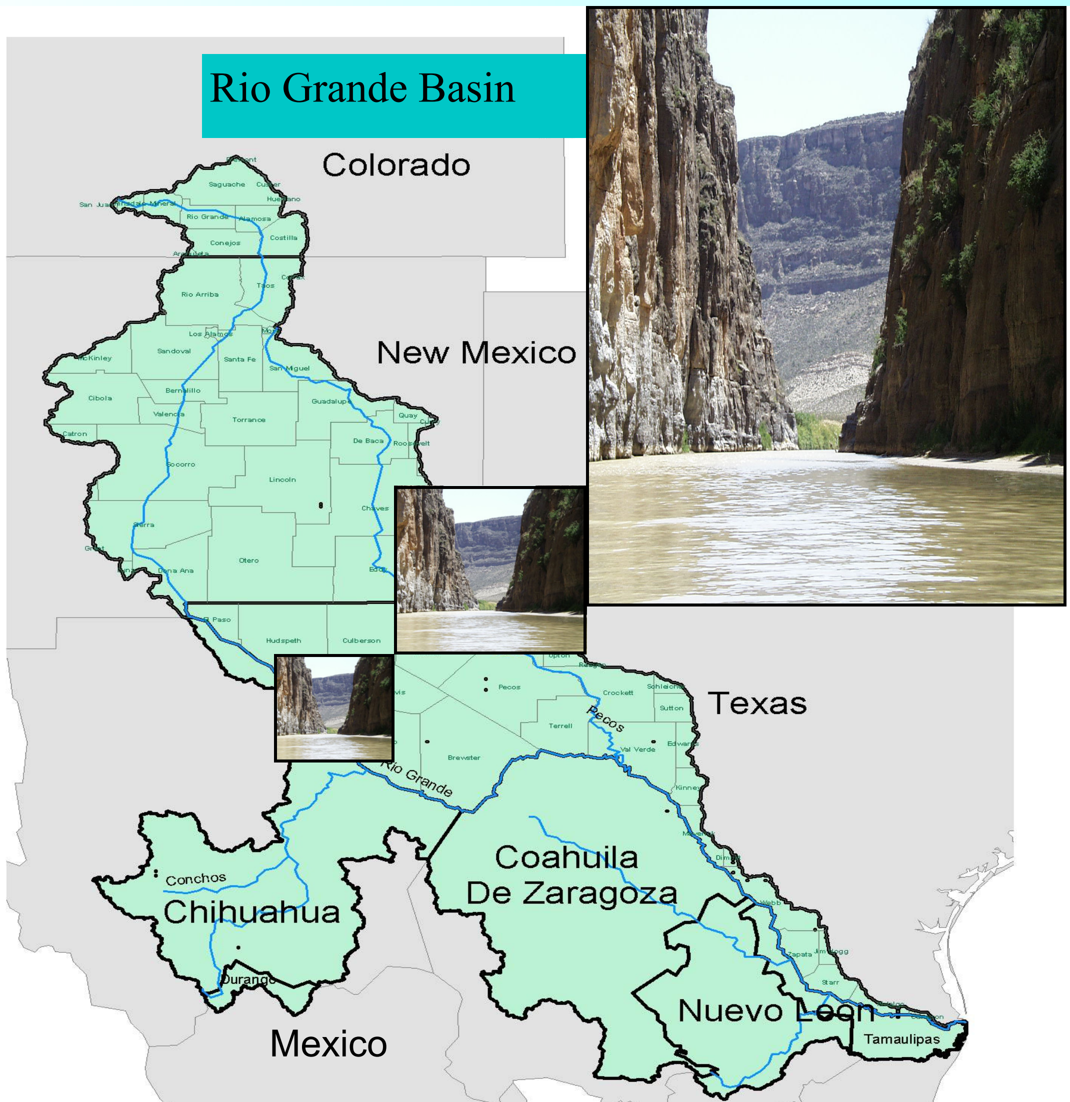
TWRI Technical Report 214

Rare, Threatened and Endangered Species of the Rio Grande/ Rio Bravo Basin:

A Bibliography



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April 2003

Texas Cooperative EXTENSION The Texas A&M University System
LAND INFO Land Information Systems
Texas Water Resources Institute make every drop count
Wildlife & Fisheries Sciences Texas A & M University

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Wildlife & Fisheries Sciences
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Resources Institute
make every drop count

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Cover photo (Mariscal Canyon) by Miguel Mora
Translation and Cover design by Karine Gil

Any error encountered within this document is solely our own.

Instructions

In the compact disk attached to this publication, there are three files: Rio Grande PDF, Rio Grande EndNote and Rio Grande Word.

Rio Grande PDF: Information in Acrobat Reader for all abstracts, references and Web pages.

Rio Grande EndNote®*: This database provides a simple way to directly search for references. You can also add references to the Rio Grande Basin Endangered and Threatened Species bibliography.

Rio Grande Word: Chapters I-IV are also provided in Microsoft Word with links to Internet sites.

***EndNote®**: This program for Microsoft Word or Corel WordPerfect allows you to build a reference database. Installation of EndNote® is required.

I. Introduction

The Rio Grande/Rio Bravo Basin drains some of the harshest terrain in North America. The river and its tributaries are major drainages for the plateau shrub lands of central New Mexico, the Chihuahuan Desert and the Tamaulipan Mezquital. The Chihuahuan Desert of New Mexico, Texas and Mexico ranks as the world's most biologically diverse desert ecoregion, supporting a species richness of more than 100 mammals, 250 birds, 100 reptiles and 20 amphibians (Ricketts et al. 1999). Likewise, the Tamaulipan Mezquital of South Texas and adjacent Mexico is considered one of the "last great habitats" in North America due its unique biological resources (Fulbright and Bryant 2002).

Over time, native plants and animals in the regions surrounding the Rio Grande have adapted to extreme cycles of prolonged drought, flood, repeated fires and the recurrent pressures of large grazing animals. As a consequence, many species have developed specialized strategies for enduring these environmental pressures. Often, it is the most specialized of these species that becomes endangered with extinction when the historical cycles of drought, flood, fire and grazing are abruptly altered. Likewise, many of these species are not able to readily adapt to habitat changes or the highly modified environments that can develop with the introduction of non-native species.

Although it maintains a significant biological value, much of the Rio Grande/Rio Bravo Basin is highly degraded when compared to its condition of 50 to 100 years ago (Ricketts et al 1999). Human impacts from water diversion, changing land use, urbanization and the introduction of non-native species inevitably impacts some native plants and animals, and the ecosystems upon which they depend. As a result, some species are in danger of extinction and become the subject of conservation concern. Technically, under the US Federal Endangered Species Act (ESA), those species listed as "endangered" are considered to be in danger of extinction throughout all, or a major portion, of their range. A "threatened" species is considered likely to become endangered in the foreseeable future. Under state endangered species acts, the designations are similar, except that the focus tends to be on the species' status within the boundaries of the state.

Because of the complicated administrative process often involved in listing endangered and threatened species under the ESA (and sometimes under the corresponding state acts), the numbers of threatened or endangered species do not always reflect the overall condition of a region's biological resources. However, those trends that consistently lead to "endangered" or "threatened" designations may highlight ecosystems at risk of loosing substantial biological diversity. We offer the following work partly for the purpose of exploring and discovering those trends.

The purpose of this publication is to provide an easily-accessible reference to the scientific information on those species listed as endangered or threatened under the federal ESA or a similar state process. This bibliography includes references, annotations, and Internet citations for more than 400 sources of scientific information for 181 species of threatened or endangered concern in the Rio Grande/Rio Bravo Basin. This publication and its searchable database are a significant starting point for planners and those conducting environmental assessments, as well as students and researchers interested in rapidly accessing and reviewing scientific literature.

Key words: Rio Grande, Rio Bravo, Endangered, Threatened, Endangered Species Act, Chihuahuan desert, Tamaulipan Mezquital, Biological Diversity, Water Resources

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The River

The Rio Grande/Rio Bravo and its tributaries drain a basin of some 656,100 km^2 (253,320 mi^2), about 48% of which lies in Mexico. The river's upstream source is in the San Juan Mountains of Colorado at an elevation 4267 m (14,000 feet). From that headwater source, the river runs 3,154 km (1,960 miles) where it drains into the Gulf of Mexico. The average annual precipitation in the high mountain valleys of the Rio Grande's headwaters can exceed 125 cm (50 inches). Downstream, as the river enters the Chihuahuan Desert, annual precipitation can drop as low as 20 cm (8 inches). As water losses increase (through evaporation, plant transpiration and lateral seepage) and inputs from the watershed decrease, the river tends to naturally lose flow. While this is a natural process for rivers that traverse an arid region, the added human diversions of water can actually cause the river to completely lose flow along certain reaches. For example, the river commonly loses its flow due to diversions near El Paso and does not resume significant flow until confluence with the Rio Conchos—about 250 miles downstream.

Water use and allocation has become a major political, social and economic issue in the entire basin. Water diverted for human use accounts for more than 90 percent of the river's average annual flow. Although 80 percent of diverted water is used for irrigation agriculture, the municipal demands for the river's water continue to grow near the major cities of Albuquerque, El Paso, and Ciudad Juarez. Most of the rare, threatened and endangered species in the basin are directly or indirectly dependent upon the basin and how it is managed.

Introducción

La cuenca del Río Grande/Río Bravo riega el terreno más árido de Norteamérica. El río y sus tributarios son drenajes importantes para matorrales de las planicies centrales del estado de New México, del desierto Chihuahuense, y del Mezquital Taumalipeco. El desierto Chihuahuense de New México, de Texas y de México, se reconoce como la ecoregión desértica del mundo con la mayor diversidad biológica posible. Contiene una riqueza de especies alrededor de 100 mamíferos, 250 aves, 100 reptiles y más de 20 especies de anfibios (Ricketts et al. 1999). Asimismo, el Mezquital Tamaulipeco adyacente al sur de Texas y de México se considera uno de los "últimos grandes hábitats en Norteamérica debido a sus recursos biológicos únicos (Fulbright y Bryant 2002).

A través del tiempo, las plantas y los animales nativos o autóctonos de las regiones que rodean el Río Grande se han adaptado a los ciclos extremos de sequía prolongada, de inundaciones, de quemas repetidas, y de las presiones recurrentes por los animales de pastoreo. Por consiguiente, muchas especies han desarrollado las estrategias especializadas para soportar o tolerar estas presiones ambientales. A menudo, las especies denominadas especialistas quedan en peligro de extinción cuando los ciclos de sequía, de inundación, de fuego y de pastoreo se alteran precipitadamente. Asimismo, muchas de estas especies no pueden adaptarse facilmente a los cambios del habitat, o a los ambientes altamente modificados que pueden transformarse por la introducción de especies exóticas.

Aunque la cuenca del Río Grande/Río Bravo ha mantenido un valor biológico significativo , gran parte de esta ha sido altamente degradada al compararse con su condición de hace 50 a 100 años (Ricketts et al 1999). Los impactos humanos producidos por la desviación del agua, los cambios en el uso del suelo, la urbanización e introducción de especies exóticas, afectan inevitablemente a algunas plantas y animales nativos y los ecosistemas de los cuales dependen. Consecuentemente ciertas especies quedan en peligro de extinción, y se convierten en el tema de preocupación para su conservación. Tecnicamente, según el listado federal de especies decretadas “en peligro” (endangered) por los Estados Unidos (ESA), las especies en esa lista se consideran en ese status porque están en peligro de extinción, tanto la especie o una porción importante de ésta. Una especie "amenazada" (threatened) se considera que probablemente se pondrá en peligro en un futuro próximo. Bajo el listado estadal, las designaciones de los decretos sobre las especies son similares, excepto que el enfoque tiende a estar dentro de los límites del estado.

Debido a lo complicado del proceso administrativo que implica colocar en el listado según ESA una especie bajo amenaza o en peligro (y a veces bajo el listado correspondiente al estado), la cantidad específica de especies amenazadas o en peligro no refleja siempre la condición total de los recursos biológicos de las regiones. Sin embargo, mantener la tendencias de denominar las especies “en peligro" o "amenazadas" puede hacer destacar que el ecosistema esté bajo riesgo de perder una diversidad biológica substancial. El siguiente trabajo ofrece parcialmente la posibilidad de explorar y de descubrir esas tendencias.

El propósito de esta publicación es proporcionar una referencia de fácil acceso a la información científica sobre las especies decretadas en peligro o bajo amenaza, según ESA y procesos similares en los estados. Esta bibliografía incluye referencias, anotaciones, y/o las localizaciones por el Internet para más de 400 fuentes de información científica para 181 especies consideradas bajo amenaza o en peligro en la cuenca del Río Grande/ Río Bravo. Esta publicación y su base de datos para investigación son un punto de partida significativo para los planificadores, y aquellos que conduzcan evaluaciones ambientales , así como para los estudiantes y los investigadores interesados en tener rápidamente acceso a una revisión de la literatura científica.

Palabras claves: Río Grande, Río Bravo,(endangered) especie en peligro de estinción, (Threatened) amenazada, (Chihuahuan desert) desierto Chihuahuense, (Tamaulipan Mezquital) Mezquital Tamaulipeco, diversidad biológica, recursos hídricos.

El Rio

El Río Grande/Rio Bravo y sus tributarios riegan un área de 656.100 km^2 (253.320 mi^2); de la cual cerca del 48% cae sobre México. La fuente de aguas arriba del río está en las montañas de San Juan de Colorado, a una elevación de 4.267 m (14.000 pies). Desde la cabecera, el río recorre cerca de 3.154 kilómetros (1.960 millas) hasta llegar al Golfo de México. La precipitación media anual en los valles montañosos en las cabeceras del Río Grande puede exceder los 125 centímetros (~50 pulgadas). Río abajo, cuando el río entra en el desierto Chihuahuense, la precipitación anual puede descender hasta 20 centímetros (8 pulgadas). Mientras la pérdida de agua aumenta (evaporación, transpiración de la planta, y percolación), y el ingreso de agua por la cuenca disminuye, el río tiende naturalmente a perder su flujo. Así como esto es un proceso natural en los ríos que atraviesan una región árida, el adicionarle desviaciones al agua para actividades humanas puede hacer que el río realmente pierda totalmente su flujo a lo largo de ciertos puntos. Por ejemplo, el río pierde su flujo debido a las desviaciones cerca de El Paso y no recupera su flujo significativamente hasta la confluencia con el Río Conchos – cerca de 250 millas río abajo. El uso del agua y la asignación de esta se ha convertido en materia importante desde un punto de vista político, social, y económico en toda la cuenca. El agua desviada para las actividades humanas se estima que está cerca del 90% del flujo medio anual del río. Mientras que cerca del 80% del agua desviada se está utilizando para la irrigación agrícola, la demanda municipal de agua está en aumento, especialmente en áreas cercanas a las principales ciudades de Albuquerque, El Paso, y Ciudad Juárez. La mayoría de las especies raras, amenazadas, y en peligro de extinsión en la cuenca estan directa o indirectamente dependiendo de cómo ésta sea manejada.

II. Annotated Bibliography, References and Web Pages

The production of the database, references and annotated bibliography was based on a meticulous revision of listings of animal and plant species from the US Endangered Act (ESA), and listings of threatened species from the states of Texas, New Mexico and Colorado and some states of Mexico. Special attention was given to those counties and regions within the Rio Grande Basin.

This work exhibits the search and successful detection of information from studies made on these species in the United States. The need to do this investigation in Mexico still exists for the states of Chihuahua, Coahuila de Zaragoza, New Leon and Tamaulipas based on the lack of data obtained in this study.

The range of distribution in the river basin was confirmed for every species. Searches for the species' common and scientific names using databases and electronic journals from the library at Texas A&M University provided abstracts and references from 1993 to 2002 (CAB and BIOSIS). All abstracts were imported into this document using EndNote®.

Abstracts: Scientific studies conducted regarding threatened and endangered species:

- In the different terrestrial ecoregions of North America that form part of the Rio Grande/Rio Bravo Basin: Tamaulipan Mezquital, Chihuahua Desert , Edwards Plateau Savannas (SW), Colorado Plateau Shrub lands and Western Gulf Coastal Grasslands (Ricketts et al. 1999) .

- In the different freshwater ecoregions of North America that form part of the Rio Grande/Rio Bravo Basin: Upper Rio Grande/ Rio Bravo del Norte, Pecos, Rio Conchos, Guzman, and Lower Rio Grande/Rio Bravo (Abell et al.2000).

- In zones near Rio Grande Basin and in other U.S states with the same species.

- In others countries with the same endangered and threatened species.

References: Scientific studies, without abstract attached from:

- Specific books for each taxon and for each region or state that is part of the Rio Grande Basin.

- Compact disk with information regarding threatened species distribution in the State of Texas, GIS Database environmental Contaminants in Rio Grande/Rio Bravo Basin, USGS (Mora 2001).

- Reports, information and scientific magazines.

Web Pages: Direct connections (in the Microsoft Word version) to obtain:

- Photos, characteristic, distribution, present status, threats, recommendations and mentioned literature.

- Direct information from the Department of the Interior, from the Federal Registry via the Internet, with additional information of the species, antecedents, previous situation to the registry, commentaries, recommendations, summary of the factors that affect the species, habitat, and measure of conservation.

Bibliografia Anotada, Referencias y Páginas Web

La producción de este material de base de datos, referencias o bibliografia anotada sobre las especies amenazadas y en peligro de extinción que se encuentran en la cuenca del Río Grande o Río Bravo, se basó sobre una revisión minuciosa de todas las especies de plantas, y animales decretados en peligro en las listas de ESA (US Federal Endangered Act) , y en el listado de cada uno de los estados de Estados Unidos (Texas, New Mexico y Colorado) y en los estados de México que conforman la cuenca del Río Grande.

Este trabajo presenta la búsqueda y encuentro exitoso de información en los Estados Unidos, de los diversos estudios realizados sobre estas especies en los condados que forman parte de la cuenca . Se considera establecida la necesidad de desarrollar esta investigación en México en los estados de Chihuahua, Coahuila de Zaragoza , Nuevo Leon y Tamaulipas dada la escasa información que se obtuvo por este medio en el presente estudio.

De cada especie se confirmó su rango de distribución en la cuenca, sobre todo en los condados pertenecientes al sistema. A través del nombre común y su nombre científico se buscó electronicamente en la biblioteca de Texas A&M University, los resúmenes (abstracts) desde los años 1972 al 2002 (CAB y BIOSIS) y luego se import directamente a este documento electronico cada resúmen usando END NOTE.

Resúmenes (abstracts): Estudios científicos realizados sobre cada una de las especies en peligro de extinción y amenazadas.

- En las distintas Ecoregiones de Nortíamerica pertenecientes a la cuenca de Río Grande: Mezquital Tamaulipeco, desierto Chihuahuense, Sur oeste de la Planicie de Edward , matorrales de la planicie de Colorado y pastizales costeros al oeste del Golfo de México.

- En las distintas ecoregiones de agua dulce de Norteamerica, Upper Rio Grande/Rio Bravo del norte, Pecos, Rio Conchos, Guzman, y Lower Rio Grande/Rio Bravo.

- En zonas cercanas a la cuenca y en otros estados fuera de la cuenca, pero en los Estados Unidos.

- En otros paises con las mismas especies en peligro y amenazadas.

Referencias: Estudios científicos, sin el resúmen anexo.

- Libros específicos para cada taxón y por cada región o estado perteneciente a la cuenca.

- Disco Compacto CD. con amplia información sobre la distribución de las especies amenazadas en el Estado de Texas (GIS Database for environmental Contaminants in Rio Grande/Rio Bravo Basin, USGS) Mora 2001 .

- Reportes, Informes y Revistas Científicas

Página Web: Información de conexión directa y de fácil conexión (en letras azules).

- Fotos, características, distribución, status actual, amenazas, recomendaciones y literatura citada.

- Información directa del Departamento del Interior, desde el Registro Federal vía el Internet , con información suplementaria de la especie, antecedentes, situación previa al registro, comentarios, recomendaciones, resúmen de los factores que afectan a la especie, hábitat, y medidas de conservación.

III. Summary of Species and References

Total Endangered and Threatened Species in the Rio Grande/ Rio Bravo Basin					
TAXON	TEXAS	NEW MEXICO	COLORADO	MEXICO	TOTAL
Invertebrates	21	22	2	?	43
Reptiles and Amphibians	24	11	2	2	35
Fishes	18	11	3	2	27
Birds	27	17	6	?	36
Mammals	14	8	1	1	18
Plants	22	?	?	?	22
Total/State	126	69	14	5	Total/Basin 181

Number of References for Endangered and Threatened Species in the Rio Grande/ Rio Bravo Basin				
TAXON	ABSTRACTS	REFERENCE	WEB PAGES	TOTAL/TAXON
Invertebrates	9	9	9	27
Reptiles and Amphibians	25	40	5	70
Fishes	33	14	7	54
Birds	39	47	17	103
Mammals	47	44	15	106
Plants	13	6	23	42
Total/Category	166	160	76	402

IV. Taxon Index

This bibliography includes annotations, references and unabridged documents intended to provide users with a summary of available scientific literature on the ecology, management, conservation and ecological models of the species considered as endangered and threatened.

Taxon	Orden/Groups
Invertebrates	Crustaceans Insects Mollusks Gastropoda
Reptiles and Amphibians Herps	Reptiles Turtles Lizards Snakes Salamanders Frogs and Toads
Fish	Large River Fish Minnows Suckers Killifishes Livebearers Perches Coastal Fish
Mammals	Bats Rodents Marine Mammals Carnivores Herbivores
Birds	Waterbirds Raptors Shorebirds Songbirds
Plants	Cacti Trees, Shrubs and Subshrubs Wildflowers Grasses and Grass-Like Plants

V. List of References

Endangered and Threatened Invertebrates in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

CRUSTACEANS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Socorro Isopod *Thermosphaeroma thermophilum*	E*		Jormailainem and Shuster 1997, 1999.	Shuster 1981	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/%20T%26E%20BR%20Booklet.pdf
Noel's amphipod *Gammarus desperatus*	E*			Cole 1981	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/%20T%26E%20BR%20Booklet.pdf
Peck's Cave Amphipod *Stygobromus pecki*	E	E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
INSECTS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
American Burying Beetle *Nicrophorus americanus*		E	Holloway and Schnell 1997. Lomolino and Creighton 1996. Lomolino et al. 1995		http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Comal Springs Riffle Beetle *Heterelmis comalensis*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Tooth Cave Ground Beetle *Rhadine persephone*		E			http://www.tpwd.state.tx.us/nature/endang/animals/thcavegb.htm
A Ground Beetle *Rhadine exilis*		E	Assman and Janssen 1999.		http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
A Ground Beetle *Rhadine infernalis*		E	Manderbach and Reich 1995.		http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Kretschmarr Cave Mold Beetle *Texamaurops reddelli*		E			http://www.tpwd.state.tx.us/nature/endang/animals/kretscv.htm
Coffin Cave Mold Beetle *Batrisodes texanus*		E	Franc 1997.		http://www.tpwd.state.tx.us/nature/endang/animals/coffcave.htm
Helotes Mold Beetle *Batrisodes venyivi*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Comal Springs Dryopid Beetle *Stygoparnus comalensis*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm

Invertebrates

SPIDERS AND RELATIVES	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Tooth Cave Spider *Neoleptoneta myopica*		E			http://www.tpwd.state.tx.us/nature/endang/animals/toothcsp.htm
Government Canyon Cave Spider *Neoleptoneta microps*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Bee Creek Cave Harvestman *Texella reddelli*		E			http://www.tpwd.state.tx.us/nature/endang/animals/beecrkhv.htm
Bone Cave Harvestman *Texella reyesi*		E			http://www.tpwd.state.tx.us/nature/endang/animals/boncavha.htm
Robber Baron Cave Harvestman *Texella cokendolpheri*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Tooth Cave Pseudoscorpion *Tartarocreagris texana*		E			http://www.tpwd.state.tx.us/nature/endang/animals/toothcps.htm
Madla's Cave Spider *Cicurina madla*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Robber Baron Cave Spider *Cicurina baronia*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Veni's Cave Spider *Cicurina venii*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Vesper Cave Spider *Cicurina vespera*		E			http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
MOLLUSKS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Texas hornshell *Popenaias popeii*	E*			Taylor 1983	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Ouachita Rock-pocketbook Mussel *Arkansia wheeleri*	E	E	Vaughn and Pyron 1995.		http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm
Pecos Assiminea Snail *Assiminea pecos*	E*	PE		Taylor 1983, 1987	http://www.tpwd.state.tx.us/nature/endang/animals/invertebrates.htm www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Swamp fingernailclam *Musculium partumeium*	T*			Taylor 1983	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Lilljeborg peaclam *Pisidium lilljeborgi*	T*			Taylor 1983	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf

Invertebrates

MOLLUSKS CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Sangre de Cristo peaclam *Pisidium sanguinichristi*	T*			Taylor 1983, 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
GASTROPODA	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Socorro Pyrg. *Pyrgulopsis neomexicana*	E*			Taylor 1983, 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Roswell Pyrg. *Pyrgulopsis roswellensis*	E*			Taylor 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Wrinkled marshnail *Stagnicola caperata*	E*			Taylor 1983, 1985	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Shortneck snaggletooth *Gastrocopta dalliana dalliana*	E*			Bequaert and Miller 1973	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Gila Pyrg *Pyrgulopsis gilae*	T*			Taylor 1983, 1987. Landye 1981.	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Pecos pyrg. *Pyrgulopsis pecosensis*	T*			Taylor 1983,1987. Landye 1981	http;//www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
New mexico hot spring Pyrg. *Pyrgulopsis thermalis*	*T**			Taylor 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Alamosa tryonia *Tryonia alamosae*	T*		Hershler 2001	Taylor 1983,1987. Melhop 1993.	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Koster's tryonia *Tryonia kosteri*	T*		Hershler 2001	Taylor 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Star gyro *Gyraulus crista*	T*		Strzelec 1999	Taylor 1983	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Ovate vertigo *Vertigo ovata*	T*			Bequaert and Miller 1973.	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Mineral Creek mountainsnail *Oreohelix pilsbryi*	T*			Metcalf and Smartt 1997.	http;//www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Doña Ana talussnail *Sonorella todseni*	T*			Metcalf and Smartt 1997	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf

Endangered and Threatened Reptiles and Amphibians in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

REPTILES	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
General information				Mora 2001 Dixon 1987	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm http://wildlife.state.co.us/T&E/list.asp
TURTLES	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
General information				Hobart and Chizszar 1997. Boundy 1994	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Loggerhead Sea Turtle *Caretta caretta*	T	T	Plotkin et al.1993 Heppell 1996, 2000 Chaloupka and Limpus 2002 Shaver 1998	Crowder 2001	http://www.nmfs.noaa.gov/prot_res/PR3/Turtles/turtles.html http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Green Sea Turtle *Chelonia mydas*	T	T	Chaloupka 2002 Chaolupka 2001 Shaver 1998		http://www.nmfs.noaa.gov/prot_res/PR3/Turtles/turtles.html http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Atlantic Hawksbill Sea Turtle *Eretmochelys imbricata*	E	E	Shaver 1998 Shaver 1994		http://www.nmfs.noaa.gov/prot_res/PR3/Turtles/turtles.html http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Kemp's Ridley Sea Turtle *Lepidochelys kempii*	E	E	Kenyon et al. 2001. Fretey 1999 Renaud 1995 Renaud and Carpenter 1996 Shaver 1980 Shaver 1998	Dunaus 1996 Marquez et al. 1995. Ren 1995	http://www.nmfs.noaa.gov/prot_res/PR3/Turtles/turtles.html http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm

TURTLES CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Leatherback Sea Turtle *Dermochelys coriacea*	E	E	Shaver 1998	Crowder 2001 Sampaio 1999	http://www.nmfs.noaa.gov/prot_res/PR3/Turtles/turtles.html http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Chihuahuan Mud Turtle *Kinosternon hirtipes*	T		Ligon and Peterson 2000		http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Texas Tortoise *Gopherus berlandieri*	T		Kasmaier et al. 2001(a),(b),(c), (d)	Gerrnano 1994 Bury and Germano 1994 Smith and Chiszar 1997	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Western river cooter *Pseudemys gorzugi*	T*		Seidel 1994	Degenhardt et al. 1996 Stuart 1995	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
LIZARDS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Reticulated Gecko *Coleonyx reticulatus*	T				http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Reticulate Collared Lizard *Crotaphytus reticulatus*	T				http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Texas Horned Lizard *Phrynosoma cornutum*	T E+		Fair and Scott 1999 Burrow et al. 2001 Blackshear and Richerson 1999 Cohen and Cohen 1990	Donaldson et al.1994 Runyan and Mehlhop 1997	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm http://wildlife.state.co.us/T&E/list.asp
Mountain Short-Horned Lizard *Phrynosoma hernandesi*	T				http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Sand dune lizard *Sceloporus arenoculus*	T*			Degenhardt et al. 1996	www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
SNAKES	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Black-Striped Snake *Coniophanes imperialis*	T			Mejenes et al. 1999 Smith et al. 1993	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Indigo Snake *Drymarchon corais*	T			Enkerlin et al.1993 Rossi 1994	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Speckled Racer *Drymobius margaritiferus*	T				http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Northern Cat-Eyed Snake *Leptodeira septentrionalis*	T			Russell 1999 (a), (b)	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm

SNAKES CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Concho Water Snake *Nerodia paucimaculata*		T			http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Big Bend Blackhead Snake *Tantilla cucullata*	T				http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Texas Lyre Snake *Trimorphodon biscutatus*	T			Boundy 1994	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Plainbelly water snake *Nerodia erythogaster*	E*			Paiter 1991 Degenhardt et al. 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Gray-banded kingsnake *Lampropeltis alterna*	E*			Degenhardt et al. 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
(Mottled) rock rattlesnake *Crotalus lepidus lepidus*	T*		Forstner et al. 1997 Beaupre 1993	Swinford 1990 Dickerman and Painter 2001. Lemos et al. 2000	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Narrow head garter snake *Thamnophis rufipunctatus*	T*		De Queiroz et al. 2001	Degenhardt et al. 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Sacramento mountain salamander *Aneides hardii*	T*			Ramotnik 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
SALAMANDERS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Black-Spotted Newt *Notophthalmus meridionalis*	T			Boundy 1994 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
South Texas Siren (large form) *Siren* sp. 1	T		McAllister and McDaniel 1992	Boundy 1994 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Jemez Mountains salamander *Plethodon neomexicanus*	T*			Williams 1973 Wiltenmuth 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Gila Monster *Heloderma suspectum*	E*		Gienger and Tracy 2001	Shaw 1950 Degenhardt et al. 1996 Sullivan et al. 2002 Jennings and Beck 1997 Goldberg and Lowe 1997	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf

Reptiles and Amphibians

FROGS AND TOADS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Mexican Treefrog *Smilisca baudinii*	T		Lee 1993	Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
White-Lipped Frog *Leptodactylus labialis*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Sheep Frog *Hypopachus variolosus*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Mexican Burrowing Toad *Rhinophrynus dorsalis*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/reptile.htm
Lowland leopard frog *Rana yavapaiensis*	E*		Jaeger et al.2001 Sartorius and Rosen 2000	Jennings 1987 Degenhardt et al. 1996	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf
Western Toad *Bufo boreas*	E* E+		Chivers et al. 1999	Stuart and Paiter 1994	http://www.gmfsh.state.nm.us/Page_MillImages/NonGame/T&E BR Booklet.pdf http://wildlife.state.co.us/T&E/list.asp

Endangered and Threatened Fish in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

FISH	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
General information			Mora et al. 2001 Contreras and Lozano 1994	Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf http://www.cnr.vt.edu/fishex/nmex_main/species/ http://wildlife.state.co.us/T&E/list.asp
LARGE RIVER FISH	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Shovelnose Sturgeon *Scaphirhynchus platorynchus*	T		Keenlyne 1997	Mora 2001 Lee et al. 1980	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
MINNOWS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Mexican Stoneroller *Campostoma ornatum*	T			Lee et al. 1980 Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Devils River Minnow *Dionda diaboli*	T	T	Cantu and Winemiller 1997	Lee et al. 1980 Mora 2001	http://ecos.fws.gov/servlet/TESSpeciesreport/genate http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Rio Grande Chub *Gila pandora*	T SCE+			Mora, 2001 Lee et al. 1980 Rinne 1995	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://wildlife.state.co.us/T&E/list.asp
Rio Grande Silvery Minnow *Hybognathus amarus*	E E*	E	Platania and Altenbach 1998. Bestgen and Propst 1996. Beyer 1995. Booker and Ward 1999.	Bestgen and Platania, 1991	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Chihuahua Shiner *Notropis chihuahua*	T			Mora, 2001 Lee et al. 1980	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm

Fish

MINNOWS CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Proserpine Shiner *Cyprinella proserpina*	T		Richardson and Gold 1999. Cantu and Winemiller 1997.	Lee et al. 1980 Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
SUCKERS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Blue Sucker *Cycleptus elongatus*	T E*		Burr et al.1996	Lee et al. 1980 Gehlbach and Miller 1961 Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Rio grande Sucker *Catostomus plebeius*	E* SCE+		Calamusso et al. 2002 Swift-M et al.1999a,1999b	Rinne 1995	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://wildlife.state.co.us/T&E/list.asp http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
KILLFISHES	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Leon Springs Pupfish *Cyprinodon bovinus*	E	E	Sappington et al. 2001 Echelle and Echelle 1995,1997	Lee et al. 1980 Campbell 1995 Mora 2001	http://ecos.fws.gov/servlet/TESSpeciesreport/genate http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Comanche Springs Pupfish *Cyprinodon elegans*	E	E	Winemiller and Anderson 1997. David 1979,1980. Echelle and Echelle 1995	Lee et al. 1980 Campbell 1995 Mora 2001	http://ecos.fws.gov/servlet/TESSpeciesreport/genate http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Conchos Pupfish *Cyprinodon eximius*	T		Cantu and Winemiller 1997. Echelle and Echelle 1995.	Lee et al. 1980 Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Pecos Pupfish *Cyprinodon pecosensis*	T T*		Wilde 1997, Child 1996, Echelle and Echelle 1995. Davis 1980, Wilde and Echelle 1997.	Lee et al. 1980 Echelle et al.1997 Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf

Fish

LIVEBEARERS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Big Bend Gambusia *Gambusia gaigei*	E	E	Hubbs 2001	Campbell 1995 Mora 2001	http://ecos.fws.gov/servlet/TESSpeciesreport/genate http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Pecos Gambusia *Gambusia nobilis*	E E*	E	Hubbs and Karges 1999 Hubbs 1999,2001. Winemiller and Anderson 1997. Berduaz 1979	Lee et al. 1980 Campbell 1995 Mora 2001	http://ecos.fws.gov/servlet/TESSpeciesreport/genate http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Blotched Gambusia *Gambusia senilis*	T		Hubbs 1999	Mora 2001 Lee et al. 1980	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
PERCHES	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Rio Grande Darter *Etheostoma grahami*	T		Cantu and Winemiller 1997	Aguilera 1999 Mora, 2001 Lee et al. 1980	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
COASTAL FISH	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
River Goby *Awaous banana*	T			Mora 2001	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm hppt://www.ims.usm.edu/~musweb/awous.htm (May 26,1998)
Blackfin Goby *Gobionellus atripinnis*	T			Mora, 2001 Lee et al. 1980	http:/www.tpwd.state.tx.us/nature/endang/animals/aquatic.htm
Rio Grande Cutthroat trout *Oncorhynchus clarki virginialis*	E* SCE+		Despain et al. 2000		http://www.gmfsh.state.nm.us/ http://wildlife.state.co.us/T&E/list.asp http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Mexican Treta *Astyanax mexucanus*	T*			Koster 1957	http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
(Pecos) bluntnose shiner *Notropis sinus pecosensis*	T*			Hatch et al. 1985	http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Gray redhorse *Scartomyzon congestum*	T*			Cowley and Sublette 1987	http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf

Fish

COASTAL FISH CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Green Throat darter Etheostoma lepidum	T*			Anderson et al. 1995	http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Bigscale Logperch *Percina macrolepida*	T*			Stevenson 1971	http://www.gmfsh.state.nm.us/PageMill_Images/Publication/esfish.pdf
Chirostoma charari	E **		Soto et al . 1999		
Chirostoma compressum	E **		Soto et al. 1999		

Endangered and Threatened Mammals in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

MAMMALS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
General Information	E T E*T*			Davis and Schmidly 1994 Findley et al. 1975	http://www.tpwd.state.tx.us/animalia.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
BATS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Mexica Long-nosed Bat *Leptonycteris nivalis*	E E*	E E*	Moreno et al.2001 Vargas and Hernandez, 2001	Mora 2001 Eastrela 1972 Hoyt et al . 1994	http://www.tpwd.state.tx.us/nature/endang/animals/lnosebat.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Southern Yellow Bat *Lasiurus ega*	T		Sheeler and Smith 2001. O'Farrel et al. 1999	Mora 2001 Kurta 1995	http://www.nsrl.ttu.edu/tmot1/lasiega_.htm
Spotted Bat *Euderma maculatum*	T T*		Rabe et al. 1998 Perry et al. 1997 Fullard and Dawson 1997 Obrist 1995 Storz 1995	Mora 2001 Eastrela 1973 Perry et al. 1995	http://www.nsrl.ttu.edu/tmot1/eudemacu.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
Long nosed Bat *Leptonycteris curasoae*	*E* T*	E	Rojas et al. 1999 Flemming et al. 1998. Eguiarte and Burguez 1987. Martino et al. 2002. Arizaga et al. 2000 Ceballos et al. 1999. Valiente et al. 1996	Fleming 1994, 2000 Hinmann 1999 Tellez et al. 2000 Jorgensen et al.1994 Findley et al. 1975	http://www.tpwd.state.tx.us/animalia.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
RODENTS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Coues' Rice Rat *Oryzomys couesi*	T		Vazquez et al. 2000	Mora 2001 Alvarez 1994	http://www.nsrl.ttu.edu/tmot1/oryzcoue.htm http://www.tpwd.state.tx.us/nature/endang/animals/animalia

Mammals

RODENTS CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Least Shrew *Cryptotis parva*	T*			Choate and Reed 1988. Hoditschek et al. 1985	httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
Colorado chipmunk *Tamias quadrivittatus asutralis*	T*			Findley et al. 1975 Sullivan 1996	httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
MARINE MAMMALS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Atlantic Spotted Dolphin *Stenella frontalis*	T		Davis et al. 1998 Wursig et al. 1998 Delgado 1997. Jefferson and Schiro 1997 Mullin et al. 1994 Jefferson and Lymn 1994.	Davis et al. 1996 Mills and Rademarcher 1996 Zavala et al. 1994	http://www.nsrl.ttu.edu/tmot1/stenfron.htm http://www.tpwd.state.tx.us/nature/endang/animals/animalia http://www.nmfs.noaa.gov/prot_res/species/Cetaceans/cetaceans.html
West Indian Manatee *Trichechus manatus*	E	E	Ames and Vleet 1996. Marsh and Lefebre 1994	O'shea et al.2001 Bossart 1999. Baumgardner and Brooks 2001.	http://www.nsrl.ttu.edu/tmot1/tricmana.htm http://www.tpwd.state.tx.us/nature/endang/animals/animalia
CARNIVORES	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Grey Wolf *Canis lupus*	E E* E+	E E*	Mladenoff et al. 1999. Mech 1998 Mladenoff and Sickley 1998	Wayne and Brown 2001 Brown 1983 McBride 1980	http://www.tpwd.state.tx.us/animalia.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. Pdf http://wildlife.state.co.us/T&E/list.asp
Black Bear *Ursus americanus*	T	T	McClinton et al.1992 Rudis and Tansey 1995	Mora 2001	http://www.nsrl.ttu.edu/tmot1/ursuamer http://www.tpwd.state.tx.us/nature/endang/animals/animalia
Mexican Wolf (Lobo gris mexicano) *Canis lupus baileyi*	E		Garcia Moreno et al.1996 Servin 1997, 2000 Warren et al 2000	Parsons and Nicholopoulus 1995. Parsons 1998	http://www.tpwd.state.tx.us/animalia.htm httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
White-nosed Coati *Nasua narica*	T		Valenzuela and Ceballos 2000 Aranda and Lopez 1999 Mora et al. 1999 Escamilla et al.2000 Gompper et al. 1997	Mora 2001 Russell 1996 Gompper 1995 Ratnayeke et al. 1994	http://www.nsrl.ttu.edu/tmot1/nasunari.htm http://www.tpwd.state.tx.us/nature/endang/animals/animalia

Mammals

CARNIVORES CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Ocelot *Felis pardalis*	E	E	Mora et al. 2000 Chiarello 2000 Shindler and Tewes 1998 Pence et al. 1995	Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/ocelot.htm
Jaguarundi *Felis yaguarondi*	E	E	Pope et al. 1998 Swanson and Wilds 1997	Mora 2001 Sanchez et al. 2002	http://www.tpwd.state.tx.us/nature/endang/animals/jag.htm
American marten Martes americana	T*			Koehler and Hornocker 1977 Soutierre 1979	httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
HERBIVORES	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
(Deser) bighorn sheep *Ovis canadensis mexicana*	E*			Buechner 1960	httm://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet. pdf
Colombian white-tailed deer *Odocoileus virginianus*	E	E	Ruthven et al. 1994 Steuter and Wright 1980		

Endangered and Threatened Birds in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

BIRDS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
General Information			Wainwright et al. 2001. Farley et al. 1994	Rappole and Blacklock 1994 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://endangered.fws.gov/wildlife.html#Species http://wildlife.state.co.us/T&E/list.asp
WATERBIRDS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
"Eastern" Brown pelican *Pelecanus occidentalis*	E E*	E	Wilkinson et al.1994 Blus et al. 1974	Williams 1999	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Reddish egret *Egretta rufescens*	T				http;//www.glo.state.tx.us/wetnet/species/egrets.html
White-faced ibis *Plegadis chihi*	T		Mora 1997	Flickinger and Meeker 1972	http://www.tpwd.state.tx.us/nature/wild/birds/ibis/htm
Wood stork *Mycteria americana*	T				http://www.tpwd.state.tx.us/nature/endang/animals/birds http://ecos.fws.gov/servlet/speciesProfile?spcode=B060
Leasts tern *Sterna antillarum*	E E* E+		Hooperm et al.1998 Lockely 1995	Hubbard 1978 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf http://wildlife.state.co.us/T&E/list.asp
RAPTORS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Swallow-tailed kite *Elanoides forficatus*	T				http://www.tpwd.state.tx.us/nature/birding/swallowtailedkite/annual_report/index.htm
Common black-hawk *Buteogallus anthracinus*	T T*			Skaggs 1996	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
White-tailed hawk *Buteo albicaudatus*	T				http://www.tpwd.state.tx.us/nature/endang/animals/birds

Birds

RAPTORS CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Zone-tailed hawk *Buteo albonotatus*	T				http://www.tpwd.state.tx.us/nature/endang/birds/index.htm
Northern aplomado falcon *Falco femoralis septentrionalis*	E E*	E	Mora et al. 1997 Mora and Wainwright 1998	Rappole and Blacklock 1994 Ligon 1961 Montoya et al.1997 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/birds/aplomfal.htm http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Peregrine falcon *Falco peregrinus*	E,T T* SC+	D	Lanning and Lawson 1977 Mora 1997 Mora et al.2002 Ins.CDR1977 a,b Kennedy et al. 1995 Key 1980 Hitchcock 1977	Rappole and Blacklock 1994 Mora 2001 Johnson 1999	http://www.tpwd.state.tx.us/nature/endang/birds/peregrin.htm http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf http://wildlife.state.co.us/T&E/list.asp
Cactus ferruginous pygmy-owl *Glaucidium brasilianum cactorum*	T	PE		Rappole and Blacklock 1994	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://refuges.fws.gov/NWRSFiles/WildlifeMgmt/SpeciesAccounts/Birds/Cactus
"Mexican" spotted owl *Strix occidentalis lucida*	T T+	T	Ward and Salas 2000 Seamans et al. 1999. Young et al. 1998. Delaney et al. 1999. Chojnacky and Dick 2000. Swarthout and Steidl 2001. Peery et al. 1999 Sureda and Morrison 1998. Ganey et al. 1999. Despain et al. 2000. Enriquez-R and Rangel 1993. Fiedler and Cully 1995.	Mealey et al. 1984 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/birds/mexowl.htm http://wildlife.state.co.us/T&E/list.asp
Bald eagle *Haliaeetus leucocephalus*	T* T+			Williams 2000	http://wildlife.state.co.us/T&E/list.asp http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf

Birds

SHOREBIRDS	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Piping plover *Charadrius melodus*	T T* T+	T	Loegering et al. 1995 Watts and Bradshaw 1995	Ryan et al. 1993 William 1995 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/birds/piplover.htm http://wildlife.state.co.us/T&E/list.asp www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
"Interior" least tern *Sterna antillarum athalassos*	E	E	Allen et al. 1998	Ryan and Kluza 1999 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://eelink.net/EndSpp.old.bak/interior.html
Sooty tern *Sterna fuscata*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds
SONGBIRDS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
"Northern" beardless-tyrannulet *Camptostoma imberbe*	**T**			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds
"Southwestern" willow flycatcher *Empidonax traillii extimus*	E	E	Finch and Stoleson 2002 Schweitzer et al. 1998		http://www.tpwd.state.tx.us/nature/endang/animals/birds http://ecos.fws.gov/servlet/SpeciesProfile?spcode=B094
Rose-throated becard *Pachyramphus aglaiae*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds
Black-capped vireo *Vireo atricapillus*	E	E	Grzybowski et al. 1994 Schnepf et al. 1998	Mora 2001	http://www.tpwd.state.tx.us/nature/endang/birds/bcv.htm
Tropical parula *Parula pitiayumi nigrilora*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds
Golden-cheeked warbler *Dendroica chrysoparia*	E	E	Kroll 1980 Rappole et al. 1999	Mora 2001	http://www.tpwd.state.tx.us/nature/endang/birds/gcw.htm
"Texas" Botteri's sparrow *Aimophila Botterii texana*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds
"Arizona" Botteri's sparrow *Aimophila Botterii arizonae*	T			Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Ferruginous pygmy owl *Glaucidium brasilianum*	E			Rappole and Blacklock 1994	http://www.tpwd.state.tx.us/nature/endang/animals/birds
Spotted owl *Strix occidentalis*	E				http://www.tpwd.state.tx.us/nature/endang/animals/birds
Willow flycatcher *Empidonax trailli*	E E* E+			Unit 1987 William and Leal 1998 Mora 2001	http://www.tpwd.state.tx.us/nature/endang/animals/birds http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf http://wildlife.state.co.us/T&E/list.asp

Birds

SONGBIRDS CONTINUED	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
White tailed ptarmigan *Lagopus leucuras*	E*			Ligon 1961	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Common ground –dove *Columbina passerina*	E*			Ligon 1961	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Buff-collared nightjar *Caprimulgus ridgwayi*	E*			Williams 1999	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Elegant trogon *Trogon elegans*	E*			Hall and Karubian 1996	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Neotropic Cormorant *Phalacrocorax brasilianus*	T*			Hundertmark 1974	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Broad-billed hummingbird *Cynanthus latirostris*	T			Williams 1998	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Bell's vireo *Vireo belli*	T*			Hubbard 1978	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Gray vireo *Vireo vicinior*	T*				http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf
Varied bunting *Passerina versicolor*	T*			Williams 1994	http://www.gmfsh.state.nm.us/PageMill_Images/NonGame/T&E BR Booklet.pdf

Endangered and Threatened Plants in the Rio Grande Basin

Endangered (E), Threatened (T) or Proposed Endangered (PE)
State Status (SS): Texas ( ), New Mexico (*), Colorado (+) or Mexico (**)
Federal Status (FS)

CACTI	SS	FS	ANNOTATED	REFERENCE	WEB PAGE
Tobusch Fishhook Cactus *Ancistrocactus tobuschii*	E	E	Sutton et al. 1997	Lockwood 1995	http://www.tpwd.state.tx.us/nature/endang/plants/tobusch.htm
Bunched Cory Cactus *Coryphantha ramillosa*	T	T			http://www.tpwd.state.tx.us/nature/endang/plants/bunchcc.htm
Black Lace Cactus *Echinocereus reichenbachii* var. *albertii*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/blkcca.htm
Davis' Green Pitaya *Echinocereus viridiflorus* var. *davisii*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/davgrpit.htm
Chisos Mountains Hedgehog Cactus *Echinocereus chisoensis* var. *chisoensis*	T	T			http://www.tpwd.state.tx.us/nature/endang/plants/chios.htm
Lloyd's Mariposa Cactus *Neolloydia mariposensis*	T	T			http://www.tpwd.state.tx.us/nature/endang/plants/maripcac.htm
Nellie Cory Cactus *Coryphantha minima*	E	E	Malda et al. 1999		http://www.tpwd.state.tx.us/nature/endang/plants/nellicac.htm
Sneed Pincushion Cactus *Coryphantha sneedii* var. *sneedii*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/sneedcac.htm
Star cactus *Astrophytum asterias*	E	E	Rodriguez 1994	Wu and Smeins 1996	http://www.tpwd.state.tx.us/nature/endang/plants/starcac.htm
TREES, SHRUBS and SUBSHRUBS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Hinckley's Oak *Quercus hinckleyi*	T	T			http://www.tpwd.state.tx.us/nature/endang/plants/hinkley.htm
Johnston's Frankenia *Frankenia johnstonii*	E	E	Wu and Smeins 2000	Wu and Smeins 1996	http://www.tpwd.state.tx.us/nature/endang/plants/johnston.htm

Plants

TREES, SHRUBS and SUBSHRUBS CONTINUED	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Texas Snowbells *Styrax texanus*	E	E	Turner and Guy 2000 Fritsch 1997	McDonald 1996	http://www.tpwd.state.tx.us/nature/endang/plants/snowbell.htm
Walker's Manioc *Manihot walkerae*	E	E	Wu and Smeins 2000		http://www.tpwd.state.tx.us/nature/endang/plants/wmanioc.htm
WILDFLOWERS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
South Texas Ambrosia *Ambrosia cheiranthifolia*	E	E	Wu and Smeins 2000	Wu et al. 1997	http://www.tpwd.state.tx.us/nature/endang/plants/ambrosia.htm http://www.tpwd.state.tx.us/publications/wildlife_habitat/pdf_docs/s_tx_ambrosia_t_e.pdf
Puzzle Sunflower, Pecos Sunflower *Helianthus paradoxus*	T	T			http://www.tpwd.state.tx.us/nature/endang/plants/plants
Ashy Dogweed *Thymophylla tephroleuca*	E	E	Crank 1992		http://www.tpwd.state.tx.us/nature/endang/plants/ashy.htm
Terlingua Creek Cat's-eye *Cryptantha crassipes*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/terlingu.htm
Slender Rush-pea *Hoffmannseggia tenella*	E	E	Simpson 1999		http://www.tpwd.state.tx.us/nature/endang/plants/rushpea.htm
Texas Poppy-mallow *Callirhoe scabriuscula*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/popmallo.htm
American Chaffseed *Schwalbea americana*		E	Kirkman et al. 1998 Obee and Robert 1997 Helton et al.2000		http://www.tpwd.state.tx.us/nature/endang/plants/chafseed.htm
GRASSES AND GRASS-LIKE PLANTS	**SS**	**FS**	**ANNOTATED**	**REFERENCE**	**WEB PAGE**
Little Aguja Pondweed *Potamogeton clystocarpus*	E	E			http://www.tpwd.state.tx.us/nature/endang/plants/littleag.htm
Texas ayenia *Ayenia limitaris*					

VI. Abstracts and References

Abell, R. A., D. M. Olson, et al. 2000. Freshwater Ecoregions of North America. Washington D.C., Island Press. 319 pp.

Aguilera, C., R. Mendoza, et al. 1999. Eggs, larvae, and early juveniles of *Etheostoma grahami* (Teleostei: Percidae). Southwestern Naturalist 44(2): 214-218.

Allen, G. T., S. H. Blackford, et al. 1998. Arsenic, mercury, selenium, and organochlorines and reproduction of interior least terns in the northern Great Plains, 1992-1994. Colonial Waterbirds 21(3): 356-366.

> Concentrations of arsenic, mercury, and selenium were evaluated in 104 eggs and chlorinated hydrocarbon compounds in 78 eggs of Interior Least Terns (*Sterna antillarum athalassos*) from Kansas, Nebraska, South Dakota, North Dakota, and Montana from 1992 through 1994. Data on Least Tern reproduction in the region were also reviewed. Arsenic was detected in only 13 eggs; it is considered unlikely that it affected the populations studied. The geometric mean mercury concentration for each state each year was below the level known to affect other avian species. Eighty percent of the eggs contained more than the three micro g g-1 dry-weight selenium concentration considered unsafe for avian reproductive success. Concentrations of chlorinated hydrocarbons were too low to have affected nesting success. Nesting success reported for the study area was not sufficient to support the local populations. Nest flooding and predation probably were the major causes of low recruitment, but determination of the effect level for selenium in Least Tern eggs is needed.

Alvarez-Castaneda Sergio, T. 1994. Current status of the rice rat, *Oryzomys couesi peninsularis*. Southwestern Naturalist. 39(1): 99-100.

Ames, A. L. and E. S. van Vleet. 1996. Organochlorine residues in the Florida manatee, *Trichechus manatus latirostris*. Marine Pollution Bulletin 32(4): 374-377.

> Forty-five tissue samples, consisting of 15 liver samples, 19 kidney samples and 11 blubber samples from the Florida manatee, *Trichechus manatus latirostris*, were analyzed using GC and combined GC-MS for a variety of chlorinated hydrocarbons. Pesticides (o,p-DDT, o,p-DDD [TDE], hexachlorobenzene and lindane) were detected in all 3 tissues, but they were found most frequently in the liver and kidney. However, due to the low frequency of observed pesticides, their concn could not be related to age, sex length or the geographical location where the manatee carcasses were recovered. Compared to most manatees in the study, 1 female perinatal manatee born in captivity had elevated concn of lindane in the liver and TDE in the kidney, suggesting that the pesticides found in this animal were transferred from the mother prior to birth.

Anderson, A. A., C. Hubbs, et al. 1995. Texas fresh water fish assemblages following three decades of environmental change. The Southwestern naturalist 40: 314 -321.

Aranda, M. and L. Lopez-de Buen. 1999. Rabies in skunks from Mexico. Journal of Wildlife Diseases. 35(3): 574-577.

An enzootic focus of rabies in skunks in Mexico is described. Fifty three wild animals including two badgers (*Taxidea taxus*), 32 bats (various species), one bobcat (*Lynx rufus*), two coatis (*Nasua narica*) three foxes (*Urocyon cineroargenteus*), one raccoon (*Procyon lotor*) and 12 skunks (see below) were tested for rabies by direct immunofluorescence assay from 1991 to 1997 in the central part of San Luis Potosi State, Mexico. Rabies occurrence was 21% of all tested mammals, with 19% in skunks and only 2% in other wild species (one bobcat). Skunks represented 23% of all mammals tested and had a rabies prevalence of 83%. Only 10 individuals were identified: three hog-nosed skunks (*Conepatus leuconotus*) and seven spotted skunks (*Spilogale putorius*). All were involved in human attacks; the spotted skunk attacks were inside bedrooms while people were sleeping, and the hog-nosed skunk attacks occurred outdoors. Skunk cases of rabies represented 40% of all rabies cases in 1997, and100% of cases registered for wild animals in San Luis Potosi state. This situation constitutes an important public health problem and requires further epidemiological research to make the human population aware of the problem and to establish measures to limit further human attacks by rabid skunks.

Arizaga, S., E. Ezcurra, et al. 2000. Pollination ecology of *Agave macroacantha* (Agavaceae) in a Mexican tropical desert. II. The role of pollinators. American Journal of Botany. 87(7): 1011-1017.

We did a series of observational studies and manipulative experiments on the guild of nocturnal visitors of *Agave macroacantha*, including (1) a description of the hourly patterns of visits by moths and bats, (2) an evaluation of the relative contribution of bats and moths to flowering success, and (3) an evaluation of the pollination efficiency of the different bat species. Scapes exposed to moths but excluded to bats yielded apprx50% fewer fruits than those exposed to both pollinator groups. Flowers exposed to the bat species *Leptonycteris curasoae* showed similar fruiting success to those exposed to *Choeronycteris mexicana* and to those exposed to the whole nocturnal visitor guild. However, the fruits originated from flowers pollinated by *Leptonycteris curasoae* yielded significantly more seed than those exposed to *Choeronycteris mexicana* or to the whole pollinator guild. It is concluded that Agave macroacantha is extremely dependent on nocturnal pollinators for its reproductive success and that bats are especially important for successful pollination. Some of these pollinators are migratory and have been reported to be steadily declining. A continuing decline in the populations of pollinators may impede the successful sexual reproduction of the plant host and may put the long-term survival of this agave species under risk.

Assmann, T. and J. Janssen. 1999. The effects of habitat changes on the endangered ground beetle *Carabus nitens (Coleoptera: Carabidae).* Journal of Insect Conservation. 3(2). 107-116.

Carabus nitens, one of the most endangered ground beetles in Central Europe, was investigated with pitfall traps at 30 sampling sites in 17 heath fragments of the largest German heath landscape under nature conservation (nature reserve 'Luneburger Heide'). The preference for damp Erica heaths and dry Calluna heaths in the building phase was thereby evident. Calluna heaths in the mature and degenerate phase, with and without extensive coverage by Avenella flexuosa, are either not inhabited or are avoided. The results of ovary dissections indicate that the populations in two successive spring seasons consisted mainly of animals which had already reproduced and were therefore older than one and a half years. Allozyme electrophoreses revealed variation for three of the nine investigated enzyme loci, and large differences in the allele frequency at one of these loci indicated genetic drift and fluctuations in the size of local populations. According to these results and statements in the literature, the loss of heathland areas and habitat quality are both responsible for the decline of the species. Suitable measures for preserving the species are (1) restoration of building phases of the Calluna heaths and (2) interconnection of at least the smaller heath fragments. Finally, recommendations are given for reintroductions.

Ballard Warren, B., A. Whitlaw Heather, et al. 2000. Survival of female elk in northern Arizona. Journal of Wildlife Management. 64(2). 500-504.

Because modeling and sound management of ungulate populations requires reliable estimates of survival and mortality, we measured survival and cause-specific mortality rates for 43 yearling and 197 adult, radio-collared female elk (*Cervus elaphus*) in hunted and unhunted areas of northern Arizona during 1985-93, and for 18 adult radio-collared females from the moderately hunted White Mountain Tribal Reservation (1983-85). Hunting-related causes were the largest source (62%) of adult mortality. Annual survival was highest in the unhunted segment of the population (0.969). Elk survival rates in northern Arizona are representative of an expanding elk population with few limiting factors, and our data provides baseline information for Mexican wolf *(Canis lupus baileyi)* reintroductions.

Baumgardner, G. D. and D. M. Brooks. 2001. Documentation of West Indian manatee *Trichecus manatus* (Mammalian: Sirenia) from San Jose Island, Aransas County, Texas. Texas Journal of Science 53(3): 292-294.

Beaupre, Steven, J. 1993. An ecological study of oxygen consumption in the mottled rock rattlesnake, *Crotalus lepidus lepidus*, and the black-tailed rattlesnake, *Crotalus molossus molossus*, from two populations. Physiological Zoology. 66(3): 437-454.

Studies of metabolism are critical to calculating ecological energy balance. Metabolism of rattlesnakes as a group has been little studied. I investigated the effects of mass, temperature, sex, time of day, population of origin, and species on O-2 consumption of field-acclimatized *Crotalus lepidus lepidus* and *Crotalus molossus molossus* from two populations in Big Bend National Park. Factors that significantly affected O-2 consumption included mass, temperature, sex, time of day, and population of origin. No mass-independent differences between these species were identified. Populations significantly differed in the relationship between body mass and metabolic rate. Oxygen consumption increased with increasing temperature and was lowest between 0700 and 1300 hours CDT. Non-gravid females had lower rates of O-2 consumption at 25 degree C than did gravid females and males. This is consistent with results of some previous studies. Mass-specific metabolic rates of *C. l. lepidus* and *C. m. molossus* were lower than those of other snakes studied to date. Regression models for the prediction of maintenance cost as a function of body mass and temperature are reported.

Beduarz, J. C. *1979.* Ecology and status of the Pecos gambusia, *Gambusia nobilis (Poeciliidae),* in New Mexico. Southwestern Naturalist 24(2): 311-322.

The *Pecos gambusia (Gambusia nobilis),* an endangered species of fish, formerly occurred throughout the lower Pecos River drainage. In New Mexico it is presently limited to seven isolated locations at Bitter Lake National Refuge (Chaves County) and one population at Blue Spring (Eddy County). An estimate of these populations is approximately 933,500 fish. Natural cover used by *Pecos gambusia* consisted of aquatic vegetation and submerged cliffs. A transplanting operation in 1973 to establish additional *G. nobilis* populations at the refuge was successful in two of 19 attempts. Reasons for stocking failures were unknown, but water quality may have been a factor as no *G. nobilis* were found in habitats where hardness exceeded 5,100 mg/l or conductivity greater than 28,000 micromhos. Also, the presence of green sunfish (*Lepomis cyanellus*) and the lack of aquatic vegetation were probably factors in one case. An estimated 900,000 *G. nobilis* and over 2,000,000 *G. affinis* were found sympatrically throughout Blue Spring. The proportion of *G. nobilis* collected was greatest in spring flows or seepages. *Pecos gambusia* were found to feed on dipterans and other surface or sub-surface insects of suitable size. Dissection of 20 gravid *G. nobilis* revealed a mean of 38 plus or minus embryos, which was significantly less than *G. affinis*, with a mean of 56 embryos. The smallest male *G. nobilis* found with a mature gonopodium was 22 mm, standard length.

Bequaert, J. C. and W. B. Miller. 1973. The mollusks of the Arid Southwest with an Arizona checklist. Tucson, University of Arizona. 271 pp.

Bestgen, K. R. and S. P. Platania 1991. Status and conservation of the Rio Grande silvery minnow, *Hybognathus amarus*. The Southwestern Naturalist 36: 225 - 232.

Bestgen, K. R. and D. L. Propst .1996. Redescription, geographic variation, and taxonomic status of Rio Grande silvery minnow, *Hybognathus amarus* (Girard,

1856). Copeia (1): 41-55.

Hybognathus amarus is redescribed and geographic variation assessed to resolve its taxonomic status. *Hybognathus amarus* is distinguished from congeners by its small size, ovate cross-section, short basioccipital with a wide and shallowly concave posterior margin, moderate orbit diameter that is less than gape width or snout length, rounded snout, subterminal mouth, lateral band that does not intersect the lateral line, and relatively short intestine. Characters and univariate and multivariate analyses of morphometric variables support recognition of *H. amarus* as a valid taxon but did not support designation of subspecies for *H. amarus* from the Rio Grande, New Mexico; the Pecos River, New Mexico; or the lower Rio Grande, Texas. Rather, most geographic variation was at the scale of subsamples within those regions. Comparisons of body size, orbit diameter, gape and body width, body circumferential scale counts, and basioccipital process shape useful for identification of all *Hybognathus* species are presented. Conservation measures are needed to ensure survival of the formerly widespread and common *H. amarus*, since it presently occurs only in the middle Rio Grande, New Mexico, which is lt 10% of its original range.

Beyers, D. W. 1995. Acute Toxicity of Rodeo Herbicide to Rio Grande Silvery Minnow as Estimated by Surrogate Species: Plains Minnow and Fathead Minnow. Archives of Environmental Contamination & Toxicology 29(1): 24-26.

Use of Rodeo herbicide (53.8% glyphosate, active ingredient) to control vegetation in or along irrigation canals in the Rio Grande basin in New Mexico has become a concern because of potential for populations of a federally endangered species, the Rio Grande silvery minnow (*Hybognathus amarus*), to be exposed. To investigate the potential for adverse effects, toxicity of Rodeo herbicide was estimated by conducting 96-h renewal-acute toxicity tests with a closely related species, plains minnow (*Hybognathus placitus*), and a standard laboratory animal, fathead minnow (*Pimephales promelas*). Rodeo herbicide had no effect on survival of plains minnow or fathead minnow at concentrations as high as 1,000 mg/L; thus, no-observed-acute-effect concentrations (NOAEC) for both species were 1,000 mg/L. Direct estimates of toxicity of Rodeo herbicide to Rio Grande silvery minnow were not possible because the species was not available for testing. However, the similarity of responses by plains minnow and fathead minnow suggests that 1,000 mg/L Rodeo herbicide is an acceptable estimate of the 96-h NOAEC for Rio Grande silvery minnow.

Blackshear, S. D. and J. V. Richerson. 1999. Ant diet of the Texas horned lizard (*Phrynosoma cornutum*) from the Chihuahuan Desert. Texas Journal of Science 51(2): 147-152.

This study examined the gastrointestinal tracts of 30 museum specimens of *Phrynosoma cornutum* collected from Chihuahuan Desert habitats in Texas, New Mexico and the Mexican state of Chihuahua. Data collected included percentage of volume and number, mean and frequency of occurrence. Representatives of twelve ant genera were consumed. Pogonomyrmex was the most frequently eaten ant (frequency = 90.0%) and had the greatest total volume and total number of all the items recovered from the

gastrointestinal tract. Pogonomyrmex is the preferred prey item of *P. cornutum* because of its low aggressiveness, high foraging numbers and availability in the horned lizard's habitat.

Blus, L. J., A. A. Belisle, et al. 1974. Relations of the brown pelican to certain environmental pollutants. Pesticides Monitoring Journal 7(3/4): 181-194.

Details are given of studies in the United States to determine the relation between the population trends of the eastern brown pelican (*Pelecanus occidentalis carolinensis*) in Florida and South Carolina and some environmental pollutants, mainly insecticides. Additional information obtained in California on the California brown pelican (*P. o. californicus*) is also presented. All the 100 eggs examined contained measurable amounts of DDE, which appears to have been responsible for the eggshell thinning detected in almost all the eggs. Most eggs also contained measurable quantities of p,p'-DDD, p,p'-DDT, dieldrin or polychlorinated biphenyls. There was strong evidence that DDE played a major role in the reduced reproductive success of the birds in South Carolina and California and the decline of populations in South Carolina. Other compounds such as dieldrin may have played a part in South Carolina. In carcasses of pelicans shot in Florida and South Carolina in 1970 the levels of residues varied with the age of the birds and the location. Residues were smaller in birds less than one year old than in older birds.

Booker, J. F. and F. A. Ward. 1999. Instream flows and endangered species in an international river basin: the upper Rio Grande. American Journal of Agricultural Economics 81(ref): 5, 1262-1267.

The hypothesis that new intra-state, inter-state, and international institutions are required, particularly during drought, to protect endangered species is tested. Sufficient measures for endangered species protection on an inter-state and international river require changing water allocation institutions at all jurisdictional levels. A case study of potential approaches to maintaining or enhancing habitat for the Rio Grande (New Mexico) silvery minnow is presented to test the hypothesis. Results are discussed.

Bossart, G. D. 1999. The Florida manatee: on the verge of extinction. Journal of the American Veterinary Medical Association 214(8): 1178-1183.

Boundy, J. 1994. County records for Texas amphibians and reptiles. Herpetological Review 25(3): 129.

Brown, D. E. 1983. The wolf in the Southwest: The making of an endangered species. Tucson, University of Arizona press. 195 pp.

Buechner, H. K. 1960. The bighorn sheep in the United States: its past, present and future. Wildlife Monograph 4: 174.

Burr, B. M., K. M. Cook, et al. 1996. Selected Illinois fishes in jeopardy: New records and status evaluations. Transactions of the Illinois State Academy of Science 89(3-4): 169-186.

Recent collections (late 1980s, early 1990s) in Illinois waters by resource management and university personnel conducting status surveys of jeopardized fishes, drainage-wide biotic integrity studies, and routine sampling have documented significant new vouchered records for 15 fish species that have been variously placed on lists of rare, threatened, or endangered species. Three species (Sturgeon Chub *(Macrhybopsis gelida),* Blue Sucker *(Cycleptus elongatus),* Greater Redhorse *(Moxostoma valenciennesi))* are candidates for listing as federally endangered or threatened by the U.S. Fish and Wildlife Service and are restricted to large rivers. Specifically, we document: 1) the threatened Least Brook Lamprey (*Lampetra aepyptera*) in Lusk and Bay creeks; 2) photographic and anecdotal accounts from the 1950s and 1960s of the presumably extirpated Alligator Gar (*Atractosteus spatula*) in the Mississippi River and Horseshoe Lake; 3) the first records in over 30 years of the Alabama Shad (*Alosa alabamae*) from two locations in the Mississippi River; 4) extension of the northern limits of the Blacktail Shiner (*Cyprinella venusta*) in the Clear Creek system upstream to Dutch Creek; 5) the continued occurrence of the endangered Cypress Minnow (*Hybognathus hayi*) in the middle Cache River and below Horseshoe Lake dam; 6) the first record in just over 30 years of the endangered Bigeye Chub (*Hybopsis amblops*) from the Little Vermilion River; 7) the sporadic occurrence of the endangered Sturgeon Chub in the Mississippi River at Grand Tower; 8) numerous records of the endangered Bigeye Shiner (*Notropis boops*) indicating its localized abundance in the Clear Creek system and the Little Vermilion River; 9) the continued occurrence of the River Chub (*Nocomis micropogon*) in the Little Vermilion River, perhaps the only spawning stream known for this fish in Illinois; 10) several records of young-of-the-year Blue Sucker from the mainstem Mississippi and Wabash rivers, the first evidence of spawning in Illinois waters in decades; 11) five new records of the endangered Greater Redhorse from the Fox, Vermilion, and Illinois rivers; 12) the first records of the distributionally restricted Spring Cavefish (*Forbesichthys agassizi*) and threatened Bantam Sunfish (*Lepomis symmetricus*) from the middle Cache River drainage; 13) the sporadic occurrence of the endangered Western Sand Darter (*Ammocrypta clara*) in the Mississippi River; and 14) the first record of the Harlequin Darter (*Etheostoma histrio*) from the Wabash River of Illinois in over 90 years. We recommend legal protection for three species (i.e., Alabama Shad, Blue Sucker, and Blacktail Shiner) that presently lack any formal conservation status.

Burrow, A. L., R. T. Kazmaier, et al. 2001. Microhabitat selection by Texas horned lizards in southern Texas. Journal of Wildlife Management 65(4): 645-652.

The Texas horned lizard (*Phrynosoma cornutum*) has declined throughout its range. Understanding habitat selection by the Texas horned lizard is an important factor in its conservation. We examined daily and seasonal habitat requirements of Texas horned lizards and determined whether habitat selection differed among land management treatments in southern Texas. We used 5 study sites, each with a different burning and grazing treatment. Adult lizards caught in the study sites were fitted with backpacks carrying radio transmitters and relocated daily. Habitat characteristics at radio locations and random points 10 m from the lizard were assessed using 50- X20-cm quadrants. Relocations were made during 3 time intervals (morning, afternoon, evening) and 2 seasons (active, inactive). Horned lizards used bare ground and herbaceous vegetation similar to their availability in the morning and evening for thermoregulation and foraging purposes, but avoided bare ground in the afternoon. In the afternoons, lizards selected woody vegetation and litter as thermal refuges and cover from predators. Lizards also appeared less dependent on herbaceous vegetation and more dependent on woody vegetation and litter in the inactive season compared to the active season as a result of increased temperatures. We did not detect differences in habitat selection among land management treatments. Habitat management for Texas horned lizards should focus on creating a mosaic of bare ground, herbaceous vegetation, and woody vegetation in close proximity.

Bury, R. B. and J. Germano David. 1994. Biology of North American Tortoises: Introduction. U S Fish & Wildlife Service Fish & Wildlife Research. (13): 1-6.

Calamusso, B., J. N. Rinne, et al. 2002. Distribution and abundance of the Rio Grande sucker in the Carson and Santa Fe National Forests, New Mexico. Southwestern Naturalist 47(2): 182-186.

Rio Grande sucker (*Catostomus plebeius*) was once common in the Rio Grande Basin; however, its current status in New Mexico is unknown. We surveyed 20 streams for Rio Grande sucker in the Carson and Santa Fe National Forests in northern New Mexico. Rio Grande sucker were found in 3 streams on the Carson National Forest. In 2 of these streams Rio Grande sucker co-occurred with white sucker (*Catostomus commersoni*). On the Santa Fe National Forest, Rio Grande sucker occupied 11 streams in the Jemez River drainage and 2 streams in the Chama River drainage. Rio Grande sucker co-occurred with white sucker in 1 of the 2 streams draining into the Chama River drainage. The abundance of Rio Grande sucker was inversely proportional to stream gradient.

Cantu, N. E. V. and K. O. Winemiller. 1997. Structure and habitat associations of Devils River fish assemblages. Southwestern Naturalist 42(3): 265-278.

Spatial variation in the structure of fish assemblages at eight sites in the Devils River was examined seasonally over one year. Data were analyzed to explore natural variation at the mesohabitat scale. The local fish fauna was dominated by, four minnows (*Cyprinidae*) and one mosquitofish (*Poeciliidae*). Overall assemblage composition in this study was similar to that reported previously, but three species were not reported before, and nine species previously reported were not observed during our study. Four threatened species ranked among the most abundant fishes encountered during our surveys. Species diversity (H') and fish abundances showed relatively large variation between mesohabitats as well as between seasons within most mesohabitats, The most species-rich mesohabitats were pools, channels, channel edges, and riffles, whereas the least species occurred in shallow, isolated pools dominated by *Cyprinodon eximius*. Spatiotemporal patterns of taxonomic composition were examined using principal components analysis. Seasonal shifts in assemblage structure were associated primarily with an axis that contrasted domination by *Moxostoma congestum*, *Etheostoma grahami*, *Cyprinodon eximius*, and *Dionda diaboli* versus domination by *Micropterus dolomieu*, *Cyprinella proserpina*, *Cyprinella venusta*, and *Cichlasoma cyanoguttatum*. Canonical correlation analysis was performed using assemblage data in combination with a set of environmental parameters. The first pair of canonical axes described a pattern in which fishes occupied a wide range of sites during summer, and in which during winter, most species were associated with shallow, channel mesohabitats with high dissolved oxygen. The Devils River is dominated by small fishes that have extended spawning periods and that scatter their eggs over open substrates.

Ceballos, G., H. Fleming Theodore, et al. 1997. Population dynamics of *Leptonycteris curasoae* (Chiroptera: Phyllostomidae) in Jalisco, Mexico. Journal of Mammalogy. 78(4). 1220-1230.

We estimated population size and sex ratio, and recorded mass, levels of fat, and reproductive condition of adults of *Leptonycteris curasoae* living in a sea cave in Chamela Bay, Jalisco, Mexico, 10 times between October 1992 and February 1994. We used carbon and nitrogen stable-isotope techniques to determine the general diet of this plant-visiting bat in 1993 and 1994. Size of roost in 1993 varied from ca. 5,000 individuals in March to ca. 75,000 in November. Females were absent from, or uncommon in, the roost from March through September. Beginning in July or August, many males and females migrated to the roost; bats left the roost in December. Some of these females migrate north to the Sonoran Desert to form maternity colonies in spring. Size of testis increased markedly from October through December, which we postulate is a mating period in this roost. Bats were lean in April and June (dry season) and fat in October and November (end of wet season). Stable-isotope analysis revealed that bats fed primarily at nonsucculent (C3) plants throughout the year; values for nitrogen were higher in the wet season than in the dry season. From a review of data on other roosts of L. curasoae, we conclude that most roosts have a seasonal fluctuation in size and sexual composition. We also postulate that two reproductive populations of females exist in Mexico; a spring-birth population and a winter-birth population. Seasonal fluctuations in size of roost mean that the timing of visits to the roost is critical for assessing the population status of this federally listed endangered bat.

Chaloupka, M. 2001. A system-of-equations growth function for southern Great Barrier Reef green sea turtles. Chelonian Conservation & Biology 4(1): 88-93.

A system-of-equations growth model was used to describe and summarize sex-specific growth for green sea turtles (*Chelonia mydas*) resident in Australia's southern Great Barrier Reef (sGBR) foraging grounds. Each sex-specific growth function in this system has a Weibull-type nonlinear functional form that accounts for a wide range of size-at-age growth behaviors including skew-symmetric or asymmetric monophasic growth. An extension to accommodate polyphasic growth in a systems approach is straight-forward.

The system-of-equations model was estimated using nonlinear seemingly unrelated regression (nonlinear SUR) that accounts for contemporaneous correlated error structure as well as allowing for the sharing of parameters across equations in the system. The system-of-Weibull-equations model used here was a good fit to the sex-specific spline growth curves derived from actual measurements of the sGBR green sea turtle stock. An advantage of a parametric growth function over the empirical spline function is that it can be used to derive simple analytic forms of time-specific growth rate functions useful for comparative demographic studies and development of growth state theory. Therefore time-dependent growth derivatives of the Weibull-type function are also provided.

Chaloupka, M. 2002. Stochastic simulation modeling of southern Great Barrier Reef green turtle population dynamics. Ecological Modeling 148(1): http //www elsevier com/locate/ecolmodel.

A stochastic simulation model was developed for the southern Great Barrier Reef (sGBR) green sea turtle stock to foster better insight into local population dynamics and to assess the risk of harvesting on long-term stock viability. The model was age class-structured with time-varying, nonlinear and stochastic demographic processes that were parameterized using recent findings on sex- and age class-specific growth and survivorship and female breeding behavior subject to environmental stochasticity. Monte Carlo based uncertainty analysis was used to estimate population growth given demographic parameters subject to sampling error and environmental stochasticity. Model validity was based on replication of stock reference behaviors with sensitivity evaluated using parameter perturbation and Monte Carlo simulation within a fractional factorial sampling design. Fertility and adult survival were the most important high level parameters affecting population growth, where fertility is a function of fecundity and temporal variability in breeding likelihood. A dynamic stochastic form of the model was then used to evaluate stock viability given various turtle harvesting scenarios. It was found, given model assumptions, that even limited turtle harvesting would result in the sGBR stock being categorized, as vulnerable under IUCN criteria for listing of threatened species. It is apparent that extensive harvesting of either eggs or turtles is probably not a prudent management policy, if the long-term viability of the sGBR green sea turtle stock is the primary conservation objective.

Chaloupka, M. Y. and C. J. Limpus. 2002. Survival probability estimates for the endangered loggerhead sea turtle resident in southern Great Barrier Reef waters. Marine Biology 140(2): 267-277.

Sex- and age-class-specific survival of a loggerhead turtle population resident in southern Great Barrier Reef waters was estimated using a long-term capture-mark-recapture (CMR) study and the Cormack-Jolly-Seber modeling approach. The CMR history profiles for 271 loggerheads tagged over 9 years (1984-1992) were classified into two age classes (adult, immature) based on somatic growth and reproductive traits. The sex and maturity status of each turtle was determined from visual examination of reproductive organs using laparoscopy. A reduced-parameter model accounting for constant survival with sex- and time-specific recapture was adequate for estimating age-class-specific survival probabilities, but inclusion of time-specific transient behavior was informative for the immature age class. The annual fluctuations in the estimated proportion of transient immatures was not a function of sampling effort, but could be due to anomalous oceanographic conditions affecting dispersal of the immature class. There was no sex-specific difference in survival probabilities for either age class, but females were more likely to be recaptured than males, which might be related to behavioral differences such as sex-biased dispersal. The expected annual survival probability for adults was 0.875 (95% CI: 0.84-0.91). The expected annual survival probability for immatures was 0.859 (95% CI: 0.83-0.89), but when the transients were accounted for, the expected annual survival for the resident immature loggerheads was 0.918 (95% CI: 088-0.96). These are the first substantive estimates of annual survival probabilities for any loggerhead sea-turtle stock and provide a basis for developing a better understanding of loggerhead population dynamics.

Chiarello, A. G. 2000. Conservation value of a native forest fragment in a region of extensive agriculture. Revista Brasileira de Biologia 60(2): 237-247.

A survey of mammals and birds was carried out in a semi-deciduous forest fragment of 150 ha located in a zone of intensive agriculture in Ribeirao Preto, Sao Paulo, SE Brazil. Line transect sampling was used to census mammals and birds during 6 days, totaling 27.8 km of trails and 27.8 h of observation. Twenty mammal species were confirmed in the area (except bats and small mammals), including rare or endangered species, such as the mountain lion *(Puma concolor [Felis concolor])*, the maned wolf *(Chrysocyon brachyurus)*, and the ocelot *(Leopardus pardalis [Felis pardalis])*. The brown capuchin monkey *(Cebus apella)* and the black-tufted-ear marmoset *(Callithrix penicillata)* were found frequently, suggesting high population density in the fragment. Regarding the avifauna, 49 bird species were recorded, most of them typical of open areas or forest edges. Some confirmed species, however, are becoming increasingly rare in the region, as for example the muscovy duck *(Cairina moschata)* and the toco toucan *(Ramphastos toco)*. The results demonstrate that forest fragments of this size are refuges for native fauna in a region dominated almost exclusively by sugarcane plantations. Besides faunal aspects, the conservation of these fragments is of great importance for the establishment of studies related to species preservation in the long term, including reintroduction and translocation projects, as well as studies related to genetic health of isolated populations.

Childs, M. R., A. A. Echelle, et al. 1996. Development of the hybrid swarm between pecos pupfish (Cyprinodontidae: *Cyprinodon pecosensis*) and sheepshead minnow (*Cyprinodon variegatus*): A perspective from allozymes and mtDNA. Evolution 50(5): 2014-2022.

A comparison of allozyme and mtDNA frequencies was used for insight into a situation in the Pecos River, Texas where contact between the endemic pupfish (*Cyprinodon pecosensis*) and an introduced congener (*C variegatus*) has resulted in rapid, geographically extensive genetic introgression. Temporal changes in mean frequencies of diagnostic allozyme markers indicate that the clinal pattern of introduced genetic material (Echelle and Connor 1989) is slowly decreasing in amplitude. Significant rank concordance in diagnostic allele frequencies among sites and across sampling years indicates directional influences upon temporal allele frequency change. These

observations are consistent with the theory of gene flow in neutral clines. Levels of introgression indicated by each of four allozyme loci and mtDNA were roughly equivalent. The early history of the hybrid swarm is explained by genetic swamping, possibly mediated by selection for *C. variegatus* or *C. variegatus* times *C. pecosensis*, at a time when the normally abundant endemic species had been catastrophically depleted. High frequencies of an introduced GPI-A allele in all samples of intergrades suggests that the introduced genome originated with a single founding event.

Chivers, D. P., J. M. Kiesecker, et al. 1999. Shifts in life history as a response to predation in western toads (Bufo boreas). Journal of Chemical Ecology 25(11): 2455-2463.

Larval western toads (*Bufo boreas*) are known to exhibit antipredator behavior in response to both chemical alarm cues released from injured conspecifics and chemical cues of predatory invertebrates. In this study, we tested whether long-term exposure to predator and alarm cues resulted in an adaptive shift in life history characteristics of the toads. We raised groups of tadpoles in the presence of: (1) predatory backswimmers (*Notonecta spp.*) that were fed toad tadpoles, (2) nonpredatory water boatman (*Corixidae*), and (3) chemical alarm cues of injured conspecifics. Tadpoles raised in the presence of both chemical alarm cues and cues of predators fed tadpoles metamorphosed in significantly shorter time than those raised in the presence of the nonpredator control. Reducing time taken to reach metamorphosis would reduce exposure to aquatic predators. There was no difference among treatments in the size at metamorphosis. Our results suggest that this shift in metamorphic characteristics may represent a facultative alteration in life history.

Choate, J. R. and M. P. Reed. 1988. Leats shrew, *Cryptotis parva*, in southwestern Kansas and southwestern Colorado. Southwestern Naturalist 33: 361 - 362.

Chojnacky, D. C. and J. L. Dick. 2000. Evaluating FIA forest inventory data for monitoring Mexican spotted owl habitat: Gila National Forest example. Western Journal of Applied Forestry 15(4): 195-199.

The habitat of the Mexican spotted owl (*Strix occidentalis lucida*) must be monitored because of the owl's threatened status under the US Endangered Species Act of 1973. A possible data source for habitat monitoring is the network of permanent plots maintained by Forest Inventory and Analysis (FIA), USDA Forest Service, Rocky Mountain Research Station. This article demonstrates how FIA data might be used to calculate stand density measures for monitoring owl habitat. Test results for New Mexico's Gila National Forest showed 26% of the mixed conifer and 35% of the pine-oak as suitable owl habitat for a forest structure scenario. 95% confidence intervals for these estimates were from plus or minus 20 to plus or minus 35% for the mixed-conifer habitat area; for pine-oak they were plus or minus 50 to plus or minus 73%. Although results are encouraging for using FIA data to monitor owl habitat, critical linkage needs to be established between the owl's home-range requirements and the stand-density metrics tested.

Cohen, A. C. and J. L. Cohen. 1990. Ingestion of blister beetles by a Texas horned lizard. SO - Southwestern Naturalist. 35: 3, 369. 6 ref.

The ingestion of 11 meloid beetles (*Megetra cancellata*) by an individual horned lizard (*Phrynosoma cornutum*) is reported, based on observations made in New Mexico. The beetles that were eaten were on the ground or less than 3 cm up in their host plant (*Kallstromia sp.*). Reflex bleeding from the joints of the beetles, a characteristic defensive reaction known to release cantharidin-containing body fluids, was ineffective as a feeding deterrent for the horned lizard. Cantharidin was shown to be present in extracts of *M. cancellata* using gas chromatography.

Cole, G. A. 1981. *Gammarus desperatus*, a new species from New Mexico (*Crustacea: Amphipoda*). Hydrobiologia 76: 27 - 32.

Contreras-B, S. and M. L. Lozano-V. 1994. Water, endangered fishes, and development perspectives in arid lands of Mexico. Conservation Biology 8(2): 379-387.

Nearly half of Mexico is arid or semiarid, with scarce waters. At least 92 springs and 2500 km of river bone dried in this area. Surface waters have diminished, and phreatic waters are sinking deeper, provoking intrusion of saline waters and salinization of agricultural wells in Sonora, reversing phreatic circulation in the Comarca Laguenera, allowing arrival of arsenic to agricultural waters, and threatening metropolitan Torreon. There are nearly 200 species of freshwater fishes in this region, 120 under some threat, 15 extinct through human impact. As of 1985, an average of 68% of species was eradicated in local fish faunas. Finally, salinization of the lower Rio Bravo del Norte has replaced 32 native fish of fresh or slightly brackish water with 54 mainly marine or highly salt-tolerant species; the salinization threatens all uses of water. Some marine fishes invade up to 400 km upstream. Pollution is strong, and fish kills have been reported. These low-quality and scarce waters comprise future resources for cities such as Monterrey, which, along with its border twin cities, is expected to double its human population by 2010. Redesign of regional development is urgently needed, in keeping with the real availability of water. All water use should be equal to or less than lower recharge averages; norms of integral basin management should rely on criteria of high-use efficiency, recuperation, recycling, and reutilization. Also necessary are reduced pollution and increased treatment of residual waters. Innovative environmental vision is especially essential in light of expectations for development through the North American Free Trade Agreement, the Border Integral Environmental Plan, industrial expansion, and the modernization and internationalization of the northern Mexican border belt. These all conflict with the high priority recently decreed for species conservation by the Mexican Act, creating the National Committee on Knowledge and Use of Biodiversity.

Cowley, D. E. and Sublette.J.E. 1987. Distribution of fishes in the Black River drainage, Eddy County, New Mexico. The Southwestern Naturalist 32: 213 - 222.

Crank, E. 1992. Seed germination studies on the endangered species Thymophylla tephroleuca. Wildflower 5(2): 23-27.

This perennial, which has bright yellow flowers produced throughout the year and aromatic foliage, is native to 2 counties in the far south of Texas and grows in a desert environment. It was federally listed as endangered in 1984. Seeds were collected from 3 sites on 3 dates (9 Nov. 1989, 5 June 1990 and 4 May 1991) and stored under dry conditions at 40 deg F. Stratification was also investigated. Germination and tetrazolium tests were conducted to examine germination rates, possible seed dormancy and seed viability after storage. Seeds pretreated with a moist-heat stratification (100 deg for 8 h in light + 85 deg for 16 h in darkness) showed 48.9% germination, compared with 23.8% for untreated seeds. Seeds remained viable in storage with a constant germination rate.

Crowder, L. B. 2001. Reversing the decline of sea turtles: Insights from life-history population models. Ecological Society of America. Annual Meeting Abstracts 86:12.

Davis, J. R. 1979. Die-offs of an endangered pupfish *Cyprinodon elegans* (Cyprinodontidae). Southwestern Naturalist. 24: 3, 534-536. 4 refs.

The Comanche Springs pupfish Cyprinodon elegans is an endangered species, which presently lives only in a series of irrigation ditches and in Toyah Creek near Balmorhea, Texas. Declining flow poses a threat to its continued survival. Improved management practices are recommended to cope with this threat.

Davis, J. R. 1980. Rediscovery, distribution, and populational status of *Cyprinodon eximius* (Cyprinodontidae) in Devil's River, Texas. Southwestern Naturalist 25(1): 81-88.

Recent collections of *Cyprinodon eximius* from Devil's River in west Texas, the first in 10 years, have dispelled reports of its extinction there. However, populational status is precarious due to severe habitat loss and range restriction. Distributional data and ongoing morphological observations suggest that two allopatric populations once inhabited the river. A population that once occurred above Dolan Falls is now extinct, apparently a victim of a series of catastrophic events in the mid-l950's. A second population originally inhabited lower Devil's River and an immediately adjacent portion of the Rio Grande, but the filling of Amistad Reservoir in 1968 inundated over 75% of that reach. Now, only a remnant of the second population survives, restricted to a 10.9-km reach above Amistad Reservoir.

Davis, J. R. 1980. Diet of the Pecos River pupfish, *Cyprinodon pecosensis* (Cyprinodontidae). Southwestern Naturalist 25(4): 535-540.

Cyprinodon pecosensis is omnivorous, with a diatom-detritus mixture comprising the bulk of the diet. Other important dietary items include benthic animals, filamentous algae, macrophytes, sand, and seeds. Sex, gut length, and habitat contribute to dietary differences among individual fish. The ability of *C. pecosensis* to subsist on a variety of foods is highly advantageous for survival in harsh, desert environments.

Davis Randall, W., A. J. Worthy Graham, et al. 1996. Diving behavior and at-sea movements of an Atlantic spotted dolphin in the Gulf of Mexico. Marine Mammal Science. 12(4). 1996. 569-581.

Davis, R. W., G. S. Fargion, et al. 1998. Physical habitat of cetaceans along the continental slope in the north-central and western Gulf of Mexico. Marine Mammal Science. 14(3). July, 1998. 490-507.

The physical habitat of cetaceans found along the continental slope in the north-central and western Gulf of Mexico was characterized from shipboard sighting data, simultaneous hydrographic measurements, and satellite remote sensing. The study area was encompassed by the longitude of the Florida-Alabama border (87.5degreeW), the southernmost latitude of the Texas-Mexico border (26.0degreeN), and the 100-m and 2,000-m isobaths. Shipboard surveys were conducted seasonally for two years from April 1992 to May 1994. A total of 21,350 km of transect was visually sampled in an area of 154,621 km2. Sighting localities of species in the study area were differentiated most clearly with bottom depth. Atlantic spotted dolphins (*Stenella frontalis*) were consistently found in the shallowest water on the continental shelf and along the shelf break. In addition, the bottom depth gradient (sea floor slope) was less for Atlantic spotted dolphins than for any other species. Bottlenose dolphins (*Tursiops truncatus*) were found most commonly along the upper slope in water significantly deeper than that for Atlantic spotted dolphins. All the other species and species categories were found over deeper bottom depths; these were Risso's dolphins (*Grampus griseus*), short-finned pilot whales (*Globicephala macrorhynchus*), pygmy/dwarf sperm whales (*Kogia spp.),* rough-toothed dolphins (*Steno bredanensis*), spinner dolphins (*Stenella longirostris*), sperm whales (*Physeter macrocephalus*), striped dolphins (*Stenella coeruleoalba*), *Mesoplodon spp*., pantropical spotted dolphins (*Stenella attenuata*), Clymene dolphins (*Stenella clymene*) and unidentified beaked whales (*Ziphiidae*). Risso's dolphins and short-finned pilot whales occurred along the upper slope and, as a subgroup, were significantly different from striped dolphins, *Mesoplodon spp*., pantropical spotted dolphins, Clymene dolphins, and unidentified beaked whales, which occurred in the deepest water. Pygmy/dwarf sperm whales, rough-toothed dolphins, spinner dolphins, and sperm whales occurred at intermediate depths between these two subgroups and overlapped them.

Davis, W. B. and D. J. Schmidly 1994. The Mammals of Texas. Austin, TX, Texas Parks and Wildlife Press,. 338 pp.

de Queiroz, A., C. Henke, et al. 2001. Geographic variation and ontogenetic change in the diet of the Mexican Pacific lowlands garter snake, *Thamnophis validus.* Copeia (4): 1034-1042.

> The Mexican Pacific lowlands garter snake, *Thamnophis validus*, is found in aquatic habitats on the Pacific coast of Mexico from the states of Sonora to Guerrero and in the Cape Region of the Baja California peninsula. We characterized the diet of *Thamnophis validus* through examination of stomach contents of museum specimens and from literature records. The diet of *T. validus* consists almost entirely of fishes and larval and adult anurans. There is strong geographic variation in the diet: snakes from uplands of Baja California contained only anurans, whereas the majority of snakes from mainland Mexico that contained prey had eaten fishes. Mainland snakes show a pronounced ontogenetic shift from feeding primarily on anurans to feeding primarily on fishes. When mainland snakes are divided into three size classes, the intermediate class shows the most generalized diet (i.e., the most even distribution between fishes and anurans). We suggest that this nonmonotonic relationship between predator size and the level of specialization may be relatively common in snakes. Prey mass and the variance in prey mass both increase with increasing predator size in *T. validus*, as is the case for many carnivorous animals. *Thamnophis validus* apparently differs from other aquatic garter snakes (*T. atratus, T. couchii, T. hammondii, T. melanogaster, and T. rufipunctatus*) in feeding heavily on adult anurans and in the common use of aquatic open-mouth searching behavior.

Degenhardt, W. G., C. W. Painter, et al. 1996. Amphibians and Reptiles of New Mexico. Albuquerque, University of New Mexico Press. 431 pp.

Delaney, D. K., T. G. Grubb, et al. 1999. Effects of helicopter noise on Mexican spotted owls. Journal of Wildlife Management 63(1): 60-76.

> It is noted that military helicopter training over the Lincoln National Forest (LNF) in south central New Mexico, USA, has been severely limited to protect nesting Mexican spotted owls (*Strix occidentalis lucida*). To evaluate nesting and non-nesting spotted owl responses to helicopter noise, flush frequency, flush distance, alert behavior, response duration, prey delivery rates, female trips from the nest, and nest attentiveness were measured during manipulated and non-manipulated periods between 1995 and 1996. Chainsaws were included in the manipulations to increase experimental options and to facilitate comparative results. Manipulated and nonmanipulated nest sites did not differ in reproductive success ($P = 0.59$) or the number of young fledged ($P = 0.12$). As stimulus distance decreased, spotted owl flush frequency increased, regardless of stimulus type or season. No spotted owl flushes were recorded when noise stimuli were > 105 m away. Spotted owls returned to predisturbance behavior within 10-15 min after a stimulus event. All adult flushes during the nesting season occurred after juveniles had left the nest. Spotted owl flush rates in response to helicopters did not differ between non-nesting (13.3%) and nesting seasons (13.6%: $P = 0.34$). Chainsaws were more disturbing to spotted owls than helicopter flights at comparable distances. The data indicate a 105 m buffer zone for helicopter overflights on the LNF would minimize spotted owl flush response and any potential effects on nesting activity.

Delgado-Estrella, A. 1997. Interaction of bottlenose dolphins, *Tursiops truncatus* and spotted dolphin, Stenella frontalis with shrimp fishery in the Campeche Sound, Mexico. Anales del Instituto de Biologia Universidad Nacional Autonoma de Mexico Serie Zoologia. 68(2). 317-338.

Two surveys were made on shrimp ships (June and October, 1989) to record the activities and interactions with fisheries of bottlenose dolphins *Tursiops truncatus* and Atlantic spotted dolphins Stenella frontalis in the Campeche Sound, Mexico. During 157 hours and 33 days (11 on June and 22 on September-October) 687 bottlenose dolphins (5.5% of calves only on June) and 257 spotted dolphins (4.2% of calves) were sighted. The dolphins stayed behind of the shrimp ships and ate the bycatch discarded (principally at night). Because of the position of the dolphins in relation with the trawl nets, low possibilities of incidental catch exist. Apparently, the dolphins synchronize the activities with the different trawling stages but not depending exclusively on the bycatch discard after the trawl. The mean school size of S. frontalis was larger than that of *T. truncatus*. Bottlenose dolphins had a wide altitudinal distribution.

Despain, D. G., P. Beier, et al. 2000. Modeling biotic habitat high risk areas. Journal of Sustainable Forestry 11(1/2): 89-117.

Fire, especially forest stand replacing fire, poses a threat to many threatened and endangered species as well as their habitat. On the other hand, fire is important in maintaining a variety of successional stages that can be important for other animals such as elk. Modeling methods are given here on a variety of ways to approach risk assessment to assist in prioritizing areas for allocation of fire mitigation funds in western Colorado, USA. One example looks at assessing risk to the species and biotic communities of concern followed by the Colorado Natural Heritage Program, another looks at the risk to Mexican spotted owls [*Strix occidentalis lucida*], a third looks at the risk to cutthroat trout (*Onchorynchus clarki stomais [Oncorhynchus clarkii stomias*], *O. clarkii pleuriticus, O. clarkii virginalis*), and a fourth considers the general effects of fire in relation to elk [*Alces alces*].

Dickerman Robert, W. and W. Painter Charles. 2001. *Crotalus lepidus lepidus* (mottled rock rattlesnake). Diet. Herpetological Review. 32(1). 46.

Dixon, J. R. 1987. Amphibians and Reptiles of Texas. College Station, Texas A&M University Press. 434 pp.

Donaldson, W., A. H. Price, et al. 1994. The current status and future prospects of the Texas horned lizard (*Phrynosoma cornutum*) in Texas. Texas Journal of Science 46(2): 97-113.

Eastrela, D. V. 1972. Status of *Leptonycteris nivalis* (*Phylostomatidae*) in Big Bend National Park, Texas. Southwestern Naturalist 17: 287 - 292.

Eastrela, D. V., Ed. 1973. Ecology of the 18 species of Chiroptera at Big Bend National Park, Texas. Northwest Missouri State University Studies. 165 pp.

Echelle, A. A., H. C.W, et al. 1997. Expanded occurrence of genetically introgressed pupfish (Cyprinodontidae: *Cyprinodon pecosensis x variegatus*) in New Mexico. The Southwestern naturalist 42: 336-339.

Echelle, A. A. and A. F. Echelle. 1997. Genetic introgression of endemic taxa by non-natives: A case study with Leon Springs pupfish and sheepshead minnow. Conservation Biology 11(1): 153-161.

> Genetic studies of a pupfish (*Cyprinodon bovinus*) endemic to a small, spring-fed system in west Texas illustrate the potential for small introductions of non-native species to cause large-scale genetic changes through hybridization and genetic introgression. We performed a genetic survey (allozymes and RFLP analysis of mtDNA) of four samples of *C. bovinus* representing all wild populations of the species and a captive population maintained since 1976 at Dexter, New Mexico. The results indicate genetic introgression of the entire wild population by sheepshead minnow (*C. variegatus*), a coastal species with a history of introductions in west Texas. Frequencies of foreign genetic elements averaged across four diagnostic allozyme loci and mtDNA varied from 6.1 to 15.1%. The captive population appears free of foreign genetic material. Comparisons with past studies of *C. bovinus* indicate the present situation is largely due to a recent introduction of *C. variegatus*, not to an introduction in the mid-1970s; however, residual effects from the earlier introduction cannot be completely discounted. Genetic analysis indicates that the source of introduced *C. variegatus* in Diamond Y Draw is the nearest known population, an introduced stock in Lake Balmorbea approximately 90 km away. The results demonstrate the value of maintaining imperiled species in captivity. Captive *C. bovinus* provide an opportunity to restore the genetic integrity of wild populations.

Echelle, A. A., A. F. Echelle, et al. 1995. Genetic variation in the endangered fish fauna *(Atheriniformes: Cyprinodontidae)* associated with pluvial Lake Sandia, Nuevo Leon, Mexico. Southwestern Naturalist 40(1): 11-17.

> Levels of genetic variation and divergence among five species of cyprinodontid fishes endemic to waters associated with Pluvial Lake Sandia, Nuevo Leon, Mexico, were evaluated by means of protein electrophoresis. The five species include *Cyprinodon alvarezi* and the monotypic *genus Megupsilon* from the Potosi Basin and three species of *Cyprinodon* from Sandia Basin. *Megupsilon* was highly divergent from the four species of

Cyprinodon. Allele distributions support previous conclusions from morphology that the Potosi pupfish (*C. alvarezi*) is the sister species to a clade comprising the species from the Sandia Basin. Wild populations of all four species of *Cyprinodon* exhibited moderate to high levels of genetic variation (H = 0.023 to 0.091), as did a sample of *Megupsilon* (H = 0.034) from a captive population. The implications for genetic conservation are briefly discussed.

Eguiarte, L. and A. Burquez. 1987. Reproductive ecology of *Manfreda brachystachya*, an iteroparous species of Agavaceae. Southwestern Naturalist. 32: 2, 169-178.

The reproductive ecology of *M. brachystachya* was studied at the Pedregal de San Angel Preserve, in Mexico City. The floral characteristics are consistent with bat pollination, and the main pollinator was the Little Long-nosed bat. Hawkmoths and hummingbirds were minor pollinators, and birds and bees (mainly honeybees) robbed nectar. D. G. Lowe.

Enkerlin-Hoeflich, E. C., M. J. Whiting, et al. 1993. Attempted predation on chicks of the threatened green-cheeked Amazon parrot by an indigo snake. Snake 25(2): 141-143.

Enriquez-Rocha, P., J. L. Rangel-Salazar, et al. 1993. Presence and distribution of Mexican owls: A review. Journal of Raptor Research 27(3): 154-160.

Mexico has a rich owl assemblage, represented by 27 species. Eighteen of these species occur in the Nearctic and Neotropical regions, and nine species occur only in the Neotropical region. Their biology, ecology and distribution, however, are poorly known. We recorded 3683 specimens collected between 1840 and 1991 from 11 national and 37 foreign museums, and reviewed the literature concerning these owls. From these data we present a more unified distribution of Mexican owls. Four species, Barn Owl (*Tyto albo*), Great Horned Owl (*Bubo virginianus*), Ferruginous Pygmy-Owl (*Glaucidium brasilianum*) and Burrowing Owl (*Speotyto cunicularia*), have a wide distribution. The Balsas Screech Owl (*Otus seductus*) is endemic to the central Pacific region. Oaxaca and Michoacan had the highest owl species richness with 21 and 19 species, respectively. Aguascalientes, Campeche and Tlaxcala had the lowest owl species richness, four, five, and five respectively. The Ferruginous Pygmy-Owl was the most collected owl, representing 30.7% of the specimens, and the Unspotted Saw-whet Owl (*Aegolius ridgwayi*) the least with 0.19%. Of the Neotropical species, the Unspotted Saw-whet Owl, Striped Owl (*Asio clamator*), and Stygian Owl (*A. stygius*) are considered endangered by the Mexican government. The screech-owl group (*Otus*) and the Barred Owl (*Strix varia*)/Fulvous Owl (*S. fulvescens = S. v. fulvescens*) have uncertain distributions due to taxonomic uncertainties.

Escamilla, A., M. Sanvicente, et al. 2000. Habitat mosaic, wildlife availability, and hunting in the tropical forest of Calakmul, Mexico. Conservation Biology 14(6):

1592-1601.

A study was conducted during May 1992 to June 1994 to investigate the effects of habitat loss and subsistence hunting on wildlife in Calakmul Biosphere Reserve, Campeche, Mexico. Subsistence hunting patterns were compared in 4 villages with differing ethnic composition and degree of habitat disturbance. In addition, harvest composition and prey availability were used to determine hunting preferences. The surroundings of each village were dominated by different successional stages of subsistence agricultural mosaic with semideciduous tropical humid forest and seasonally flooded forest. Dominant trees included *Manilkara zapota, Brosimum alicastrum, Bursera simaruba, Vitex gaumeri* and *Cecropia obtusifolia*. A Landsat TM satellite image was used to analyze the degree of habitat disturbance around each village (comparing percent area of disturbed habitat in (i) the total land-holding, (ii) a 6 km radius for each village and (iii) the land-holding in the same 6 km radius). Periodic surveys of subsistence hunting and prey availability were conducted. Wildlife availability was assessed monthly on 9 transects (3000 m) established in the vicinity of 3 villages. The relative amount of disturbed habitat was smaller in the indigenous Maya village (IV) and larger in the mestizo village (MV). The two mixed-composition villages (MCVJ) had intermediate levels of habitat disturbance. Ten animal species, 4 large (*Odocoileus virginianus, Mazama spp., Pecari tajacu*, and *Tayassu pecari*) and 6 small (*Agouti paca, Dasyprocta punctata, Nasua narica, Dasypus novemcinctus, Crax rubra and Agriocharis ocellata*) accounted for 97% of the hunting records. Hunting was more intense in IV and less intense in MCVJ. The three village types exhibited different hunting preferences. The habitat-mosaic composition in the vicinity of the villages influenced prey availability and subsistence-hunting preferences. Changes in the habitat mosaic were caused by the size of the land-holding and by ethnic composition. In spite of longer settlement time, the habitat mosaic in the vicinity of IV was less transformed than that of the other sites and it is suggested that the larger holding size and greater diversity of economic activities of the Mayas may be responsible for the less transformed landscape around their village.

Fair, W. S. and S. E. Henke. 1999. Movements, home ranges, and survival of Texas horned lizards (*Phrynosoma cornutum*). Journal of Herpetology 33(4): 517-525.

Home ranges, movements, and survival rates of nine Texas horned lizards (*Phrynosoma cornutum*) were determined by radio-telemetry in Duval County, Texas, during March through October 1994. Lizards were tracked five days each month from time of initial capture until hibernation and were located every 1-2.5 h from sunrise to sunset during these days. Nine of 16 radio-transmitted lizards were followed for gtoreq 1 month of telemetry. Total area of use for horned lizards ranged from 291 to 14,690 m2, and lizards exhibited considerable overlap between their respective areas. However, Texas horned lizards exhibited minimal overlap between their concurrent weekly home ranges, and their weekly home ranges appeared mobile. The average weekly home ranges of horned lizards in spring were small, peaked in June, and decreased in size each month until the lizards entered hibernation. Minimum daily movements averaged by month ranged from 58.9 m in June to 14.0 m in October. The minimum daily movements ranged from 0.0 to 246.7 m. Daily survival rate for Texas horned lizards was 99%. Assuming that survival of lizards was not altered by transmitters and that rates were constant over time, the annual survival rate ranged from 9% to 54%, based on a 245 d active period and calculated from lizards presumed dead (i.e., missing or dead) and confirmed dead, respectively.

Farley, G. H., L. M. Ellis, et al. 1994. Avian species richness in different-aged stands of riparian forest along the middle Rio Grande, New Mexico. SO - Conservation Biology. 8: 4, 1098-1108. 49 ref.

In order to counteract continued loss of riparian forests, several mitigation programs were developed in the middle Rio Grande Valley, New Mexico. Three areas ranging from 50 to 140 ha were revegetated with native trees using pole planting and cattle exclosures, and changes in vegetation structure were quantified after 2, 3 and 5 yr. The oldest site contained the most heterogeneous mix of plant species and the greatest structural diversity. Avian use of the revegetated sites was compared with that of a mature cottonwood (*Populus fremontii var. wislizeni*) forest site, about 30 yr old. As the revegetated sites matured and habitat features changed, the population dynamics of individual avian species and patterns of guild structure changed. The older revegetated sites showed a greater similarity to mature forest, suggesting that reclamation establishes quality riparian habitat for birds within 5 yr. The revegetated sites appeared especially important for Neotropical-migrant birds. We suggest that a mosaic of riparian woodlands containing mixtures of native tree and shrub species of different size classes is necessary to maintain avian species richness in the middle Rio Grande drainage, and probably throughout the southwestern United States.

Fiedler, C. E. and J. F. Cully, Jr. 1995. A silvicultural approach to develop Mexican spotted owl habitat in southwest forests. Western Journal of Applied Forestry 10(4): 144-148.

Mexican spotted owl (Strix *occidentalis lucida*) is listed as an endangered species in Arizona and New Mexico, mainly as a result of habitat degradation through timber harvesting. A silvicultural approach is proposed that takes account of owl habitat needs and forest health issues. The approach focuses on regenerating seral species on degraded habitat, developing vertical and horizontal diversity with moderate crown closure, and recognizing the contribution of low levels of insects, mistletoes, diseases and fires to habitat quality.

Finch, D. M. and S. H. Stoleson. 2000. Status, ecology, and conservation of the southwestern willow flycatcher. General Technical Report - Rocky Mountain Research Station, USDA Forest Service. Rocky Mountain Research Station, Fort Collins, USA: 2000. No. RMRS-GTR-60, ii + 131 pp. ref. at end of each chapter.

The southwestern willow flycatcher (*Empidonax traillii extimus*), a neotropical migrant, is an endangered species, partly because of destruction and modification of cottonwood/willow riparian ecosystems which are essential habitat in the southwestern USA. This publication, written by a team of experts from multiple agencies and organizations, includes 11 chapters which provides a comprehensive assessment of the population status, biology, ecology, habitats, threats, and conservation and management

of the species.

Findley, J. S., A. H. Harris, et al. 1975. Mammals of New Mexico. Albuquerque, University of New Mexico Press. 360 pp.

Fleming Theodore, H. 1994. Foraging behavior of *Leptonycteris curasoae*: How much is under plant control? Bat Research News. 35(4). 98.

Fleming Theodore, H. 2000. Is *Leptonycteris curasoae* an unreliable pollinator? Bat Research News. 41(4). Winter. 116-117.

Fleming Theodore, H., A. Nelson Aurelia, et al. 1998. Roosting behavior of the lesser long-nosed bat, *Leptonycteris curasoae*. Journal of Mammalogy. 79(1). 147-155.

> We analyzed infrared video recordings from a maternity roost in southwestern Arizona to determine social behavior and time and activity budgets of adult *Leptonycteris curasoae* (Chiroptera: Phyllostomidae) for 2 weeks late in the nursing period. Between 2000 and 0330 h, females nursed their young an average of two times for a total of ca. 52 min. Females nursed only their own babies; they occasionally interacted with other young and adults, most frequently by touching noses. Adults returned to and left their young independently of each other, not in synchronized fashion. Between 0500 and 1900 h, adults seldom interacted, although they were clustered tightly. Young were in a nursing position, presumably nursing, ca. 50% of the time. Adults never appeared to sleep and spent 74% of the day quietly alert and 24% grooming themselves. We observed no cooperative behavior such as allogrooming, communal nursing, or sharing of food at any time. We suggest that absence of stable associations of adults caused by long-distance migration and occasional changes in roosting sites has prevented evolution of overtly cooperative behavior in dayroosts of *L. curasoae*.

Flickinger, E. L. and D. L. Meeker. 1972. Pesticide mortality of young white-faced ibis in Texas. Bulletin of Environmental Contamination & Toxicology. 8: No.3, 165-168.

Forstner, M. R. J., R. A. Hilsenbeck, et al. 1997. Geographic variation in whole venom profiles from the mottled rock rattlesnake (*Crotalus lepidus lepidus*) in Texas. Journal of Herpetology. 31(2). 277-287.

> Venom variation in the mottled rock rattlesnake (*Crotalus lepidus lepidus*) was assessed by polyacrylamide gel electrophoresis. Whole venom samples were stained for general

protein, the banding recorded, and these profiles were used to compare the variation within and between populations in Texas. Analyses using agglomerative methods (phenetic clustering methods and neighbor-joining analyses) and ordination from Principal Components analyses provide several geographically correlated groups of rattlesnake venom profiles. Evidence is provided for differences in venom profiles of geographically distinct populations. Venom profiles of *C. lepidus* collected along the Rio Grande River, though geographically disparate, are generally homogeneous. Thus, the analyses support previously hypothesized dispersal of *C. lepidus* in Texas along these Rio Grande canyons. A potential region of population interchange between eastern plateau populations and those of the west Texas mountain ranges was identified at the southern end of the Davis Mountains in Brewster Co. Lethality assessments using LD-50 analyses reveal variation in venom toxicity to range from 2.20-0.72 mg/kg across the geographic range for this subspecies.

Franc, V. 1997. Old trees in urban environments-Refugia for rare and endangered beetles (*Coleoptera*). Acta Universitatis Carolinae-Biologica. 41(3). 1997. 273-283.

A survey of interesting findings of arboricolous beetles (*Coleoptera*) made during the last 14 years in the urban area of Banska Bystrica is presented in this paper. The occurrence of rare and remarkable species: *Anemadus strigosus, Euthiconus conicicollis, Euconnus pragensis, Quedius truncicola, Hesperus rufipennis, Batrisodes buqueti, Osmoderma eremita, Synchita separanda, Triplax elongata, Cicones variegatus* and *Rhopalocerus rondanii* is documented here. These species confirm the very high ecosozological and genofund values of old hollow trees even if they are situated in urban environments. Therefore, they deserve more attention from entomologists and conservationists.

Fretey, J. 1999. Distribution of the turtles of the genus *Lepidochelys Fitzinger*, 1843. I. The western Atlantic. Biogeographica (Paris) 75(3): 97-117.

The whole current bibliographic data allows an approach to the distribution of two close species *Lepidochelys olivacea* and *L. kempii* in West Atlantic, but leaves a few uncertainties as to the exact dividing line. *L. olivacea*, rather southern, appears to be present between the latitude of 34degree south and 21degree north, whereas *L. kempii*, rather northern, is mainly found in the Gulf of Mexico (from 19degree to 30degreeN) but sometimes appears up to a latitude of nearly 47 degree North. *L. kempii* seems to occasionally go down towards the Greater Antilles and the north of South America, while *olivacea* goes up the West Indian Arc. The presence of *L. olivacea* has bee confirmed in the French West Indies. *L. olivacea* regularly nests on the beaches of Brazil and of the 3 Guianas, though in lesser numbers than they used to *L. kempii*, a species whose populations are greatly endangered, regularly nests only on some beaches mainly Mexican. Several doubtful or aberrant occurrences have been reported from places out of typical nesting regions. No case of natural hybridization between the 2 forms has been observed.

Fritsch Peter, W. 1997. A revision of Styrax (Styracaeae) for western Texas, Mexico, and Mesoamerica. Annals of the Missouri Botanical Garden. 84(4). 705-761.

Despite a recent taxonomic treatment of Styrax from North America and the Caribbean, the taxonomy of this genus has remained poorly understood. In an effort to clarify the taxonomy of Styrax from western Texas through Mesoamerica, morphological characteristics of over 2500 specimens from 29 herbaria were examined. The previous treatment emphasized vegetative characters for circumscription, whereas the present revision includes heretofore poorly characterized features of the androecium. This revision comprises 19 species and 24 taxa in the area considered, nearly three times as many species as recognized previously. It includes six new species (*S. gentryi, S. incarnatus, S. nicaraguensis, S. radians, S. steyermarkii, S. tuxtlensis*), two new subspecies (*S. platanifolius subsp. mollis, S. nicaraguensis subsp. ellipsoidalis*), three new combinations (*S. platanifolius subsp. stellatus, S. platanifolius subsp. texanus, S. platanifolius subsp. youngiae*), and two new species names (*S. austromexicanus, S. lanceolatus*). Two names (*S. glabrescens var. pilosus and S. jaliscanus*) are lectotypified. Nearly 70% of the species recognized in the revision are narrow endemics. This work has provided the basis for a taxonomic revision of all neotropical Styrax that is currently under way.

Fullard James, H. and W. Dawson Jeff. 1997. The echolocation calls of the spotted bat *Euderma maculatum* are relatively inaudible to moths. Journal of Experimental Biology. 200(1). 129-137.

Previous studies of the spotted bat *Euderma maculatum* have demonstrated that this bat emits echolocation calls that are lower in frequency, shorter in duration and fainter in intensity compared with those of most other insectivorous bats, acoustic characteristics which should render it less conspicuous to eared moths. We tested this prediction by monitoring electrophysiologically the ears of sympatric noctuoid (noctuid, arctiid and notodontid) moths in a site in western Canada. Auditory threshold curves demonstrate that most of the moths tested are less responsive to the calls of *Eu. maculatum* than to those of another sympatric bat, Eptesicus fuscus. Playbacks to moth ears of pre-recorded search- and approach-phase echolocation calls of *Eu. maculatum* and *Ep. fuscus* further demonstrate that the calls of *Eu. maculatum* are poorly detectable to moths and, in some cases, completely inaudible. We estimate that, in the wild, an average noctuoid moth would detect the calls of *Eu. maculatum* at distances of less than 1 m as opposed to the calls of *Ep. fuscus* which should be first heard at distances of 20-25 m. Although most moths are unable to adequately hear *Eu. maculatum*, the observation that two individuals possessed ears sensitive to this bat's calls suggests the existence of auditory pre-adaptation to this type of echolocation.

Ganey, J. L., W. M. Block, et al. 1999. Mexican spotted owl home range and habitat use in pine-oak forest: implications for forest management. Forest Science 45(1): 127-135.

To better understand the habitat relationships of the Mexican spotted owl (*Strix occidentalis lucida*), and how such relationships might influence forest management, home-range and habitat use of radio-marked owls were studied in ponderosa pine (*Pinus ponderosa*)-Gambel oak (*Quercus gambelii*) forest in a study in Arizona, USA, in 1990-93. Annual home-range size (95% adaptive-kernel estimate) averaged 895 ha plus or minus

70 (SE) for 12 individuals and 997 ha plus or minus 186 (SE) for 7 pairs of owls. On average, the 75% adaptive-kernel contour (a probability contour containing 75% of the owl locations) included 32 and 30% of the annual home range for individuals and pairs, respectively, suggesting high concentration of activity in a relatively small portion of the home range. Relative area of three cover types (ponderosa pine forest, pine-oak forest, and meadow) did not differ between seasonal ranges, and owls used these cover types in proportion to their relative area during both breeding and nonbreeding seasons. In contrast, relative area of four canopy-cover classes varied between seasons. Breeding-season ranges contained greater proportions of areas with canopy cover more than or equal to 60% and lower proportions of areas with 20-39% canopy cover than nonbreeding-season ranges. Owls roosted and foraged in stands with more than or equal to 60% canopy cover more than expected during both breeding and nonbreeding seasons, and used stands with 20-39% canopy cover less than expected except for foraging during the breeding season. Stands used for foraging did not differ in structure between seasons and had greater canopy cover and less rock cover than stands with no documented use. Stands used for roosting differed between seasons in a multivariate comparison, but no individual habitat variables differed between seasons in subsequent univariate comparisons. In both seasons, stands used for roosting had greater canopy cover than stands with no roosting use. Closed-canopy forests, which were used heavily by owls, were relatively rare on the study area, suggesting that such forests warrant special protection in areas managed for spotted owls. This may conflict with efforts to restore more open conditions in ponderosa pine forests.

Garcia-Moreno, J., D. Matocq Majorie, et al. 1996. Relationships and genetic purity of the endangered Mexican wolf based on analysis of microsatellite loci. Conservation Biology. 10(2). 376-389.

The Mexican wolf (*Canis lupus baileyi*), an endangered subspecies of gray wolf, was native to Parts of Mexico and the southwestern United States. Currently, only a few individuals, if any, exist in the wild, so planned reintroduction programs must use captive-raised wolves. In only one captive population, however, designated the certified lineage, are all the founders (n = 4) known to be obtained from a wild population of Mexican wolves. Two captive populations were founded from individuals of uncertain ancestry and have not been included in the species survival plan. To preserve genetic diversity and reduce inbreeding so that fitness will be maintained, it would be desirable to include these two captive populations in the breeding program if it could be shown that they were derived from a wild population similar to the certified lineage. We compared allele frequencies of 10 hypervariable microsatellite loci in Mexican gray wolves with those found in a sample of 42 domestic dogs, 151 northern gray wolves, and 142 coyotes to determine if uncertified Mexican wolves had specific markers from these animals. We analyzed pairwise genetic distance measures to demonstrate that the three captive populations of Mexican gray wolves were closely related to each other and distinct from dogs and northern gray wolves, The three captive populations are genetically more similar to each other than to any other population of dog or wolf-like canid, and they shared alleles that were rare in other canids. The genetic distance between them is similar to that between closely spaced populations of northern gray wolves, As a group, moreover, they are the most genetically distinct population of North American gray wolf. Therefore, the three captive populations could potentially be interbred to augment the genetic diversity of the certified lineage. Source individuals for reintroduction should be derived from the captive Mexican wolf population rather than populations of captive or wild northern

gray wolves.

Gehlbach, F. R. 1993. Mountain Islands and Desert Seas. A Natural History of the U.S.-Mexican Borderlands. College Station, Texas A&M University Press. 298 pp.

Gelhbach, F. R. and M. R.R. 1961. Fishes from archaeological sites in northern New Mexico. The Southwestern Naturalist 9: 2 - 8.

Germano David, J. 1994. Comparative Life Histories of North American Tortoises. U S Fish & Wildlife Service Fish & Wildlife Research. (13). 175-186.

Gienger, C. M. and C. R. Tracy. 2001. Geographic variation in activity of the Gila monster. American Zoologist. 41(6) 1453. Meeting.

The Gila monster (*Heloderma suspectum*) is a conspicuous, but infrequently encountered species distributed across the hot deserts of the American southwest. It's infrequent activity and low population densities make intensive field study difficult, and information regarding this species is limited. To determine patterns of geographic variation in temporal and spatial activity, we synthesized the results of previous studies conducted in Utah, Arizona, and New Mexico, and combined those with data from current field investigations in southern Nevada. We also gathered over 1000 collection records from more than 30 museums and natural history collections and compare them to field data. Throughout it's range this species is most active in late spring and early summer (May and June), but activity in late summer (July and August) is variable depending on location, most likely in response to the onset of summer precipitation. Homeranges varied considerably by location, but because this species in somewhat uncommon, small sample sizes make interpretation of a geographic pattern of spatial activity difficult.

Goldberg, S. R. and C. H. Lowe. 1997. Reproductive cycle of the gila monster, *Heloderma suspectum*, in southern Arizona. Journal of Herpetology 31(1): 161-166.

Gompper Matthew, E., B. Stacey Peter, et al. 1997. Conservation implications of the natural loss of lineages in wild mammals and birds. Conservation Biology. 11(4). 857-867.

Because populations in zoological parks and nature reserves often are derived from only a few individuals, conservationists have attempted to minimize founder effects by equalizing family group sizes and increasing the reproductive contributions of all individuals. Although such programs reduce potential losses of genetic diversity, information is rarely available about the actual persistence of family groups or genetic lineages in natural populations. In the absence of such data, it can be difficult to weigh the importance of human intervention in the conservation of small populations. Separate long-term studies of two mammals, the North American bison (*Bison bison*) and the white-nosed coati (*Nasua narica*), and a bird, the Acorn Woodpecker (*Melanerpes formicivorus*), demonstrate differential extinction of genetic lineages. Irrespective of the mechanisms affecting population structure, which may range from stochastic environmental events to such behavioral phenomena as poor intrasexual competitive abilities, our results show that lineages can be lost at rapid rates from natural populations. A survey of comparable studies from the literature indicates that the loss of matrilines over the course of the study varies from 3% to 87% in wild mammals and from 30% to 80% in birds, with several small mammals losing approximately 20% of matrilines per year of study. These lineage extinctions were not an artifact of the length of the study or the generation time of the species. Such rapid losses of lineages in less than 20-year periods in natural populations suggest that efforts to maintain maximal genetic diversity within populations may not always reflect processes that occur in the wild. Conservation biologists need to give further thought to the extent to which parity among genetic lines should be a primary goal of management of captive and small wild populations.

Gompper, M. E. 1995. *Nasua narica*. Mammalian Species. 487: 1-10.

Grzybowski, J. A., D. J. Tazik, et al. 1994. Regional analysis of black-capped vireo breeding habitats. Condor 96(2): 512-544.

Black-capped vireos (*Vireo atricapillus*), which have been designated as endangered, occupy a successional stage of scrubland that can mature in a short time. Structural habitat characteristics were evaluated in the Lampasas Cut Plains and Edwards Plateau of central Texas, and Wichita Mountains and adjacent areas of western Oklahoma. In all regions, vireo territories had relatively high densities of deciduous vegetation (primarily oaks [*Quercus spp.*]) close to the ground and occurred where variation in the relative density measures of woody vegetation was highest. Differences were found between regions in the vegetation characteristics of areas defended by territorial males. Competition with other foliage-gleaning species may have contributed to the restriction of black-capped vireos to early successional stages of scrublands, where they may also avoid several species of nest predators. Periodic habitat disturbance has beneficial effects for vireos and can be used in its management. It is recommended that attempts should be made to maintain 35-55% dispersed shrub cover in spatially heterogeneous configurations; juniper [*Juniperus sp*.] cover should be kept below 10%, although in areas where amounts of deciduous vegetation are marginal junipers may contribute important cover.

Hall, L. S. and J. O. Karubian. 1996. Breeding behavior of elegant trogons in southweastern Arizona. Auk 113: 143 - 150.

Hatch, M. D., W. H. Baltosser, et al. 1985. Life history and ecology of the bluntnose shiner (*Notropis simus pecosensis*) in the Pecos River, New Mexico. The Southwestern Naturalist 30: 555 - 562.

Helton, R. C., L. K. Kirkman, et al. 2000. Host preference of the federally endangered hemiparasite *Schwalbea americana L.* (Scrophulariaceae). Journal of the Torrey Botanical Society. 127(4). 300-306.

> We examined the host-preference and optimal hosts of the federally endangered hemiparasite, *Schwalbea americana L*. We also determined the effects of four fertilizer treatments (NO3-140ppmN, NO3-280ppmN, NH4-140ppmN, and NH4-280ppmN) on the formation of haustoria of *S. americana* to two of these host species, *Panicum tenue* and *Pityopsis graminifolia*. Results of the host preference study show that *Schwalbea americana* seedlings are more likely to form haustorial connections with *Pityopsis graminifolia* and *Ilex glabra* than with other common associates. We also found that size of *Schwalbea americana* seedlings played an important role in year to year survivorship independent of host attachment. Regardless of nitrogen form, we observed a greater rate of attachment of *Schwalbea americana* to *Pityopsis graminifolia* than to *Panicum tenue*. Nitrogen treatment had no effect on parasitism of *Panicum tenue*, although more seedlings of *Schwalbea americana* survived without haustoria with the NH4-280ppm treatment. Growth (leaf area and stem height) of *Schwalbea americana* increased with NH4-280 ppm treatment with *Pityopsis graminifolia* as a host. *Panicum tenue* had much higher nitrate reductase activity levels in the leaf tissue than *Pityopsis graminifolia*, and both hosts showed low levels in the root tissue. Low levels of nitrate reductase activity were found in the leaves of *Schwalbea americana*. Host preference of *Schwalbea americana* may be related to the host's ability to utilize NH4 as opposed to its ability to reduce NO3. Growth of *Schwalbea americana* appears to be influenced by the amount of NH4 available to the host.

Heppell, S. S., D. T. Crouse, et al. 2000. Using matrix models to focus research and management efforts in conservation. Quantitative methods for conservation biology. S. Ferson and M. Burgman: 148-168.

Heppell, S. S., C. J. Limpus, et al. 1996. Population model analysis for the Loggerhead Sea Turtle, Caretta caretta, in Queensland. Wildlife Research 23(2): 143-159.

> Worldwide declines of marine turtle populations have forced a need for sound conservation policies to prevent their extinction. Loggerhead turtles, *Caretta caretta*, are declining rapidly at eastern Australian nesting beaches, which are visited by females from all feeding areas for the stock. In some feeding areas of eastern Australia, loggerheads have been protected from deleterious anthropogenic effects. Using long-term mark-recapture data from one such protected group of turtles feeding on Heron Island Reef, Queensland, we created a matrix model to analyze loggerhead demography. We also produced a model for the females nesting at Mon Repos, Queensland, a major rookery where the annual nesting population has declined at rates approaching 8% per year. As indicated by a similar model for loggerheads in the USA, our models predicted

that small declines in annual survival rates of adult and subadult loggerheads can have a profound impact on population dynamics. A loss of only a few hundred subadult and adult females each year could lead to extinction of the eastern Australian loggerheads in less than a century. Survival in the first year of life is relatively less important in these long-lived and slow-maturing animals. At Mon Repos, nesting female survival is apparently so low that even beach protection efforts resulting in 90% hatchling emergence success would not prevent population decline. Our research suggests that continued mortality pressure on subadult and adult turtles in their dispersed feeding areas of eastern and nonhem Australia is a major threat to the eastern Australian loggerhead turtle population. Measures that protect adult and subadult loggerhead turtles should be supported, including the use of turtle excluder devices (TEDs) on prawn trawls.

Hershler, R. 2001. American aquatic snail genus *Tryonia (Rissooidea: Hydrobiidae).* Smithsonian Contributions to Zoology (612): i-iii; 1-53.

Morphological variation among members of the genus *Tryonia* (and its subgenus *Paupertryonia*) is congruent with a recently published phylogenetic analysis based on mtDNA sequences that showed that these taxa are polyphyletic assemblages of ecologically similar snails. *Tryonia* is reconstituted as a North and Central American monophyletic subunit of the subfamily Cochliopinae based on a synapomorphy of posterodorsal insertion of the vas deferens into the prostate gland. Presumably derived modifications of the shell, radular teeth, and genitalia unite groups of species within this genus. *Tryonia* is redefined and 18 species are recognized in the genus. Congeners are *T. aequicostata* (Pilsbry, 1890a), distributed in the Florida peninsula; *T. cheatumi* (Pilsbry, 1935) and *T. circumstriata* (Leonard and Ho, 1960), Rio Grande Basin; *T. hertleini* (Drake, 1956), interior drainage of northeast Mexico; *T. clathrata Stimpson*, 1865, and *T. gilae Taylor*, 1987, lower Colorado River basin; *T. angulata Hershler and Sada*, 1987, *T. elata Hershler and Sada*, 1987, *T. ericae Hershler and Sada*, 1987, *T. margae Hershler*, 1989, *T. monitorae Hershler*, 1999, *T. rowlandsi Hershler*, 1989, *T. salina Hershler*, 1989, and *T. variegata Hershler and Sada*, 1987, southern Great Basin; *T. porrecta* (Mighels, 1845), lower Colorado River basin, Great Basin, Hawaii; *T. quitobaquitae Hershler* in Hershler and Landye, 1988, Rio Sonoyta basin; *T. imitator* (Pilsbry, 1899), southern California coast; and *T. exigua* (Morelet, 1851), Lake Peten Itza, Guatemala. *Tryonia protea* (Gould, 1855) is found to be a junior synonym of *Paludina porrecta* Mighels, 1845. *Tryonia kosteri Taylor*, 1987, from the Pecos River basin, is found to be a member of the genus *Durangonella Morrison*, 1945, which was previously known only from the Mexican Plateau. A new North American genus, *Pseudotryonia Hershler*, is erected for three species previously placed in *Tryonia*. *Pseudotryonia* is diagnosed by a combination of genitalic characters. Its congeners are *P. brevissima* (Pilsbry, 18990b), Florida panhandle; *P. adamantina Taylor*, 1987, and *P. alamosae Taylor*, 1987, Rio Grande basin; and an undescribed species from the Tombigbee River basin. A new monotypic genus, *Ipnobius Hershler*, is erected for *Tryonia robusta Hershler*, 1989, from Death Valley, California. *Ipnobius* is diagnosed by genitalic autapomorphies. Lectotypes are designated for *Melania exigua Morelet*, and *Amnicola protea Gould*.

Hinman Katharine, E. 1999. Pollination of *Agave palmeri* by nectar-feeding bats in southeastern Arizona and the effects of alternate resources on this system. Bat

Research News. 40(4). 173-174.

Hitchcock, M. A. 1977. A Survey of the Peregrine Falcon Population in Northwestern Mexico, 1976-77. Chihuahuan Desert Research Institute, Contribution. No. 40, 33 pp. 29 ref.

> Peregrine falcon (*Falco peregrinus anatum)* populations were surveyed over a two-year period in the Sierra Madre Occidental in Chihuahua and Durango, Mexico. Eight peregrine territories were discovered. At least 14 young were produced by seven of nine nesting pairs. The study area contains 21 known prairie falcon (*Falco mexicanus*) territories. Alternation of nesting sites between peregrine and prairie falcons is occurring and competition between the two species is being investigated. Peregrine falcon eggshell fragments collected in 1977 were found to be significantly thinner (13-25%) than pre-1947 peregrine eggshells. Investigations of pesticide use in agricultural areas confirms that DDT and chlorinated hydrocarbon pesticides are available commercially and in current use. The great-tailed grackle (*Cassidix mexicanus*) has been chosen as an indicator of environmental pollutants (i.e., PCB, DDT, DDE, and other chlorinated hydrocarbons). Results are pending from analysis of these samples.

Hoditschek, N. J., F. Cully, et al. 1985. Least shrew (*Cryptotis parva*) in New Mexico. Southwestern naturalist 30: 600 - 601.

Holloway, A. K. and G. D. Schnell. 1997. Relationship between numbers of the endangered American burying beetle *Nicrophorus americanus Olivier* (Coleoptera: Silphidae) and available food resources. Biological Conservation 81(1-2): 145-152.

> The American burying beetle *Nicrophorus americanus Oliver* (Coleoptera: Silphidae), designated in the United States as an endangered species, requires vertebrate carcasses for feeding, breeding and rearing young (optimally 80-200 g for breeding, but beetles readily feed on smaller carcasses). Previous studies at the 29000 ha Fort Chaffee Military Reservation, Arkansas and the 20000 ha Camp Gruber Training Site, Oklahoma have shown that with habitat defined based on vegetation, the species is a habitat generalist when feeding. Given that the species was not selective relative to habitat type at Fort Chaffee, we investigated whether there was a relationship between numbers of beetles and measures of vertebrate abundance. For beetles, eight baited pitfall traps were set for three nights in 1992 and 1993 along each of the 52 transects where, in previous years, birds and mammals had been censused. Birds were counted using a modified point-count technique (five counts during May-June 1989-1991), and mammals were sampled with 'museum special' snap traps and rat traps (three two-day trapping periods during May-June 1989-1991). In analyzing 0-200 g mammals trapped and birds counted on the transects, significant correlations were found of the number of American burying beetles caught with biomass of mammals; biomass of mammals plus birds; numbers of species of mammals; and numbers of individual mammals. American burying beetles frequented sites where small vertebrates (particularly mammals) were relatively abundant, irrespective of the predominant habitat at that site.

Hooper, L. M., M. K. Rust, et al. 1998. Using bait to suppress the southern fire ant on an ecological sensitive site (*Hymenoptera: Formicidae*). Sociobiology 31(3): 283-289.

Solenopsis xyloni attacks the ground nesting, endangered California least tern *(Sterna antillarum browni)* at Naval Air Station North Island, San Diego, California, USA. Baiting with selected baits suppressed ant populations, reduced *Solenopsis xyloni* attacks, and was positively correlated with increased *Sterna antillarum browni* fledging success. Granular bait containing 0.9% (wt/wt) hydramethylnon (Max Force) suppressed ant colonies up to 6 months. Even though the numbers of foraging ants were reduced, some colonies persisted. This suggests selective distribution or differential sensitivity to the active ingredient within ant colonies. Area-wide baiting reduced loss of tern eggs and chicks attributed to *Solenopsis xyloni* 40.4% within 4 years. Strategic baiting around bird nests reduced predaceous ants but was not as effective as area-wide and strategic baiting. Tern hatch success, chick survival, and percent fledging improved as the number of *S. xyloni* was reduced.

Hoyt, R. A., J. S. Altenbach, et al. 1994. Observations on long-nosed bats (*Leptonycteris*) in New Mexico. Southwestern Naturalist 39: 175 - 179.

Hubbard, J. P. 1978. Revised check-list of the birds of New Mexico. Ornithological Society Publ. 6: 110.

Hubbs, C. 1999. Effect of light intensity on brood production of livebearers *Gambusia spp*. Transactions of the American Fisheries Society 128(4): 747-750.

Experiments showed that brood production of livebearers *Gambusia spp.* was effected by light intensity. Females were exposed to 108, 216, 324, and 432 lux of incandescent light. Natural light varies with turbidity and aquatic plant cover, but clear surface waters exceed 432 lux. Western mosquitofish *Gambusia affinis* ($P = 0.025$), largespring gambusia *G. geiseri* ($P < 0.01$), and Clear Creek *gambusia G. heterochir* ($P < 0.01$) had significantly fewer broods at low lux, but *Pecos gambusia G. nobilis* ($P < 0.01$) had fewer broods at high lux. This finding was not due to differences in feeding, breeding delays, or sexual activity, because the females store sperm and were isolated from the males. *Pecos gambusia* from East Sandia Spring had more broods at highest light, and largespring *gambusia* from the same location had more broods at lower light.

Hubbs, C. 2001. Environmental correlates to the abundance of spring-adapted versus stream-adapted fishes. Texas Journal of Science 53(4): 299-326.

Large springs in the southwestern United States and northern Mexico have endemic spring-adapted fishes that have congeners, which are found inhabiting more eurythermal streams. In Texas, *Gambusia nobilis*, *G. heterochir*, *G. gaigei* and *G. geiseri* are spring-adapted fishes and *G. affinis* is a stream-adapted species. A series of 8 to 16 minnow traps were set at the headsprings and downstream of eight spring systems over a two-year period. At each spring, *G. affinis* dominated downstream, and the spring-endemic species dominated at the headsprings. A series of seven environmental parameters were measured at each trap station and correlated to the fishes captured. The results suggest that spring flow, thermal stability and pH are the most important determinates of fish species abundance. Even minor declines in spring flow appeared to have drastic negative impacts on the spring endemic species and extirpations are possible long before the final cessation of flows from springs.

Hubbs, C. and J. Karges. 1999. Additional data on habitat segregation between *Gambusia spp*. Texas Journal of Science 51(4): 339-341.

Habitat utilization by *Gambusia geiseri* and the endangered *G. nobilis* was studied at 4 locations in west Texas, during January 1998-June 1999. There was a trend for a higher percentage of *G. nobilis* to occupy deeper water than *G. geiseri*.

Hundermark, C. A. 1974. First record of *Olivaceus cormorant* nesting in New Mexico. Willson Boletin 86: 65.

Institute, C. D. R. 1977. Nesting Peregrine Falcons in Texas. Chihuahuan Desert Research Institute, Contribution. No. 37.

The Chihuahuan Desert is one of the last areas in North America where peregrine falcons (*Falco peregrinus anatum*) continue to breed and produce young. Peregrine falcons have been endangered by the past widespread use of DDT. (DDT contamination causes eggshells to be so thin that embryos do not survive.) Peregrine eyries in Texas were surveyed to determine the status of the population. Four of the five eyries studied produced a total of eleven young. In addition, a new eyrie in Big Bend National Park, Texas probably fledged at least one young. Although eggshells still remain thin, there has been an improvement in peregrine productivity due to the gradual attrition of DDT residues in the environment.

Institute, C. D. R. 1977. Peregrine Breeding Behavior at the Agua Dulce Eyrie, Lincoln Forest, New Mexico: a Successful Transplant of Captive-bred Young. Chihuahuan Desert Research Institute, Contribution. No. 38, 32 pp. 32 ref.

In 1976 a pair of peregrine falcon (*Falco peregrinus anatum*) failed to reproduce. Therefore, a transplant of captive-bred peregrine young to the eyrie was planned for 1977 by personnel from Cornell University's Peregrine Fund, the U. S. Forest Service and the Chihuahuan Desert Research Institute. The transplant involved several steps. In April, three eggs laid by the pair were replaced by plaster-filled eggs. In May, a pair of 15-day-

old prairie falcons were placed in the nest. Several days later the prairie falcons were replaced by two ten-day-old captive-bred peregrine falcons. These were raised by the adults and were fledged in June. Recommendations made by the research team include: further monitoring of the eyrie and another transplant of captive-bred young if necessary; control of grazing in riparian habitat; further efforts to halt the use of DDT, (which has been the major cause of peregrine decline).

Jaeger Jef, R., R. Riddle Brett, et al. 2001. Rediscovering Rana onca: Evidence for phylogenetically distinct leopard frogs from the border region of Nevada, Utah, and Arizona. Copeia. (2): 339-354.

Remnant populations of leopard frogs within the Virgin River drainage and adjacent portions of the Colorado River (Black Canyon) in northwestern Arizona and southern Nevada either represent the reportedly extinct taxon *Rana onca* or northern, disjunct *Rana yavapaiensis*. To determine the evolutionary distinctiveness of these leopard frogs, we evaluated mitochondrial DNA (mtDNA) restriction site variation (RFLP), mtDNA control region sequences, randomly amplified polymorphic DNA (RAPD) markers, and morphological characters. Individuals from the Virgin River drainage and Black Canyon represented a single RFLP haplotype and were identical for nucleotides along a portion of control region sequence. Evaluations of RAPD data demonstrated high levels of similarity among individuals and populations from this region. Leopard frogs from the Virgin River drainage and Black Canyon differed from *R. yavapaiensis* from west-central Arizona and northern Mexico in maximum parsimony and distance analyses of RFLP and control region sequence data and in maximum-likelihood analysis of the sequence data. Multidimensional scaling of RAPD data provided a similar and congruent indication of this separation. Analysis of principal component scores demonstrated significant morphological differentiation between leopard frog specimens from the Virgin River drainage and *R. yavapaiensis*. Parallel patterns of divergence observed in the mtDNA, RAPD, and morphological analyses indicate that leopard frogs from the Virgin River drainage and adjacent portions of the Colorado River are phylogenetically distinct. These leopard frogs should be recognized as a lineage separate from southern populations of *R. yavapaiensis* and classified as the species *R. onca*.

Jefferson, T. A. and A. J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review. 27(1). 27-50.

In order to comprehend better the distribution of Gulf of Mexico cetaceans, all available records of whales and dolphins in the offshore Gulf were assembled and analysed. This included sightings, strandings and captures of all species, except the Bottlenose Dolphin *Tursiops truncatus*, from all sources, except the recently completed GulfCet project. An attempt was made to confirm species identification for each of the records. A total of 1223 records was available for analysis. Twenty-seven species of cetaceans have been confirmed to occur in the offshore Gulf of Mexico. All of the baleen whales, with the possible exception of the Bryde's Whale *Balaenoptera edeni* appear to be extraliminal in the Gulf. The Sperm Whale Physeter macrocephalus is, by far, the most common great whale in this body of water. All previous records of Common Dolphins *Delphinus spp.* in the Gulf are rejected as either incorrect or unreliable, and there is currently no convincing

evidence that dolphins of the genus *Delphinus* occur in the Gulf. The Atlantic Spotted Dolphin *Stenella frontalis* is the only species, other than the Bottlenose Dolphin, that regularly occurs over the continental shelf The Pantropical Spotted Dolphin *Stenella attenuata* is the most common species of small cetacean in oceanic waters of the Gulf, but many other species also occur there in significant numbers.

Jefferson Thomas, A. and K. Lynn Spencer. 1994. Marine Mammal Sightings in the Caribbean Sea and Gulf of Mexico, Summer 1991. Caribbean Journal of Science. 30(1-2). 83-89.

In the summer of 1991, we conducted marine mammal surveys in the Gulf of Mexico, Caribbean Sea, and a small portion of the southwestern North Atlantic. A total of 193 hours of survey effort was conducted, and there were 60 marine mammal sightings. Species identified (number of sightings in parentheses) were: sperm whale *Physeter catodon L.* (6), Cuvier's beaked whale *Ziphius cavirostris G. Cuvier* (1), short-finned pilot whale *Globicephala macrorhynchus Gray* (1), rough-toothed dolphin *Steno bredanensis* (Lesson) (1), bottlenose dolphin *Tursiops truncatus* (Montagu) (6), Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier*)* (2), pantropical spotted dolphin *S. attenuata* (Gray) (10), spinner dolphin *S. longirostris* (Gray) (1), and striped dolphin *S. coeruleoalba* (Meyen) (3). Distribution of sightings was largely related to sighting conditions, but there were concentrations of sightings in areas with high sea floor relief—in the Straits of Florida, the area west of Martinique, and along the Mexican Ridge.

Jennings, R. D. 1987. The status of *Rana berlandieri*, the Rio Grande leopard frog, and *Rana yavapaiensis*, the lowland leopard frog in New Mexico. Santa fe, NM Dept. Game & Fish: iv +44.

Jennings, R. D. and D. D. Beck. 1997. Habitat use by Gila monsters in the Chihuahuan Desert of New Mexico. Bulletin of the Ecological Society of America. 78 (4 suppl.) 117. Meeting Abstract.

Johnson, T. J. 1999. The peregrine falcon in New Mexico 1999. Santa Fe, NM, Department of Game and Fish: 12.

Jorgensen, J., G. Dalton, et al. 1994. Management considerations of *Leptonycteris curasoae* in Arizona, including foraging and roosting information. Bat Research News. 35(4). 102-103.

Jormalainen, V. and M. Shuster Stephen. 1997. Microhabitat segregation and cannibalism in a endangered freshwater isopod, *Thermosphaeroma thermophilum*.

Oecologia, Berlin. 111(2). 271-279.

Intraspecific microhabitat segregation is expected to arise when there are age- or sex-specific differences in predation risk. The degree to which conspecific predation (cannibalism) can generate this risk, however, is poorly understood. In this paper, we examine microhabitat use, cannibalism, and individual responses to the presence of conspecifics in *Thermosphaeroma thermophilum*, an endangered isopod crustacean species that is endemic to a single, thermal spring in Socorro, N.M. USA. In samples from the natural habitat, juveniles (mancas) were found mainly on vegetation, whereas adults were found predominantly on bottom sediments. Females were found on vegetation more often than males. In laboratory containers without refuges, males cannibalized females, males and females cannibalized mancas, and mancas cannibalized each other, even in the presence of alternative food. When placed in containers provided with refuges, mancas actively avoided adults. We suggest, therefore, that cannibalism in *T. thermophilum* generates age-, size-, and sex-specific predation risks which are responsible for microhabitat segregation between mancas and adults, and between males and females. Since interspecific predation in the spring Is negligible, cannibalism appears to play a significant role in population regulation and behavioral evolution in this species. We recommend, given the current endangered status of this species, that microhabitat heterogeneity be maintained in its native spring because it provides refuges from cannibalism and may support a larger and more viable natural population.

Jormalainen, V. and M. Shuster Stephen. 1999. Female reproductive cycle and sexual conflict over precopulatory mate-guarding in *Thermosphaeroma* (Crustacea, Isopoda). Ethology. 105(3). 233-246.

In species with time-limited opportunities for insemination, precopulatory mate-guarding is expected to coevolve with the duration of female reproductive cycles. Despite this adaptation to female characteristics, it may also be advantageous for males to adjust the duration of guarding with respect to sex ratio because the benefits of guarding are dependent on the availability of females. If female fitness is reduced because of guarding, male guarding behavior leads to intersexual conflict. We studied these aspects of male mate-guarding behavior in two closely related, thermal-spring isopods (*Thermosphaeroma*). First, guarding duration showed species specificity which was related to the duration of reproductive cycle; cycle length for females and duration of guarding by males in *T. milleri* were twice as long as in *T. thermophilum*. Second, males in both species adjusted their guarding duration with sex ratio, guarding longer when a competing male was present. Third, in *T. thermophilum*, ovarian development began immediately after the birth of the previous brood and continued through guarding, sexual molt and post-molt periods until oviposition, whereas in *T. milleri*, ovarian development was largely postponed until the post-molt period. Because guarding during ovary provisioning periods may be costly for females, we tested the existence of intersexual conflict over guarding duration in *T. thermophilum*. We compared the duration of guarding of control pairs with those of pairs in which either male guarding ability or female ability to resist guarding was reduced experimentally. Guarding durations for manipulated and control males were equal, but manipulated females were guarded longer, suggesting that conflict exists and that females can effectively shorten guarding duration by their behavior. Moreover, we suggest that selection in the context of intersexual conflict may play an important role in the evolution of delayed oviposition and sperm-storage organs in mate-guarding crustaceans.

Kazmaier Richard, T., C. Hellgren Eric, et al. 2001. Mark-recapture analysis of population parameters in a Texas tortoise (*Gopherus berlandieri*) population in southern Texas. Journal of Herpetology. 35(3): 410-417.

Techniques to assess population changes in reptiles across large landscapes are a conservation and management need. We studied a population of Texas tortoises (*Gopherus berlandieri*) on a large study area (6150 ha) of contiguous thornscrub vegetation in southern Texas from 1990 to 1999. We examined cohort and temporal variation in capture probabilities; and estimated survival, population size, and lambda (finite population growth rate) for a population of Texas tortoises. We captured 2128 tortoises a total of 3,132 times during the study period. The distribution of the frequency of captures by sex varied during the active season and across years, but annual capture probabilities were similar between sexes. The ratio of juvenile to adults varied by a month-by-year interaction. Tortoises exhibited a temporary response to marking that was modeled in survival analysis. Capture probabilities of adult tortoises on an annual basis ranged from 0.12-0.38, and annual survival rate of adults was estimated to be 0.79+-0.05. We estimated the density of the adult population to be 0.26 tortoises/ha, a level of magnitude lower than previous work conducted on habitat islands. Lambda (population growth rate) was estimated to be 0.981 (95% confidence limits: 0.945-1.019) from a Jolly-Seber model. Road-cruising was an effective large-scale method for population monitoring of the Texas tortoise in our study area and may prove useful in thornscrub habitats that compose the majority of its geographic range.

Kazmaier, R. T., E. C. Hellgren, et al. 2001. Habitat selection by the Texas tortoise in a managed thornscrub ecosystem. Journal of Wildlife Management 65(4): 653-660.

Brush encroachment on semiarid shrublands resulting from livestock grazing has created global concern. Southern Texas, USA, is dominated by Prosopis-Acacia mixed brush communities typical of the Tamaulipan Biotic Province, and the geographic range of the state-threatened Texas tortoise (*Gopherus berlandieri*) is nearly identical to the boundaries of this biotic province in Texas. In light of the perceived threat to Texas tortoises because of habitat change caused by brush encroachment, we monitored 36 Texas tortoises by radiotelemetry during 1994-96 to assess habitat selection on a site containing grazed and ungrazed pastures. Tortoises did not exhibit habitat selection at the level of locations within home ranges. Differential habitat selection at the level of home ranges within study areas was not apparent for sex, but was evident for treatment (grazed or ungrazed). Analysis of pooled data indicated that tortoises exhibited broad-scale selection for home ranges within study areas. Selection was expressed as preferential avoidance of old-field and riparian habitats, which represented vegetation extremes of canopy cover. However, tortoises tolerated the broad continuum of other brush communities on the study site. Apparent treatment differences may be an artifact of our inability to adequately pair study areas given the scale of tortoise movement. Our data indicate that increases in the extent of woody canopy cover resulting from grazing-induced brush encroachment will not be detrimental to Texas tortoises. Furthermore, large-scale range improvement practices, such as root-ploughing, create unsuitable habitats for this species.

Kazmaier, R. T., E. C. Hellgren, et al. 2001. Effects of grazing on the demography and growth of the Texas tortoise. Conservation Biology 15(4): 1091-1101.

Considerable effort has been exerted in attempts to understand the complex ecological effects of grazing. North American tortoises, by virtue of their distribution, provide a good model taxon through which to study how grazing effects vary with grazing regime, habitat, and climate. The Texas tortoise (*Gopherus berlandieri*), which is restricted primarily to privately owned rangelands of southern Texas and northeastern Mexico was studied. Management of this species is hampered by a lack of information on the effects of common land use practices. The effects of moderate grazing by cattle (short-duration, winter-spring rotational grazing regime; 6-28 animal-unit days/ha/year) on this tortoise were studied by comparing two grazed and two ungrazed sites in the Western Rio Grande Plains, Texas (USA), from April 1994 to October 1997. One hundred thirty two captures of 106 individuals in the ungrazed pastures and 324 captures of 237 individuals in the grazed pastures were made. 22 tortoises were radio-tracked in the ungrazed pastures and 25 tortoises in the grazed pastures. Comparisons of relative abundance, body-size distribution, age distribution, body mass, sex ratio, adult survival, proportion of juveniles, and growth rates revealed no differences ($p>0.05$ for all parameters) between tortoises on grazed and ungrazed areas. Based on these results, we suggest that moderate grazing by cattle is not incompatible with maintenance of Texas tortoise populations. Our data were consistent with a general model of tortoise biogeography and tolerance of disturbance which suggests that Texas tortoises are tolerant to intermediate levels of disturbance. Generalities about the effect of cattle grazing on the four North American tortoises should be avoided unless they can be placed in the context of grazing regime, precipitation, habitat quality, and tortoise requirements.

Kazmaier, R. T., E. C. Hellgren, et al. 2001. Patterns of behavior in the Texas tortoise, *Gopherus berlandieri*: a multivariate ordination approach. Canadian Journal of Zoology 79(8): 1363-1371.

We compared the distribution of 19 categories of behavior exhibited by 47 adult Texas tortoises *(Gopherus berlandieri)* in Chaparral Wildlife Management Area, Texas, USA, over 3 years with the use of detrended correspondence analysis (DCA) and canonical correspondence analysis (CCA). DCA revealed a gradient from passive to active behavior along axis 1. Tortoises were more active in 1994 and less active in 1996. This pattern was likely due to the extremely hot and dry conditions in 1996. Year was the most significant variable explaining variability in behavior when sex, age, size, year, and grazing treatment (pastures grazed versus ungrazed by cattle) were used as environmental variables in CCA. Age, size, and grazing treatment were not significant variables in CCA. Tortoises used proportionally more burrows, shallow surface depressions termed pallets, and cavity pallets, and ate more cactus in 1996. More foraging and active behaviors, like courtship, were observed in 1994. Sex was a significant variable in explaining behavioral variability after the effects of year were controlled for. Males tended to exhibit more active behaviors than females. Our analyses suggested that the grazing regime used in Chaparral Wildlife Management Area did not affect the patterns of behavior exhibited by this protected tortoise.

Keenlyne, K. D. 1997. Life history and status of the shovelnose sturgeon, *Scaphirhynchus platorynchus*. Environmental Biology of Fishes 48(1-4): 291-298.

The shovelnose sturgeon, *Scaphirhynchus platorynchus*, is a freshwater sturgeon of the Mississippi and Missouri rivers and their tributaries. It is one of the smaller North American sturgeons, seldom weighing more than 2.5 kg over most of its range except in the upper Missouri River, where individuals of over 7 kg have been found. Spawning occurs in spring at temperatures between 17 and 21 degree C over rock or gravel substrate downstream from dams, near rock structures, or in tributaries. most males reach sexual maturity at 5 years, most females at 7 years. Adults do not spawn every year. Shovelnose sturgeon are found in large, turbid rivers and frequently concentrate in areas downstream from dams or at the mouths of tributaries. Population densities range up to 2500 fish per km. They are commonly found in areas of current over sandy bottoms or near rocky points or bars, where they feed primarily on aquatic invertebrates. The shovelnose sturgeon is classified as a sport species in 12 of 24 states where it occurs. Commercial harvest is allowed in seven states, where fresh shovelnose sturgeon sell for 55 to 88 cents per kg, smoked shovelnose for about 5.75 per kg, and roe from 33 to 110 dollars per kg. About 25 tons of shovelnose sturgeon are harvested commercially each year. Shovelnose sturgeon are considered extirpated in three states, fully protected in four states, and rare, threatened, or of special concern in eight states. Populations are considered stable throughout most of the upper Mississippi, lower Missouri, Red, and Atchafalaya rivers. Three states, Wyoming, West Virginia, and New Mexico, have developed plans to reintroduce the species into rivers where it has been extirpated.

Kennedy, P. L., D. W. Stahlecker, et al. 1995. Organochlorine concentrations in potential avian prey of breeding peregrine falcons in north-central New Mexico. Southwestern Naturalist 40(1): 94-100.

Despite the federal ban of DDT since 1972, some southwestern populations of peregrine falcons (*Falco peregrinus anatum*) still exhibit extremely low natural production and continue to accumulate high levels of DDE. During 1985, 35 potential species of migrant and resident prey of peregrine falcons were collected in north-central New Mexico to determine if local peregrine falcons are exposed to DDE on the breeding grounds. Thirteen (37.1%) of the 35 species pools contained DDE residues >1.0 p.p.m. Say's phoebe (*Sayornis saya*; 22.01 p.p.m.), killdeer (*Charadrius vociferus*; 13.49 p.p.m.), American pipit (*Anthus rubescens*; 11.63 p.p.m.), western meadowlark (*Sternella neglecta*; 6.25 p.p.m.), and Brewer's blackbird (*Euphagus cyanocephalus*; 5.28 p.p.m.) pools had DDE residues >5.0 p.p.m. DDE concn were not significantly related to prey diet but migration status was a significant effect with DDE residues lowest in residents (geometric mean = GM = 0.08 p.p.m.), intermediate in weakly migratory species (GM = 0.37 p.p.m.) and highest in strongly migratory species (GM = 1.63 p.p.m.). Based on the results of this study and a review of the literature, it was concluded that peregrine falcons utilizing this study area are still faced with a potential source of DDE contamination.

Kenyon, L. O., Landry Andre M, Jr., et al. 2001. Trace metal concentrations in blood of the Kemp's ridley sea turtle (*Lepidochelys kempii*). Chelonian Conservation & Biology 4(1): 128-135.

Trace metal concentrations were analyzed from the blood of 106 Kemp's ridley sea turtles (*Lepidochelys kempii*) captured alive off Texas and Louisiana, USA, during June-October 1994 and May-August 1995. Copper, lead, mercury, silver, and zinc concentrations were measured in wild and headstarted animals and both sexes. Overall, levels in whole blood were: copper (range = 215-1300 ng/g, mean = 524 ng/g), lead (range = 0.00-34.3 ng/g, mean = 11.0 ng/g), mercury (range = 0.50-67.3 ng/g, mean = 18.0 ng/g), silver (range = 0.042-2.74 ng/g, mean = 0.94 ng/g), and zinc (range = 3280-18,900 ng/g, mean = 7500 ng/g). None of these concentrations differed significantly among wild, headstarted, female, and male ridleys. Copper, mercury, and zinc concentrations exhibited significant positive relationships with turtle size. Female ridleys displayed a stronger positive correlation between mercury and zinc concentrations and size than did males. Trace metal blood levels were lower than tissue levels reported elsewhere for marine and freshwater turtles, other reptiles, invertebrates, fish, marine birds, and mammals. Analysis of whole blood is a safe method to monitor trace metal levels in live sea turtles but must be considered a conservative estimate of these loads when compared with potentially higher levels in organs or other tissues.

Key, L. J. 1980. Peregrine Falcon Breeding Status in Texas National Parks,. Chihuahuan Desert Research Institute, Alpine, Texas, Contribution (97, 19): 1980.

During the spring of 1980, researchers monitored the productivity of five known peregrine falcon (*Falco peregrinus anatum*) territories, four in Big Bend National Park and one in Guadalupe Mountains National Park. Two of the sites in Big Bend produced young. At the single eyrie site in Guadalupe Mountains National Park, a lone adult male was present. A total of four young were produced, resulting in an overall productivity of one young per adult pair. If productivity remains at the low level it reached in 1979 and 1980, the consequences for the stability of the population could be serious.

Kirkman, L. K., B. Drew Mark, et al. 1998. Effects of experimental fire regimes on the population dynamics of *Schwalbea americana L*. Plant Ecology. 137(1). 115-137.

We studied the effects of experimental fire regimes, (dormant season fire, growing season fire, growing season mowing and control, i.e., no experimental treatment) on populations of the USA federally endangered, *Schwalbea americana L.* between 1992 and 1996. Although this species occurs in fire-maintained habitat in the Southeastern USA, there is concern about the use of fire for such rare populations. The purpose of the study was to examine how seasonal timing of fire and fire suppression affect population demography, flowering phenology and spatial distribution; to identify modes of persistence associated with fire regimes; and to determine if summer mowing provides a management alternative to fire. Fire-induced flowering was demonstrated in this species. Seasonal timing of bums appears to have relatively little consequence on population structure or spatial extent, but alters flowering phenology. Burning, regardless of season, resulted in increased population density and expansion in areal extent. Two possible mechanisms of

persistence between fire events were identified including regression from reproductive stage to vegetative stage in the absence of fire and dormancy of individual plants for one or more seasons. Growing season mowing does not appear to be an adequate substitute for burning.

Koehler, D. M. and M. G. Hornocker. 1977. Fire effects on marten habitat in the Selway-bitterfoot Wilderness. Journal of Wildlife Management 41: 500 - 505.

Koster, W. J. 1957. Guide to the fishes of New Mexico. Albuquerque, N.M., The University of New Mexico Press.

Kroll, J. C. 1980. Habitat requirements of the golden-cheeked warbler: management implications. Journal of Range Management 1983. 33(1): 60-65.

Nesting and wintering habitats of *Dendroica chrysoparia* were studied in Texas and Honduras 1973-78. The birds were dependent on Ashe juniper (*Juniperus ashei*) for nesting materials and singing perches, and on scrub oak (*Quercus durandii breviloba*) for foraging. Scrub oak (mostly *Q. oleoides*) in the wintering habitat (Honduras) was structurally similar to that in the nesting habitat.

Kurta, A. and C. Lehr Glenn. 1995. Lasiurus ega. Mammalian Species. (515): 1995 1-7.

Landye, J. J. 1981. Current status of endangered, threatened, and/or rare mollusks of New Mexico and Arizona., Endangered Species Office, U.S. Fish and Wildlife Service.

Lanning, D. V. and P. W. Lawson. 1977. Ecology of the Peregrine Falcon in Northeastern Mexico, 1977. Chihuahuan Desert Research Institute, Contribution. 1977. No. 41, 71 pp. 52 ref.

The third year of study of breeding peregrine falcons (*Falco peregrinus anatum*) in the Sierra Madre Oriental in northeastern Mexico was aimed at determining reproductive status and ecological relationships. Six pairs of peregrine falcons nested within a 25-km-diameter circle, the highest known breeding density remaining in North America south of the boreal forests. Four of the six pairs produced seven young in 1977. For all years, 11 of 15 nesting attempts (73 percent) were successful, reproductive rates comparing favorably with those for peregrine populations in North America before the use of DDT. At least 20 young were produced in this study area during the three nesting seasons, for an average of 1.8 young per successful nest. A variety of organochlorine and organophosphate pesticides are used in the area, particularly in orchards. Levels of organochlorine insecticides measured in 42 putative prey birds (14 species) had a high of less than one part per million DDE and dieldrin and many were uncontaminated. These data indicate a relatively clean environment.

Lee, J. C. 1993. Geographic variation in size and shape of neotropical frogs: A precipitation gradient analysis. Occasional Papers of the Museum of Natural History University of Kansas 163: 1-20.

Anuran species richness in the Yucatan Peninsula diminishes dramatically from south to north and, especially, to the northwest. Species richness covaries positively with mean annual precipitation and negatively with seasonality of precipitation; together these two abiotic variables statistically explain 71% of interlocality variation in anuran species richness at 27 sites in the Yucatan Peninsula. Those few species that occur in the arid northwest portion of the peninsula are a nonrandom subset of the anuran fauna with respect to body size and reproductive mode. As a group, pan-peninsular species tend to be large species, and there is a highly significant rank correlation between body size and the extent to which species penetrate the most arid portion of the peninsula. In terms of reproductive mode, none of the seven species that deposit eggs out of water penetrates the driest areas of the Yucatan Peninsula. The hypothesis that large size and small appendages convey an advantage in a desiccating environment due to favorable surface-volume relationships is tested for a pan-peninsular species, *Smilisca baudinii*. This species exhibits highly significant interlocality variation in size, but a multivariate morphometric analysis reveals that this variation is not organized in a manner consistent with expectation. Thus, with respect to body size, the interspecific pattern is not recapitulated by an intraspecific one. However, independent of overall size, frogs from drier, more seasonal areas have smaller appendages, as predicted by a surface-volume desiccation argument.

Lemos-Espinal Julio, A., D. Chiszar, et al. 2000. *Crotalus lepidus lepidus* (mottled rock rattlesnake). Herpetological Review. 31(2). 113.

Ligon, D. B. and C. C. Peterson. 2000. Physiological variation in estivation among mud turtles (*Kinosternon spp*.). American Zoologist 40(6): 1104-1105.

Sonoran mud turtles (*Kinosternon sonoriense*) have long been believed to be obligately aquatic, yet recent evidence suggests that populations in the extreme eastern portion of the species' range thrive in habitats that experience annual drying. We compared the physiological response to dry conditions of *K. sonoriense* from two populations: one from Arizona, in which turtles have been described as primarily aquatic, and one from New Mexico, in which extensive estivation has been documented. For comparative purposes, the responses of groups of *K. flavescens* (a well-documented estivator) and *K. hirtipes* (a highly aquatic species) were also measured. All four groups were subjected to simulated dry-season conditions in the laboratory. Resting metabolic rates and rates of evaporative water loss were measured prior to removal from water, after seven weeks of estivation, and following rehydration. Blood samples were drawn at the same intervals. Over the

course of the study, Arizona *K. sonoriense* exhibited rates of mass loss similar to those of *K. hirtipes*, but that were higher than both the New Mexico *K. sonoriense* and *K. flavescens*. Differences among groups were evident in rates of evaporative water loss, resting metabolic rates, and several blood chemistry variables, including Na+, K+, and BUN. The effects of behavior on physiological response to estivation were examined.

Ligon, J. S. 1961. New Mexico birds. Albuquerque, NM, University of New Mexico press. 360 pp.

Lockley, T. C. 1995. Effect of imported fire ant predation on a population of the least tern—an endangered species. Southwestern Entomologist 20(4): 517-519.

The negative impact of *Solenopsis invicta* stinging and predation on *Sterna antillarum* nestlings on a beach in Gulfport, Mississippi, USA, in 1988-91 is described, as is the use of fenoxycarb to control the ants.

Lockwood, M. W. 1995. Notes on life history of *Ancistrocactus tobuschii (Cactaceae)* in Kinney County, Texas. Southwestern Naturalist 40(4): 428-430.

Loegering, J. P., J. D. Fraser, et al. 1995. Ghost crab preys on a Piping Plover chick. Wilson Bulletin 107(4): 768-769.

Predation on a chick of the endangered bird *Charadrius melodus* by a crab (Ocypode *quadrata*) is reported from Assateague Island, Maryland, USA, on 7 July 1988.

Lomolino, M. V. and J. C. Creighton. 1996. Habitat selection, breeding success and conservation of the endangered American burying beetle *Nicrophorus americanus*. Biological Conservation 77(2-3): 235-241.

We tested the hypothesis that the decline of the endangered American burying beetle *Nicrophorus americanus* resulted primarily from its relatively large size and its specialized breeding requirements (vertebrate carcasses which, after burial, are used to nourish their young). Because it is the largest member of the burying beetle guild, *N. americanus* requires larger carcasses for breeding (optimal carcass mass is between 100 and 300 g). In comparison to smaller carcasses, larger carcasses are more rare and more difficult to bury. Therefore, while *N. americanus* may feed in many habitats, its optimal breeding habitats may be limited to those with a substantial litter layer and relatively deep, loose soils. Given this, Anderson (1982 Coleopt. Bull., 36) hypothesized that the decline of *N. americanus* resulted from deforestation in North America. The results of our regional- and local-scale field studies, and manipulative field experiments, support Anderson's hypothesis. At a regional scale (i.e. across its range in Oklahoma), distributions of *N. americanus* populations were biased toward forested sites with relatively deep soils (p lt

0.001). At a local scale, individual *N. americanus* exhibited a strong and highly significant (p lt 0.001) preference for mature forests over clearcuts. Finally, our breeding experiment with pairs of N. americanus placed on carcasses in either grassland or forested habitats indicated that breeding success of this species was substantially and significantly (p lt 0.05) higher in forested ecosystems.

Lomolino, M. V., J. C. Creighton, et al. 1995. Ecology and conservation of the endangered American burying beetle (*Nicrophorus americanus*). Conservation Biology 9(3): 605-614.

Field studies were conducted on the western population of the endangered American burying beetle (*Nicrophorus americanus*) in Oklahoma and Arkansas to determine its habitat affinities. A common cause of declining populations is some specialized adaptation that makes it difficult to respond to a rapidly changing habitat. We evaluated the hypothesis that *N. americanus* is a habitat specialist in its search for food, preferring mature forests with deep, humic soils. This hypothesis was rejected. Based on comparisons of niche breadth among syntopic congeners and niche overlap, *N. americanus* is relatively generalized in its use of a range of habitats when searching for food. It is likely that the generalist nature and the endangered status of *N. americanus* both derive from the fact that it is the largest member of its guild. In comparison to smaller species, *N. americanus* breeds on larger carcasses, which are more unpredictable in space and time. It is likely, therefore, that *N. americanus* must search over a larger area and greater diversity of habitats than its smaller congeners.

Malda, G., H. Suzan, et al. 1999. In vitro culture as a potential method for the conservation of endangered plants possessing crassulacean acid metabolism. Scientia Horticulturae (Amsterdam). 81(1). 71-87.

Rare and endangered plants possessing crassulacean acid metabolism (CAM), such as cacti, usually present limited reproductive capacities and very slow growth rates. The use of in vitro culture can overcome these difficulties. The massive in vitro production of new propagules which result in totally regenerated plants is described for two endangered cacti, *Obregonia denegrii Fric*. and *Coryphantha minima Baird*. A comparison of in vitro and ex vitro growth rates demonstrated that the in vitro environment notably accelerates cacti growth. Malic acid titratable acidity indicated that increase of the net carbon dioxide uptake is associated with active growth. This might be related to particular factors of the in vitro environment such as the high relative humidity inside the culture vessels, or growth regulators supplemented to the growth media. In vitro-derived cacti showed a proficient re-establishment capability which could be related to their succulence since water loss during transplantation did not represent a crucial hydric stress. Succulence and plasticity of the CAM metabolic pathway in plants like cactus, represent some possible advantageous for the application of in vitro propagation techniques in a number of endangered, succulent plants like members of the *Cactaceae, Agavaceae, Orchidaceae*, or *Bromeliaceae* families.

Manderbach, R. and M. Reich. 1995. Effects of dams and weirs on the ground beetle communities (*Coleoptera, Carabidae*) of braided sections of the Isar floodplain. Archiv Fuer Hydrobiologie Supplementband. 101(3-4). 1995. 573-588.

The effects of a weir (Krun weir) and a dam (Sylvenstein reservoir) on the ground beetle community (*Coleoptera, Carabidae*) inhabiting gravel bars of braided Alpine rivers were studied along the Upper Isar in southern Bavaria, Germany. The alluvial floodplain is characterized by a diverse carabid community, comprising 58 species. Many of the taxa encountered are endangered in Germany. In contrast to the Krun weir the Sylvenstein reservoir distinctly alters the carabid communities in lower sections of the Isar. Below the reservoir almost all factors negatively impacting the carabid community can be attributed to alterations in fluvial dynamics caused by the reservoir. The minor impact of the Krun weir on carabid community composition suggests, that sediment transport in connection with major flood events significantly contribute to the maintenance of a typical zoocenosis. In spite of alterations in the discharge regimes at the lower water levels the most diverse carabid fauna was encountered below the Krun weir.

Marquez-M, R., A. Villanueva-O, et al. 1995. The population of the Kemp's ridley sea turtle in the Gulf of Mexico-*Lepidochelys kempii*. Biology and conservation of sea turtles. K. A. Bjorndal: 159-164.

Marsh, H. and L. W. Lefebvre. 1994. Sirenian status and conservation efforts. Aquatic Mammals 20(3): 155-170.

The Order Sirenia is represented by only four living species: three species of manatee and the dugong. All are listed as vulnerable to extinction by the IUCN (IUCN 1990). The three species of manatees all belong to the family trichechidae: the Amazonian manatee, *Trichechus inunguis*, the West African manatee, *Trichechus senegalensis*, and the West Indian manatee, *Trichechus manatus*. There are two subspecies of the West Indian manatee: the Antillean manatee, *Trichechus manatus*, and the Florida manatee, *Trichechus manatus latirostris*. The dugong, *Dugong dugon*, is the only existent species of the family dugongidae. The status of manatees and dugongs is generally poorly known outside Florida and Australia. This review provides an overview of current estimation on their distribution and abundance and highlights recent conservation activities.

Martino Angela, M. G., O. Aranguren Jaime, et al. 2002. Feeding habits of *Leptonycteris curasoae* in Northern Venezuela. Southwestern Naturalist. 47(1). 78-85.

Aspects of the feeding ecology of *Leptonycteris curasoae* in Northern Venezuela were studied through analysis of pollen collected from fur and feces. Cactaceae and Bombacaceae (100%) were the most frequently found pollen in feces, followed by Caricaceae (66.7%) and Agavaceae (22.2%). No significant differences were found between the frequency of occurrence of pollen collected from fur and that present in feces. Pollen-diet composition showed highly significant differences among seasons but not between sexes. During the year no significant differences between sexes were found in the frequency of occurrence of seeds and pollen in the feces, but when analysis was restricted to April through July, the period of late pregnancy and lactation, there were significant differences between sexes and between females in different reproductive conditions. Breeding females, especially during lactation, apparently ingest more fruits to supply their particular nutritional and energetic requirements. Differences in pollen frequency observed in the diet during the year seem related to flowering pattern of the plant families present in the study area.

McAllister, C. T. and V. R. McDaniel. 1992. Occurrence of larval *Contracaecum sp.* (Ascaridida: Anisakidae) in Rio Grande lesser sirens, *Siren intermedia texana* (Amphibia: Caudata), from South Texas. Journal of the Helminthological Society of Washington 59(2): 239-240.

Unencapsulated 3rd-stage larval *Contracaecum sp*. were recovered from the coelomic cavity of all of 8 Rio Grande lesser sirens, *S. intermedia texana*, examined from southern Texas, USA. Mean intensity was 2.1 (range 1-5) worms/host. This is the first report of larval *Contracaecum sp*. infecting a caudate amphibian.

McBride, R. T. 1980. The Mexican Wolf (*Canis lupus bailey*): A historical review and observations on its status and distribution. Albuquerque, New Mexico, U.S. Fish and Wildlife Service: 38.

McClinton, S. F., P. L. McClinton, et al. 1992. Food habits of black bears in Big Bend National Park. Southwestern Naturalist. 37(ref): 4, 433-435.

Ursus americanus scats [faeces] were collected from Big Bend National Park, Texas, USA, from 1 April to 31 December 1990 and examined for food remains and parasitic infections. Only one unidentified trichurid nematode and one unidentified pentatrichomonad [*Pentatrichomonas*] protozoan were found in the 8 scats sampled. Nematodes have been frequently reported from *U. americanus*, but this is a new host record for *Pentatrichomonas*.

McDonald, C. B. 1996. Texas snowbells (*Styrax texana*) reintroduction. Restoring diversity: Strategies for reintroduction of endangered plants. D. A. Falk, C. I. Millar and M. Olwell: 411-416.

Mealey, S. P., K. Johnson, et al. 1984. Innovative responses to conservation challenges. Transactions, Forty-ninth North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, DC, USA: 1984. 405-499.

Eight papers from the conference, 3 of which are of specific forestry interest: Salwasser, H.; Mealey, S.P.; Johnson, K. Wildlife population viability: a question of risk. 421-439 [32 ref.] With special reference to habitat and populations of the spotted owl (*Strix occidentalis*) in the Willamette National Forest, Oregon. Capp, J.C.; Lipscomb, J.F.; Sandfort, W.W. Managing forested lands for wildlife in Colorado. 440-454 [17 ref.] Thomas, J.W. Fee-hunting on the public's lands? - an appraisal. 455-468 [41 ref.] In the western USA.

Mech, L. D. 1998. Estimated costs of maintaining a recovered wolf population in agricultural regions of Minnesota. Wildlife Society Bulletin. 26(4): 817-822.

The annual costs of maintaining Minnesota gray wolves (*Canis lupus*), now numbering about 2,500, under 2 plans are compared: (1) maintaining a population of about 1,400 primarily in the wilderness and semi-wilderness as recommended by the Eastern Timber Wolf Recovery Plan, and (2) allowing wolves to continue colonizing agricultural areas for 5 years after removal from the endangered species list, as recommended by a consensus of wolf stakeholders (Minnesota Wolf Management Roundtable). Under the first plan, each year an estimated 27 farms would suffer livestock losses; wolves would kill about 3 dogs; 36 wolves would be destroyed; and the cost per wolf in the total population would be dollar sign86. Under the second plan, conservative estimates are that by the year 2005, there would be an estimated 3,500 wolves; each year 94-171 farms would suffer damage; wolves would kill 8-52 dogs; 109-438 wolves would have to be killed for depredation control; and the annual cost averaged over the total population would be $86 for each of the 1,438 wolves living primarily in the wilderness and an additional $197 for each wolf outside the wilderness.

Mehlhop, P. 1993. Establishment of a rare mollusk inventory and monitoring program for New Mexico., NMDGF.

Mejenes-Lopez, S. D. M. A., F. M. Quijano, et al. 1999. Serpentes: *Coniophanes imperialis imperialis* (black-striped snake). Herpetological Review 30(4): 235.

Metcalf, A. L. and R. A. Smartt. 1997. Land snails of New Mexico: a systematic review. New Mexico Museum of Natural History and Science Bulletin. 10: 1 -69.

Mills Lisa, R. and R. Rademacher Kevin. 1996. Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Gulf of Mexico Science. 14(2). 114-120.

Mladenoff David, J. and A. Sickley Theodore. 1998. Assessing potential gray wolf restoration in the northeastern United States: A spatial prediction of favorable habitat and potential population levels. Journal of Wildlife Management. 62(1). 1-10.

The northeastern United States was previously identified under the U.S. Endangered Species Act (ESA) as a potential location for restoration of a population of the endangered eastern timber wolf or gray wolf (*Canis lupus*). The gray wolf has been protected under the ESA since 1974. We used geographic information systems (GIS) and a logistic regression model based on regional road abundance to estimate that the Northeastern states from Upstate New York to Maine contain >77,000 km2 of habitat suitable for wolves. Using current habitat distribution and available ungulate prey (deer and moose), we estimate the area is capable of sustaining a population of approximately 1,312 wolves (90% CI = 816-1,809). This estimate is equivalent to new, much higher potentials estimated for northern Wisconsin and Upper Michigan, where wolves are rapidly recovering in the U.S. Midwest. Potential wolf densities vary from a low of <12/1,000 km2 in the Adirondack Region of Upstate New York, where prey densities are lowest, to 20-25/1,000 km2 in northern Maine and New Hampshire. A contiguous area of, favorable habitat from Maine to northeastern Vermont (>53,500 km2) is capable of supporting approximately 1,070 wolves (90% CI = 702-1,439). Such large areas are increasingly rare and important for wolf recovery if populations large enough to have long-term evolutionary viability are to be maintained within the United States. However, large-scale restoration of a top carnivore like the wolf has other consequences for overall forest biodiversity in eastern forests because wolf recovery is dependent on high levels of ungulate prey, which in turn have other negative effects on the ecosystem. In the United States, planning for wolf restoration in the Northeast should take advantage of experience elsewhere, especially the upper Midwest.

Mladenoff David, J., A. Sickley Theodore, et al. 1999. Predicting gray wolf landscape recolonization: Logistic regression models vs. new field data. Ecological Applications. 9(1). 37-44.

Recovery of populations of wolves (*Canis lupus*) and other large, wide-ranging carnivores challenges conservation biologists and resource managers because these species are not highly habitat specific, move long distances, and require large home ranges to establish populations successfully. Often, it will be necessary to maintain viable populations of these species within mixed-use landscapes; even the largest parks and reserves are inadequate in area. Spatially delineating suitable habitat for large carnivores within mixed, managed landscapes is beneficial to assessing recovery potentials and managing animals to minimize human conflicts. Here, we test a predictive spatial model of gray wolf habitat suitability. The model is based on logistic regression analysis of regional landscape variables in the upper Midwest, United States, using radiotelemetry data collected on recolonizing wolves in northern Wisconsin since 1979. The model was originally derived from wolf packs radio-collared from 1979 to 1992 and a small test data set of seven packs. The model provided a 0.5 probability cut level that best classified the landscape into favorable (road density < 0.45 km/km2) and unfavorable habitat (road density > 0.45 km/km2) and was used to map favorable habitat with the northern Great Lake states of Wisconsin, Minnesota, and Michigan. Our purpose here is to provide a better validation test of the model predictions based on data from new packs colonizing northern Wisconsin from 1993 to 1997. In this test, the model correctly classified 18 of 23 newly established packs into favorable areas. We used compositional analysis to assess use of the original habitat probability classes by wolves in relation to habitat class availability. The overall rank of habitat preference classes (P, the percentage favorability from the original model), based on the new packs, was probability class 2 (P = 75-94%) > 3 (P = 50-74%) > 1 (P = 95-100%) > 4 (P = 25-49%) > 5 (P = 10-24%) > 6 (P = 0-9%). As more of the landscape becomes occupied by wolves, classes of lower probability than the 95% class, but above the favorability cut level, are slightly more favored. The 95% class is least abundant on the landscape and is usually associated with larger areas of classes 2 and 3. Wolves may continue to occupy areas of slightly lower habitat probability if adequate population source areas are present to offset the greater mortality in these lower quality areas. The model remains quite robust at predicting areas most likely to be occupied by wolves colonizing new areas based on generally available road network data. The model has also been applied to estimate the amount and spatial configuration of potential habitat in the northeastern United States.

Montoya, A. B., P. J. Zwank, et al. 1997. Breeding biology of aplomado falcons in dessert grasslands of Chihuahua, Mexico. J. Field Ornithol. 68: 135 - 143.

Mora, J. M., V. V. Mendez, et al. 1999. White-nosed coati *Nasua narica* (Carnivora: Procyonidae) as a potential pollinator of *Ochroma pyramidale (Bombacaceae).* Revista de Biologia Tropical 2000. 47(4): 719-721.

In this study, visitation of fresh nectar-laden flowers of *Ochroma pyramidale* by the white-nosed coati, *Nasua narica* is reported for the first time for the entire geographical range of the coati, from Costa Rica. This visitation resulted in no damage to floral structures and pollen uptake on facial fur, suggesting a potential role of the coati as pollinator. The phenomenon of eutherophily in the neotropics is discussed.

Mora, M., R. Skiles, et al. 2002. Environmental contaminants in prey and tissues of the peregrine falcon in the Big Bend Region, Texas, USA. Environmental Pollution. 116(ref): 1, 169-176.

Peregrine falcons (*Falco peregrinus*) have been recorded nesting in Big Bend National Park, Texas, USA and other areas of the Chihuahuan Desert since the early 1900s. From 1993-96, peregrine falcon productivity rates were very low and coincided with periods of low rainfall. However, low productivity also was suspected to be caused by environmental contaminants. To evaluate potential impacts of contaminants on peregrine falcon populations, likely avian and bat prey species were collected during 1994 and 1997 breeding seasons in selected regions of western Texas, primarily in Big Bend National Park. Tissues of 3 peregrine falcons found injured or dead and feathers of 1 live fledgling also were analysed. Overall, mean concentrations of DDE [1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene], a metabolite of DDT [1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane], were low in all prey species except for northern rough-winged swallows (*Stelgidopteryx serripennis*, mean=5.1 micro g/g ww). Concentrations of mercury and selenium were elevated in some species, up to 2.5 micro g/g dw, and 15 micro g/g dw, respectively, which upon consumption could seriously affect reproduction of top predators. DDE levels near 5 micro g/g ww were detected in carcass of 1 peregrine falcon found dead but the cause of death was unknown. Mercury, selenium, and DDE to some extent, may be contributing to low reproductive rates of peregrine falcons in the Big Bend region.

Mora, M. A.. 1997. Transboundary pollution: persistent organochlorine pesticides in migrant birds of the southwestern United States and Mexico. Environmental Toxicology & Chemistry 16(1): 3-11.

The hypothesis that migratory birds accumulate persistent organochlorine pesticides (POPs) during the winter in Latin America has been prevalent for many years, particularly since DDT was banned in the United States in 1972. It has been suggested that peregrine falcons (*Falco peregrinus*), black-crowned night herons (*Nycticorax nycticorax*), white-faced ibises (*Plegadis chihi*), various migratory waterfowl and shorebirds, and other avian species accumulate higher concentrations of POPs while on migration or on their wintering grounds in Latin America. Nonetheless, the data obtained thus far are limited, and there is no clear pattern to suggest that such accumulation occurs on a widespread basis. In this review wildlife contaminant studies conducted along the U.S.-Mexico border and throughout Mexico are discussed. The results for the most part seem to indicate that no major accumulation of DDE, the most persistent organochlorine compound, has occurred or been reported for most parts of Mexico. The majority of the DDE values in birds from Mexico were similar to those reported in birds from the southwestern United States during the same years. More work needs to be done, particularly in those cotton-producing areas of Mexico where DDT was applied heavily in the past (e.g., Chiapas and Michoacan). Because DDT is still used for malaria control and may still be used in agriculture in Chiapas, this state is probably the one where most migrant species would still be at a significant risk of increased accumulation of DDE and DDT.

Mora, M. A., M. C. Lee, et al. 1997. Potential effects of environmental contaminants on recovery of the aplomado falcon in south Texas. Journal of Wildlife Management 61(4): 1288-1296.

Efforts to reintroduce the aplomado falcon (*Falco femoralis*) into its former range in the southern part of Texas began in 1977. Not until 1993, however, were a significant number (26) of fledgling aplomado falcons released. The first nesting pair of aplomado falcons was reported near the Brownsville ship channel during 1995. Because of a long history of pesticide use in the Lower Rio Grande Valley, the accumulation of environmental contaminants in plasma of aplomado falcons released at the Laguna Atascosa National wildlife refuge was studied in the Lower Rio Grande Valley during 1993-94. The potential contribution of typical prey species to aplomado falcon contaminant burdens was also assessed. Organochlorine pesticides and polychlorinated biphenyls (PCBs) were below detection limits (wet wt basis) in plasma. However, some organochlorines, including 1.75 and 1.41 micro g/g p,p'-DDE, and 0.49 and 1.52 micro g/g total PCBs were detected in addled eggs collected in 1995 and 1996. Mercury (Hg) was also detected at 1.5

and 4.1 micro g/g dry weight in addled eggs collected in 1995 and 1996. DDE (range 0.02-0.25 micro g/g) was also detected in carcasses of potential prey of the aplomado falcon. Trace metals were also detected in potential prey at levels which were not of concern, except for Hg, which was high in a few meadowlarks. Low levels of DDE and most trace metals in potential prey, including mourning doves (*Zenaida macroura*) and eastern meadowlarks (*Sturnella magna*), were not likely to result in adverse effects on the aplomado falcon in the Lower Rio Grande Valley. However, elevated Hg residues in meadowlarks (in a few cases) and potentially higher DDE levels in other prey species, such as the great-tailed grackle (*Quiscalus mexicanus*), could result in negative effects on the reproduction and survival of some aplomado falcons in south Texas.

Mora, M. A., D. Papoulias, et al. 2001. A comparative assessment of contaminants in fish from four resacas of the Texas, USA - Tamaulipas, Mexico border region. Environment International. 27(ref): 1, 15-20.

A recent survey of contaminant information for the Lower Rio Grande Valley (LRGV), Texas, has shown that little is known about contaminants and their impacts on biota of resacas (oxbows) along the US-Mexico border. In 1996, fish were collected from 4 resacas in the Texas-Tamaulipas border region to assess contaminant loadings and their impacts on fish and birds. Tissue residue concentrations in fish were analysed and also compared to 2 histopathological bioindicators of unhealthy environmental conditions. Of the organochlorine insecticides measured. DDE was the most common and was present at relatively high concentrations (10 micro g/g w/w) at some sites. DDE concentrations were nearly 20 times greater in fish from resacas in Texas than from resacas in Tamaulipas, although the limited sample sizes obtained precluded statistical comparisons. DDE concentrations in fish from the 2 Texas resacas were also greater than those reported in fish from nearby areas during the 1980s and 1990s. Most trace element concentrations were similar among resacas from Texas and Tamaulipas. Arsenic, however, was two to six times greater in fish from a downtown resaca in Matamoros than in fish from other resacas in Tamaulipas and Texas. The bioindicators, pigment accumulation, and macrophage aggregates (MAs), in general, reflected the contamination indicated by the tissue residues for each site. Overall, it appears that some resacas of the US-Mexico border region are contaminant sinks and could pose potential health or reproductive problems for fish and wildlife, and humans that consume fish from those sites.

Mora, M. A. and S. E. Wainwright. 1998. DDE, mercury, and selenium in biota, sediments, and water of the Rio Grande-Rio Bravo Basin, 1965-1995. Reviews of Environmental Contamination & Toxicology. 158: 1-52.

An assessment of contaminant stressors on biota of the Rio Grande (Colorado, New Mexico and Texas, USA, and Mexico) was conducted to identify relevant contaminant issues, assess exposure and ecological effects, identify data gaps and determine potential risks. Most contaminant data were from studies conducted from 1965-1995 in the Lower Rio Grande. Contaminants most frequently reported were organochlorine compounds (OCs) and trace elements. The number of records for OCs and trace elements was at least two-fold greater for fish than for birds, mammals or reptiles. Of the OCs, p,p'-DDE was the most commonly reported. Mercury (Hg) was one of the most frequently reported trace elements; however, selenium (Se), arsenic (As), lead (Pb), copper (Cu) and zinc (Zn) were also common. The highest concentrations of OCs and trace elements were reported predominantly from Lower Rio Grande Valley locations, with approximately 68% of the highest values detected from Falcon Dam to the mouth of the river. Hg and Se levels in birds and fish have remained more or less constant over the study period, but may have increased over the years in some locations. Hg was recently found at high levels in addled eggs of aplomado falcons (*Falco femoralis*) and in their potential prey. Hg was elevated in fish from the Big Bend area. Also, Se in fish sampled in 1993 and 1994 was near or above the threshold for potential effects in fish-eating wildlife. Contaminant studies of DDE, mercury and selenium in plants, sediments and water are also reviewed.

Mora Miguel, A., L. Laack Linda, et al. 2000. Environmental contaminants in blood, hair, and tissues of ocelots from the Lower Rio Grande Valley, Texas, 1986-1997. Environmental Monitoring & Assessment. 64(2). 477-492.

The ocelot (*Felis pardalis*) is an endangered neotropical cat distributed within a small range in the Lower Rio Grande Valley (LRGV), in Texas, U.S.A. Studies of the impacts of environmental contaminants in wild cats are few. Approximately one fourth of the estimated population (about 100) of ocelots in the LRGV was sampled to evaluate the impacts of chlorinated pesticides, polychlorinated biphenyls, and trace elements on the population. Hair was collected from 32 ocelots trapped between 1986-1992, and blood was collected from 20 ocelots trapped between 1993-1997. A few blood samples were obtained from individuals recaptured two or three times. Tissue samples from 4 road-killed ocelots were also analyzed. DDE, PCBs, and Hg were some of the most common contaminants detected in hair and blood. Mean Hg levels in hair ranged from 0.5 to 1.25 mug g-1 dw, Se from 1.5 to 3.48 mug g-1 dw, and Pb from 0.56 to 26.8 mug g-1 dw. Mean DDE concentrations in plasma ranged from 0.005 mug g-1 ww to 0.153 mug g-1 ww, and PCBs ranged from 0.006 mug g-1 ww to 0.092 mug g-1 ww. Mean Hg levels in red blood cells ranged from 0.056 mug g-1 dw to 0.25 mug g-1 dw. Concentrations of DDE, PCBs, or Hg, did not increase significantly with age, although the highest concentrations of DDE and Hg were found in older animals. Overall, concentrations of DDE, PCBs, and Hg were low and at levels that currently do not pose any threat to health or survival of the ocelot. This is further supported by good reproduction of the ocelot in the LRGV, where adult females averaged about 1.5 kittens/litter. Thus, it seems that the current major threat to recovery of the ocelot in the LRGV may be habitat loss, although potential impacts of new generation pesticides, such as organophosphorus and carbamate insecticides need further study.

Moreno-Valdez, A., E. Grant William, et al. 2000. A simulation model of Mexican long-nosed bat (*Leptonycteris nivalis*) migration. Ecological Modeling. 134(2-3). 117-127. http://www.elsevier.com/locate/ecolmodel.

We (1) describe a model that simulates migration of the Mexican long-nosed bat (*Leptonycteris nivalis*) based on the flowering phenology (nectar-pollen production) of agaves (Agavaceae) and hypothesized 'rules' governing bat movements; (2) evaluate the model by comparing simulated seasonal and spatial patterns of nectar production and consumption, and bat movements and densities, to patterns observed in the field; and (3) use the model to examine various hypotheses concerning factors that control migration. A nectar production sub-model represents the flowering phenology of agaves in terms of the daily availability of nectar within each of four latitudinal intervals between 18 and 29 degree N. A bat migration sub-model represents the number of bats present within each latitudinal interval each day, with bat movements from one site to another depending on availability of nectar and season. Simulated patterns of nectar consumption are similar to observed patterns of nectar production based on the number of flowering plant species present at different latitudes. Simulated patterns of bat movements are similar to general patterns observed in the field for *Leptonycteris curasoae* and *L. nivalis*. Simulated fluctuations of bat density at the southernmost latitude exhibit the same general annual cycle observed at a southern roost of *L. curasoae*. The seasonal representation of nectar production in the model corresponds well with patterns of nectar production observed over a 2-year period at a site in northern Mexico, although nectar production in the model begins somewhat earlier. Simulations examining factors hypothesized to control migration indicate that predicted migration patterns correspond well with field observations only when model rules assume that both food availability and season limit migration, and that all bats with access to sufficient energy during the correct season migrate.

Mullin Keith, D., W. Hoggard, et al. 1994. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. U S National Marine Fisheries Service Fishery Bulletin. 92(4). 773-786.

Little is known about cetaceans in the oceanic Gulf of Mexico (depths gt 200 m). From July 1989 to June 1990, we conducted aerial surveys in the oceanic north-central Gulf (long. 87.5 degree W-90.5 degree W) with the following objectives: 1) to determine which cetacean species were present; 2) to document temporal and spatial distribution for each species; and 3) to estimate relative abundance for each species. We surveyed a total of 20,593 transect km and sighted at least 18 species. Of 278 identified herds (6,084 animals), 94% of the herds and 98% of the animals represented seven species or species groups: Risso's dolphin, *Grampus griseus* (22% of the herds, 13% of the animals); sperm whale, *Physeter macrocephalus* (16%, 1%); bottlenose dolphin, *Tursiops truncatus* 14%, 7%); Atlantic spotted dolphin, *Stenella frontalis* (13%, 15%); pygmy sperm whale, *Kogia breviceps*, and dwarf sperm whale, *Kogia simus* (12%, 1%); striped dolphin, *Stenella coeruleoalba*, spinner dolphin, *S. longirostris*, and clymene dolphin, *S. clymene* (9%, 34%); and pantropical spotted dolphin, *S. attenuata* (8%, 27%). Each of these species or species groups was sighted throughout the area surveyed in at least three seasons. Mean water depths of bottlenose dolphin and Atlantic spotted dolphin sightings were less than 400 m; mean water depths of Risso's dolphins and pygmy and dwarf sperm whales were between 400-600 m; and mean water depths of striped, spinner, and clymene dolphins, sperm whales, and pantropical spotted dolphins were greater than 700 m. Mean herd sizes varied by species and species groups and ranged from 1.9 animals for pygmy and dwarf sperm whales to 87.8 animals for striped, spinner, and clymene dolphins.

Obee Elizabeth, M. and J. Cartica Robert. 1997. Propagation and reintroduction of the endangered hemiparasite *Schwalbea americana (Scrophulariaceae).* Rhodora. 99(898). 134-147.

Propagation of the endangered hemiparasite *Schwalbea americana* was conducted in the presence of several species of potential host plants. Seeds were germinated and the seedlings transferred to pots containing potential host plants. Potted seedlings and potential hosts then were transplanted to field sites adjacent to a population of *S. americana* from which the seed had been collected. Germination of seedlings was > 90% after a wet-cold treatment; a dry-cold treatment resulted in low germination. Seedlings grown in association with seedlings of the grass *Schizachyrium scoparium* did not differ in size or longevity from seedlings grown alone. Growth of seedlings was slightly greater in the presence of host plants than without, but seedlings still achieved only limited size in greenhouse conditions before transplantation (2 to 4 mm in width and height). After transplantation to the field the majority of seedlings died rapidly, but several persisted for over 45 days without showing appreciable growth. Poor seedling establishment and survival are believed to contribute to the rarity of this species. The development of improved methods for the propagation and transplantation of *S. americana*, and the greater understanding of the causes for the rarity of this endangered species, will increase options for recovery strategies.

Obrist Martin, K. 1995. Flexible bat echolocation: The influence of individual, habitat and conspecifics on sonar signal design. Behavioral Ecology & Sociobiology. 36(3). 207-219.

Acoustic signals which are used in animal communication must carry a variety of information and are therefore highly flexible. Echolocation has probably evolved from acoustic communication, still serves such functions and could prove as flexible. Measurable variability can indicate flexibility in a behavior. To quantify variability in bat sonar and relate it to behavioral and environmental factors, I recorded echolocation calls of *Euderma maculatum*, *Eptesicus fuscus, Lasiurus borealis* and *L. cinereus* while the bats hunted in their natural habitat. I analysed 3390 search phase calls emitted by 16 known and 16 unknown individuals foraging in different environmental and behavioral situations. All four species used mainly multiharmonic signals that showed considerable intra- and inter-individual variability in the five signal variables I analysed (call duration, call interval, highest and lowest frequency and frequency with maximum energy) and also in the shape of the sonagram. A nested multivariate analysis of variance identified the influences of individual, hunting site, close conspecifics and of each observation on the frequency with maximum energy in the calls, and on other variables measured. Individual bats differed in multiple comparisons, most often in the main call frequency and least often in call interval. In a discriminant function analysis with resubstitution, 56-76% of a species' calls were assigned to the correct individual. Distinct individual call patterns were recorded in special situations in all species and the size of foraging areas in forested areas influenced temporal and spectral call structure. Echolocation behavior was influenced by the presence of conspecifics. When bats were hunting together, call duration decreased and call interval increased in all species, but spectral effects were less pronounced. The role of morphometric differences as the source of individually distinct vocalizations is discussed. I also examined signal adaptations to long range echolocation and the influence of obstacle distance on echolocation call design. My results allow for discussion of the problems of echo recognition and jamming avoidance in vespertilionid bats.

O'Farrell Michael, J., W. Miller Bruce, et al. 1999. Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy. 80(1). 11-23.

> A variety of ultrasonic (bat) detectors have been used over the past 3 decades to identify free-flying bats. Analyses of recorded echolocation calls were slow and typically restricted to few calls and at a resolution obscuring details of call structure. The Anabat II detector and associated zero-crossings analysis system allows an immediate examination, via a lap-top computer, of the time-frequency structure of calls as they are detected. These calls can be stored on the hard drive for later examination, editing, and measurement. Many North American bats can be identified to species by qualitatively using certain structural characteristics of calls, primarily approximate maximum and minimum frequencies and morphological aspects of calls (e.g., linearity and changes in slope). To identify calls precisely, it is important to use a continuous sequence of calls from an individual in normal flight rather than from single isolated calls. All calls are not equally useful, and many fragmentary calls must be discarded before making a determination. Each sequence of calls must be examined to ensure that multiple bats have not been simultaneously recorded, which confounds correct identification. We found the percentage of non-usable calls within usable vocal sequences to be highest in vespertilionids (20-40%), whereas for other families this was frequently <10%. Active rather than passive collection of data maximizes quality and quantity of diagnostic calls and provides a contextual base for the investigator.

O'Shea, T. J., L. W. Lefebvre, et al. 2001. Florida manatees: perspectives on populations, pain, and protection, CRC Handbook of marine mammal medicine. CRC Press Inc Boca Raton USA: Ed.2 31-43. 32 ref.

Painter, C. 1991. Blotched water snake (*Nerodia erythrogaster transversa*). New Mexico, Dpt. Game and Fish: 7.

Parsons David, R. 1998. Green fire returns to the Southwest: Reintroduction of the Mexican wolf. Wildlife Society Bulletin. 26(4). 799-807.

Parsons David, R. and E. Nicholopoulos Joy. 1995. Status of the Mexican Wolf Recovery Program in the United States, Carbyn L. N.; Fritts S. H.; Seip D. R.: Author. Canadian Circumpolar Institute Occasional Publication No. 35; Ecology and conservation of wolves in a changing world. 1995. 141-146.

Peery, M. Z., R. J. Gutierrez, et al. 1999. Habitat composition and configuration around Mexican spotted owl nest and roost sites in the Tularosa Mountains, New Mexico. Journal of Wildlife Management 63(1): 36-43.

It is noted that the Mexican spotted owl (*Strix occidentalis lucida)* is a threatened subspecies whose recovery depends, in part, on both an understanding of its habitat requirements and the protection of its habitat. The paper evaluates the habitat composition and configuration around owl sites in the Tularosa Mountains, New Mexico, USA, using a vegetation map derived from Landsat Thematic Mapper (TM) digital imagery and digital elevation models. Vegetation was classed into seven groups: mature mixed-conifer (*Pseudotsuga menziesii, Abies concolor*); mature pine (*Pinus ponderosa, Quercus gambelii*); young mixed-conifer (*P. menziesii, A. concolor*); young pine (*P. ponderosa, Q. gambelii*); pinyon-juniper (*Pinus edulis, Juniperus deppeana*); quaking aspen (*Populus tremuloides*); and grassland. Owls occupied sites with more mature mixed-conifer and mature pine and less pinyon-juniper than random sites. No difference existed in the amount of young forest between owl and random sites. After correcting for the area of the vegetation classes within owl territories, no difference existed in the mean patch size, edge distance, mean nearest neighbor distance, mean shape index, and habitat heterogeneity. It is recommended that 235.8 ha of mature forest (124.2 ha mixed-conifer and 111.6 ha pine) should be retained around Mexican spotted owl sites, which is similar to the size of protected activity centers (243 ha) proposed by the United States Fish and Wildlife Service.

Pence, D. B., M. E. Tewes, et al. 1995. Notoedric mange in an ocelot (*Felis pardalis*) from southern Texas. Journal of Wildlife Diseases 31(4): 558-561.

Notoedric manage was diagnosed in a free-ranging adult male ocelot (*F. pardalis*) found dead in April 1994 in southern Texas, USA. The emaciated carcass had no body fat. The heart was enlarged and flaccid. There was a nonpurulent serosanguineous pericardial and peritoneal exudate. Severe encrusted skin lesions and alopecia extended from the head posteriorly to the shoulders. The forelegs and feet were less severely affected. A massive infection of Notoedres cati was observed in skin scrapings. Epidermal lesions included hyperkeratosis and parakeratosis with necrotic debris and foci of acute inflammatory cells surrounding mites and their eggs in the stratum corneum. There was mild acanthosis and spongiosis of the stratum germativum, but no chronic inflammation in the dermis. This is the first confirmed case in the ocelot, but notoedric mange has been reported from the bobcat *(F. rufus [Lynx rufus])* in southern Texas. Thus, notoedric mange could pose an additional threat to the already endangered remnant population of the ocelot.

Perry Travis, W., M. Cryan Paul, et al. 1997. New locality for *Euderma maculatum (Chiroptera: Vespertilionidae)* in New Mexico. Southwestern Naturalist. 42(1). 99-101.

Pierson Elizabeth, D. and E. Rainey William. 1994. Distribution and habitat associations of *Eumops perotis* and *Euderma maculatum* in California: Implications for conservation. Bat Research News. 35(4). 110-111.

Platania, S. P. and C. S. Altenbach. 1998. Reproductive strategies and egg types of seven Rio Grande Basin cyprinids. Copeia 1998(3): 559-569.

Reproductive strategy and egg type of *Hybognathus amarus, H. placitus, Macrhybopsis aestivalis, Notropis girardi, N. jemezanus, N. simus pecosensis,* and *N. stramineus* were determined from laboratory experiments conducted between 1991 and 1995. The first six taxa were pelagic-broadcast spawners that produced nonadhesive, semibuoyant eggs, whereas *N. stramineus* was a broadcast spawner that laid demersal-adhesive eggs. High-speed cinematography revealed that a spawning event consisted of a single male wrapping around the female's midsection and fertilizing the eggs upon expulsion. The perivitelline space of recently expelled nonadhesive eggs filled rapidly with water, thereby increasing both egg diameter and buoyancy. Semibuoyant eggs remained in suspension as long as water current was maintained. Discovery of the spawning behavior and egg types of these species allowed for the development of hypotheses to explain extirpations and extinctions of several endemic Rio Grande Basin fishes. We believe the synergistic effects of downstream transport of eggs and larval fishes and dam-related modifications of flow and habitat was probably responsible for the decline and demise of these taxa in the Rio Grande Basin.

Plotkin, P. T., M. K. Wicksten, et al. 1993. Feeding ecology of the loggerhead sea turtle *Caretta caretta* in the northwestern Gulf of Mexico. Marine Biology (Berlin) 115(1): 1-5.

Digestive tract contents collected from carcasses of 82 loggerhead sea turtles (*Caretta caretta*) found on the south Texas coast (USA) from 1986 through 1988 were examined. Benthic invertebrates were the predominant prey. Sea pens (*Virgularia presbytes*), crabs, and mollusks accounted for 94% of the dry weight of the digestive tract samples. Temporal changes in the percent occurrence and percent dry weight of sea pens, crabs, and mollusks in the digestive tract samples were significant. Loggerheads fed primarily on sea pens during spring, then primarily on crabs during summer and fall. The increase of crabs in the loggerhead diet paralleled the annual increase in the abundance of crabs in the Gulf of Mexico. Sea pens were located nearshore at depths of 6 to 12 m and had a disjunct distribution.

Pope, C. E., C. A. Johnson, et al. 1998. Development of embryos produced by intracytoplasmic sperm injection of cat oocytes. Animal Reproduction Science 53(1/4): 221-236.

Oocytes were collected from 27 domestic cats and 1 jaguarundi (*Herpailurus yaguarondi*) after superovulation with eCG or FSH and HCG. After storage at 4 deg C, cat semen was washed and processed. For intracytoplasmic sperm injection (ICSI), denuded oocytes were each injected with an immobilized spermatozoon, and for in vitro fertilization (IVF) oocytes were co-incubated with 5 x 104 motile spermatozoa/0.5 ml for 4-6 h. Non-cleaving oocytes were fixed and stained 24-28 h after injection or insemination. Presumptive zygotes were cultured before transfer on day 5 and evaluation on day 7. Fertilization rate did not differ between IVF and ICSI cat oocytes (67.9% (72/106) and

58.1% (122/210) respectively). Most non-cleaving ICSI oocytes (71/88, 80.7%) at 24 h were at metaphase II, of which half (35/71, 49.3%) had an activated spermatozoon (n = 4) or premature chromatin condensation (PCC, n = 31) of the sperm head. There was no difference in the percentage of oocytes developing to the morula and blastocyst stage between the fertilization methods (morulae, 46.7 and 50.8%; blastocysts 53.3 and 42.9% for IVF and ICSI respectively). Mean cell number in IVF and ICSI embryos was 136 and 116; morulae had 77 and 46 cells (P<0.05) and blastocysts had 187 and 209 cells respectively. After transfer of 10 or 11 day-5 ICSI morulae to each of 4 domestic cat recipients, a total of 3 kittens were born to 2 dams. Of 18 fair-to-good quality oocytes recovered from the jaguarundi, 10 (55.6%) embryos were produced by ICSI with fresh (n = 5) or frozen (n = 5) conspecific spermatozoa, but no jaguarundi kittens were born after transfer of these embryos to domestic cat recipients. In a 2nd experiment, cleavage frequency after IVF (15/17, 88.2%) and ICSI (31/38, 81.6%) was higher (P<0.05) than that following sham ICSI (only medium injected into the ooplasm) (13/35, 37.1%). Mean cell number (27 cells) and blastocyst development (0%) on day 7 was lower (P<0.05) in the sham ICSI group than in the ICSI group (45 cells, 15.6% blastocysts), which in turn was lower (P<0.05) than the IVF group (94 cells, 46.7% blastocysts).

Rabe Michael, J., S. Siders Melissa, et al. 1998. Long foraging distance for a spotted bat (*Euderma maculatum*) in northern Arizona. Southwestern Naturalist. 43(2). 266-269.

Ramotnik, C. A. 1996. Studies of the effects of forest management practices on the sacramento mountain salamander, *Aneides hardii*. Almogordo, N.M., U.S. Forest Service: 8.

Rappole, J. H. and G. W. Blacklock. 1994. A Field Guide Birds of Texas. College Station, Texas A&M University Press. 280pp.

Rappole, J. H., D. I. King, et al. 1999. Winter ecology of the endangered golden-cheeked warbler. Condor 101(4): 762-770.

The ecology of the endangered golden-cheeked warbler (*Dendroica chrysoparia)* was studied during three winter seasons, 1995-1998, in Honduras and Guatemala. Individuals of this species occurred almost exclusively as members of mixed-species flocks, occupying sites with greater densities of encino oaks (*Quercus sapotaefolia, Q. elliptica, Q. elongata, Q. cortesii*) and ground cover and fewer pines (*Pinus oocarpa*) than random sites. Most foraging observations were recorded in mid-storey encino oaks. Commonly-observed foraging activities were gleaning and sally-hovering; 83% of foraging activities were directed at the outermost portions of the oak foliage. Flocks in which golden-cheeked warblers occurred contained an average of 20.5 individuals and 12.9 species other than golden-cheeked warblers. The ratio of males to females observed was not substantially different from 1:1, and there was little evidence of sexual differences in habitat use. Golden-cheeked warblers appeared to be tolerant of moderate levels of logging and grazing, but understorey clearing to promote grazing for cattle may pose a significant threat to winter habitat availability.

Ratnayeke, S., A. Bixler, et al. 1994. Home range movements of solitary, reproductive female coatis *Nasua narica*, in south-eastern Arizona. Journal of Zoology (London). 233(2). 322-326.

Renaud, M. L. 1995. Movements and submergence patterns of Kemp's Ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29(3): 370-374.

Four Kemp's ridley (*Lepidochelys kempii*) turtles, ranging in straight-line carapace length from 51 to 60 cm and in weight from 19 to 27 kg, were released in 12 to 19 m water depths off Florida, Texas, and North Carolina and tracked for 1.0 to 8.5 months. Movements up to 2600 km were observed. The number of submergences per day was inversely proportional to the duration of submergences per day. These ridleys spent 89% of their time submerged and frequented waters ranging in depth from 1-140 m. Turtles ranged from inshore to 77 km offshore. Mean swimming speeds of these turtles were from 0.7 to 1.3 km/h, with over 95% of the actual velocity values ltoreq 5 km/h.

Renaud, M. L., J. A. Carpenter, et al. 1996. Kemp's ridley Sea Turtle (*Lepidochelys kempii*) tracked by satellite telemetry from Louisiana to nesting beach at Rancho Nuevo, Tamaulipas, Mexico. Chelonian Conservation & Biology 2(1): 108-109.

Richardson, L. R. and J. R. Gold. 1999. Systematics of the *Cyprinella lutrensis* group (*Cyprinidae*) from the southwestern United States as inferred from variation of mitochondrial DNA. Southwestern Naturalist 44(1): 49-56.

A total of 197 mitochondrial DNA (mtDNA) restriction sites was surveyed among samples representing the five species of the *Cyprinella lutrensis* group inhabiting the southwestern United States: *C. formosa, C. lepida, C. cf. lepida, C. lutrensis*, and *C. proserpina.* Average nucleotide sequence divergence between *C. proserpina* and the other four species was greater than that found between the other species and two species from the *Cyprinella whipplei* group (*C. galactura* and *C. venusta*) that were employed as outgroup taxa in phylogenetic analysis. These data coincide with other genetic data that suggest *C. proserpina* is not closely related to these species of the *C. lutrensis* group. Alternatively, *C. proserpina* may have experienced heterogeneous, perhaps rapid, genomic evolution. Maximum-parsimony analysis (employing unordered restriction-site characters) of the remaining four species (i.e., excluding *C. proserpina*) produced an unresolved tetrachotomy. Maximum-parsimony analysis that employed Dollo parsimony and neighbor-joining analysis of nucleotide sequence divergence estimates among the four species generated resolved but conflicting topologies. In the neighbor-joining analysis, branch lengths between species were short in comparison to branches to terminal taxa. Maximum-likelihood analysis generated a topology congruent with that generated by Dollo parsimony. Statistical comparisons (likelihood test of Kishino and Hasegawa), however, indicated that the conflicting topologies produced by Dollo parsimony (and maximum-likelihood) versus neighbor-joining were equally likely. The simplest interpretation of these data is that the four species evolved near-synchronously from a series of vicariant events that occurred in the western Gulf Coastal Plain. This interpretation is consistent with the hypothesis that ancestors to the *C. lutrensis* group entered the western Gulf Coastal Plain via connections with the western Great Plains before the onset of Pleistocene glaciation.

Ricketts, T. H., E. Dinerstein, et al. 1999. Terrestrial Ecoregions of North America. Washington DC, Island Press. 485 pp.

Rinne, J. N. 1995. Reproductive biology of the Rio Grande chub, *Gila pandora* (Teleostomi: Cypriniformes), in a montane stream, New Mexico. Southwestern Naturalist 40(1): 107-110.

Rinne, J. N. 1995. Reproductive biology of the Rio Grande sucker, *Catostomus plebeius* (Cypriniformes), in a Montane Stream, New Mexico. Southwestern Naturalist 40(2): 237-241.

Rodriguez, A. 1994. Astrophytum. The star cacti. New Plantsman 1(2): 84-94.

The classification, distribution and habitat, morphology and general cultural requirements of the genus are discussed. *Astrophytum lemaire* currently consists of 4 distinctive species: *A. asterias* (NE Mexico and southern Texas) and the Mexican *A. capricorne, A. myriostigma* and *A. ornatum*. These are described in detail, together with a number of named variants. Wild populations, particularly those of *A. asterias*, are increasingly threatened by collection; in the UK reputable nurseries only offer seed-grown nursery-raised material and some sources are listed.

Rojas-Martinez, A., A. Valiente-Banuet, et al. 1999. Seasonal distribution of the long-nosed bat (*Leptonycteris curasoae*) in North America: Does a generalized migration pattern really exist? Journal of Biogeography. 26(5): 1065-1077.

This paper examines the migration of the tropical nectarivorous bat *Leptonycteris curasoae* considered as a latitudinal migrant that breeds in south-west United States and northern Mexico in spring and migrates southward during fall. We tested the hypothesis that the latitudinal migration occurs only locally given by the local availability of bat resources, leading to migratory movements in zones with seasonal scarcity of resources and to resident bat populations where resources are available throughout the year. Localization We analysed the presence of *L. curasoae* along its distribution range in North America (between 14degreeN and 33degreeN). Study cases were also conducted in three Mexican localities: the Tehuacan Valley (17degree48'-18degree58'N and 96degree48'-97degree43'W), Sonoran Desert (28degree41'N and 110degree15'W), and the coast of

Jalisco (19degree32'N and 105degree07'W). Methods Geographic evidence for latitudinal migration of *L. curasoae* was analysed using 94-year capture records housed in twenty-two collections of North America. Records were analysed using a geographical information system (GIS), in which floral resources and capture records were integrated. Monthly captures in the Tehuacan Valley were conducted during three years and bats abundance and reproductive status were correlated with the phenology of bat resources. Bat captures were also conducted during two consecutive years in an extratropical desert during winter and spring, and during one spring in the coast of Jalisco. The latitudinal migration of L. curasoae in North America only occurs at latitudes near 30degreeN, whereas bats may be residents at latitudes lower than 21degreeN. Captures were associated always to the availability of floral resources in both geographical and local scales. Main conclusions The existence of resident populations in the tropics with two reproductive events support the hypothesis that migration only occurs in the northern distribution limit of this nectar-feeding bat.

Rossi, J. V. 1994. *Serpentes: Drymarchon corais couperi* (Eastern indigo snake): Prey. Herpetological Review 25(3): 123-124.

Rudis, V. A. and J. B. Tansey. 1995. Regional assessment of remote forests and black bear habitat from forest resource surveys. Journal of Wildlife Management 59(1): 170-180.

Data from forest inventories during 1984-90 for 12 southern states of the USA were used to describe forest type, seral stage and ownership of potential habitat for black bears (*Ursus americanus*) in remote forests (away from human contact), develop a classification algorithm to identify potential habitat, compare this potential habitat with observed occurrence of bears, and identify locations with potential for reintroduction of bears. The spatially explicit modeling approach provided a coarse-scaled estimate of optimum habitat in occupied ranges, areas in unoccupied range with potential for repopulation and reintroduction, and areas with scarce optimum habitat that may constrain gene flow among disjunct areas of occupied range.

Runyan, N. and P. Mehlhop. 1997. Establishment of an efficient monitoring protocol for the Texas horned lizard. Bulletin of the Ecological Society of America 78(4 suppl) 174. Meeting abstract.

Russell James, K. 1996. Timing of reproduction by coatis (*Nasua narica*) in relation to fluctuations in food resources, Leigh E. G. Jr.; Rand A. S.; Windsor D. M.: Eds. The ecology of a tropical forest: Seasonal rhythms and long-term changes. 1996: 413-431.

Russell, M. J., M. Ample, et al. 1999. Scinax elaeochroa (NCN). Herpetological

Review 30(1): 38.

Russell, M. J., M. Maple, et al. 1999. *Clelia clelia (Mussurana).* Herpetological Review 30(1): 43-44.

Ruthven, D. C., III, E. C. Hellgren, et al. 1994. Effects of root plowing on white-tailed deer condition, population status, and diet. Journal of Wildlife Management 58(ref): 1, 59-70.

> The condition, population characteristics, and diet composition of white-tailed deer (*Odocoileus virginianus*) were compared on 2 root-ploughed (low brush diversity) and 2 untreated (high brush diversity) sites in the eastern Rio Grande Plains of Texas to test the hypothesis that root ploughing, which reduces woody species diversity, reduced deer habitat quality. Eight adult female deer were collected from each site every 3 months for 6 sampling periods; condition was assessed from several physiological, reproductive, and digestive indices and food habits were determined by microhistological analysis of rumen samples. Helicopter surveys were used to estimate population size. There were no differences ($P > 0.1$) between sites of high and low brush diversity in deer density, fawn production, age, mass, reproductive characteristics, ruminal nitrogen and neutral detergent fiber, and fat, blood, and urine indices. There was a faecal nitrogen treatment by season interaction ($P < 0.05$). Blood, urine, fat, digestive, and ovarian indices varied seasonally ($P < 0.05$). Four nitrogen indices provided conflicting information on population protein status. Therefore, data on diet composition were necessary for index interpretation. Percent browse in the diet was greater ($P < 0.10$) in untreated sites. Browse, forb, and grass use varied seasonally ($P < 0.05$). Yearly differences in precipitation were associated with changes in body condition, reproduction, and diet. Nutritional condition and population status of white-tailed deer were similar in untreated sites and sites root ploughed 17 years earlier. In treated sites, the greater abundance of forbs and huisache (*Acacia smallii [A. farnesiana*]) mast offset the effects of reductions in browse diversity on deer biology.

Ryan, M. R., B. G. Root, et al. 1993. Status of piping plovers in the Great Plains of North America: a demographic simulation model. Conservation Biology 7: 581 - 585.

Ryan, T. P. and D. A. Kluza. 1999. Additional records of the Least Tern from the west coast of Mexico. Western Birds 30(3): 175-176.

Sampaio, C. L. S. 1999. *Dermochelys coriacea* (Leatherback sea turtle). Herpetological Review 30(1): 39-40.

Sanchez, O., J. Ramirez-Pulido, et al. 2002. Felid record from the State of Mexico, Mexico. Mammalia. 66(2). 289-294.

Sappington, L. C., F. L. Mayer, et al. 2001. Contaminant sensitivity of threatened and endangered fishes compared to standard surrogate species. Environmental Toxicology & Chemistry 20(12): 2869-2876.

Standard environmental assessment procedures are designed to protect terrestrial and aquatic species. However, it is not known if endangered species are adequately protected by these procedures. At present, toxicological data obtained from studies with surrogate test fishes are assumed to be applicable to endangered fish species, but this assumption has not been validated. Static acute toxicity tests were used to compare the sensitivity of rainbow trout, fathead minnows, and sheepshead minnows to several federally listed fishes (Apache trout, Lahontan cutthroat trout, greenback cutthroat trout, bonytail chub, Colorado pikeminnow, razorback sucker, Leon Springs pupfish, and desert pupfish). Chemicals tested included carbaryl, copper, 4-nonylphenol, pentachlorophenol, and permethrin. Results indicated that the surrogates and listed species were of similar sensitivity. In two cases, a listed species had a 96-h LC50 (lethal concentration to 50% of the population) that was less than one half of its corresponding surrogate. In all other cases, differences between listed and surrogate species were less than twofold. A safety factor of two would provide a conservative estimate for listed cold-water, warm-water, and euryhaline fish species.

Sartorius Shawn, S. and C. Rosen Philip. 2000. Breeding phenology of the lowland leopard frog (*Rana yavapaiensis*): Implications for conservation and ecology. Southwestern Naturalist. 45(3): 267-273.

We monitored breeding phenology and population levels of *Rana yavapaiensis* by use of repeated egg mass censuses and visual encounter surveys at Agua Caliente Canyon near Tucson, Arizona, from 1994 to 1996. Adult counts fluctuated erratically within each year of the study but annual means remained similar. Juvenile counts peaked during the fall recruitment season and fell to near zero by early spring. *Rana yavapaiensis* deposited eggs in two distinct annual episodes, one in spring (March-May) and a much smaller one in fall (September-October). Larvae from the spring deposition period completed metamorphosis in early summer. Over the two years of study, 96.6% of egg masses successfully produced larvae. Egg masses were deposited during periods of predictable, moderate stream flow, but not during seasonal periods when flash flooding or drought were likely to affect eggs or larvae. Breeding phenology of *Rana yavapaiensis* is particularly well suited for life in desert streams with natural flow regimes which include frequent flash flooding and drought at predictable times. The exotic predators of *R. yavapaiensis* are less able to cope with fluctuating conditions. Unaltered stream flow regimes that allow natural fluctuations in stream discharge may provide refugia for this declining ranid frog from exotic predators by excluding those exotic species that are unable to cope with brief flash flooding and habitat drying.

Schmidly, D. J. 1991. The Bats of Texas. College Station, TX, Texas A&M University Press. 188 pp.

Schnepf, K. A., J. A. Heselmeyer, et al. 1998. Effects of cutting Ashe juniper woodlands on small mammal populations in the Texas hill country (USA). Natural Areas Journal 18(4): 333-337.

The effects of cutting Ashe juniper (*Juniperus ashei*) woodlands on populations of small mammals was studied at Friedrich Wilderness Park, Texas, during 1995-97. Three patches of juniper ranging from 1.8 ha to 2.4 ha were cut in spring 1995 and 1996 to provide habitats for endangered black-capped vireos (*Vireo atricapillus*). Small mammals were subsequently trapped along transects placed in the treated patches and in untreated areas of the park from October to May 1995-96 and 1996-97. Three species of small mammals were trapped, but *Peromyscus pectoralis* Osgood (white-ankled mouse) was the most common. *Peromyscus pectoralis* was more abundant in the treated patches in which the juniper had been removed. Trapping success in the 3 cut areas was consistently higher (average of 12%) than in the untreated woodlands. Mice that colonized treated patches survived longer than mice in control areas. Each year the number of *P. pectoralis* increased during the winter and spring, with juveniles accounting for up to 32% of captures. The management of habitat for an endangered species, such as the black-capped vireo, enhanced the biodiversity of small mammals in this study.

Schweitzer, S. H., D. M. Finch, et al. 1998. The brown-headed cowbird and its riparian-dependent hosts in New Mexico. General Technical Report - Rocky Mountain Research Station, USDA Forest Service. Rocky Mountain Research Station, Fort Collins, USA: 1998. No. RMRS-GTR-1, 23 pp. 3 pp. of ref.

Numbers of brown-headed cowbirds (*Molothrus ater*) are increasing in some regions of North America, while certain populations of long-distance, neotropical migratory songbirds (NTMs) are declining. In the Southwestern United States, several species of NTMs nest only in riparian habitats. The significant decline of two species of NTMs dependent upon riparian habitat, the southwestern willow flycatcher (*Empidonax traillii extimus*) and the least Bell's vireo (*Vireo bellii pusillus*), is of great concern. Brood parasitism by the brown-headed cowbird and loss of riparian habitat may be the primary causes of the decline of these populations. Extant data on the distribution, abundance, density, and rates of parasitism of the brown-headed cowbird in New Mexico have not been synthesized and interpreted. This study aimed to collect and review existing data on the brown-headed cowbird in New Mexico, compare them to data from adjacent western states, and interpret the findings. It was hypothesized that increased human use of riparian habitats in New Mexico had resulted in increased abundance of brown-headed cowbirds and their parasitism on riparian-dependent NTMs. It was suggested that quantitative studies should be conducted to determine the distribution, abundance, density, and rates of parasitism of brown-headed cowbirds in New Mexico's riparian habitats because existing data are inadequate. Results of such studies will allow conclusions to be made about the multiplicative effects of riparian habitat use and modification by human activities on cowbird and rare NTM populations.

Seamans, M. E., R. J. Gutierrez, et al. 1999. Demography of two Mexican spotted owl populations. Conservation Biology 13(4): 744-754.

The demography of the Mexican spotted owl (*Strix occidentalis lucida*) was studied at opposite ends of the Upper Gila Mountains Forest Province in Arizona and New Mexico from 1 April 1991 to 20 August 1997. The area is characterized by pinyon-juniper (*Pinus edulis-Juniperus spp.*) woodland at lower elevations, *Pinus ponderosa* at mid-elevations and mixed conifer forest on north facing slopes at higher elevations. Annual survival rates, fecundity rates and abundance were measured to test the hypothesis that population trends were stationary. Although annual fecundity rates (0.494 for Arizona and 0.380 for New Mexico) and annual juvenile survival rates (0.179 for Arizona and 0.109 for New Mexico) differed in magnitude between the study areas, they exhibited similar temporal patterns. Annual survival for territorial owls varied randomly in Arizona but declined linearly in New Mexico. Mean annual survival for territorial owls was 0.814 in Arizona and 0.832 for owls more than or equal to 3-years-old and 0.644 for owls 1- to 2-years-old in New Mexico. Based on survival and fecundity estimates, the annual rates of change (lambda) indicated that both populations were declining at more than or equal to 10% a year. These estimates were corroborated by observed declines in abundance. It is suggested that one regional factor may have been affecting fecundity, whereas a combination of factors may have been affecting survival. Two reasons suggested for the population declines are declines in habitat quality and regional trends in climate. It is concluded that a ban on harvesting of all large oaks standing, alive, or dead would provide adequate nesting sites, and that the protection of specific habitats (as in the Mexican Spotted Owl recovery plan US Dept. of the Interior 1995) and a 10 year monitoring program would be beneficial.

Seidel Michael, E. 1994. Morphometric Analysis and Taxonomy of Cooter and Red-Bellied Turtles in the North American *Genus Pseudemys* (Emydidae). Chelonian Conservation & Biology. 1(2). 117-130.

Examination of 30 mensural and 15 qualitative external characters in *Pseudemys* (cooter and red-bellied turtles) indicated extensive morphological overlap among recognized subspecies and species. Because variation in *P. concinna* appears to be clinal, occurring throughout most of its range, recognition of the subspecies *P. c. hieroglyphica, P. c. metteri,* and *P. c. mobilensis* cannot be justified. Two cooters in Florida, *P. c. suwanniensis* and *P. floridana peninsularis*, are morphologically distinct and may be recognized as species. Similarly, two southwestern species, *P. gorzugi* and *P. texana*, are recognizable. The Florida cooter, *P. f. floridana*, and river cooter, *P. c. concinna*, could not be distinguished morphometrically, but may be separated by their markings in some parts of their range. Interactions of these two forms are complex and it is recommended that floridana be considered a variant (subspecies) of *P. concinna*. Electrophoretic analysis indicated no protein polymorphism among cooters. However, two proteins, presumably homologous, separate the red-bellied turtles (*P. alabamensis, P. nelsoni, P. rubriventris*) from the cooters (*P. concinna, P. gorzugi, P. peninsularis, P. suwanniensis, P. texana*).

Servin, J. 1997. The mating, birth and growth periods of the Mexican wolf (*Canis lupus baileyi*). Acta Zoologica Mexicana Nueva Serie. 0(71). 45-56.

The Mexican wolf (*Canis lupus baileyi*) is endangered, but it has been until recently that information about its biology, behavior and ecology has been obtained. There are few data on the mating and breeding seasons, but there are no data about the growth of pups and the size of litter. This paper present new data on these topics, including growth of three months old pups. Data were obtained from the captivity population reported at the International Studbook for the Mexican Gray Wolf and direct observations on two groups kept in captivity at the Western Sierra Madre in Biosphere Reserve La Michilia, Durango, Mexico; in a 1.5 ha enclosure in an oak-pine forest at 2500 m above sea level. Growth rate found is closely at the lower limited reported for the gray wolf (*Canis lupus*). It is necessary to gathering more information from this predator in Mexico.

Servin, J. 2000. Duration and frequency of chorus howling of the Mexican wolf (*Canis lupus baileyi*). Acta Zoologica Mexicana Nueva Serie. (80). 223-231.

The Mexican wolf (*Canis lupus baileyi*) is an endangered species but remains poorly studied. I report the Mexican wolf chorus howling frequency through the year, from a pack with five adults (three males and two females) in captivity in La Michilia Biosphere Reserve at the Western Sierra Madre in Durango, Mexico. These is the first quantitative howling data reported for the Mexican wolf. Two hundred and eighty six chorus howls were recorded between January and December. Chorus howling was most common during the breeding season (January/February), and trends to listen at the dusk and sunrise, likely in wolves from northern populations. Daily howling chorus varied significantly in frequency between months ($p<0.005$); in February, chorus occurred 2.3 per day and duration of 59.2 +- 6.6 sec, whereas in August 0.9 chorus per day and duration of 26.7 +- 3.5 sec was recorded. The mean duration of chorus were 41 +- 9 sec for this wolf pack, were shorter than those reported from wolves packs of the northern United States and Canada.

Shaver, D. J. 1998. Sea turtle strandings along the Texas coast, 1980-94. Noaa (National Oceanic & Atmospheric Administration) Technical Report Nmfs (National Marine Fisheries Service): 57-72.

During 1980-94, 3,283 stranded sea turtles (2,929 dead, 354 alive) were found along the Texas coast, including 1,139 Kemp's ridley, *Lepidochelys kempii*, 1,524 loggerhead, *Caretta caretta*, 258 green, *Chelonia mydas*, 170 hawksbill, *Eretmochelys imbricata*, and 57 leatherback, *Dermochelys coriacea*, turtles and 135 unidentified turtles. More turtles stranded during 1994 than during any year from 1980 to 1993. There were various sources of mortality during 1980-94. A large percentage of the strandings were probably due to incidental capture in shrimp trawls. Fewer stranded turtles were found during the Texas Closure (when some Gulf of Mexico waters off Texas were closed to shrimp trawling) than before and after the closure. During 1994, temporal and spatial distributions of the strandings coincided with nearshore shrimping and the numbers of stranded turtles were inversely related to Turtle Excluder Device enforcement. Stranding records reveal the importance of Texas waters for Kemp's ridley turtles. This species

comprised an increasing percentage of the strandings along the Texas coast; 48% percent of the 527 documented strandings during 1994 were Kemp's ridley turtles. Fewer, but larger, Kemp's ridley turtles stranded along the middle and lower Texas coast. Based on analyses of digestive tract contents, some Kemp's ridley turtles in Texas are consuming the by-catch discarded by shrimp trawls. Turtles may concentrate in areas of shrimping to exploit that easily obtainable food and thereby become vulnerable to capture by trawls.

Shaw, C. E. 1950. The Gila monster in New Mexico. Herpetological 6(2): 37 - 39.

Sheeler-Gordon Lorinda, L. and S. Smith Jean. 2001. Survey of bat populations from Mexico and Paraguay for rabies. Journal of Wildlife Diseases. 37(3). 582-593.

A mammalian survey was conducted in Mexico (October 1994-January 1996) and in Paraguay (August 1996-March 1997); a complete specimen was collected for each bat in the survey, including primary voucher specimen, ectoparasites, karyotype, and various frozen tissues. The surveys combined provided 937 brain samples (65 bat species) for rabies diagnosis. One male Lasiurus ega, collected in Paraguay, tested positive for the rabies virus (overall prevalence rate of 0.1%). Nucleotide sequence from a 300 bp region of the rabies nucleoprotein gene was compared with sequence obtained for representative rabies virus samples in the repository at the Centers for Disease Control and Prevention (Atlanta, Georgia, USA). Rabies virus extracted from the brain material of *L. ega* differed by only one nucleotide from a 300 bp consensus sequence (>99% homology) derived from samples for the variant of rabies virus transmitted by *Lasiurus cinereus*. *Lasiurus ega* differed by approximately 15% for the variant transmitted by *Desmodus rotundus*. Phylogenetic analysis found no evidence to suggest *L. ega* is a reservoir for rabies antigenic variant 6. The most likely explanation for rabies in *L. ega* was infection following contact with a rabid *L. cinereus*.

Shindle, D. B. and M. E. Tewes. 1998. Woody species composition of habitats used by ocelots (*Leopardus pardalis*) in the Tamaulipan Biotic Province. Southwestern Naturalist 43(2): 273-279.

Woody species composition of habitats used by ocelots *(Leopardus pardalis [Felis pardalis])* was quantified in the Lower Rio Grande Valley of southern Texas and Tamaulipas, northeastern Mexico. Data were collected from October 1993 to January 1995 on 3 sites known to have resident populations of ocelots. The dense thornshrub communities contained 28, 45 and 51 species of woody plants. Similarity indices suggested that the 3 dense thornshrub communities used by ocelots were not highly similar in terms of woody species composition and relative cover. However, based on the predominant species common to 2 sites, the selection of granjeno (*Celtis pallida*), snake-eyes (*Phaulothamnus spinescens*), crucita *(Eupatorium odoratum [Chromolaena odorata]),* desert olive (*Forestiera angustifolia*), colima (*Zanthoxylum fagara*), whitebrush (*Aloysia gratissima*), brasil (*Condalia hookeri*) and lotebush (*Ziziphus obtusifolia*) would be justified for restoration of habitat for the endangered animal

Shuster, S. M. 1981. Life history characteristics of *Thermosphaeroma thermophilum*, the Socorro isopod (Crustacea: Peracarida). Biological Bulletin 161: 291 - 302.

Simpson Beryl, B. 1999. A revision of Hoffmannseggia (Fabaceae) in North America. Lundellia. (2): 14-54.

Hoffmannseggia, a genus of the Caesalpinieae, Caesalpinioideae, has been treated as a synonym of *Caesalpinia* or as a distinct genus with as many as 25 species. Recent molecular and morphological work has provided strong support for a monophyletic *Hoffmannseggia* distinct from either *Caesalpinia* or *Pomaria*. This revision provides the first complete nomenclature and discussion of the 11 species (12 taxa) of *Hoffmannseggia* occurring in North America. Included are a key to the species, maps showing distributions, and photographs of flowers or fruits of six species.

Skaggs, R. W. 1996. The common black-hawk in southwestern New Mexico, 1994 - 1995 inventories. Santa fe, New Mexico Department of Game and Fish: 14.

Smith, H. M., V. O. Flores, et al. 1993. New variational extremes for *Tantilla calamarina* and a locality record correction for *Conophis vittatus viduus* (Reptilia: Serpentes). Bulletin of the Maryland Herpetological Society 29(1): 1-3.

Smith Hobart, M. and D. Chiszar. 1997. New records for amphibians and reptiles from Texas. Herpetological Review. 28(2). 99-100.

Soto-Galera, E., J. Paulo-Maya, et al. 1999. Change in fish fauna as indication of aquatic ecosystem condition in Rio Grande de Morelia-Lago de Cuitzeo Basin, Mexico. Environmental Management 24(1): 133-140.

The Rio Grande de Morelia-Lago de Cuitzeo basin in west central Mexico has experienced major increases in water pollution from a rapidly growing human population. We examined changes in the long-term distribution of fishes in relation to water quality and quantity in order to assess the condition and health of aquatic ecosystems in the basin. Sampling between 1985 and 1993 revealed that five (26%) of the 19 native fish species known from the basin had been extirpated. Two of these were endemics, *Chirostoma charari* and *C. compressum*, and they are presumed extinct. Twelve (63%) of the remaining species had declines in distribution. Sixteen (80%) of the 20 localities sampled had lost species. The greatest declines occurred in Lago de Cuitzeo proper and in the lower portion of the Rio Grande de Morelia watershed. Species losses from the lake were attributable to drying and hypereutrophication of the lake because of substantial reductions in the amount and quality of tributary inputs, whereas losses from the Rio Grande de Morelia watershed were the result of pollution from agricultural, municipal, and industrial sources, especially in the region around the city of Morelia. Three localities in the upper portion of the Rio Grande de Morelia watershed-Cointzio reservoir, La Mintzita spring, and Insurgente Morelos stream-contained most of the remaining fish species diversity in the basin and deserve additional protection. Fish faunal changes indicated major declines in the health of aquatic ecosystems in the Morelia-Cuitzeo basin.

Soutierre, E. C. 1979. The effects of timber harvesting on the marten. Journal of Wildlife Management 43: 850 - 860.

Steuter, A. A. and H. A. Wright. 1980. White-tailed deer densities and brush cover on the Rio Grande Plain. Journal of Range Management 1980. 33(ref): 5, 328-331.

Habitats on the Rio Grande Plain, Texas with a range in total brush cover from 10 to 97% were selected from 3 brush control treatments and native brush types. White-tailed deer (*Odocoileus virginianus*) density in each habitat was determined from helicopter census and observation towers from May 1977 to the end of July 1978. The data indicated that there were three intensities of deer use during the summer that were dependent on brush cover class: areas with less than 43% total brush cover had a max. density of 1.4 deer/40.5 ha; areas with 43-60% brush cover had a max. density of 3.25 deer/40.5 ha; and areas with 60-97% brush cover had the highest summer density (7.5 deer/40.5 ha). Rio Grande plain habitats in Texas (USA) with a range in total brush cover from 10-97% were selected from three brush control treatments and native brush types. White-tailed deer (*Odocoileus virginianus*) density in each habitat was determined from helicopter census and observation towers. Three brush cover classes resulted in three levels of white-tailed deer use during summer. Areas with less than 43% total brush cover had a maximum density of 1.4 deer/40.5 ha. Brush cover from 43-60% had a maximum density of 3.25 deer/40.5 ha. Highest summer deer use occurred on areas with 60-97% total brush cover (7.5 deer/40.5 ha).

Stevenson, M. M. 1971. *Percina macrolepida* (Pisces, percidae, Etheostominatinae), a new percid fish of the subgenus *Percina* from Texas. The Southwestern naturalist 16: 65 - 93.

Storz Jay, F. 1995. Local distribution and foraging behavior of the spotted bat (*Euderma maculatum*) in northwestern Colorado and adjacent Utah. Great Basin Naturalist. 55(1). 78-83.

This study investigated local distribution and foraging behavior of the spotted bat (*Euderma maculatum*) in Dinosaur National Monument, Colorado-Utah, by monitoring audible echolocation calls. The occurrence of this species was verified in a variety of habitat types in canyon bottoms and other relatively low elevation sites, indicating that the animals are widely distributed and locally common in the area. Foraging spotted bats concentrated flight activity in the open-air space above meadows and occasionally exploited near-canopy habitat (within 8 m of foliage). Bats began to forage shortly after dark, and activity levels were relatively constant throughout the night. Foraging spotted bats attacked airborne prey every 2.15 min on average. Consistent with published observations, spotted bats maintained exclusive foraging areas. Distinct vocalizations indicating agonistic encounters occurred when a bat encroached on the foraging area of a conspecific.

Strzelec, M. 1999. Dolomitic bed - rock as the factor affecting the distribution of freshwater snails in sinkhole ponds of Upper Silesia (Poland). Mitteilungen der Deutschen Malakozoologischen Gesellschaft (62-63): 43-48.

Studies on distribution of freshwater snails in Upper Silesia have shown that not only the chemistry of water, bottom sediments and vegetation play the important role in occurrence and abundance of these mollusks. One of the main factors influencing the fauna is the character of bed rock on which the water bodies are situated. The dolomite layer in bed - rock acts negatively on the richness and diversity of freshwater snail fauna in Upper Silesia.

Stuart James, N. 1995. Notes on aquatic turtles of the Rio Grande drainage, New Mexico. Bulletin of the Maryland Herpetological Society. 31(3). 147-157.

Stuart, J. N. and C. W. Painter. 1994. A review of the distribution and status of the boreal toad. Bufo boreas boreas. in New Mexico. Bull. Chicago Herpetolo. Soc. 29(6): 113 -116.

Sullivan, B. K., G. W. Schuett, et al. 2002. *Heloderma suspectum* (Gila monster). Mortality/predation? Herpetological Review 33(2): 135-136.

Sullivan, R. M. 1996. Genetics, ecology and conservation of montane population of Colorado chipmunks (*Tamias quadrivattatus*). Journal of Mammalogy 61: 455-464.

Sureda, M. and M. L. Morrison. 1998. Habitat use by small mammals in southeastern Utah, with reference to Mexican spotted owl management. Great Basin Naturalist 58(1): 76-81.

Temporal and spatial differences in abundance and habitat use by small mammals were determined in southeastern Utah, USA as part of an effort to enhance management of the Mexican Spotted Owl (*Strix occidentalis lucida*), listed by the federal government as

threatened. Woodrats (*Neotoma spp.*) were captured only in canyons and most frequently in the pinyon-juniper (*Pinus edulis-Juniperus osteosperma*) vegetation type. White-footed mice (*Peromyscus spp.*) were found in a variety of vegetation types in both canyons and mesas. The deer mouse (*P. maniculatus*) was generally the most frequently captured species among vegetation types. Seasonal and yearly differences were found in relative abundance of each small mammal species. The data suggest that the pinyon-juniper vegetation type within canyons is an important component of Mexican Spotted Owl habitat.

Sutton, K., T. Baccus John, et al. 1997. Habitat of *Ancistrocactus tobuschii* (Tobusch fishhook cactus, Cactaceae) on the Edwards Plateau of central Texas. Southwestern Naturalist. 42(4). 441-445.

Ancistrocactus tobuschii (Tobusch fishhook cactus), an endangered species, has an endemic distribution on the Edwards Plateau of central Texas. It is only found in the Juniperus Ashei-Quercus fusiformis association on limestone dominated soils. The objective of our study was to characterize plant composition and physical features of the terrain in the immediate area of *A. tobuschii* at the Walter Buck Wildlife Management Area, Kimble County, Texas (99degree47'N, 30degree28'W). We visually estimated the percent cover or calculated the percent frequency of grasses, pteridophytes, woody plants, forbs, coarse rock fragments, bedrock, and bare ground in the immediate area of 291 *A. tobuschii* plants with a 1.0 m2 quadrat in October 1996. Forty-one plants associated with the cactus had a composite mean ground cover of 33%. The median number of plant species per quadrat was five. *Bouteloua curtipendula, Hilaria belangeri, Bouteloua hirsuta*, and *Panicum hallii* were the dominant plant species in the habitat. The percent cover of the surface in the immediate area of cacti was 19% bedrock, 44% coarse rock fragments and 4% bare ground. The habitat of A. tobuschii on the Edwards Plateau of central Texas can be characterized as low stony hill range sites with large amounts of bedrock, coarse rock fragments, limited bare ground, and sparse, patchy vegetation.

Swanson William, F. and E. Wildt David. 1997. Strategies and progress in reproductive research involving small cat species. International Zoo Yearbook. 35. 152-159.

Captive populations of small cats are often comprised of fewer than 50 animals that are widely dispersed geographically, making them difficult to study in scientifically meaningful numbers. This paper reviews the progress that has been made in reproductive research and describes how it can be applied to the conservation of small felids. The domestic cat serves as a general reproductive research 'model' for felids but normative databases of individual species are still required. Fundamental physiological studies included a 2 year survey of the reproductive status of 186 male felids in Latin American Zoos. Almost 60% of cats produced fewer than 1,000,000 total sperm per ejaculate and several species, including the *Margay Leopardus wiedii*, Little spotted cat *Leopardus tigrinus* and *Jaguarundi Herpailurus yaguarondi*, had low percentages (<40%) of structurally normal spermatozoa. This type of survey can highlight management or husbandry problems which may contribute to poor reproduction. Basic physiological information is essential to developing and applying assisted reproductive techniques, such as ovulation induction, artificial insemination (AI), in vitro fertilization, embryo transfer (ET) and genome resource banking.

Swarthout, E. C. H. and R. J. Steidl. 2001. Flush responses of Mexican spotted owls to recreationists. Journal of Wildlife Management 65(2): 312-317.

Mexican spotted owls (*Strix occidentalis lucida*) occupy narrow canyons on the Colorado Plateau, some of which are subject to high levels of recreational activity. These activities represent a potential threat to owls, yet due to the confines of canyon walls, spatial restrictions on recreational activities would likely eliminate all activity within these canyons. We assessed factors that influenced flush responses (flush or no flush), flush distances, distances of avoidance flights, and behavioral changes of owls in response to a single hiker that approached roosting owls. Increased perch height decreased the likelihood that adults (odds ratio=0.09) and juveniles (odds ratio=0.17) would flush in response to the presence of a hiker; having flushed previously the same day increased the likelihood of adults flushing on subsequent approaches (odds ratio=6.83). Juveniles and adults were unlikely to flush at distances more than or equal to 12 m and more than or equal to 24 m from hikers, respectively, and neither age class was likely to alter its behavior in response to the presence of a hiker at distances more than or equal to 55 m. Based on these response thresholds, placing a 55-m buffer zone around roosting sites would eliminate virtually all behavioral responses of owls to hikers, but would restrict hiker access to 80% of canyons occupied by owls. A less conservative 12-m buffer zone would eliminate 95% of juvenile and 80% of adult flush responses, and restrict hiker access to 25% of canyons occupied by owls.

Swift-Miller, S. M., B. M. Johnson, et al. 1999. Factors affecting the diet and abundance of northern populations of Rio Grande sucker (*Catostomus plebeius*). Southwestern Naturalist 44(2): 148-156.

We surveyed streams within a broad portion of the northern range of Rio Grande sucker (*Catostomus plebeius*) to assess factors associated with the species' diet and abundance. We also examined potential interplay between habitat, food availability, and dietary overlap with the nonnative white sucker (*Catostomus commersoni*). Rio Grande sucker and white sucker primarily consumed periphyton, resulting in high diet overlap. Amount of fine sediment in streams was negatively related to abundance (catch per effort) and condition of Rio Grande sucker. Condition of Rio Grande sucker was negatively related to white sucker catch per effort, and abundance of Rio Grande sucker was significantly lower in streams with white sucker. We suggest that the high degree of diet overlap between the two sucker species may be ecologically important.

Swift-Miller, S. M., B. M. Johnson, et al. 1999. Distribution, abundance, and habitat use of Rio Grande sucker (*Catostomus plebeius*) in Hot Creek, Colorado. Southwestern Naturalist 44(1): 42-48.

Rio Grande sucker, *Catostomus plebeius*, has declined in the Rio Grande Basin in Colorado, and was listed as a Colorado state endangered species in 1993. The fish is now known to occur in only one location, Hot Creek. We documented distribution and abundance of Rio Grande sucker in Hot Creek in 1994 and described aspects of its biology, habitat use, and fish assemblage. Rio Grande sucker occurred in about 8 km of Hot Creek, with a streamwide population size of 1,426 fish (95% confidence interval = 651-2,201). The only micro- or meso-scale habitat characteristic that was related to Rio Grande sucker abundance was amount of fine sediment. Hybridization with the nonnative white sucker does not appear to be a major factor in decline of Rio Grande sucker in Colorado but other biotic interactions with that species may be important.

Swinford, G. W. 1990. Collecting the banded rock rattlesnake (*Crotalus lepidus klauberi*) in the mountains of southern New Mexico. Purpose: captive breeding. Vivarium 3(1): 8-10.

Taylor, D. W. 1983. Endangered species: status investigation of mollusks of New Mexico.

Taylor, D. W. 1987. Fresh - water mollusks from New Mexico and vicinity. N.M. Bur Mines & Min. Res. Bull 116. Professional Service Contract. Report number: 519-69.01 and 519-69-01A.

Tellez, G., A. Medellin Rodrigo, et al. 2000. Evidence of migration of *Leptonycteris curasoae* in the Mexican tropics. Bat Research News. 41(4). 143.

Townsend John, F. 1997. An unusual concentration of the federally endangered *Schwalbea americana L.* (Scrophulariaceae) in South Carolina. Castanea. 62(4): 281-282.

Turner, B. L. and L. Nesom Guy. 2000. Use of variety and subspecies and new varietal combinations for *Styrax platanifolius* (Styracaceae). Sida Contributions to Botany. 19(2). 257-262.

The term variety has historical precedence over subspecies and is either prescribed or recommended by the ICBN as the rank to be first used in the description of infraspecific taxa. The rank subspecies is then used to cluster related varieties. Accordingly, to replace earlier combinations at subspecific rank, the following new combinations in *Styrax platanifolius* are proposed: *var. mollis* (P.W.Fritsch) B.L.Turner, comb. et stat. nov.; var. *texanus* (Cory) B.L.Turner, comb. et stat. nov.; and var. *youngiae* (Cory) B.L.Turner, comb. et stat. nov. No subspecies are recognized here in *S. platanifolius*.

Unitt.P. 1987. *Empidonax traillii extimus*: an endangered subspecies. Western Birds 18: 137 - 162.

Valenzuela, D. and G. Ceballos. 2000. Habitat selection, home range, and activity of the white-nosed coati (*Nasua narica*) in a Mexican tropical dry forest. Journal of Mammalogy. 81(3): 810-819.

We investigated how white-nosed coatis (*Nasua narica*) cope with the extreme seasonality of a Mexican tropical dry forest by studying their activity, home ranges, and habitat selection in relation to climatic seasonality. From November 1994 to March 1997, we radio-tracked 7 solitary adult males, and 11 bands of females and juveniles. Males extended their activity more into night hours, were more active in both the dry and the wet seasons, and traveled a greater daily distance during the wet season than groups of coatis. Average total home range was 383.0 ha +- 32.86 SE and did not differ between sexes. Home ranges differed seasonally only in groups that used areas during the dry season that were twice as large as those used during the wet season. Three major habitats that differed in phenology were used by coatis. Both males and groups preferred arroyo forest to dry forest and semideciduous forests. These results illustrate the importance of behavioral traits that permit coatis to have access to habitats where sparse resources (e.g., food and water) are more available as a mechanism to cope with climatic seasonality. Our study provides a basis for design of management and conservation strategies for the Chamela-Cuixmala Biosphere Reserve. The population of coatis in this reserve may be considered as a model to predict the type of behavioral responses that other populations of coatis may use to cope with climatic seasonality in other tropical dry forests throughout Mexico and Central America.

Valiente-Banuet, A., C. Arizmendi Maria Del, et al. 1996. Ecological relationships between columnar cacti and nectar-feeding bats in Mexico. Journal of Tropical Ecology. 12(1). 103-119.

A bibliographical and herbarium investigation on the pollination syndrome of Mexican columnar cacti tribe *Pachycerecae* was conducted. Most Mexican species of columnar cacti show a chiropterophilic-pollination syndrome and they flower synchronously in March to May. The floral biology, reproductive system and visitors to both fruits and flowers of *Neobuxbaumia tetetzo*, the most abundant and dominant columnar cactus of succulent forest in the Tehuacan Valley, were studied. This species reached densities of c. 1200 individuals ha-1. The bats *Leptonycteris curasoae* and *Choeronycteris mexicana* were its only pollinators, while a more diverse array of visitors disperse seeds. Contrary to findings for multiple pollinators of columnar cacti in extratropical deserts in North America, the relationships between *N. tetezo* and nectar-feeding bats was strong and tightly coupled in Mexico.

Vargas-Contreras Jorge, A. and A. Hernandez-Huerta. 2001. Altitudinal distribution of the mammal fauna in the biosphere reserve El Cielo, Tamaulipas, Mexico. Acta Zoologica Mexicana Nueva Serie. (82). 83-109.

The Biosphere Reserve El Cielo is one of the most important areas in Tamaulipas, Mexico, holding a rich biodiversity. This reserve embraces tropical semideciduous forest, cloud forest, pine-oak forest and dry scrub, which possess a unique fauna. Here, we determined which mammals were associated to each vegetation type. We observed five distributional patterns for mammals along an elevational gradient: four species with a wide distribution, seven species with a medium distribution, 31 species with a reduced distribution, 12 species with leap frog distribution, and 42 species with a specific distribution. Furthermore, tropical semideciduous forest have more species (19) with specific distribution that cloud forest (10), dry scrub (9), and pine-oak forest (4). Simpson's index was used to measure species similarity among habitats. A high percentage of shared species was found between tropical deciduous forest and cloud forest (72.54%), in comparison with other habitats; whose values varied between 28.57 and 58.33%. Meanwhile, pine-oak forest and dry scrub shared few species with other habitats and their values of similarity are between 28.57 and 58.33%. Thus, the Biosphere Reserve El Cielo mammals' are clustered in three groups: tropical semideciduous forest-cloud forest, pine-oak forest, and dry scrub mammals.

Vaughn Caryn, C. and M. Pyron. 1995. Population ecology of the endangered Ouachita rock-pocketbook mussel, *Arkansia wheeleri (Bivalvia: Unionidae)*, in the Kiamichi River, Oklahoma. American Malacological Bulletin. 11(2). 145-151.

The only known remaining viable population of *Arkansia wheeleri* Ortmann and Walker, 1912, in the world occurs within a 128-km stretch of the Kiamichi River in Pushmataha County, Oklahoma. Within this river, *A. wheeleri* occurs only within the most species-rich mussel beds. In its optimal habitat, this species is always rare; mean relative abundance varies from 0.2-0.7% and the mean density is 0.27 individuals/m-2. The youngest individual *A. wheeleri* encountered was approximately 12 years of age. Forty-three percent of the historically known subpopulations of *A. wheeleri* below where inflow from an impounded tributary enters the Kiamichi River have apparently been extirpated, and no new subpopulations have been located. *A. wheeleri* survives at 75% of the historically known locations above the impounded tributary and five new subpopulations have been located.

Vazquez, B. L., R. A. Medellin, et al. 2000. Population and community ecology of small rodents in Montane forest of Western Mexico. Journal of Mammalogy 81(1): 77-85.

This study reports results of a 14-month live-trap study of small-rodent communities in 2 habitats, cloud forest and disturbed cloud forest (abandoned agricultural land), at Las Joyas Scientific Station of the Sierra de Manantlan Biosphere Reserve, western Mexico. Seven taxa of 2 families (*Muridae, Het- eromyidae*) of small rodents were captured (*Hodomys alieni, Liomys pictus, Oryzomys couesi, Peromyscus aztecus, Reithrodontomys fulvescens, R. sumichrasti, and Sigmodon alieni*). Information about age structure, population dynamics, biomass, and reproduction were obtained with mark-recapture techniques for the most abundant species (*P. aztecus and R. .fulvescens*) in both habitats.

These species comprised 80.3% of the 707 captures in the cloud forest (*P. aztecus*, 51.2%; *R. fulvescens*, 29.1%), whereas, in the disturbed areas, *R. fulvescens* represented 81.7% of the 916 captures. Species varied in population density, relative abundance, and timing of reproduction, which was seasonal. Reproductive activity for *P. aztecus* peaked in the middle of the wet season (September 1995) in the cloud forest and in the wet season and middle of the dry-cold season (January 1996) in the disturbed areas. *R. fulvescens* showed reproductive activity in the wet season (July-October 1995) in both habitats. Density fluctuated annually for *P. aztecus* in both habitats, with a peak in January and February 1996; *R. fulvescens* showed the same patterns of density in both habitats with the highest values at the end of the wet season.

Wainwright, S. E., M. A. Mora, et al. 2001. Chlorinated hydrocarbons and biomarkers of exposure in wading birds and fish of the lower Rio Grande Valley, Texas. Archives of Environmental Contamination & Toxicology 40(1): 101-111.

During 1997 we evaluated reproductive success in colonial water birds nesting in the Lower Rio Grande Valley (LRGV), Texas, USA and correlated success with concentrations of contaminants in eggs. We also measured steroid hormones and gonadosomatic index (GSI) as biomarkers of endocrine effects in common carp (*Cyprinus carpio*). Nest and fledging success of green herons (*Butorides virescens*) and great egrets (*Ardea alba*) were similar to those found in other parts of North America; however, nesting success of black-crowned night-herons (*Nycticorax nycticorax*) was lower, very likely due to flooding of the nesting area. Except for DDE and toxaphene [camphechlor], all chlorinated pesticides in bird eggs were low and not of concern for negative effects on any of the three species. DDE was highest in green heron eggs and seemed to increase along a geographic gradient form west to east, with eggs from Falcon Reservoir containing low concentrations, and those at Los Indios containing the highest concentrations (approx. 11 000 ng/g WW), near or above the threshold for reproductive impairment. DDE levels in great egrets and black-crowned night-herons were below those that are associated with reproductive impairment. Mean DDE levels in carp at the JAS Farms site were above the threshold level suggested for predator protection. Toxaphene was detected in about 20% of the samples with high levels observed in green heron eggs from Los Indios (mean = 4402 ng/g WW). These are the highest toxaphene levels reported in bird eggs in the LRGV. Toxaphene levels in fish ranged between 90 and 312 ng/g WW. In general, PCBs in bird eggs and fish tissue were low and at levels not of concern for reproductive effects. The greatest concentrations of testosterone and 11-ketotestosterone were detected in fish from the JAS Farms site, which also had the greatest concentrations of DDE. Increased androgen production and gonad development in fish at this site, relative to Pharr, could be possibly associated with endocrine disrupting effects of p,p'-DDE. DDE, toxaphene, PCBs, and hormones were highest in birds and fish from the eastern edge of the study area.

Ward, J. P., Jr. and D. Salas. 2000. Adequacy of roost locations for defining buffers around Mexican spotted owl nests. Wildlife Society Bulletin 28(3): 688-698.

An analysis was made of the distance between roosts and nests of individual spotted

owls (*Strix occidentalis lucida*) in mixed forests in the Sacramento Mountains of New Mexico. The ability of local resource managers to delineate protective buffers using information associated with the roost locations was examined.

Watts, B. D. and D. S. Bradshaw. 1995. Ghost crab preys on Piping Plover eggs. Wilson Bulletin 107(4): 767-768.

In the Barrier Islands of Virginia, USA, 2 eggs of the endangered plover *Charadrius melodus* were observed on 4 June 1994 to have been broken by a ghost crab (*Ocypode quadrata*) which had its burrow in the birds' nest.

Wayne Robert, K. and M. Brown David. 2001. Hybridization and conservation of carnivores, Gittleman John L.; Funk Stephan M.; MacDonald David W.; Wayne Robert K.: Eds. Conservation Biology Series (Cambridge). Carnivore conservation. 5: 145-162.

Wilde, G. R. and A. A. Echelle. 1997. Morphological variation in intergrade pupfish populations from the Pecos River, Texas, U.S.A. Journal of Fish Biology 50(3): 523-539.

In the early 1980s, sheepshead minnow *Cyprinodon variegatus* was introduced into the Pecos River, Texas, U.S.A. where it hybridized with the endemic Pecos pupfish *C. pecosensis*. By 1985, pupfish populations throughout approximately 300 km of the river consisted exclusively of individuals of hybrid origin (intergrades). There was significant (P lt 0.05) geographic variation in most morphological characters; the general pattern of variation was of a bidirectional cline centered near Pecos, Texas. At that site, morphology of intergrade populations resembled mostly that of the introduced species. Upstream and downstream from Pecos, morphology shifted progressively toward that typical of the native form. Intergrade populations were morphologically intermediate to the parental forms, showed a rapid approach to random assortment of characters, and generally exhibited greater morphological variability than occurred in either parent species. These observations and the consistent lack of bimodality in frequency distributions of a morphological hybrid index support the contention that intergrade populations comprise panmictic admixtures of *C. variegatus* and *C. pecosensis*.

Wilkinson, P. M., S. A. Nesbitt, et al. 1994. Recent history and status of the Eastern Brown Pelican. Wildlife Society Bulletin 22(3): 420-430.

The eastern brown pelican population in the United States has recovered dramatically from a decline in the 1950's and 1960's since being listed as endangered in 1970. Little has been published about the range-wide status of the eastern brown pelican since the Pelican Recovery Plan was completed in 1979. By the late 1980's, brown pelicans were nesting in record numbers in Florida, South Carolina, and North Carolina. In 1985, they were removed from the Federal Endangered Species List from Alabama east along the Gulf Coast and from Florida north along the Atlantic Coast. They have also recovered substantially in Louisiana and Texas but remain federally endangered there. As recovery has continued, pelicans have expanded their nesting range for the first time to Alabama, Georgia, Virginia, and Maryland and have unsuccessfully attempted nesting in Delaware and New Jersey. Brown pelican nesting on the United States Gulf Coast has more than doubled from 17 colonies with 5,598 nests in 1970 to 31 colonies and 12,699 nests in 1989. On the Atlantic Coast, brown pelican nesting has increased from 8 colonies with 2,796 nests in 1970 to 27 colonies with 13,737 nests in 1991. The eastern brown pelican breeding population increased from 25 colonies with 8,394 nests in 3 states in 1970 to 55 colonies with 26,461 nests in 9 states in 1989. The brown pelican is somewhat protected from localized problems because nesting expanded over a wide area into a large number of colonies. If brown pelicans are to survive and flourish as the human population increases, pelican populations and their critical habitats must be monitored. Range-wide surveys should be better coordinated among states to allow standardization and synchrony of survey and census techniques.

Williams, S. O. I. 1995. New Mexico.Spring season 1995. N.A.S. Field Notes: 288 - 290.

Williams, S. O. I. 1999. New Mexico: fall season 1998. N.Am.Birds 53: 86-88.

Williams, S. O. I. and D. A. Leal. 1998. Summary of willow flycatcher surveys in New Mexico during 1993 - 1998. Santa Fe, New Mexico Department of Game and Fish: 5.

Williams, S. R. 1973. *Plethodon neomexicanus*. Cat. Amer. Amphib. Rept.: 131.1 - 131.2.

Williams, S.O. III. 2000. History and current status of bald eagles nesting in New Mexico. New Mexico Ornithological Society Bull. [In press.]

Wiltenmuth, E. B. 1996. Behavior of plethodontid salamanders during rehydration.

Winemiller, K. O. and A. A. Anderson. 1997. Response of endangered desert fish populations to a constructed refuge. Restoration Ecology 5(3): 204-213.

The U.S. Bureau of Reclamation created a shallow, 110-m channel to provide habitat for two endangered fishes, *Cyprinodon elegans* (Comanche Springs pupfish) and *Gambusia nobilis* (Pecos gambusia), at the site of the fishes' former natural habitat. The cienega (marsh) associated with Phantom Lake Spring in Jeff Davis County, Texas, was destroyed by the creation of an irrigation canal system. In 1993, the endangered fishes were stocked into the refuge with individuals from the irrigation canals, and in the case of *C. elegans*, hatchery stocks. The condition of habitat, status of fish populations, and fish ecology within the refuge were then monitored for two years. The abundance and density of both species increased in accordance with aquatic plant development. *Cyprinodon elegans* abundance peaked after one year and stabilized at an average density of 14.7/m-2 by the end of our study. Juvenile *C. elegans* were always rare, which may indicate that the population reached the refuge's carrying capacity and that recruitment is low. *Gambusia nobilis* was the most abundant fish in the refuge (average density 96/m-2), used the entire refuge, and out-competed non-indigenous *G. geiseri*. The two *Gambusia* species used similar habitats but showed almost no dietary overlap. High densities of aquatic plants reduced the amount of open water areas necessary for *C. elegans*. The refuge will sustain the two endangered fishes at this historic site of endemism while maintaining flow to the irrigation system; however, the refuge is not equivalent to a restored cienega.

Wu, X. and F. E. Smeins. 1996. GIS-based models for predicting potential habitats of rare plants in South Texas. Bulletin of the Ecological Society of America. 77:492. Meeting abstract.

Wu, X., F. E. Smeins, et al. 1997. Predicting potential habitats of the endangered *Ambrosia cheiranthifolia* with environmental factors and disturbance regimes. Bulletin of the Ecological Society of America. 78:210. Meeting abstract.

Wu, X. B. and E. Smeins Fred. 2000. Multiple-scale habitat modeling approach for rare plant conservation. Landscape & Urban Planning. 51(1). 11-28..

Multiple-scale habitat assessment for rare plants is an important component of conservation and development planning. It is challenging, however, due to lack of information synthesis on the ecology of rare plants, lack of effective approaches for habitat assessment at multiple spatial scales, and lack of spatial data for relevant environmental attributes and scales. A multiple-scale habitat modeling approach was developed to meet this need. Regional-, landscape-, and site-scale habitat models were developed for eight rare plant species found in southern Texas, USA. The models were partially validated and used for planning of rare plant conservation and highway construction. Regional-scale habitat models were used to predict, based on coarse-scale geographic information system (GIS) data, spatial distribution of areas containing potential habitat of rare plant species and the probability of encountering potential rare plant habitats. Site-scale models, based on synthesis of the literature and field investigations, were developed for field survey and mapping of rare plant habitats to enable accurate assessment of potential and present habitat suitability of specific locations using fine-resolution field data on soil, landform and vegetation structure. The greatest need for assessing the presence and potential habitat of rare plants is at the landscape scales. Thus, landscape-scale models were developed for spatially explicit

assessment of potential and present habitat suitability, based on site-scale models but using GIS and remote sensing-based data. These models can be used as effective tools for conservation planning, monitoring and management of rare plant habitat, as well as for reduction of land use conflicts and development cost. The processes of model development and application synthesizes the diffuse literature, identifies knowledge and data gaps to guide future research, and provides a framework for assimilating new information acquired in the future to improve habitat assessment.

Wursig, B., K. Lynn Spencer, et al. 1998. Behavior of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. Aquatic Mammals. 24(1). 41-50.

Data on behavior may help address relative differences in sight-ability and identifiability among species. As part of the 1992-1994 GulfCet program of shipboard and aerial cetacean surveys in the north-central and western Gulf of Mexico, we assessed cetacean responses to survey ships and aircraft. *Kogia spp*. and ziphiids showed the most avoidance reactions towards the ships (73%, 11 of 15 sightings), with large delphinids (e.g., blackfish) at 15% (7/48), small delphinids (e.g., *Stenella spp.*) at 6% (15/247), and *Stenella frontalis* and *Tursiops truncatus* at 0% each (26 and 88 sightings, respectively). *S. coeruleoalba* moved to avoid the ships in 33% (9/27) of sightings. Species which responded to the ships (either approaching or avoiding) also changed behavior in response to the survey airplane. *Kogia spp*. changed their behavior in response to the airplane during 40% (12/30) of sightings, and ziphiids during 89% (8/9). Several of the smaller delphinids also showed sensitivity to disturbance by the airplane. 'Diving' and 'other' were the most common responses to the airplane. For all cetacean species, the behavioral states 'milling' and 'resting' appeared to be sensitive to disturbance; more than 39% of initial observations of these behaviors were followed by a new behavior. Cryptic species, such as *Kogia spp*. and ziphiids, which were seen resting on most occasions, responded to the airplane a high proportion of the time. Less cryptic species, such as the small delphinids, may have responded as often, but their response did not necessarily make them harder to identify. These data indicate that the sight-ability and identification of cetaceans may change with variable behavior of species, and should be taken into account when extrapolating from sightings to population status as determined from density estimates. Density estimates for long-diving cetaceans, such as *Physeter macrocephalus*, and species which often react negatively to the survey vessel, such as *S. coeruleoalba*, may tend to be biased downwards, while the reverse may be true for species which tend to approach the ship, unless data can be collected to estimate the value of the detection function.

Young, K. E., R. Valdez, et al. 1998. Density and roost site characteristics of spotted owls in the Sierra Madre Occidental, Chihuahua, Mexico. Condor 100 (4): 732-736.

Density was estimated and roosting habitat of Mexican Spotted Owls (*Strix occidentalis lucida*) characterized in 1994 in the Sierra Madre Occidental in southwestern Chihuahua, Mexico. Forest habitats were dominated by pine (*Pinus*)/oak (*Quercus*). Mean Spotted Owl density in Chihuahua (0.089 owls km-2) was approximately half that reported for

Arizona and New Mexico. Owls were primarily (70%) roosting in medium-sized trees, which likely resulted from a paucity of mature and old-growth forest on the study area. Spotted Owl roosts had steeper slopes, more canopy layers, greater canopy closure, and greater live tree basal area than random sites. Management objectives should promote increasing canopy closure and understorey diversity to improve habitats for Mexican Spotted Owls in northern Mexico.

Zavala-Gonzalez, A., J. Urban-Ramirez, et al. 1994. A note on artisanal fisheries interactions with small cetaceans in Mexico, Perrin W. F.; Donovan G. P.; Barlow J.: Eds. Report of the International Whaling Commission Special Issue; Gillnets and cetaceans. (15). 235-237.