pyrrhocorax*) en las principales gralleras conocidas del Parque Nacional y zonas próximas. Tras recopilar la información disponible sobre la posible presencia de simas con características favorables para estas especies y realizadas una serie de encuestas entre el personal laboral del Parque (Agentes de Protección de la Naturaleza, vigilantes, celadores, naturalistas y ornitólogos, etc.), en el año 2014, se visitaron y censaron un total de siete gralleras, situadas en el Parque Nacional y zonas aledañas. Las gralleras se visitaron a lo largo del periodo reproductor y se recopilaron datos sobre la presencia y abundancia de individuos de chova piquigualda y/o piquirroja en cada una de ellas mediante censos realizados al anochecer. Posteriormente se seleccionaron las dos cavidades que presentaron los núcleos poblacionales más importantes en el Parque para su monitorización a largo plazo: la grallera de Sestrales (valle de Añisclo) y la sima de las Grajas (valle de Escuaín). Estas gralleras han sido censadas durante los años 2015, 2017 y 2018 para ver cuál es la evolución temporal de las colonias de dichas especies. Además, y con objeto de obtener más información sobre la presencia, abundancia y usos del espacio (ubicación de refugios, zonas de alimentación, movimientos estacionales), a principios de verano del 2018 se marcó un individuo de chova piquigualda con un emisor GPS-GPRS (modelo Ornitela Ornitrack 10- 3G) en el entorno de refugio de Góriz (valle de Ordesa). En el presente trabajo se darán a conocer los resultados obtenidos en los distintos censos realizados en las diferentes cavidades, así como los datos obtenidos del marcaje con emisor GPS-GPRS del ejemplar capturado.

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Threats affecting the population of red-billed choughs in an insular World Biosphere Reserve, La Palma, Canary Islands.

Félix Manuel Medina.

Servicio de Medio Ambiente, Cabildo Insular de La Palma, Avenida Los Indianos, nº 20, 2º piso, 38700 Santa Cruz de La Palma, Canary Islands, Spain; felix.medina@cablapalma.es.

The red-billed chough (*Pyrrhocorax pyrrhocorax barbarus*) is a native species from the Canary Islands, currently present only in La Palma, where it represents the south-western limit of their global distribution. Its population was estimated in 2010 at more than 2500 birds, a steady trend since 2005 (>2600 choughs estimated). Main threats include destruction of natural habitats, abandonment of cultivated areas, bad use of pesticides in agriculture, as well as persecution for their damage on cultivated areas, hunting and nest plundering. However, lack of deep knowledge about its biology does not allow establishing adequate measures to protect this emblematic species. Recovery centers for wildlife provide an interesting source of information about the current threats of protected birds because they relate the causes of attendance to injured animals they receive. In La Palma this role is played by the insular Government. In the present contribution I provide data about the number of choughs and causes of attention in the Recovery Center of Wildlife of the Cabildo de La Palma, from 2000 to 2018. During this period, a total of 3554 animals were rescued (3301 birds, 216 reptiles, 33 mammals, 3 fishes and 1 amphibian). In general, the main causes were recovery of fledged chicks (40.34%), undetermined causes (26.63%), and collisions (19.64%). Other causes included: injures by fire arms (1.07%), fishing gear (3.74%), captivity (1.13%), diseases (0.68%), spotting hydrocarbon (0.28%), poisoning (1.44%), migration (1.86%), glue (1.41%) or beached on the coast (0.31%). In the case of birds, causes were the same, reaching similar percentages because most of the wild animals cared for were birds. A total of 118 individual choughs were rescued with a high percentage of unrecovered birds (61.02% deaths and 38.98% recovered). The most important causes were undetermined cases (n= 48), fledged chicks (n= 36), collisions (n= 17) and injured by fire arms (n= 9). Undetermined cases include: found inside houses or buildings, in captivity, found with undetermined injuries in the wild, or injuries by predators (cats and dogs). By locality, most of the choughs were rescued from El Paso (25.42%), Mazo (13.56%), Breña Alta (11.86%), and Los Llanos de Aridane (9.32%), coinciding with the most important distribution areas of this species on the island. As it was previously established in La Palma, main threats upon the chough population are related to habitat destruction due to development of human constructions such as buildings and roads, causing collisions (with cars, buildings, electric cables, etc.). Persecution and illegal hunting also currently affect this bird on the island. More studies about population, biology and ecology, surveillance by authorities, and education campaigns are the most important solutions to minimize impacts on the populations of this native bird in La Palma World Biosphere Reserve.

Preliminary red-billed chough movement data from GPS-GPRS devices in central Spain.

Juan Manuel Pérez-García .

Departamento de Biología Aplicada, Universidad Miguel Hernández, Elche, Spain; juanmapg@gmail.com.

Satellite tracking technology development enables to obtain huge amounts of robust spatial animal movement data at predefined intervals, which reveal essential information about species' space use pattern and dispersal. This knowledge is especially important to design and optimize the conservation and management strategies of endangered species, particularly in species with a nomadic lifestyle such as the red-billed chough (*Pyrrhocorax pyrrhocorax*). To contribute to the knowledge of the movement patterns of red-billed choughs, a total of six birds 2 adults (1 male and 1 female) and 4 nestlings (3 males and 1 female) were captured in Central Spain between May and

August of 2019. Birds were tagged with 10-g solar-powered GPS-GSM transmitters (Ornitela, Lituania).Four birds were found death during the first month of tracking (2 predated, 1 electrocuted and 1 unknown cause). Another transmitter disappeared due to unknown causes. Preliminary results show the extent of the movements of fledgling choughs during their dispersive stage (Segovia), and how the adult birds used very specific foraging areas and roost sites during the entire monitoring period. Maximum distance from nest to foraging areas was 15 km. By contrast, juveniles show a parental dependence period around 42 days during which they explored the areas around the nest. Only one individual showed long-distance dispersal behavior. This bird started the dispersal trip on July 12 arriving to the first dispersal area in Segovia (85 km north of the nest) in two hours. The bird stayed there for 12 days until it was predated by a booted eagle. The information derived from this project will have a direct and practical application on the management and conservation of choughs, a significant impact on management and legislation on the protection of dispersal areas and communal roosts, as well as on the assessment of mortality risks during dispersal, i.e. dangerous power lines.

Anversa degli Abruzzi: a pilot example of good practices in favor of the conservation of red-billed choughs in the Regional Natural Reserve and WWF Oasis "Gorges of Sagittarius".

S. Inzaghi[1], F. Ricci[1], A. De Sanctis[2].

1Riserva Naturale Regionale e Oasi WWF "Gole del Sagittario" – Anversa degli Abruzzi; 2Stazione Ornitologica Abruzzese Onlus; augustodesanctis@gmail.com.

In the territory of the Regional Natural Reserve and WWF Oasis "Gorges of Sagittarius" there is a colony of red-billed chough (*Pyrrhocorax pyrrhocorax*) with 7 nesting pairs in 2019 (we observed a strong reduction in breeding pairs from 15 to 7). The environment of the Reserve is characterized by the presence of large cliffs, extensive wooded areas, pastures and uncultivated areas. In the downstream areas alternate uncultivated areas, olive groves and a few extensive crops. The olive groves offer a wide variety of resources for numerous wild species including the red-billed chough, which feeds on olives fallen to the ground especially in winter months as shown by some research carried out in the past years in the same Natural Reserve. Olive growing is also an integral part of the local tradition and culture, although in recent decades it has suffered a sharp decline in this and in all marginal areas for economic and social reasons. To try to recover some olive groves abandoned for years, but potentially still vital, during the work of rearrangement of the road which crosses the Nature Reserve and passes under the nesting wall of the red-billed chough, in 2016 an agreement was signed between the Province of L'Aquila, entity managing the road, and the Municipality of Anversa degli Abruzzi, entity managing the "Gorges of Sagittarius" Natural Reserve, after an integration of the project for rearrangements of the road. In the project integration were identified the mitigation and compensation measures envisaged pursuant to Dir. 43/92 / EC "Habitat" and the relative financial resources which permitted the realization of the pilot project in favor of the conservation of the red-billed chough. The project completed in 2017, assumed for the recovery of abandoned olive groves in the area surrounding the nesting site of the red-billed chough for a radius of 5 km from the wall itself, in order to make them useful again for this and other bird species. As the final result was the recovery of over three hectares of olive groves for a total of 150 plants by trimming, weed removal, pruning and fertilization of the olive trees with enrichment of organic substance deriving from the cutting of the twigs left on site. Besides, there were stipulated agreements with landowners for the failure of the harvesting of olives for at least three years, while among the mitigation activities it was established the prohibition of noise production with perforations during the pre-roost hours of red-billed choughs.

Study and conservation of the population of red-billed choughs Pyrrhocorax pyrrchocorax of the southern Massif Central, France.

Jérémie Demay, Alexis Rondeau, Nathalie Lamande, Patrick Boudarel, Jocelyn Fonderflick, Samuel Talhoet, Lucas Caussade, Evan Martin, Karen Joyaux, Laure Jacob, Camille Fraissard, Fabien Sane, Mexime Mollard, David Lacaze, Alain Ravayrol, Thibaut Couturier, Aurélien Besnard.

Conservatoire d'espaces naturels Languidoc-Rousillon, 26 Allée de Mycènes, Montpellier 34000, France; jeremie.demay@cenlr.org.

In France, four populations of red-billed choughs are known, and are located in Brittany, Alps, Pyrenees and southern Massif Central. The red-billed choughs use cliffs and their natural cavities to reproduce, and use cliffs and sink holes for social roosting. Open lands are known to be very important feeding areas. During the breeding period, breeding pairs isolate themselves or congregate in loose colonies. Social behavior is much higher during the non-breeding period when choughs gather in groups of few to hundreds of individuals to feed and roost. These winter meetings are thought to melt the breeding and non-breeding (20 to 60%) components of the population. Simultaneous counting of all known communal roosts in the southern Massif Central were conducted in winter. In 2018 and 2019, between 1200 and 1400 individuals were censused in 33 effective roosting sites, for 46 surveyed sites in2019 (respectively 31 and 38 in2018). These censuses raise the southern Massif Central as a significant territory for the species at the French scale, as the national head count is estimated between 4000 and 6000 nesting individuals. Simultaneous winter counts at communal roosting sites appear to be a very useful and highly repeatable tool to monitor the winter population of the southern Massif Central. Feeding habitat in the southern Massif Central has been described by multi-scale analysis: choughs mainly exploit areas of short grass (<5 cm high) and a high proportion of bare soil, and feeding habitat selection is done at both landscape and micro-habitat scales. Updated knowledge, shared by both conservation stakeholders and land management crews throughout the Natura2000 network, is now available in order to plan conservation efforts.

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