

Conservation Strategies for the World's Largest Known Raptor Migration Flyway: Veracruz the River of Raptors

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INTRODUCTION

Each autumn and spring across the North American continent, hawk watchers take to the hills and coastlines to enjoy raptor migration. Daily counts per site range from 10 to thousands of hawks and a few count sites in the United States and Canada exceed 40,000 hawks in a season (Bildstein 1998). Hawk Mountain Sanctuary, Pennsylvania, the longest running migration count site in the world, averages 20,000 hawks each autumn (Goodrich 1997). Overall, hawk migration watching has grown by leaps and bounds in the past 20 years with count sites established in nearly every U.S. state and Canadian province with thousands of sites monitored (Bildstein 1998).

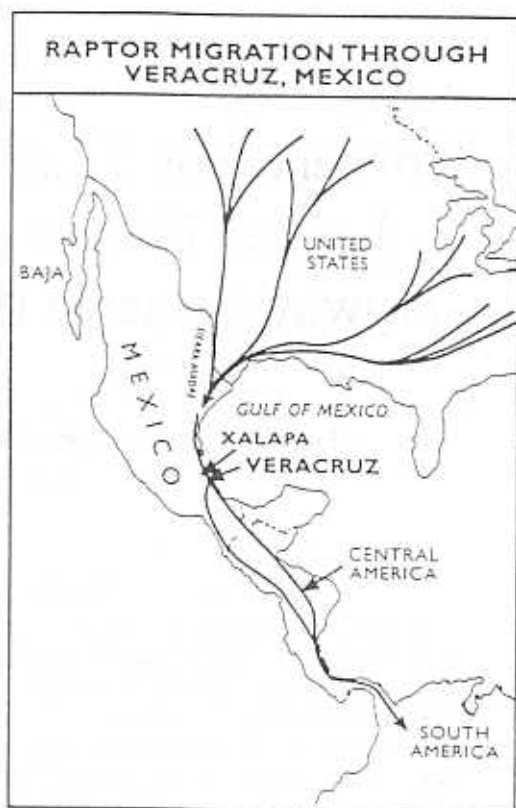
Until recent years, little was known about the raptor migration patterns and numbers passing through Mexico. Periodic observations of migrating raptors in central Veracruz, Mexico, had suggested that it might harbour a significant raptor migration flyway (Andrle 1968, Thiollay 1980, Tilly *et al.* 1990). However, no season-long migration counts had been conducted and the volume of migration was unknown.

In spring 1991, Hawk Mountain Sanctuary, HawkWatch International and Pronatura Veracruz, in Xalapa, Mexico, established a partnership to begin the first standardized count of migrant raptors ever to be conducted in Mexico. During that first spring, more than 400,000 hawks were counted at four sites over a 45-day count, verifying prior observations (e.g., Thiollay 1980). Thousands of waterbirds and songbird migrants were also observed, suggesting that this corridor was used by more than just raptors. These early observations confirmed that most of the migrants were passing east of the central Sierra Madre mountain range and west of the Gulf of Mexico (Figure 1). In central Veracruz, these two geographic features converge to form a narrow 70 kilometre bottleneck constricting the migration flow across the Gulf coastal plain. Most of the migrants concentrate in the area with strongest thermal activity stretching approximately 30 kilometres from the coast to the lowest foothills.

Exciting though this discovery was, it raised conservation concerns due to extensive threats facing resident and migrating birds in this region (Ruelas 1997). Regional deforestation, pesticide use (including DDT), illegal pet and falconry trade, and shooting of hawks, all were increasing.

Veracruz population growth was estimated at 2.4% per year, and only 30 percent of the natural habitat remained. Several of the most abundant migrants using this corridor were suspected to be declining (e.g., Swainson's and Broad-winged Hawks).

Figure 1. Location of the Veracruz Raptor Migration Flyway.



During autumn 1992, the three partner organizations launched a long-term conservation initiative to monitor and conserve this critical migration corridor. The initiative was spearheaded by Pronatura and christened the Veracruz Rio de Rapaces or Veracruz River of Raptors project (VRR). It included several short and long-term objectives, one of which was to determine the seasonal and geographic patterns of raptor migration and which site(s) might be appropriate for long-term hawk migration monitoring. Another important objective was to launch environmental education programmes focused on the migration. In this paper, we present an overview of the first five years of work and the initial strategies developed for long-term conservation of the flyway.

METHODS

Monitoring

Autumn migration counts were conducted between 20 August and 20 November from 1992 through 1996 at one to three sites per year within the flyway. Counts were conducted from 0900 to 1800 daily. Only one site was monitored in 1994 due to funding difficulties. Counts were conducted

by one to three observers at each site and counts recorded hourly along with weather variables. In recent years, the counts have been conducted at two towns near the central part of the flyway, Cardel and Chichicaxtle. The Cardel watch site is on top of the largest building in this medium sized town, 6.5 kilometres from the coast. The Chichicaxtle count was conducted from on top of a scaffold in a ball field at the edge of the village, approximately 18 kilometres from the coastline.

In the later years of the study monitoring techniques were modified to cope with the large volume flights. Count teams of three observers were necessary to record both the volume of the large flocking migrants, such as the Broad-winged Hawk *Buteo platypterus*, as well as recording the single dispersed migrants such as American Kestrel *Falco sparverius* and Peregrine Falcon *Falco peregrinus*. Counters are trained in flock size estimation and hawk identification before the season begins. Count teams rotate through with two days counting and one day off to protect against fatigue.

Education

Education outreach consisted of handing out brochures and conservation posters through the flyway region, holding bird festivals in local towns, and presenting formal education programmes at schools during the autumn season. Educators have also held teacher training workshops and shared activities focused on general ecological principles and migration ecology. School programmes have developed into an eight-week formal programme for fourth grade students with pre and post testing of students. Informal education occurs at the count sites with students that may stop by to assist the counters.

RESULTS AND DISCUSSION

The first autumn migration count was conducted in autumn 1992 and tallied more than 2.5 million hawks at three count sites spaced across the coastal plain from the Gulf of Mexico west to the foothills of the Sierra Madre mountains. The four most abundant migrants were the Broad-winged Hawk, Turkey Vulture *Cathartes aura*, Swainson's Hawk *Buteo swainsoni* and the Mississippi Kite *Ictinia mississippiensis*. Other than the Turkey Vulture, these species are not well-monitored within other North American monitoring programmes or hawk migration counts. Count estimates suggested that over 90 percent of the world's population of these three species, (excluding Turkey Vulture) were concentrated in this narrow corridor each spring and autumn. These phenomenal numbers placed Veracruz as the world's most concentrated flyway for raptors, surpassing counts from sites such as Eilat, Israel, and Panama. These data also suggest that Veracruz could serve as a long-term monitoring station for continental populations of some raptor species.

In the years since 1992, improved count methodology has revealed an annual autumn migration of three to five million raptors in central Veracruz (Table 1). Twenty species of raptors have been recorded together with over 220 other species of neotropical migrant birds (Ruelas *et al.* 1997). Regular rarer migrants have included species such as the Hook-billed and Plumbeous Kites, Zone-tailed Hawk, and Golden Eagle (Table 1).

The timing of the migration varies among species. Mississippi Kites peak in late August with daily counts of over 10,000 birds in a record day, and a peak flight number exceeding 30,000 in some years. Broad-wings peak in late September and early October with daily peak flights of up to 600,000 birds. Swainson's Hawks peak in early to mid-October when the combined total of Swainson's, Turkey Vultures, and Broad-wings may surpass one million birds in a record day. Peak flights of falcons and accipiters are recorded during October as well. The Turkey Vulture is the last abundant migrant in autumn. Their migration is prolonged with peak numbers occurring in mid to late October, although substantial flights are recorded into mid-November. By late November, most of the hawks have passed through, well on their way to non-breeding ranges in Central and South America (Ruelas *et al.*, 1997), to help estimate and monitor the flight volume through the region.

Environmental education has been a critical component of the VRR project since its inception. Without the awareness and subsequent support of the local people, there will be no hope of protecting migrating raptors or the habitat critical to their survival. The first formal education efforts took place in 1992 and focused on elementary school students and their teachers, as well as the general public.

Posters and brochures were developed to help inform the adult public about the migration and the importance of these birds to the ecosystem. The first teacher's guide and teacher training workshops were held in autumn 1992 (Silva & Gaughan 1992). Further development of the educational approach and materials resulted in a soft-bound teacher's manual with lesson plans and topics designed to suit the fourth grade curriculum in Veracruz (Mesa *et al.* 1995). Many of the topics have focused on simple ecological concepts as well as bird migration patterns and identification. Student testing has suggested that many of the students are retaining the ecological concepts contained in the Veracruz River of Raptors programme (Mesa *et al.* 1997). Some of the local students in Chichicaxtle area that have spent the most time with the hawk counters are now in training to become hawk counters in the future. Several of them are taking English classes so that they may attend internships in the United States in the future. In 1998 one of them served as an assistant bird counter.

Table 1. Five-year averages for each raptor species monitored during the autumn migration in Veracruz.

Species	Five-Year Average, 1992-96*
Turkey Vulture (<i>Cathartes aura</i>)	1,202,000
Osprey (<i>Pandion haliaetus</i>)	1,500
Swallow-tailed Kite (<i>Elanoides forficatus</i>)	50
Mississippi Kite (<i>Ictinia mississippiensis</i>)	34,900
Plumbeous Kite (<i>Ictinia plumbea</i>)	5
Hook-billed Kite (<i>Chondrohierax uncinatus</i>)	60
Northern Harrier (<i>Circus cyaneus</i>)	200
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	2,800
Cooper's Hawk (<i>Accipiter cooperii</i>)	1,100
Harris Hawk (<i>Parabuteo unicinctus</i>)	2
Zone-tailed Hawk (<i>Buteo albonotatus</i>)	23
Red-shouldered Hawk (<i>Buteo lineatus</i>)	20
Broad-winged Hawk (<i>Buteo platypterus</i>)	1,452,000
Swainson's Hawk (<i>Buteo swainsoni</i>)	513,000
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	140
Ferruginous Hawk (<i>Buteo regalis</i>)	<1
Golden Eagle (<i>Aquila chrysaetos</i>)	<1
American Kestrel (<i>Falco sparverius</i>)	4,400
Merlin (<i>Falco columbarius</i>)	50
Peregrine Falcon (<i>Falco peregrinus</i>)	290
Unidentified Raptor	80,000
TOTAL	3,295,000

*The numbers shown are LESS than the numbers known to pass through this area, because in some years we had incomplete coverage. In 1996, a complete count yielded 4.6 million hawks with over two million Broad-winged Hawks, and this number is believed to be closer to the true number of migrants passing each autumn.

Conservation outreach to the adult population has proven more difficult. Poster distribution and occasional talks at agricultural meetings have been only moderately successful. During 1996 and 1997 funds were raised to build a small education centre and bird monitoring station at the heart of the flyway. One of the purposes of this centre is to operate a nature centre and museum focusing on bird migration and the importance of raptors in the ecosystem. Modelled after the successful Hawk Mountain Sanctuary, in Pennsylvania, the centre should serve as a nucleus of public outreach year-round. The centre, the Veracruz Bird Observatory, will be built during 1999, and will house a full-time naturalist/educator. It will serve as one of the main count sites for the monitoring programme.

and provide comfortable hawk watching for visiting tourists. Nature trails and habitat restoration areas will serve to introduce local residents to local birds and bird-watching.

The extreme concentration of migrants in this narrow corridor has also highlighted the need for habitat protection within this area. Many of the migrants, particularly Broad-winged Hawks, seek out wooded areas for evening roosts. Long-term project goals include identification and conservation of roosting habitat for raptor migrants. Much of the grassland habitat has been converted into sugar cane plantations in recent years, further restricting the habitat for feeding and resting migrants, as well as native raptors. Other goals include establishing outreach programmes to local farmers to reduce pesticide use, and promote native habitat protection.

One of the important critical challenges of the VRR project has been to maintain funding to continue the monitoring and education initiatives. To support long-term conservation and monitoring programmes in the flyway, the VRR project launched a membership programme in 1996. To date nearly 200 people have become founding members, supporting the annual hawk count and education programmes. Pronatura-Veracruz is also developing ecotourism as another avenue to support their monitoring and education programmes. From 1994 to 1998 the numbers of visiting tours has grown from one to seven in 1998. Local businesses that benefit from the tourism are also beginning to contribute to the conservation programme.

In summary, hawk migration counts in central Veracruz have established this site as the most concentrated raptor migration site in the world, hosting three to five million raptors each autumn. Most the world's Broad-winged and Swainsons' Hawks, and Mississippi Kites pass through this narrow corridor each spring and autumn. Habitat loss and alteration continues throughout this region, highlighting the need for focused conservation efforts. Long-term conservation strategies include enhanced environmental education and public outreach, continued long-term monitoring, research on raptor and waterbird migration including use of radar to estimate flight volumes, and habitat conservation initiatives focused on protection of forests and other native habitats.

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REFERENCES

- ANDRLE, R. 1968. Raptors and other North American migrants in Mexico. *The Condor* 70:393-395.
- BILDSTEIN, K. 1998. Long-term counts of migration raptors: a role for volunteers in wildlife research. *J. of Wildlife Management* 62:435-445.
- GOODRICH, L. 1997. The Migration Report. Hawk Mountain News No. 86:8-14.
- MESA, S.L., L. CORONADO, & S.M. GAUGHAN 1995. Veracruz: Río de Rapaces, Manual de Educación Ambiental para la Conservación de las Aves Rapaces y sus Hábitats en Veracruz. Dirigido a Maestros de Enseñanza Primaria. Pronatura Veracruz and National Fish and Wildlife Foundation. In-house Publication.
- MESA, S.L., E. RUELAS INZUNZA & X. OSORIO M. 1997. Programa de educación ambiental Veracruz Río de Rapaces: su inserción en el curriculum de 4o. grado de enseñanza primaria. Pp. 101-114. In: de Alba y E. González Gaudiano. *Evaluación de programas de educación ambiental. experiencias de America Latina y El Caribe*. CESU-UNAM/Cecadesu. México, D.F.
- RUELAS INZUNZA, E. 1997. The River of Raptors: What's going on in Veracruz? *Amigos del Río de Rapaces newsletter* 1, 1:1-3.

- RUELAS INZUNZA, E., S.W. HOFFMAN, L.J. GOODRICH, & S.L. MESA 1997. Veracruz River of Raptors II, Project 96-124 Progress Report. Submitted to National Fish and Wildlife Foundation, Washington, D.C.
- RUELAS INZUNZA, E., S.L. MESA, & J. MONTEJO 1997. Veracruz River of Raptors I. Project 94-256 Final Report. Submitted to National Fish and Wildlife Foundation, Washington, D.C.
- SILVA R., E. & S.M. GAUGHAN, 1992. México: un Puente para la Migración, una guía de referencia para maestros sobre educación para la conservación de las aves rapaces. Hawk Mountain Sanctuary Association/ Pronatura. Veracruz In-house Publication. Kempton, PA.
- THIOLLAY, J. 1980. Spring hawk migration in eastern Mexico. *Raptor Research* 14:12-14.
- TILLY, F., S. HOFFMAN, & C. TILLY. 1990. Spring hawk migration in southern Mexico, 1989. *J. of Hawk Migration Studies* 15:21-29.

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