

# Preserving La Mancha's Wetland Avian Heritage with a Community-Driven Bird Monitoring Initiative

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## ABSTRACT

The region of La Mancha includes several bodies of water and communities of wetlands and jungles. It has a rich flora and fauna, and its wetlands are a Ramsar site (La Mancha-El Llano no 1336). Since 1999, there has been a community ecotourism group made up of farmers, ranchers, and fishermen who actively participate in research projects at CICOLMA (a reserve and field station of the Instituto de Ecología A.C., a public research center). They supported the restoration of freshwater wetlands, and since then, one of their members has been monitoring monthly the birds that arrive at the restored wetland. He has recorded 200 species, including aquatic, wading, and terrestrial birds. His training and enthusiasm have allowed him to constantly support data collection and generate this list, showing the role of a small wetland in bird richness. The group's activity has also resulted in greater community interest in conservation and becoming a livelihood.

Key words: conservation, community ecotourism, freshwater wetlands

## RESUMEN

La región de La Mancha comprende varios cuerpos de agua y comunidades de humedales y selvas. Alberga una gran diversidad de fauna y sus humedales son un sitio Ramsar (La Mancha-El Llano no 1336). En la zona, desde 1999, hay un grupo de ecoturismo comunitario, formado por campesinos, rancheros y pescadores. Participan activamente en proyectos de investigación en CICOLMA, una reserva y estación de campo del Instituto de Ecología A.C., un centro público de investigación. Apoyaron en la restauración de humedales de agua dulce y desde entonces uno de sus miembros ha venido monitoreando mensualmente las aves que llegan al humedal restaurado. Ha registrado 200 especies, entre aves acuáticas, veadoras y terrestres. Su capacitación y entusiasmo le han permitido apoyar de manera constante la toma de datos y generar este listado, mostrando el papel de un pequeño humedal en la riqueza de aves. La actividad del grupo también ha resultado en un mayor interés comunitario en la conservación además de convertirse en un medio de vida.

Palabras Clave: conservación, ecoturismo comunitario, humedales de agua dulce

## INTRODUCTION

Mexico's coastal wetlands are vital and unique ecosystems that extend along its extensive coastline of more than 11,000 kilometers, bathed by the Pacific Ocean, the Gulf of Mexico, and the Caribbean Sea. These areas, characterized by their transition between terrestrial and aquatic environments, play a fundamental role in the biodiversity conservation and the country's ecological balance. Mexico is home to many coastal wetlands, including mangroves, marshes, floodplain forests, freshwater marshes (popales), cattail marshes (tulares), coastal lagoons, estuaries, and beaches, each with unique characteristics and functions.

Mangroves are one of Mexico's most emblematic types of coastal wetlands, where they occupy an area in 2020, of 905,086 ha (CONABIO 2021). These forests consist of trees adapted to living in saline waters and provide a refuge and critical habitat for a wide variety of birds, fishes, crustaceans, and marine mammals. In addition, they serve as natural barriers against flooding due to storm surges (Blankespoor et al. 2017), act as carbon storages (Herrera-Silveira et al. 2020), and are nurseries for many aquatic species (López-Portillo et al. 2011). Mangroves are the only ecosystem fully protected by Mexican laws, meaning they cannot be cut down, and their hydrology cannot be modified throughout the territory. Additionally, coastal lagoons and estuaries that surround the mangroves are reproductive and breeding areas for many fish species, crustaceans, and mollusks, making them essential fishing centers for the local economy.

Freshwater coastal wetlands include various communities with different compositions and structures, which occupy an extensive area, especially in the country's southeast. They include tree and herbaceous communities established on freshwater gradients behind the mangroves and frequently connected to them (Moreno-Casasola et al. 2017). They are not as well known by society or decision-makers, yet provide fundamental ecosystem services, such as carbon storage (Sjogersten et al. 2021; Hernández and Moreno-Casasola 2018), regulation of freshwater flooding peaks that flow down the basins (Campos et al. 2011), plant and animal resources (González-Marín et al. 2012, 2017), filter water (Verhoeven et al. 2006) and are widely used for livestock grazing in the Mexican tropics (Moreno-Casasola et al. 2012).

Birds are an essential component of wetlands, and permanent monitoring helps expand bird listings, document habitat alterations, and changes due to climate conditions, among other benefits. In areas with migration routes, they allow identification of changes in species population numbers and timing. In some countries, birdwatchers are an essential and reliable source of information on bird occurrence and migration, but in many others, there is a lack

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of citizens devoted to bird-watching. Alternatives to fulfill these roles should be explored.

Local residents in rural counties depend on the resources provided by coastal wetlands. These habitats face significant threats due to urbanization, pollution, overexploitation of resources, and climate change. The conservation and preservation of these valuable ecosystems are crucial for the well-being of Mexico's coastal inhabitants. Conservation initiatives should form part of the existing relationship that is established between nature and people. Community ecotourism serves to raise awareness among local inhabitants of the importance of conserving the ecosystems, utilize them sustainably, and diversify livelihood options. The purpose of this paper is to share the experience of a community ecotourism group called La Mancha en Movimiento (<https://www.ecoturismolamancha.org/>) with an emphasis on bird watching and monitoring. The latter has proved to be a valuable mechanism to expand knowledge of the site's diversity, increase local appreciation of wetlands, spark interest in local inhabitants on birds, and increase the group's income through guiding bird-watching tours. The project we are describing has been developed in the neighboring freshwater wetlands of Laguna La Mancha, in Veracruz, Gulf of Mexico.

Table 1. Surface area occupied by different coastal ecosystems and land uses in the La Mancha region, corresponding to the map shown in Figure 1.

Community	Area (ha)
Coastal dune grassland and scrub	214.2
Crops	477.6
Flooded pasture	332.8
Freshwater marshes	18
Mangrove	266.2
Mobile dunes	196.1
Pasture	1175.5
Riparian	142.4
Secondary thicket	760.1
Swamp	6.2
Tropical forest	588.4
Urban	66.4

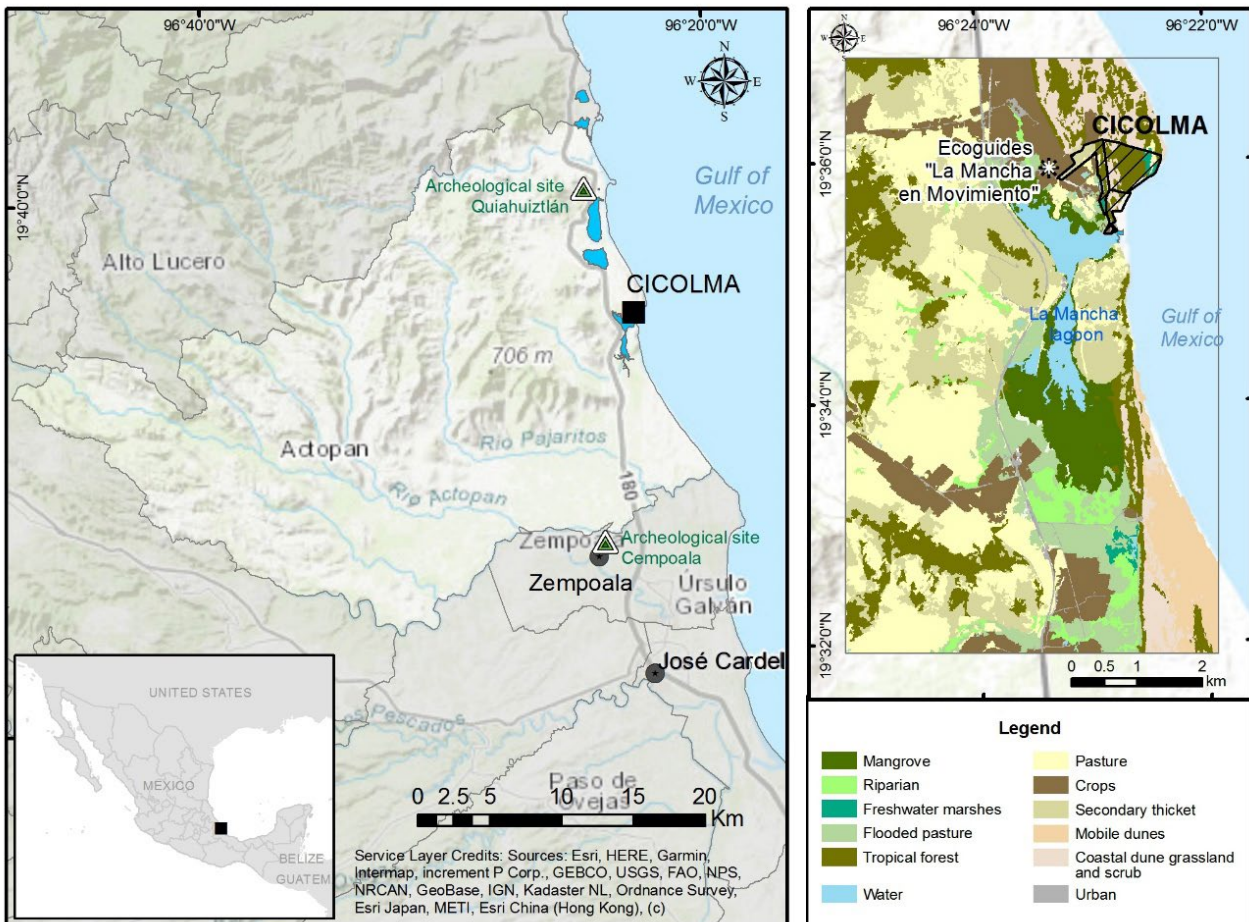


Figure 1. Map of La Mancha region. Three water bodies are shown: El Llano- a hypersaline coastal lagoon towards the north; lake Farallón a freshwater system; Laguna La Mancha. Topography and towns are also shown. The map on the right shows CICOLMA and its protected dune and wetland area, as well as other habitat types in the area.

## LA MANCHA REGION

La Mancha is located in a portion of the center of Veracruz, within the coastal area of the Actopan municipality, with an exciting history of human occupancy and a critical ecosystem and species richness. This site has a long history of occupation by pre-Hispanic societies and has significant cultural and historical value. For example, there are records of Totonacan human settlements in the area, both residential and ceremonial (the archeological sites of Quiahuiztlán, El Bernalillo, Cempoala and Cacalótlán), vestiges of salt extraction, clam farming, fishing, hunting, and gathering, that date back to between 2700-1500 BC (Medellín 1970 in Ortíz-Espejel and Hernández-Trejo 2006).

Like much of the Veracruz shoreline, La Mancha is characterized by discontinuous systems of mangroves, dunes, coastal wetlands, and lagoons – an example of the great coastal diversity present in the region and the basis of the primary activities of many of the inhabitants. Although a small area, it is rich in ecosystems (Table 1) and species (Table 2). Figure 1 shows a map of the region with the location of the water bodies, topography, main populated areas, and a public research institute, CICOLMA (La Mancha Coastal Research Center, part of the Instituto de Ecología A.C. -INECOL), where the bird monitoring has taken place.

The most recently published checklist counts 296 bird species (González-García 2006) for the La Mancha-El Llano area shown in Figure 1 (Table 2). According to this list, resident birds constitute 46% of the reserve's total avifauna, migratory species from North America 37%, transitory species 13%, and occasional species 4%. Forty-nine species are considered threatened in various categories by national or international legislation. Also, CICOLMA is located on one of the main routes for migratory birds, where nearly 13 million birds travel in a single annual season (Ruelas-Inzunza 2006). Studies have also cataloged 841 plant species representing more than 100 families (Castillo-Campos and Travieso-Bello 2006). Plant richness is a result of the different vegetation types both on dunes (pioneer species, coastal thickets and grasslands, and tropical forests) as well as wetlands (Moreno-Casasola et al. 2010). Land uses also increase plant richness. These plant communities are also important for birds, and migratory routes increase the number of bird species that use these environments as a stopover. Further studies will likely add to the number of other animal species as well.

These characteristics led to the area's designation as a Wetland of International Importance (Ramsar Site No. 1336) by the Ramsar Convention on Wetlands in 2004. In addition, the area was established as a site for long-term ecological studies by the Mexican Network-LTER (Long Term Ecological Research Site 11) and is recognized as an Important Bird Areas (IBA) by BirdLife International; it is one of the CONABIO's priority sites and is part of

Table 2. Number of recorded and protected species in the La Mancha-El Llano region. (Adapted from Moreno-Casasola 2006)

Group	Species	Species protected by the Mexican legislation (NOM-059-SEMAR-NAT-2010)	Endemic species
Amphibians	12	3	1
Reptiles	35	18	3
Mammals	52	16	0
Birds	296	38	1
Phanerogams	837	14	7

the Coastal and Marine Monitoring Network in Mexico to monitor the red tide. The area belonging to CICOLMA was also registered as a private natural protected area.

## FRESHWATER WETLAND RESTORATION

In 2007, a restoration project took place on three hectares of a freshwater wetland that a C4 grass had invaded, Antelope Grass (*Echinochloa pyramidalis*). The main objective of the restoration research was to recover the original freshwater marsh. Plant structure and richness and the presence of bird, reptiles, and amphibian species were used as success indicators. Antelope Grass was introduced to the area as forage grass for livestock due to its tolerance to flooding. The original wetland of the site was a "popal" (freshwater broad-leaved marsh) dominated by *Sagittaria lancifolia* (Arrowhead) and *Pontederia sagittata* (Pickerelweed) as reported by Novelo (1978). The Eco-guides worked actively in its restoration with the researchers involved and helped with a plant and animal monitoring program to determine the success of the restoration activities.

The wetland is located in an interdune depression and has some isolated trees of *Pachira aquatica* (Apompo), *Annona glabra* (Pond Apple), and *Salix humboldtiana* (Willow). By 2016, the wetland was utterly free of the invasive grass, except in a control plot (where this species was not dealt with). Several experiments were done prior to the restoration project to better understand the biology and responses of the invader and dominant native plants (López-Rosas et al. 2006; López-Rosas and Moreno-Casasola 2012; López-Rosas et al. 2015).

Restoration activities involved: 1) cutting vegetation to the soil level before flooding season, 2) piling and burning cut grass to eliminate stolons, 3) extracting and planting native plants in the greenhouse (which proved not to be necessary very soon), 4) monthly manual extraction of grass resprouting, and 5) blocking water passage to keep the area flooded for 16 months to reduce grass resprouting. Other activities took place depending on particular situations:



Figure 2. View of the popal restoration in areas previously occupied by Antelope Grass: A) view of the restored wetland with a water body in 2014, and B) view of the restored wetland completely covered by broad-leaved plants in 2019. (Photos by P. Moreno-Casasola).

1) covering the soil with black thick plastic after flooding to reduce resprouting, 2) covering with shade greenhouse mesh to reduce sunlight for C4 grass when natives were abundant and grass was scarce, and 3) leveling soil (40 cm lower) to ensure sufficient flooding. A 1 m wide and 1 m deep channel was excavated to separate the restoring plot from the neighbor's grazing field. The channel filled naturally with water, and seedlings of *Pachira aquatica* trees were planted along the border to increase shading and prevent invasion from the field into our plot. The creeping shrub *Dalbergia brownii* was particularly resistant, covered the trees, killing them, and the rooting place could not be detected, so systemic herbicide was injected into this shrub's stems. The native hydrophytic species characteristic of the reference wetland recovered (i.e., detailed results can be seen in López-Rosas et al. 2010 and López-Rosas et al. 2013). The project maintained a body of water for the first three years. After that, broad-leaved plants and cattails covered the whole area (Figure 2). Part of these activities involved monitoring bird usage. Enrique Romero (one of the Eco-guides) played a crucial role in this activity and he is still actively monitoring birds in the freshwater wetland and helping researchers understand the importance the wetland restoration project has had for bird life.

### CONSERVING COASTAL ECOSYSTEMS AND BIODIVERSITY

La Mancha, with its coastal ecosystem diversity and the field station of CICOLMA, has provided an excellent opportunity to develop sustainable community projects linked to local conservation activities. The relationship established with residents, mainly farmers, cattle ranchers, and fishermen in a town with 450 inhabitants, has allowed a small group to organize around ecotourism, research, restoration, and conservation activities.

### ECO-GUIDES AND ECOTOURISM

The “La Mancha en Movimiento” ecotourism project was initiated in 1999. A group of farmers and fishermen have

established themselves as an ecotourism microenterprise that guides groups of tourists as well as high school and university students from different parts of the country along established trails and canals through beaches, dunes, mangroves, and wetlands, including the restored wetlands (Figure 3). Several of them actively participate as field technicians supporting the field research work of researchers, resulting in bachelor's, master's, and doctoral students' theses. Their knowledge of local ecosystems, their flora and fauna, and their capacity for daily observation have made them invaluable to researchers at CICOLMA.

The eco-guides have become community leaders with meaningful participation in their community and in events such as the Shorebird and Wetlands Festival — an annual event since 1999 that allows several organized local groups to develop activities to show visitors their projects. Ecotourism tours, educational workshops, sports, and cultural activities receive up to 3,000 visitors each year, and bird watching is one of the activities. In addition, they have provided training to other community groups in Veracruz (Moreno-Casasola and Salinas-Pulido, 2007) that want to develop ecotourism as a means of making a living. All these and other activities have increased not only their technical abilities but also their environmental awareness. They have become pillars of conservation in the region, significantly helping to reduce clandestine hunting and clearing forests, while increasing residents' awareness of the environment.

Enrique Romero, one of the members of Ecoguías La Mancha en Movimiento, specialized in bird watching. He found a true vocation, and as he relates: “In the mornings, when I wake up, the first thing I hear is the birds singing; I know who starts and who is next. I know where they perch and where they nest.” He has been conducting ecotourism tours through the mangrove channels, freshwater wetlands, and dunes for 25 years and has provided support to numerous students and researchers in their field studies. All of this has given him great experience not only in the identification

and habits of birds but also great observational capacity, sensitivity, and environmental awareness of conservation issues.

Since 2007, Enrique Romero has systematically walked monthly, with only brief interruptions, a path surrounding the popal restoration area and crossing the wetland along a series of wooden walkways (Figure 3). Enrique has been monitoring the presence of birds in this relatively small restored wetland within CICOLMA (3 hectares). He has recorded 200 different species of birds (Table 3), representing almost 50% of the total number of birds detected in the La Mancha-El Llano region. The Appendix (at the end of this article) lists the birds registered during the monitoring.

Table 3. The number of bird species in each category registered during the monitoring developed from 2012 to 2022.

Habitat	Species #
Terrestrial	145
Freshwater and terrestrial	7
Freshwater	34
Marine	2
Marine and freshwater	2
Marine, freshwater and brackish	9
Brackish and freshwater	1

## BIRD OBSERVATION AND MONITORING

Through his observations, rare species that had not been reported at the site have been detected, such as the Green Macaw (*Ara militaris*). Two individuals of this species were seen flying over the wetland on December 17, 2012, and Enrique commented that he had already heard the characteristic calls of these birds on other occasions. However, it was not until then that they were recorded as part of the monitoring work. These types of observations highlight the importance of the La Mancha-El Llano region and the participation of locals in the monitoring work.

Another outstanding species detected is the Northern Pootoo (*Nyctibius jamaicensis*). This bird is characterized by being a shy species with nocturnal habits that, during the day, remains entirely still on the trunk of a tree to conceal itself (Figure 4). Since it has preferred resting places, it is possible to find it at the exact location on different days. Many of the visiting bird watchers at CICOLMA have this species on their target lists, and Enrique has been able to take them to its perch to observe it.

Bird monitoring has also revealed some migration patterns of different birds. They are marked in the Appendix. In one morning in November 2022, Enrique recorded 1,128 individuals of the American White Pelican (*Pelecanus erythrorhynchus*) flying over the site (Figure 5). Although



Figure 3. Location of the wetland site where the bird monitoring is taking place within the restoration area of CICOLMA. The monitoring route is shown with the yellow line. The two yellow arrows indicate the direction of the mangrove route.



Figure 4. Northern Pootoo (*Nyctibius jamaicensis*) at its roosting perch during the day. (Photo from NaturaList - La Mancha en Movimiento)



Figure 5. American White Pelican (*Pelecanus erythrotynchus*) flying over the La Mancha Lagoon on their migratory winter route towards the south. (Photo from NaturaLista - La Mancha en Movimiento)

La Mancha is recognized as a migratory route for many birds of prey and sea birds, many migratory birds occupy these sites as resting points. Such is the case of species like the White-winged Dove (*Zenaida asiatica*) or the Eastern Kingbird (*Tyrannus tyrannus*), which can be seen perching on trees in groups of hundreds of individuals.

The monitoring has also recorded several species in the area protected by national or international environmental legislation. Various parrot species, such as the Yellow-headed Parrot (*Amazona oratrix*) or the Red-lored Parrot (*Amazona autumnalis*), stand out (Figure 6).

In the restored wetland, although native hydrophytes were restored, continuous periods of drought during the last several years (2016-2021) caused the popal to go dry for extended periods. Consequently, some aquatic bird species, like ducks, gallinules, and grebes, are no longer seen at the restoration site, and the overall richness has significantly decreased compared to the first years of the monitoring (Figure 7). However, the increased dry terrain favored other bird species that tend to forage in more vegetated areas. These birds including the Spot-breasted Wren (*Pheugopedius maculipectus*) or the Ovenbird (*Seiurus aurocapilla*) were only registered by the monitoring recently. Also, there are sightings of new birds of prey, like the Peregrine Falcon (*Falco peregrinus*) or the White-tailed Hawk (*Geranoaetus albicaudatus*). These changes in the species composition of the site show how dynamic bird usage is and could serve as bioindicators of the habitat successional processes that occur on a larger timescale (Figure 7). The participation of residents is the only way to ensure long-term monitoring. Community monitoring has been practiced in some countries where bird watching is an important hobby, i.e., Great Britain. Our experience through a sustainable research/ecotourism project that has generated income and helps develop awareness and technical capacities has proved successful. The eco-guides have helped us train other rural eco-guides in other parts of Veracruz, and in these groups,



Figure 6. Different species of parrots protected by the national environmental legislation have been detected: Yellow-headed Parrot (*Amazona oratrix*) on left and Red-lored Parrot (*Amazona autumnalis*) on right. (Photos from NaturaLista - La Mancha en Movimiento).

there is always one or two persons who become very interested in birds.

In most ecological communities, the largest number of individuals comes from a few very abundant species, while species with only a few individuals represent the vast majority of species present in the community. If we graph the relative abundance of the species registered by Enrique's bird monitoring in a year, we can see that this is true for the bird community at the restoration site. From morning to afternoon, this pattern stays the same, but the most abundant species varies. At the beginning of the day, the most common species is the White-winged Dove (*Zenaida asiatica*), a migratory species that travels in groups of hundreds at the site, followed by the Olive-throated Parakeet (*Eupsittula nana*). These doves are only seen at La Mancha in the autumn-winter season, between September and December. As the sun sets, the abundance of doves gets lower, and the parakeets become the most abundant species, followed

by the Montezuma Oropendola (*Psarocolius montezuma*). These gregarious birds return to the same perching sites or their hanging nests at the restoration site to roost during the night. Some other species, like the Broad-billed Ani (*Crotophaga sulcirostris*), the Great Kiskadee (*Pitangus sulphuratus*), or the Golden-fronted Woodpecker (*Melanerpes aurifrons*), remain with similar relative abundance numbers throughout the day, and we can expect to see them at any given moment. These patterns show how the wetland is differentially used by several species (and not only wetland species) as the day passes (Figure 8).

As stated before, most of the species in any given community are represented by few individuals. In long-term monitoring such as the one made in La Mancha, we can expect that many species will be recorded only one or two times at most. These species are called singletons and doubletons (SD species to abbreviate), respectively, and their presence at the study site can give us information about some ecosystem characteristics. Of the 200 species detected, almost 23% were SD species. Whilst some of these could be rare species, the truth is that sometimes a bird can only be registered a few times because of the presence or absence of particular habitats or the shy and elusive behavior of some species. In this monitoring, some waterbirds were detected only once at the popal restoration site, although they are more common in the lagoons in the region, at least in one season. Examples are the Neotropic Cormorant (*Nannopterum brasilianum*) and the Spotted Sandpiper (*Actitis macularius*). Other singletons were

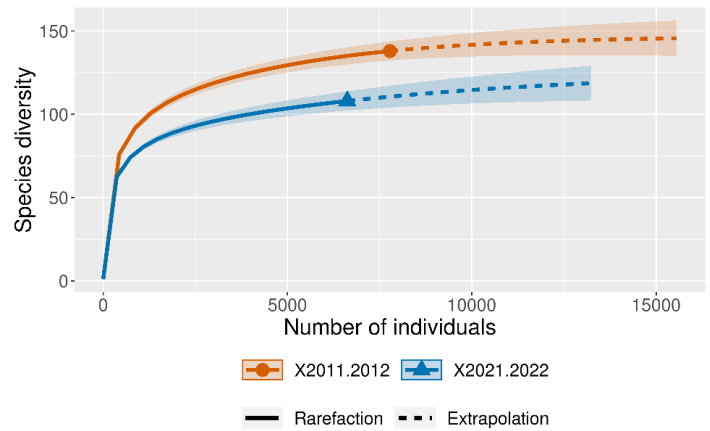


Figure 7. Number of species detected along the restored wetland in La Mancha in two time periods. The absence of overlapping on the confidence intervals (shaded areas) indicates that the richness of both communities is significantly different, being lower between 2021 and 2022 (blue line).

nocturnal species, like the Black-crowned Night Heron (*Nycticorax nycticorax*) or the Northern Potoo (*Nyctibius jamaicensis*). Some other records were rare and out-of-range sightings, like the Military Macaw (*Ara militaris*) or the Bonaparte's Gull (*Chroicocephalus philadelphia*). Also, the monitoring registered some nationally protected species using this restored wetland, like the Limpkin (*Aramus guarauna*, Threatened) or the Yellow-headed Parrot (*Amazona oratrix*). These unique sightings give insight into the broader-scale distribution patterns of these species and the range of habitats and conditions where they can occur

### Rank-abundance curves for morning and afternoon point-counts

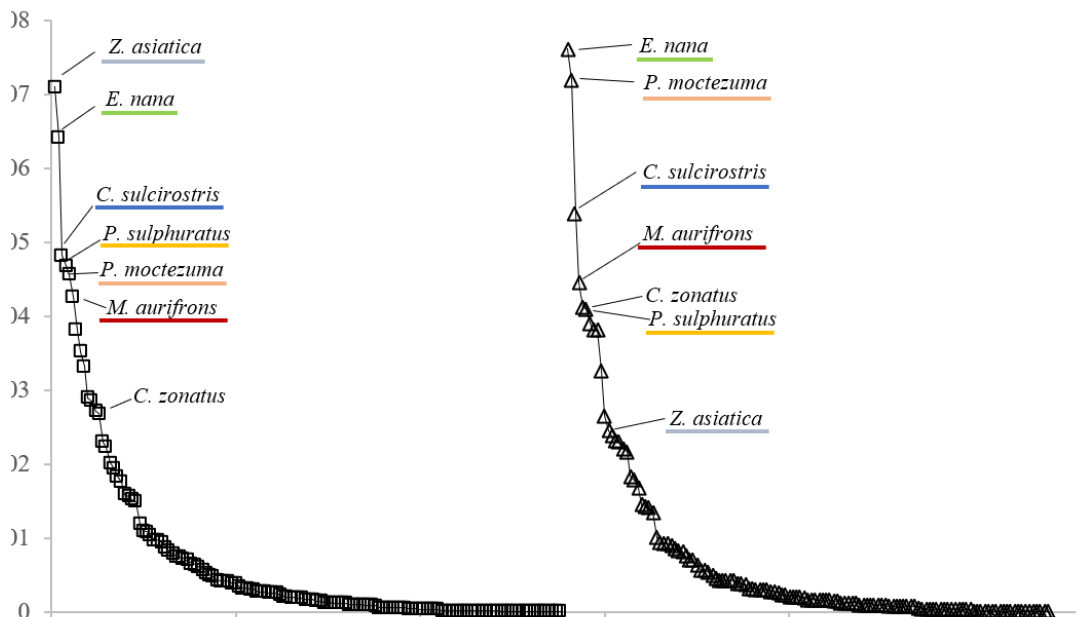


Figure 8. Rank abundance curves showing the proportion or relative abundance ( $\pi_i$ ) of birds for morning and afternoon point-counts in the freshwater wetland. Some birds use the restored wetland differentially through the day, with migrant species like the White-winged Dove (*Zenaidura asiatica*) being more abundant during early hours; gregarious birds that are recurrent with their perching sites, like the Montezuma Oropendola (*Psarocolius montezuma*) become more abundant in the wetland at dusk. Some other birds are abundant all day long.

throughout the year, deepening our understanding of their dynamics and enhancing our knowledge of their conservation.

Figures 9 and 10 show several species of wetland birds in La Mancha. The source of the photographs is Naturalista, a CONABIO project where photos are uploaded, and experts identify them or check the identification given by the photographer. La Mancha en Movimiento members have uploaded over 500 plant and animal photographs taken in La Mancha.

## CONCLUSION

Although La Mancha is a small site, it has several coastal ecosystems that favor species richness. The migration corridor increases this diversity, making it a vital monitoring site. The interaction between academics and residents, such as the eco-guides, has proven invaluable for generating information over time and supporting local conservation efforts. Community ecotourism can be a mechanism that not only promotes environmental awareness among visitors but also helps advance local research projects and better the income of local people, all while helping the conservation of natural ecosystems.

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Figure 9. Resident wading birds are seen in La Mancha wetlands throughout the year. Top-left, Reddish Egret (*Egretta rufescens*), listed as “At Risk of Extinction” by national legislation (NOM-059-SEMARNAT-2010) and “Near Threatened” by IUCN. Top-right, Great Egret (*Ardea alba*) and Snowy Egret (*Egretta thula*). Bottom, Green Heron (*Butorides virescens*). (Photos from Naturalista - La Mancha en Movimiento).





Figure 10. Some waterbird species found in La Mancha wetlands. Top-left, Redhead (*Aythya americana*). Top-right, Wood Stork (*Mycteria americana*). Bottom-left, Great Blue Heron (*Ardea herodias*). Bottom-right, Neotropical Cormorant (*Nannopterum brasilianum*). (Photos from Naturalista – La Mancha en Movimiento).

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