CURRENT RAPTOR STUDIES IN MÉXICO

Edited by

Ricardo Rodríguez-Estrella

Centro de Investigaciones Biológicas del Noroeste, S.C.
Comisión Nacional para el Conocimiento y Uso de la Biodiversidad
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Current Raptor Studies in México

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PREFACE

Biological diversity of México, raptors and scientific research

México is one of the most biologically diverse countries on the planet, as a result of its very complex geological history, geographic position, and environmental heterogeneity, among other factors. Its biological diversity is such, that together with 17 other countries such as India, China and Brazil, it is referred to as Megadiverse. Together, these countries sustain more than 70% of all living organisms, including plants, animals and microorganisms, México ranking first for its diversity of reptiles and amphibians, third for its mammalian diversity, fourth for its diversity of vascular plants, and eleventh for its diversity of birds. Moreover, a high percentage of the species, up to 65% in amphibians, are endemic to México; i.e. with geographic ranges restricted to the country.

The biological diversity of México has been part of the geographic and natural settings that have accompanied its inhabitants since they first settled in the country more than 12,000 years ago. The legendary diversity of the country has astonished scientists such as Baron Alexander Von Humbolt, who described México as a biological paradise. Unfortunately, this impressive natural diversity of the country is practically unknown by most Mexicans, who instead should be proud of their biological inheritance.

Nowadays, the biological diversity of México is seriously threatened. Hundreds of species and thousands of populations are endangered, mainly because of human population size and social inequity. México's population size is expected to become stable around 145 millions, but only in three decades. The loss of biological diversity has severe consequences at a biological and social level, because populations and species are the basis for the structure and functioning of biological systems, which provide us for free with environmental goods and services. These goods and services, which include the maintenance of a proper atmospheric gas composition, the ozone layer, soil fertility and quality and quantity of water, among others, generate the environmental conditions that allow life on Earth. They are the basis of our existence. Paradoxically, their continuance depends on our activities.

The only way to understand the complex relationships of living organisms with their environment, their role in providing environmental services, and better management of these living organisms to reconcile their use with their conservation, is through a solid investment in scientific research. However, many governments, including the Mexican government, surrender to the temptation of investing little in scientific and technological research, focusing on other approaches to fight social and economic problems. Those governments ignore that one of the few ways out of poverty is through the generation of scientific and technological knowledge, which is fundamental to the development of any country.

That is why I have received with great satisfaction this volume addressing the ecology and conservation of raptors – one group of species very sensitive to anthropogenic disturbances. As top predators, with low population sizes, raptors are susceptible to environmental changes that can affect them negatively, and thus increase the risk of their extinction. That is precisely why their status is an indication of environmental conditions, much like canary birds long ago used to indicate the presence of toxic gases to miners. The results presented by researchers working with raptors in México can have an immediate application in conservation.

The careful editing of the editor has produced an interesting book of high scientific quality. I am sure that time will be the best test of the benefits of this type of publications, which are essential to maintain the welfare of our society.

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Breeding biology and success of the osprey (*Pandion haliaetus*) in Laguna San Ignacio, B.C.S., México, in 1998, 2000, and 2001

Ricardo Rodríguez-Estrella
Laura B. Rivera Rodríguez
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ABSTRACT

Few studies have been done with year-round resident osprey (*Pandion haliaetus*) populations. Studies with resident populations are needed to understand the behavioral ecology and the dynamics of population movements and also for conservation purposes. We present our results on the breeding biology and success of a year-round resident population in Laguna San Ignacio, Baja California Sur, México during three breeding seasons, 1998, 2000, and 2001. The aim of this study is to contribute to the long-term studies of the osprey populations of the middle portion of Baja California peninsula, probably among the densest populations in the world. The breeding chronology extended from December to June in 1998, December to July in 2000, and January to July in 2001. A strong asymmetry existed in laying, hatching and fledging dates in all years. A total of 110 fledglings were recorded from the 116 active nests surveyed in 1998, 77 fledglings from the 93 active nests in 2000 and 41 fledglings from 78 active nests in 2001. Productivity for

successful nests was 1.7, 1.5 and 1.3 fledglings/nest, while total productivity (for both successful and unsuccessful nests) was 0.9, 0.8 and 0.7 fledglings/nest. High mortality rates existed in 1998 and 2000 during the incubation period before hatching (25% and 22%, respectively) even higher in 2001 (32%), but it increased during rearing (38%, 51% and 62%, respectively). Significant differences were detected in fledging success only between 1998 (the year with highest success) and 2001 (the year with lowest success), both from laying ($z_{1998\text{-}2000}$=1.08, P>0.05; $z_{1998\text{-}2001}$=2.61, P<0.01; $z_{2000\text{-}2001}$=1.19, P>0.05) and hatching ($z_{1998\text{-}2000}$=1.67, P>0.05; $z_{1998\text{-}2001}$=3.61, P<0.01; $z_{2000\text{-}2001}$=1.77, P>0.05) periods. Asynchronous reproduction seems to be a general pattern for resident breeding populations as Laguna San Ignacio, Laguna Ojo de Liebre and Guerrero Negro, coastal Sonora and Bahía de Los Angeles resident breeding colonies in Baja California, and those of Florida showed a similar trend in asynchronous reproduction. The productivity of the osprey populations of Laguna San Ignacio is within that reported for resident populations, but seems to be lower than the productivity of migrant populations. The 68-75% of hatching success recorded for the Laguna San Ignacio osprey population is within the normal range reported for the species. Our results show the osprey population of Laguna San Ignacio can be considered a stable population, although with trends to decrease.

Key words: osprey, breeding biology, *Pandion haliaetus*, Laguna San Ignacio, Baja California Sur, México.

RESUMEN

Pocos estudios se han realizado con poblaciones de águilas pescadoras (*Pandion haliaetus*) residentes todo el año. Los estudios con poblaciones residentes se requieren para entender la ecología del comportamiento y la dinámica de los movimientos de las poblaciones, así como con fines de conservación. Se presentan los resultados sobre la biología y éxito reproductivo de una población residente todo el año en Laguna San Ignacio, Baja California Sur, México durante 3 estaciones reproductivas, 1998, 2000 y 2001. El propósito de este estudio es contribuir a los estudios planeados a largo plazo de las poblaciones de águila pescadora en la porción media de la península de Baja California, que probablemente contiene las poblaciones más densas en el mundo. La reproducción ocurrió entre diciembre y junio de 1998, diciembre y julio de 2000, y enero a julio de 2001. Se presentó una fuerte asimetría en las fechas de puesta, eclosión y liberación de volantones en ambos años. Un total de 110 volantones fueron registrados en 116 nidos activos en 1998, 77 volantones en 93 nidos activos en 2000, y 41 volantones en 78 nidos activos en 2001. La productividad de los nidos exitosos fue de 1.7, 1.5 y 1.3 volantones/nido, mientras que la productividad total (considerando tanto nidos exitosos como no exitosos) fue de 0.9, 0.8 y 0.7 volantones/nido. Se registraron altas tasas de mortalidad en 1998 y 2000 durante el periodo de incubación antes de la eclosión (25% y 22%, respectivamente) siendo aún mayor en 2001 (32%), pero se incrementó durante la crianza (38%, 51% y 62%, respectivamente). Se detectaron diferencias significativas en el éxito de volantones

sólo entre 1998 (el año con el éxito más alto) y 2001 (el año con el éxito más bajo), tanto desde el periodo de la puesta ($z_{1998\text{-}2000}$=1.08, P>0.05; $z_{1998\text{-}2001}$=2.61, P<0.01; $z_{2000\text{-}2001}$=1.19, P>0.05) como desde la eclosión ($z_{1998\text{-}2000}$=1.67, P>0.05; $z_{1998\text{-}2001}$= 3.61, P<0.01; $z_{2000\text{-}2001}$=1.77, P>0.05). La reproducción asincrónica parece ser un patrón general para poblaciones residentes reproductivas puesto que las poblaciones reproductivas de Laguna San Ignacio, Laguna Ojo de Liebre y Guerrero Negro, la costa de Sonora y Bahía de Los Ángeles en Baja California, y aquellas de Florida muestran una tendencia similar a la reproducción asincrónica. La productividad de la población del águila pescadora en Laguna San Ignacio se encuentra entre los rangos reportados para poblaciones residentes, y es menor que la de las poblaciones migratorias. El 68-75% de éxito en la eclosión registrado para la población de Laguna San Ignacio se encuentra en el rango normal reportado para la especie. Los resultados de este trabajo muestran que la población de águila pescadora de Laguna San Ignacio puede ser considerada como estable pero con una tendencia a decrecer.

INTRODUCTION

The osprey (*Pandion haliaetus*) is one of the most studied raptor species around the world. The concern for the crash of several populations in the USA. due to pesticides, and the extirpation from several European countries due to human activity, promoted intensive studies on the biology and ecology of ospreys in many regions of its distribution (Newton 1989, Poole 1989). However, most studies have

been done with populations that migrate once they breed (Poole 1989). Few studies have been made with year-round resident populations, and most of them have been made in Florida and México (Ogden 1977, Henny and Anderson 1979, Judge 1983, Salinas *et al.* 1989, Castellanos and Ortega 1995, Cartron 2000, Cartron *et al.* in this publication). Studies with resident populations are needed to understand the behavioral ecology and the dynamics of population movements related to food availability (Poole 1989). Our results focus on the breeding biology and success of a year-round resident population in Baja California Sur, México. The osprey population of Laguna San Ignacio has been reported since the beginning of 1900s by Bancroft (1927) who cited only few nesting pairs. Now, the population has increased to over 80 pairs, even growing to almost 120 breeding pairs (Reitherman and Storrer 1981, 1982, Danemann 1994).

The aim of this study is to present information on the osprey population of Laguna San Ignacio in three breeding periods, in order to contribute to the long-term studies started for the osprey populations of the middle portion of Baja California peninsula, probably among the densest in the world.

STUDY AREA

The study was conducted in Laguna San Ignacio located in the middle portion of the Baja California peninsula (Fig. 1). The lagoon is shallow with an average depth of 2 to 4 m, and some channels with 26 m of profundity. Climate is warm and dry with

annual average temperatures oscillating between 18 and 22°C. Precipitation occurs in the summer and is less than 150 mm annually (Reitherman and Storrer 1981, Danemann 1994). The breeding population we studied constructed their nests in two small islands, Isla Garzas and Isla Pelícanos (both are also known as Whale Island). During low tide, both islands connect and can be reached by foot. The total area of

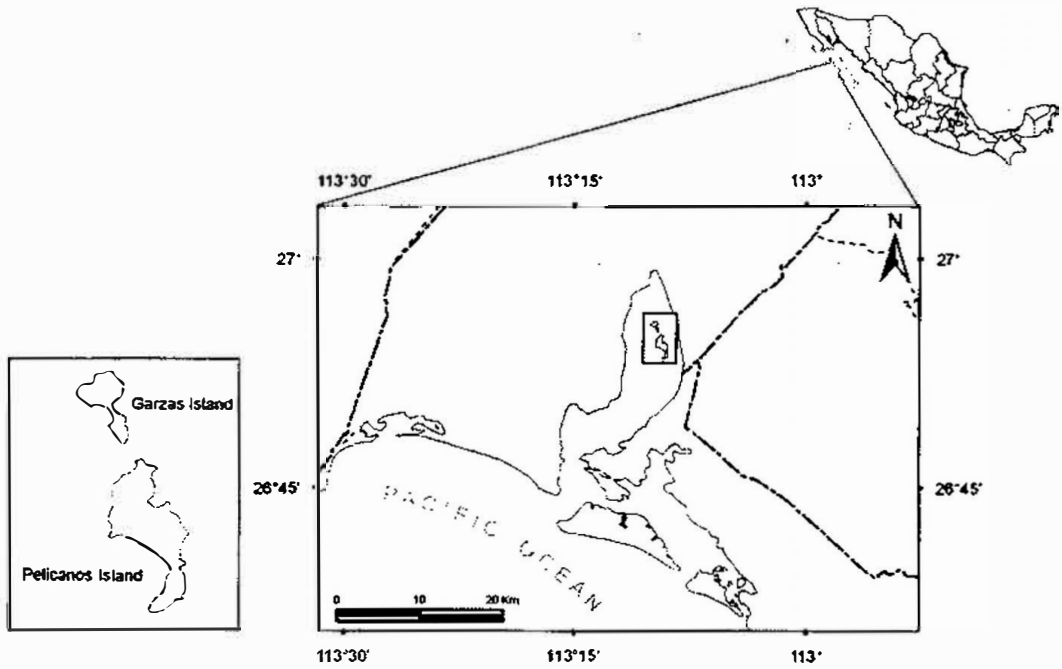

Figure 1. Isla Garzas and Isla Pelícanos study area in Laguna San Ignacio, B.C.S.

Vegetation is scarce and is dominated by characteristic plants of the adjacent desert on the mainland, mainly cholla (*Opuntia* spp), garambullo (*Lophocereus schotti*), and pitaya agria (*Machaerocereus gummosus*). Other breeding colonies of marine birds in the orders of hundreds occur in the islands, such as cormorant (*Phalacrocorax auritus*),

brown pelicans (*Pelecanus occidentalis*), rededish egret (*Egretta rufescens*), great blue heron (*Ardea herodias*), Caspian tern (*Sterna caspia*), and western gull (*Larus occidentalis*).

Although some fishermen visit the island, they only stay at the coast to prepare the fish they netted. No other human activity was recorded during our visits to the islands. The islands are under official protection as they are included in the Vizcaino Biosphere Reserve. Thus, visits to the islands are completely limited to research purposes.

METHODS

From January to July 1998, 2000 and 2001, we visited the colonies of Isla Garzas and Isla Pelícanos located at Laguna San Ignacio in a monthly basis to determine the breeding chronnlogy and biology of reproductive pairs. Nests were visited throughout the breeding period, which lasted approximately 92 days from the incubation to chicks fledging (Danemann 1994). In every visit, we marked all new active nests, and recorded the content of the new nests. To determine whether a nest was active or not we observed the presence or absence of eggs or chicks. Nests were checked only once during the incubation period (39 days; from Danemann 1994). Age of chicks was determined by comparing the measurements of bill, tarsus and wing of every chick with those of the growth curves estimated by Danemann (1994) for the same population. We used calipers with accuracy of 0.1 mm to take measurements. At the age of 20 days we tagged the chicks with plastic bands (white

and blue colors, containing a black alphanumeric code). The frequency of visits to the colonies depended upon the estimated age of fledging of chicks to record the exact number of fledglings, but an average of 7-9 visits were made during the nestling period. A nest was considered to be successful if fledglings were observed around the nests. Productivity was calculated as the number of fledglings *per* nest. The number of chicks dying during the different periods was recorded, and then we estimated the total productivity of breeding pairs.

RESULTS

We surveyed 116, 93 and 78 active nests in 1998, 2000 and 2001 breeding seasons, respectively. The breeding chronology extended from December to June in 1998, December to July in 2000, and January to July in 2001 (Fig. 2). A strong asymmetry existed in laying, hatching and fledging dates in all years, but differences between years in the average dates for each reproductive stage were not significant (Fig. 1; t-student tests $P > 0.05$, Sokal and Rohlf 1995).

A total of 110 fledglings were recorded from the 116 active nests surveyed in 1998, 77 fledglings from the 93 active nests in 2000, and 41 fledglings from 78 active nests in 2001. Breeding success varied between years, 62% in 1998, 49% in 2000 and 39% in 2001 (Table 1). Productivity for successful nests was 1.7, 1.5 and 1.3 fledglings/nest, while total productivity (for both successful and unsuccessful nests) was 0.9, 0.8 and 0.7 fledglings/nest (Table 1). High mortality rates existed in 1998

and 2000 during the incubation period before hatching (25% and 22%, respectively) even higher in 2001 (32%), but it increased during rearing (38%, 51% and 62%, respectively) (Table 1). Significant differences were detected in fledging success only between 1998 (the year with highest success) and 2001 (the year with lowest success), both from laying ($z_{1998\text{-}2000}$=1.08, P>0.05; $z_{1998\text{-}2001}$=2.61, P<0.01; $z_{2000\text{-}2001}$=1.19, P>0.05) and hatching ($z_{1998\text{-}2000}$=1.67, P>0.05; $z_{1998\text{-}2001}$=3.61, P<0.01; $z_{2000\text{-}2001}$=1.77, P>0.05) periods (test of hypothesis between means, Daniel 1996).

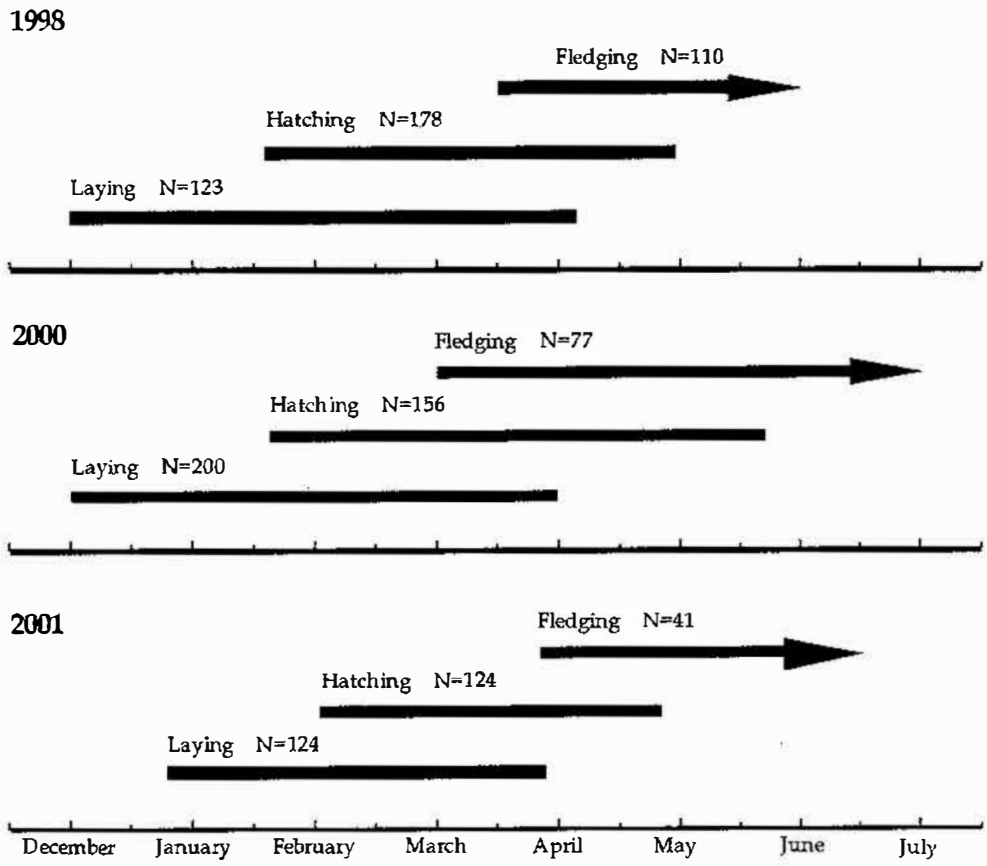

Figure 2. Breeding chronology of the osprey in Laguna San Ignacio, B.C.S., México; 1998, 2000, and 2001.

Table 1. Summary of the osprey productivity in Laguna San Ignacio, B.C.S., México during the 1998 and 2000 breeding seasons.

	1998	2000	2001
No. active nests	116	93	78
No. successful nests (%)	65 (56)	51 (55)	32 (41)
No. of eggs	237	200	180
No. eggs hatching (%)	178 (75)	156 (78)	122 (77.7)
No. unsuccessful eggs	59	44	38
No. fledgings (% nestling survival)	110 (62)	77 (49)	47 (38)
Fledging success (%)	62 (35)	49 (31)	41 (34)
Productivity fledglings/successful nest	1.67±0.46	1.50±0.6	1.28±0.52
Productivity fledglings/attempt	0.95±0.65	0.83±0.9	0.68±0.74

DISCUSSION

The resident osprey population of Laguna San Ignacio continues to be one of the densest populations in the world, with an estimated density of 89.2 pairs/km^2 in 1998, 71.5 pairs/km^2 in 2000 and 60 pairs/km^2 in 2001. Since the first report for this population in 1927 (Bancroft 1927) when reproduction was reported 'in small numbers', the population size has showed continued growth. The trend of increasing numbers of active osprey pairs is similar to that reported for Laguna Ojo de Liebre (Salinas *et al.* 1991, Castellanos and Ortega 1995), which is located about 100 km North of Laguna San Ignacio. Laguna Ojo de Liebre contains an estimated population of 150 active pairs but density is lower here. In spite of this growth rate, the last estimated trends for the osprey population in Laguna San Ignacio indicate this population is declining. El Niño events, low prey availability and parasitism (see

Blanco *et al.* in this publication) may be playing an important synergistically role in the declining of the population.

Asynchronous reproduction seems to be a general pattern for resident breeding populations. Ojo de Liebre and Guerrero Negro lagoons, coastal Sonora and Bahía de Los Angeles resident breeding populations in Baja California, and those of Florida showed a similar trend in asynchronous reproduction as in our study area (Judge 1983, Poole 1989, Castellanos and Ortega 1995, Cartron 2000). However, the longest periods of breeding activity are reported for the middle portion of Baja California populations, about eight months (December to July; Castellanos and Ortega 1995, this study), while those of Bahía de Los Angeles (at the north of the Gulf of California) and Florida lasted about 3 months (January to March; Judge 1983, Poole 1989). In contrast, the breeding period for migrant populations of northern latitudes is very short and synchronous (Poole 1989). For instance, the laying period in northern latitudes lasts three weeks (Poole 1989) while it lasted about 16, 16 and 12 weeks in the Laguna San Ignacio population in 1998, 2000 and 2001, respectively. Weather and food availability seem to be the main factors influencing the migratory process. Resident populations stay in areas with more stable conditions, with more predictable food sources (Poole 1989). Mild weather conditions and predictable food sources permit long breeding periods of birds. The osprey population of Laguna San Ignacio seems to be in this last kind of condition.

The overall productivity of the osprey population of Laguna San Ignacio is

comparable to that reported for other resident populations (Poole 1989, Castellanos and Ortega 1995, Cartron 2000, Cartron *et al.* in this publication), but is lower than the productivity of migrant populations (Poole 1989). The 68-75% of hatching success recorded for the Laguna San Ignacio osprey population is within the normal range reported for the species (Henny and Anderson 1979).

Preliminary data of osprey population studies in Laguna San Ignacio and Laguna Ojo de Liebre led us to propose that the middle portion of Baja California Peninsula, particularly the islands of the Pacific coast, is playing an important role in the dynamics and stability of osprey populations along the Pacific coast of Baja California. More in-depth studies should be done to be certain about our proposal, but the conservation of Laguna San Ignacio will assure the preservation of one of the densest breeding populations in the world.

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