

The Importance of Riparian Habitats for the Conservation of Endangered Mammals in Mexico¹

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ABSTRACT.- An analysis of the status of endangered mammals from Mexico is presented. 47 species are threatened with extinction. Seven (one aquatic and six semiaquatic ones) are confined to riverine ecosystems. The increasing exploitation of their populations and the destruction of riparian habitats is the main threat for the long-term survival of those species.

INTRODUCTION

Conservation biology and ecology confront a staggering increase in the number of extinct and endangered species in recent times. In the last four centuries at least 226 species of vertebrates have become extinct (Allen 1942, Greenway 1958, King 1981). Estimates of current extinction rates are close to one species per day (Myers 1984). If these rates continue to increase, it is probable that one million species will be lost by the end of the century (Myers 1984).

Why are so many species being lost at such devastating rates? What is the impact of these massive extinctions in natural ecosystems? Present mammal related extinctions are caused by the rapid ecological changes resulting from direct and indirect human activities. Species are exterminated by exploitation (e.g. hunting) and qualitative and quantitative changes of the environment (e.g. habitat destruction) (Allen 1942, Diamond 1984, Simon and Geroudent 1970).

Exploitation differs from other factors affecting the environment by the scale and degree of its effects in natural ecosystems. On the one hand, species tend to be exploited because they have certain characteristics that make them valuable or undesired. Indeed, man has proven to be very successful in exterminating many populations and species of organisms that fall in any of these categories. The process is, however, species-specific. On the other hand, factors affecting qualitative and quantitative aspects of the environment, tend to be very unselective. Many species are affected at the same time.

The destruction of habitats and ecosystems is increasing every day. It is not surprising that this is one of the main cause of extinction. Deforestation, urbanization, agriculture and other development-related factors impose increasing pressures on natural ecosystems, many of which are extremely susceptible to degradation. Tropical, arid and riv-

erine ecosystems are particularly fragile (Gomez-Pompa et al 1972, Miller 1961, Rea 1983).

In this paper I discuss the degradation of riparian habitats and its consequences for the conservation of endangered mammals in Mexico. I emphasize the historical changes in the distribution of several species restricted to those habitats.

RIPARIAN HABITATS IN MEXICO

Riparian habitats are widely distributed in Mexico, being important components of temperate and tropical ecosystems (Rzedowski 1978). These habitats develop along the rivers' margins, and are surrounded by drier vegetation. Riparian habitats are the ecotone between aquatic and terrestrial ecosystems. They differ in their vegetation diversity, heterogeneity, composition and productivity from adjacent areas (Johnson, Haight and Simpson 1977). The strongest contrasts are found in arid lands, where water is a limiting resource. However, riparian habitats also differ from adjacent habitats in mesic temperate and tropical regions (Rzedowski 1978).

The characteristics of riparian habitats make them unique, with a rich plant and animal life. These habitats provide many species of vertebrates with refuges, shelter and food, and usually, with abundant water. Riparian habitats and riverine ecosystems also act as biogeographic dispersal barriers and corridors (e.g. Boeer and Schmidly 1977).

In Mexico riverine ecosystems have been greatly degraded. Developmental expansion have resulted in profound changes in all the large rivers of the country. Reduction of stream flow, grazing, pollution, salination, siltation, dissication and removal of plant cover are some of the main problems changing the face of riverine ecosystems. A dramatic example is the Lerma river, which water is used to supply Mexico city. Presently, the river flow is almost non-existent and the water is highly pollu-

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ted by chemical wastes from a nearby industrial park. The marshes and willow trees that used to grow along the river banks, have practically disappeared. The marshes were important wintering grounds for waterfowl in central Mexico. A few endemic species of vertebrates are critically endangered, and at least one, the slender-beaked grackle (Quiscalus palustris) is extinct (King 1983).

The problem of degradation of riverine ecosystems is particularly severe in arid regions of northern Mexico, where the main rivers have been seriously altered, increasing desertification and causing the extinction of some freshwater fishes (Contreras-Balderas 1978). In central and southern Mexico the situation is similar; the main problems are land use and water pollution.

Even though the degradation of riparian habitats have been extensive, there are still areas in which riverine ecosystems are unspoiled. Many pristine ecosystems are found in very inaccessible areas. Some of these areas represent the last stronghold for populations of several endangered mammals.

MEXICAN EXTINCT AND ENDANGERED MAMMALS

An analysis of the conservation status of Mexican mammals revealed that, at least, 47 species are endangered and five have become extinct since 1850 (Table 1). Seven of these endangered species are confined to riparian habitats.

Table 1.-- Extinct and endangered mammals from Mexico. The status (En= endangered or Ex= Extinct) and the cause of extinction (O= exploitation, H= habitat destruction, U= unknown) for each species are mentioned. For extinct species the year of last record of occurrence is also given. Species confined to riparian habitats are marked with an asterisk (*).

Species	Status	Causes
<u>Alouatta palliata</u>	En	H,O
<u>Alouatta pigra</u>	En	H,O
<u>Antilocapra americana</u>	En	O,H
<u>Arctocephalus townsendii</u>	En	O
<u>Ateles geoffroyi</u>	En	H,O
<u>Bison bison</u>	EX 1900?	O
<u>Canis lupus</u>	En	O,H
<u>Castor canadensis</u> *	En	H,O
<u>Cervus canadensis</u>	En	O
<u>Chironectens minimus</u> *	En	H
<u>Cynomys ludovicianus</u>	En	H
<u>Cynomys mexicanus</u>	En	H
<u>Eira barbara</u>	En	H,O
<u>Enhydra lutris</u>	EX 1912	O
<u>Erethizon dorsatum</u>	En	H,O
<u>Eschrichtius robustus</u>	En	O
<u>Felis concolor</u>	En	O,H
<u>Felis onca</u>	En	O,H
<u>Felis pardalis</u>	En	O,H
<u>Felis weidii</u>	En	O,H
<u>Felis yagouaroundi</u>	En	O,H
<u>Galictis vittata</u>	En	H,O
<u>Lepus flavigularis</u>	En	H,O

<u>Lutra longicaudis</u> *	En	H,O
<u>Mazama americana</u>	En	H,O
<u>Mirounga angustirostris</u>	En	O
<u>Monachus tropicalis</u>	EX 1962	O
<u>Nasua nelsoni</u>	En	H
<u>Odocoileus hemionus</u>	En	O,H
<u>Ondatra zibethicus</u> *	En	H
<u>Ovis canadensis</u>	En	O,H
<u>Peromyscus pembertonii</u>	EX 1931	U
<u>Phoca vitulina</u>	En	H
<u>Procyon pygmaeus</u>	En	H,O
<u>Rheomys mexicanus</u> *	En	H
<u>Romerolagus diazi</u>	En	H,O
<u>Sylvilagus insonus</u>	En	H,O
<u>Tapirus bairdii</u> *	En	H,O
<u>Tayassu peccari</u>	En	H,O
<u>Taxidea taxus</u>	En	H,O
<u>Trichechus manatus</u> *	En	H,O
<u>Ursus arctos</u>	EX 1962	O,H
<u>Ursus americanus</u>	En	O,H
<u>Vampyrum spectrum</u>	En	H
<u>Vulpes macrotis</u>	En	H,O
<u>Zalophus californicus</u>	En	O

Are Riparian species more prone to extinction than other mammals?

The characteristics of endangered and extinct species of mammals from Mexico follow similar trends to those observed in other geographic areas. Species tend to be more prone to extinction with: 1) increasing body size, specialization and trophic level, and 2) decreasing population size, and area of distribution (Brown and Gibson 1983, Ceballos and Navarro 1985, Diamond 1984).

Most species of mammals confined to riparian habitats are endangered. These species are very susceptible to extinction because they tend to have small geographic distributions, low population densities, highly specialize habitat and feeding requirements, and to be restricted to very fragile ecosystems.

TEMPERATE MAMMALS

Beaver and Muskrat

Two species of semiaquatic temperate mammals are critically endangered in Mexico: the beaver (Castor canadensis) and the muskrat (Ondatra zibethicus). Both species have distributions restricted to the Colorado river in the Sonora-Baja California border, and to the Rio Bravo and its tributaries (figs. 1,2).

The present status of the population of muskrat is unknown; however, they still survive in low numbers.

Beaver was once abundant in Mexico; however, intense trapping depleted its populations (Leopold 1965). In recent decades beaver has also been threatened by encroachment on their habitat, by agriculture and ranching. The populations of northern Sonora, in the San Pedro river, have become extinct. The status of the species in the delta of the Colorado river is unknown, but it is probably very scarce. In the Rio Bravo and its tribu-

taries, beaver has survived better (Bernal 1978, Leopold 1965). In Nuevo Leon, an estimate of the population size was 256 individuals, distributed along 860 km of riverine ecosystems (Table 2) (Bernal 1978)

Table 2.-- Number of individuals and beaver colonies in Nuevo Leon, Mexico (from Bernal 1978).

RIVER	Km	Colonies	Individuals
Salado	135	19	76
San Juan	180	18	72
Alamo	60	13	52
Sabinas	120	5	20
Pilon	80	3	12
Agualeguas	30	2	8
Del Macho	15	2	8
Mohinos	70	1	4
Lobo	55	1	4
Other	115	0	0
TOTAL	860	64	256

These estimates show how critical the situation is for this species in Mexico. Very likely, there are less than 1000 individuals in the country.

TROPICAL MAMMALS

Five species of neotropical mammals restricted to riparian habitats are endangered in Mexico. The main problem faced by all of them is the destruction of their habitat. The tropical forests of the country have disappeared at an astonishing rate; if the present destruction continues, the last remnant of tropical evergreen forest will be lost within the next 10 years.

Manatee

Manatee (*Trichechus manatus*) is the only totally aquatic freshwater mammal in Mexico. They were widely distributed along the Gulf of Mexico and the Caribbean sea, from Tamaulipas to the Yucatan Peninsula (Hall 1981). Populations of manatee were hunted to extermination in many areas, and their habitat destroyed or polluted (e.g. Rio Coatzacoalcos, Veracruz). Presently, the whole population in Mexico probably does not exceed a few hundred individuals scattered along rivers and lagoons in Tabasco, Chiapas, Yucatan, Campeche and Quintana Roo (Villa and Colmenero 1982, Gallo 1982) (fig. 1).

Rheomys and Chironectens

Two species, *Rheomys mexicanus* and *Chironectens minimus*, are endangered exclusively by the loss of their habitat. *Rheomys* is a small rat, endemic to Oaxaca. It lives in the banks of a few rivers and streams, feeding on aquatic insects and small fishes (fig. 1).

Chironectens is a semiaquatic marsupial found along rivers in the tropical evergreen forest

(fig. 1). Population of this species have low densities, and they seem to very very susceptible to perturbations. So far this species is known from a few localities in Oaxaca (one), Tabasco (two) and Chiapas (several).



Figure 1.- Present (close symbols) and past (open symbols) distribution of beaver (circles), manatee (squares) and *Rheomys* (triangles) in Mexico.

Tapir

Tapir (*Tapirus bairdii*) is distributed from Veracruz to Chiapas and the Yucatan Peninsula (fig. 2) (Hall 1981, Leopold 1965). The species has been exterminated throughout most of its range, surviving in isolated localities in Quintana Roo, Chiapas and, probably, Oaxaca.

The populations' status of tapir in Mexico is little known. There is information about a few individuals in Quintana Roo (close to Belize), Chiapas (Lacandona forest), and there are unconfirmed records from Oaxaca (Chimalapa). The demise of the species has been closely associated to habitat destruction. In newly colonized areas, tapir is one of the first species to disappear. The future for the species is uncertain. If the few populations surviving are not protected immediately, they will vanish during the next 20 years.

River Otter

River otters (*Lutra longicaudis*) are still widespread in the tropical lowlands of Mexico (fig. 2). The densities are, in most of its range, very low. The species has been able to cope with the destruction of its habitat, mainly because of its dispersal abilities and broad feeding habits (fishes and aquatic invertebrates). It is probable that if the degradation of natural habitats continues at the same scale, river otters will be the last, of the seven mammals here mentioned, to disappear.

It is probable that another species of river otter, *Lutra canadensis*, is extinct in Mexico.

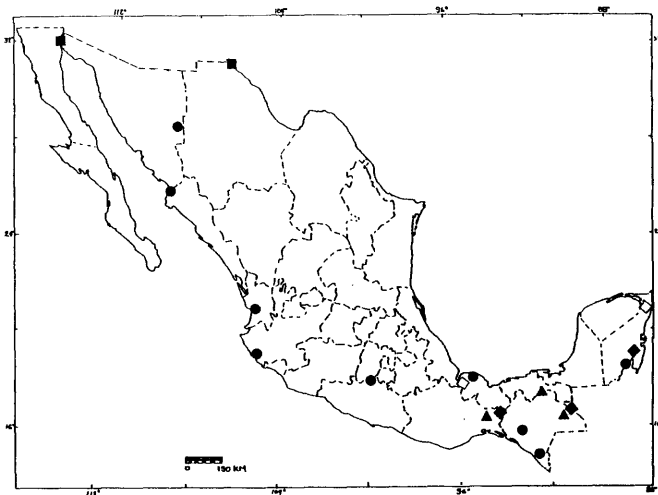


Figure 2.- Present (close symbols) and past (open symbols) distribution of muskrat (squares), river otter (circles), *Chironectens* (triangles), and tapir (diamonds) in Mexico.

DISCUSSION

Riverine ecosystems have been extensively degraded in Mexico. The populations of several species of mammals which distribution is restricted to riparian habitats have sharply declined in recent years. Important reasons for their decline have been overkilling and the destruction of their habitat. Other Mexican mammals are threatened by similar problems (Ceballos and Navarro 1985).

The ecological consequences of the extinction of riparian mammals are little known. However, some species play key roles in riparian communities. For instance, beaver is a key species in riverine ecosystems because its dams create freshwater ponds that are used by many organisms (Hill 1982). Several species of fishes are endangered in southwestern USA and northern Mexico because the loss of their habitats, which has often been linked to the disappearance of beaver (e.g. San Pedro River) (Miller 1961).

Another example is the role of manatees in limiting the population growth of aquatic plants. In southern Mexico the control of aquatic hyacinth (*Eichornia crassipes*), is an increasing problem. This aquatic angiosperm was accidentally introduced from South America. It rapidly invaded all kind of aquatic habitats, changing their physical conditions (e.g. oxygen concentration). Manatees are a natural option to control this plant.

Riverine ecosystems are unique in their biotas. Bird studies in USA have documented that the highest breeding densities of North American land birds are found in southwestern riparian habitats (Carothers, Johnson and Aitchison 1974). In Mexico the decline of tree ducks (*Dendrocygna* spp) and muscovy ducks (*Cairina moschata*) is associated to the loss of riparian habitats. Both species nest in trees, and are susceptible to changes in the availability of nesting sites (e.g. Rangel and Bolen 1984).

Pollution, dissipation, and other physical changes in riverine ecosystems have a profound

impact on aquatic organisms. Dozens of fishes are endangered in northern Mexico, especially by modifications to their habitats (Contreras-Balderas 1978). Several species are known from one or few localities (e.g. *Prietella phreatophila*), and at least one, *Stypodon signifer*, is extinct. The same is true for amphibians and aquatic reptiles. For instance, habitat modifications caused the extinction of *Sternotherus odoratus*, a turtle known in one locality in Mexico (Smith and Smith 1979).

It is important to emphasize that the conservation and rational management of riparian habitats in Mexico will ensure the survival of many species of plants and animals, and the perpetuation of unique and yet little biologically known ecosystems.

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