United Nations Environment Programme

Convention on the Conservation of Migratory Species of Wild Animals

CMS

3rd Meeting of the CMS Multi-Stakeholder Energy Task Force (ETF3)
Sharm El Sheikh, Egypt, 16 November 2018

ETF3/Inf.9

LITHIUM MINING AND HIGH ANDEAN FLAMINGOS

CHAMPION PLUS

The Government of the Federal Republic of Germany, through the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) were recognized as Champion Plus for their generous support and commitment towards Reconciling Energy Sector Developments with Migratory Species Conservation for the period 2018-2020. The Energy Task Force has been funded with the contribution granted by Germany under the Migratory Species Champion Programme.

Supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
based on a decision of the German Bundestag

The High Andean Flamingos and the Lithium Triangle, from utopia to ecological dystopia

Patricia Marconi[1,2], Amelia Clark[1,3] & Felicity Arengo[1,4]

[1] High Andes Flamingos Conservation Group -GCFA, Mariano Moreno 1950 (A4401XAK), San Lorenzo, Salta, Argentina.

[2] Fundación YUCHAN, Alfonsina Storni 2315 (A4401XAK), San Lorenzo, Salta, Argentina.

[3] Universidad Católica de Salta, Chachapoyas, Salta, Argentina

[4] Center for Biodiversity and Conservation, American Museum of Natural History, 200 Central Park West, New York, NY 10024, EEUU

Flamingos are emblematic species for the conservation of saline wetlands because they make use of resources on a landscape scale. They are itinerant, detecting and tracking changes in the availability of resources over time and space, using multiple wetlands in an alternative and complementary manner on a wide geographic scale during their annual and life cycles.

Of the six species of flamingos in the world, three are found in southern South America. The Puna Flamingo (*Phoenicoparrus jamesi*) and the Andean Flamingo (*P. andinus*) are mostly restricted to the Altiplano shared by Argentina, Bolivia, Chile and Peru, and are therefore referred to as the high Andean flamingos, although part of the populations move to lowland wetlands in central Argentina during winter. The Andean Flamingo is the species with the smallest population in the world, with total counts of 56,000 individuals in 2015, low reproductive success and a high degree of threat, so it is classified as "vulnerable" according to the IUCN criteria. The Puna Flamingo population was estimated at around 160,000 individuals in 2015, with a distribution in the Altiplano more restricted than that of the Andean Flamingo. A third species of flamingo, the Chilean Flamingo (*Phoenicopterus chilensis*) is more abundant and has a wider distribution throughout the Southern Cone, from the saline lakes of the Central Dry Puna to the coastal wetlands of Patagonia.

The Altiplano of South America extends from the Andes of southern Peru along Bolivia and northern Chile to northwestern Argentina. It includes two eco-regions, the Puna between 3000 and 4300 meters above sea level and high Andean ecoregion, above 4300 meters. The plateau has large basins divided by north-south mountain chains, surrounded by the highest peaks in the Americas, that reach around 6,900 m and separated into a system of endorheic basins -salars- created by vulcanism and local uplift. The climate is harsh, cold and dry, with temperatures below zero degrees practically year round and annual rainfall between 350 and 50 mm. The daily thermal amplitude exceeds 30ºC.

The saline wetlands of the Altiplano that constitute flamingo habitat, as well as the associated flora and fauna, are threatened by industrial development - expansion of metallic and non-metallic mining, expansion of geothermal energy production, and installation of gas pipelines and powerlines – increasing agriculture and overgrazing, and unregulated tourism. In the lowland wetlands, agricultural industrialization, particularly the soy monoculture and the consequent compression of soils, causes the expansion and dilution of saline wetlands or the drainage and dry down for urban development and road networks.

In 1996, a group of scientists, researchers, and specialists in protected areas concerned about the conservation of High Andean flamingos and their habitats formed the High Andes Flamingos Conservation Group -GCFA (Grupo de Conservacion Flamencos Altoandinos)-. The GCFA brings together conservationists from civil society, academia and the governmental sector of Argentina, Bolivia, Chile and

Peru, and also researchers from other countries and international organizations. Since its inception, the GCFA has coordinated a regional research and conservation program focused on the monitoring of flamingo populations, habitat use studies, and strengthening conservation and management of key sites, including protection of nesting colonies. At the same time, it has developed training and outreach activities for park rangers, students, professionals and the general public. The evolution in the conservation of High Andean Flamingos and their habitats can be summarized in a timeline shown in Figure 1.

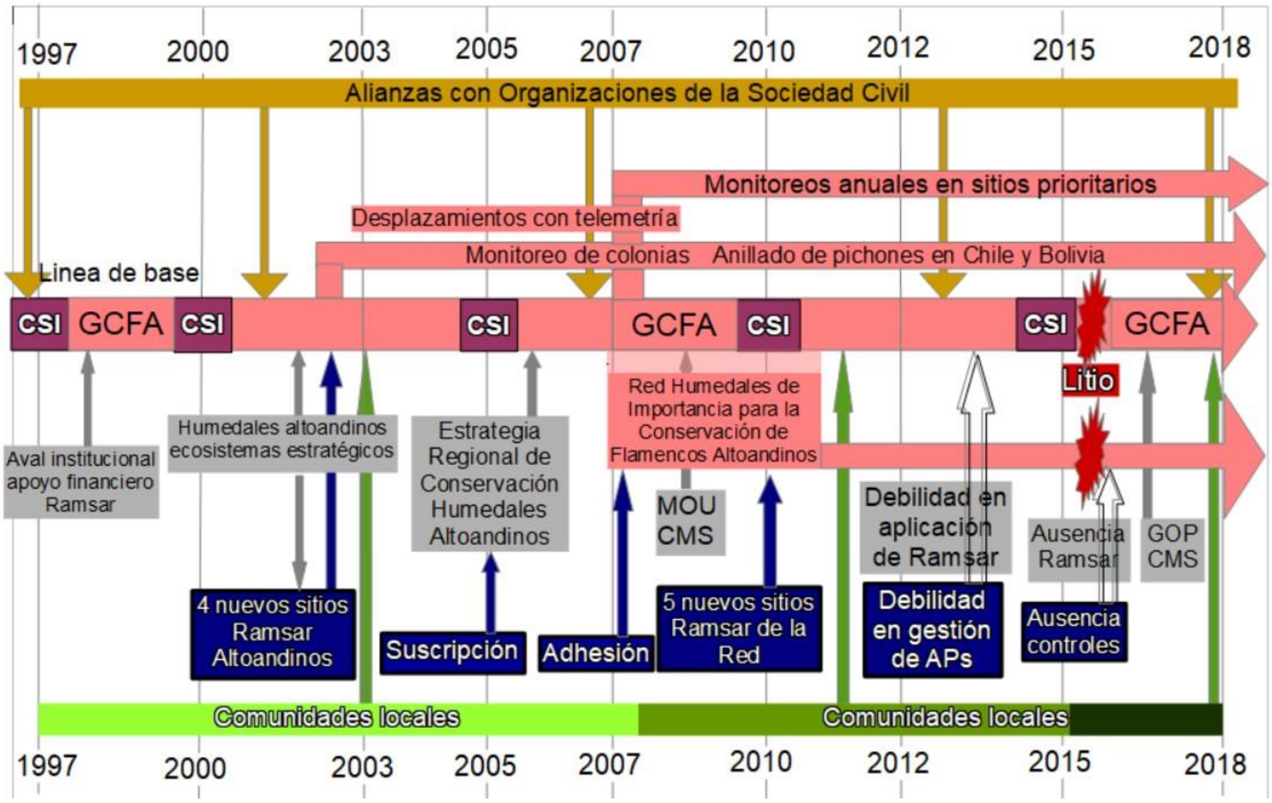

Fig. 1. Time line of GCFA conservation activities from 1997 to the present

The main method for obtaining information about the abundance of the two species of High Andean Flamingos was the census or direct and simultaneous counting of flamingos, covering their entire distribution area (Parada 1992, Caziani & Sureda 2002, Rodríguez 2006, Marconi 2010).

Based on the results of the first international simultaneous censuses (CSI), which provided the global data on abundance and summer and winter distribution, breeding and habitat characteristics and threats, an ecological baseline was created for the two species of high Andean flamingos (Valqui *et al.* 2000, Caziani *et al.* 2007) and new questions were identified that gave rise to other studies, oriented towards knowing in more detail the life cycle and movements of these species. The regional programs for nesting colony monitoring and chick banding (Amado *et al*. 2007; Rocha *et al*. 2009) have provided information on breeding and banding of individuals, provided life cycle and movement data. In parallel, movement studies were developed using satellite telemetry (Arengo *et al*. 2005) that were crucial in documenting connectivity between high Andean wetlands and between these and the Lowlands wetlands (Romano *et al*. 2008).

During this first stage of international work coordinated between 2002 and 2005, local and government stakeholders were identified and incorporated into the activities of the GCFA, playing a convening role in the different instances of field training. The first local and transboundary conservation efforts were also developed (Fig 1), the latter supported by the Ramsar Convention on Wetlands and the Convention on Migratory Species (CMS).

The analysis of the CSI 2005 data allowed the identification of priority wetlands for the conservation of high Andean flamingos and thus focused protection actions, through the formulation of a Network of Wetlands of Importance for the Conservation of High Andean Flamingos (Marconi 2007). In the formulation of this project, the GCFA adopted an ecosystem approach, incorporating a wide range of goals in terms of biodiversity and promoting integrated management based on scientific information, aimed at the sustainable use of saline wetlands. A priority site for the Network was defined harboring 1% of the global population of one of the two species of high Andean flamingos at any time of the year and / or records of breeding colonies of one of the two species.

The Network project was officially presented in 2007 and had the immediate formal endorsement of 70% of the administrators of the proposed priority sites and was incorporated as a subregional project of the Regional Strategy for the Conservation of High Andean Wetlands, promoted by the Ramsar Convention signed by eight countries in America, including Argentina, Bolivia, Chile and Peru. From 2007 onwards, annual monitoring of the priority sites of the Network was carried out, in addition to the CSI carried out every five years (Fig. 1). In terms of effective protection, priority was focused on those sites that did not have any conservation status, first promoting their designation as Ramsar sites and then complementing them with other national or subnational protected area status (Fig. 1).

In 2008 three of the four countries of the Network signed the Memorandum of Understanding (MOU) for the conservation of the two species of High Andean Flamingos, initiating the process of formulating international management plans by species in the framework of the Convention on Migratory Species.

More recently, the GCFA has developed in some priority sites such as Catamarca (Marconi *et al*. 2014) and Vilama (Marino *et al.* 2016), participatory conservation programs incorporating local communities in the planning and effective protection of high Andean wetlands, and developing, together with the private and government sectors, guidelines and protocols for sustainable practices in tourism and mining.

If the abundance of both species can be considered an indication of success, comparing the censuses of similar coverage -CSI05 CSI10 and CSI15, a constant and definite trend of population growth of *P. andinus* and *P. jamesi* is observed with an increase between 2010 and 2015 that reaches 50.9% for *P. jamesi* and 49.5% for *P. andinus*. However, there are some alarming phenomena such as the mass mortality event due to malnutrition observed in 2015 in Laguna Grande, Catamarca (Marconi *et al.* 2016) at the beginning of the migration from lowlands of Argentina, where the available habitat has been reduced for last 30 years to accommodate soybean monoculture, and other factors such as the increase in the duration and frequency of events of complete drying of Lake Poopó in Bolivia. The temporary or permanent disappearance or deterioration of wetlands can be compensated on a regional scale and delay their effects on wild populations of long-lived species such as flamingos. But once the population decline is recorded, the trend will be impossible to reverse because the mosaic of natural habitats will have disappeared.

The goal of the GCFA has been and continues to be to implement a long-term regional conservation strategy that, through the conservation of the flamingos, ensures the functional integrity of the High Andean wetlands and the associated Lowland wetlands and their permanent contribution to local and global human systems. This requires a regional and transboundary approach and a shared effort not only by the countries of the distribution area of the High Andean flamingos, but also by all the sectors - mining, tourism, livestock production - that intervene in the Altiplano. In this sense, the spaces for analysis and coordination offered by international conventions such as CMS and Ramsar, and the agreed guidelines for the regulation of human activities can be a substantive contribution to this initiative.

As of 2015, in the context of the global demand for alternatives to fossil fuels, the international commodity market has focused its attention on the exploitation of lithium for the production of batteries, an indispensable input for consumer electronic devices such as mobile phones and laptops, in the manufacture of hybrid and electric cars and, most likely, in the development of energy banks, essential for the storage of renewable energy.

Lithium comes from deposits in rock and in continental brines. The highest concentration of lithium in brine is found in the High Plateau of South America (Munk *et al*. 2016) and its distribution coincides with the priority sites of the Network of Wetlands of Importance for the Conservation of High Andean Flamingos (Fig 2). The most pressing issue with lithium mining in continental brines is that it requires water extraction and use, that is, both current technologies, based on evaporative methods and technologies in the design stage in the laboratory, depend on the consumptive use of water. The net loss of water evaporated from the natural system with the current production capacity of lithium in brine is estimated at least at 42.5 million m3 per year (Flexer *et al.* 2018) while the net loss of fresh water of the natural system during processing with the current lithium production capacity, is estimated at least at 1.8 million m3 per year (Meconi & Sticco 2012).

In this high altitude desert environment, the water balance, even without human intervention, is negative. The extraction of the volumes of fresh and brackish water mentioned causes serious water imbalances and hydrogeological disturbances within the intervened basin (Meconi and Sicco 2012) and in adjacent basins (Corenthal *et al*. 2016) with their consequent impacts on hydrological landscapes (Winter 2001), biodiversity (Albarracín *et al.* 2015, Farías *et al.* 2013) and the livelihoods of local communities, mostly made up of indigenous peoples.

The projected lithium demand, linked to the manufacture of batteries, has caused a true "lithium fever". In the case of lithium brine, it has manifested itself in the expansion of facilities for extraction and processing by companies in operation and in the exponential multiplication of exploration projects in almost all the salt flats of the Altiplano of South America (Mining News Digest 2018) from 2015 (Fig. 1).

The Life Cycle Assessment (LCA) of a product is a process to assess the environmental burden, identifying and describing the use of energy, characterizing their sources and raw materials used, as well as the release of waste to the environment. With regard to lithium ion batteries, there are already studies that systematize LCA inventories, or analysis of cradle to grave (Ager-Wick Ellingsen *et al.* 2016; Richa 2016; Tagliaferri *et al* 2016). As a benchmark for these analyses, the data provided by SQM (Stamp *et al.* 2012) is used, which establishes that the diesel fuel consumption for the lithium salt concentrate is 0.002416 BOE / ton, based on a natural concentration of lithium in brine of 1,500 ppm, corresponding to the Salar de Atacama. In the rest of the brines in production - Hombre Muerto, Olaroz Cuchari, etc. - the lithium concentration is lower than 700 ppm (Flexer *et al*. 2018). These LCA analyses do not incorporate the consumptive use of brine water used in the evaporation process and fresh water for lithium processing. The omission of this resource in the analysis threatens the sustainability of the production of lithium batteries and the process of substitution of hydrocarbons for renewable energies.

Mining projects require obtaining environmental and social license. The process of obtaining these licenses depends on the approval of environmental impact assessments (EIA). The EIAs in the lithium triangle do not conform to international criteria and standards: basically, the hydrological aspects are underestimated; water, when valued, is computed only as a commodity, not as an environmental service; they lack an ecosystem approach and integrated watershed management, and the status of a protected area (Biosphere Reserve, Ramsar Site, National o Subnational Reserve) is ignored. The EIAs are approved only by the mining authority, without binding intervention from other administrative areas such as environment, tourism, agriculture or water resources. Public participation is restricted to informative presentations and the commitments emanating from international conventions are ignored, as well as the planning and participatory management tools of protected areas.

Therefore, the utopia of a Network of Wetlands for the Conservation of High Andean Flamingos that implies the sustainable use of these wetlands, is very close to becoming an ecological dystopia-- a true ecological disaster. To avoid this dystopia it will be necessary to support research to reduce the high cost of water in the processes and to determine the hydrogeological dynamics of all the closed basins of the Altiplano, establish zoning based on scientific information in order to protect the most valuable and vulnerable wetlands, and ensure participation of communities; and strengthening international, national and local regulation in all stages of the production of lithium batteries, from cradle to grave.

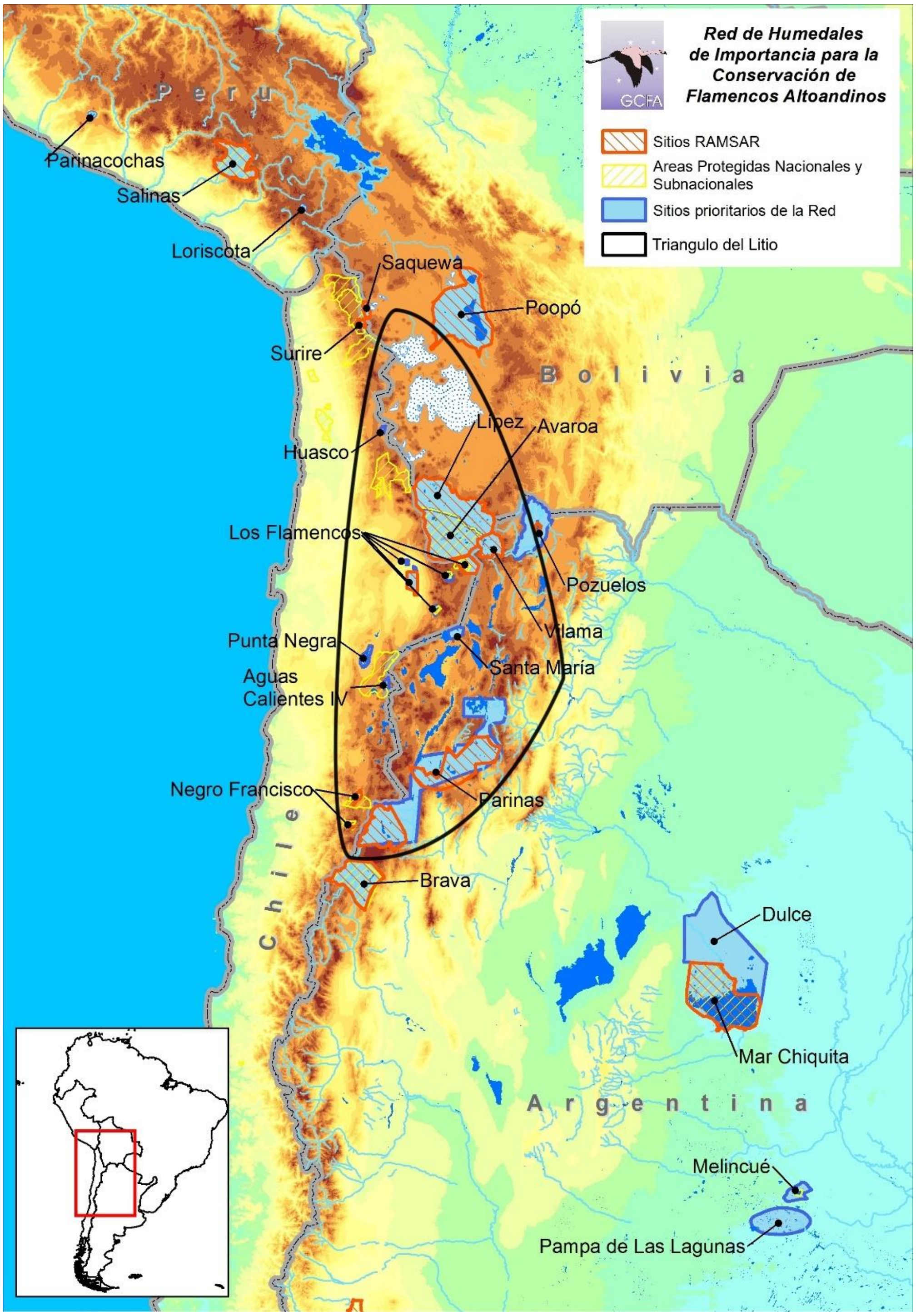

Fig. 2: Red de Humedales de Importancia para la conservación de los Flamencos Altoandinos y actual Triángulo del Litio.