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CONSERVATION OF THE FRESH WATER TURTLE SPECIES OF VENEZUELA IN NATURAL PROTECTED AREAS

CONSULTATION DRAFT REVIEW PROTOCOL

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1. BACKGROUND

On global terms turtles are facing serious problems. They are hunted, killed, consumed and sold in disproportional numbers. The eggs, hatchlings and adults are used for food and traditional medicine, and exploited indiscriminately without considering the sustainability. Consequently, many species are facing extinction and a few others have already gone extinct (Turtle Conservation Fund 2002). What is more worrying is that the natural history characteristics of most turtles which are characterised by a slow growth, late sexual maturity and long reproductive period, limits the sustainability of wild harvests (Thorbjanarson et al. 2000). Even medium sized harvests of wild populations will very likely result in population declines (Crouse et al. 1987).

There exist approximately 300 species of continental turtles (terrestrial and freshwater turtles) in the world, of which 200 (66.6%) are catalogued in the IUCN red list of animals facing extinction (Turtle Conservation Fund, 2002). In South America there are 57 species of freshwater turtles (Turtle Conservation Fund, 2000) of which 17 of these can be found in Venezuela; *Chelus fimbriatus, Mesoclemmys gibba, Mesoclemmys heliostemma, Mesoclemys raniceps, Mesoclemmys zuliae, Platemys platycephala, Rhinemys rufipes, Phrynops tuberosus, Peltocephalus dumerilianus, Podocnemis expansa, Podocnemis unifilis, Podocnemis vogli, Podocnemis erythrocephala, Kinosternon scorpioides, Rhinoclemmys diadamata, Rhinoclemmys punctularia* y *Trachemys callirostris* (Rueda-Almonacid et al. 2007).

Even though river turtles are not as diverse as fish, they may be found in extremely high densities and may contribute significantly to the biomass and energy flow of the ecosystem (Moll & Moll 2000). An example of this importance is that of *P. expansa* at the beginning of the 19th century when the naturalist Alejandro Humboltd estimated that there were about one million females that came ashore to nest every year (Humboltd, 1991). Taking these figures into account, we can estimate that there were more than 2800 tons of eggs laid and more than 1600 tons of hatchlings which could be predated upon by a number of different species. Similar productivity levels would have been expected in the 19th century for other turtle species that were equally abundant. The abundance of these species is one of the reasons why turtles are considered to be key species in the ecosystem's food chain.

The considerable abundance of *P.expansa* has also been historically reported for Brazil. In 1863, the English naturalist, Henry Bates (1825-1892) described this exceptional abundance of freshwater turtles in the Amazonian rivers, and reported that *P.expansa* was the most common species at the end of the eighteenth century. At the time, 48 million eggs were harvested annually, which were collected mainly from the Solimoes and Madeira rivers (Kemenes & Pantoja, 2006).

According to Ojasti (1995), national reports from Brasil, Colombia, Ecuador, Peru and Venezuela report the presence of capture of *Podocnemis erythrocephala*, *P. expansa*, *P. sextuberculata* and *P. unifilis* for their sale in cities and towns. However it is very possible that the number of fresh water turtles sold may be underestimated firstly because of its

illegality, and secondly because hunting and fishing statistics have to date not been included in the reports (Ojasti, 1995). Gorzula (1995) estimated the capture of between 200,000 and 400,000 individuals in the Venezuelan Amazonian forest of the Big-headed Amazon river turtle (*Peltocephalus dumerilianus*), Red-headed Amazon river turtle (*Podocnemis erythrocephala*) and Yellow-spotted side-necked turtle (*Podocnemis Unifilis*). In the Capanaparo River, in South-eastern Venezuela, members of the Yaruros ethnic group as well as creoles that inhabit the region have noted unexpected reductions in *P. expansa* populations as well as significant reductions in *P. unifilis populations* (Thorbjanarson et al. 1997).

Habitat loss has been well documented for many turtle species and is considered to be the main cause of the decline and loss of turtle populations. The protection of a single turtle population or isolated habitat without considering the ecosystem as a whole is an environmental conservation method that is known as halfway technology which may contribute to the extinction of many turtle species (Mitchell & Klemens 2000). For example, habitat disturbance can cause changes in the runoff water increasing the floods during the nesting season which can consequently cause the loss of the whole of the turtle nest productivity as the eggs of most species cannot be submerged (Moll & Moll 2000).

Many of these actions have been undertaken to protect freshwater turtles in South America, in the Biological station Abufari in the Amazon where the IBAMA guards the area to prevent the capture of turtles. In 2000 and 2001, the IBAMA collected 122 fishing nets that had been placed in the river by poachers to capture turtles and 48 nets were collected in 2004. In 2000 and 2001, 3978 turtles (of four turtle species) were seized and 2139 samples were seized in 2004, all of which were captured within this reserve. In August 1999 alone, a ship headed for Manaus seized 38 thousand turtles in the Salimoes River (Kemenes & Pantoja, 2006).

Another river in Brazil where the IBAMA protects *P. expansa* nesting beaches is the Araguaia River, where in the year 2000, a total of 352 nests were recorded in 22 protected beaches, the latter which represents a reduction in comparison to previous years (Dias & Amorin, 2005).

In Venezuela in 1989, the Arrau turtle Wild Fauna Refuge (Refugio de Fauna Silvestre de la Tortuga Arrau) was created, and the management plan to protect the Arrau turtle in the Mid-Orinoco River was implemented. The plan's objectives are the following: protect nesting beaches, protect and conserve a viable population of the species, make the region's inhabitants environmentally conscientious (Licata & Elguezabal, 1997).

The Wild Fauna Refuge for the Arrau Turtle has since 1993 released thousands of one year old Arrau juveniles annually in order to reinforce Mid-Orinoco populations (Hernández & Espín, 2006).

In order to conserve turtles more efficiently in the long term, it is necessary to redirect the conservation efforts. Instead of trying to protect species and small habitat areas, conservation efforts should be carried out on a larger scale, at a meta-population or ecosystem level. Large areas of land are needed to maintain meta-populations and to include all of the phases of the

ecosystem's dynamic processes that are required to maintain the turtles´ habitat (Klemens 2000).

Moll and Moll (2000) concluded that for the conservation of riverside turtles, it is necessary to implement conservation actions at the population level so that all age classes are protected. At the habitat level, all feeding and nesting areas should be protected. And at the landscape level, entire river basins should be protected from canalisations, damming, erosion and contamination. The creation of sanctuaries and reserves should be prioritized, followed by the protection of nesting areas and lastly by captive breeding strategies.

In Venezuela there exist 16 categories of protected areas (PA) encompassing 265 areas, that cover a total of 612.489 Km^2 (Bevilacqua et al. 2006), and an average of 2311.3 Km^2 per protected area. This considerable extension of land makes the protected areas ideal for species conservation, and permits the conservation of meta-populations and entire ecosystems.

Even though these protected areas total 67% of the national territory, in the present day the Plan de Sistema Nacional de Areas Protegidas (National Scheme of Protected Areas) is dismantled and inoperative. However, today protected areas have the legal right to establish conservation programs (Bevilacqua, 2006).

Today in Venezuela there are 35 natural monuments, 43 national parks, 2 Biosphere reserves, 6 fauna reserves and 7 fauna refuges, of which only one of these areas, the Tortuga Arrau Wild Fauna Refuge (Refugio de Fauna Silvestre de la Tortuga Arrau) was decreed to protect one turtle species. However there is no doubt that many of the PAs that exit today in Venezuela encompasses habitats that favour the protection of some species. With this systematic review using the Conservation Based Evidence methodology, we will try to determine which freshwater turtles are present in PAs in Venezuela, and the effectiveness of these PAs to protect this group of *Chelonia*.

2. OBJETIVE OF THE REVIEW

Evaluate the effectiveness of natural protected areas (PA) as strategies to recover freshwater turtle populations in Venezuela.

2.1. Primary question

Are protected areas effective to recover freshwater turtle populations in Venezuela?

2.2. Secondary question

What characteristics of a protected area (nesting, vigilance, extension, presence of inhabitants, etc.) are determinant for the conservation of freshwater turtle species?

3. METHODS

3.1. Search strategy

The following data bases will be consulted:
Google Académico
Scielo International
Science Citation Index Expanded
Latindex Catalogo
Biosis Previews
Zoological Record

The libraries, technical reports, theses and archives of the following institutions will be consulted:
Ministerio del Poder Popular para el Ambiente
FUDECI
INPARQUES
Universidad Central de Venezuela
Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora
Universidad Simón Bolívar
Universidad Nacional Experimental Guayana
Fundación La Salle
Universidad Centro Occidental Lisandro Alvarado

The web pages and newsletters of the following institutions will be consulted:
IUCN/SSC-Reintroduction Specialist Group
IUCN/SSC, Tortoise and Freshwater Turtle Specialist Group
WWF
WCS
Turtle specialist in Venezuela will also be interviewed

For the search the following keywords and the combination of the latter will be used

Table 1. Terms in english and spanish

Terms in English	***Terms in Spanish***
Podocnemis	*Podocnemis*
Chelus	*Chelus*
Peltocephalus	*Peltocephalus*
Phrynops	*Phrynops*
Platemys	*Platemys*
Rhinoclemmys	*Rhinoclemmys*
Pseudemys	*Pseudemys*
Batrachemys	*Batrachemys*
Mesoclemys	*Mesoclemys*
Rhinemys	*Rhinemys*
Kinestrom	*Kinestrom*

Trachemys	*Trachemys*
Freshwater Turtle, river turtle	Tortuga de agua dulce
Distribution	Distribución
Turtle predation	Depredation de Tortugas
Turtle exploitation	Consumo de Tortugas
Hunting	Caza-cacería
Poaching	Cacería furtive
Protected areas	Áreas Naturales Protegidas
Habitat loss	Hábitat, perdida de
Wildlife conservation	Conservación de fauna Silvestre
Turtle conservation	Conservación de Tortugas

In each of the web searches, the first 100 articles will be assessed for relevance for the review.

3.2. Study inclusion criteria

Relevant subject(s): All freshwater turtle species in Venezuela

Types of intervention: Creation and functioning of PA

Types of comparator:
The following variables will be compared: population density, nest density, nest predation, turtle density in protected areas and in areas that are not under any type of legal protection regime, where turtles and the habitat of the latter are present. In this way these variables will be compared with private lands protected by their owners where turtles are present.

Types of outcome: Changes in the size structure, abundance and nest density per beach
The review will consider all those responses to interventions that have been carried out with related species which have been used for food. Turtle population density, nest size, number of sacked nests.

Types of study: All those studies that have been carried out in Venezuela on freshwater turtles

Potential reasons for heterogeneity: The biology of the different turtle species. Changes in the public policies towards the local communities and Pas could make the authorities more permissive towards the use of resources by local communities, and a reduction in the assigned local budget for the establishment of local interventions. PA with or without personal, and resources for vigilance and control.

3.3. Study quality assessment

Initially in the review, all studies dealing with freshwater turtles in Venezuela will be considered using the previously mentioned search criteria. Both qualitative and quantitative studies will be included as well as scientific and grey literature.

Considering that many of the studies containing quantitative data and consistent methods may be difficult to find, qualitative studies that clearly describe the criteria on which results and conclusions are based, will also be included in the review. If only a few studies are available for a species, all of the latter will be considered in the review.

It will also be necessary to compile information on the possible bias sources and measures that have been carried out by the researchers to try and mitigate the latter. In this sense, the following sources of experimental bias will be considered:

- Differences in the scale of the analysis and scale of the studied process
- Selection of the study unit (spatial and temporal autocorrelation)
- Pseudoreplication
- Detection bias (detection probability)
- Omission bias (open population)
- Sample size
- Sample methodology
- Comparator use
- Selection of statistics analysis used
- Probability of making Type II error (statistical length)

The potential bias sources will be independently assessed in a predefined scale that will very likely vary from 0 to 1. Once each of these sources has been evaluated, the results will be summed up to determine the percentage of bias of the study. If the value of the sum is greater than 5, the study may be in included in the quantitative analyses of the review.

3.4 Data extraction strategy

For each of the reviewed studies, a table will be used where the following data will be included:

Author:
Year:
Location:
Species:
Protected area considered:
Type of protection present in the protected area:
Extension of the protected area:
Duration of PA program:
Evaluation before the intervention: yes/no
Summary of methodology used:
Result type: quantitative/qualitative
Results:
Conclusions of study:
Any other information related to the questions of the systematic review.

3.5. Data synthesis

Considering the types of studies compiled in this review, it will probably only be possible to perform the synthesis on semi-formal data. Tables will be created in which for each intervention, the results will be analysed (i.e. specifying whether the result was positive or negative). To determine the trend in the answers according to the intervention, a vote count methodology will be used.

However, if enough studies with quantitative data are found, a meta-analysis will be performed to estimate the joint effect of the different studies. Depending on the studies found, it will be determined which model is most convenient, considering the models of mixed effects, random, fixed constants and fixed constants with moderator variables.

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

None declared

5. REFERENCES

Bevilacqua, M., Cárdenas, L., Medina, D., 2006. Las áreas protegidas en Venezuela: diagnóstico de su condición. 1993/2004. ACOANA, UICN, Fundación Polar, CI Venezuela. Caracas. 165 pp.

Crouse, D.T., Crowder, L.B., Caswell, H., 1987. A state-based population model for loggerhead sea turtles and implications for conservation. Ecology 68:1412-1423

Dias, P.D., Amorin P.T., 2005. Nest Placement of the giant Amazon river turtle, Podocnemis expansa, in the Araguaia river, Goiás State, Brazil. Ambio. 34 (3): 212-217.

Gorzula, S., 1995. Diagnóstico faunístico del Estado Amazonas, propuesta para un manejo sustentable. In: Amazonas modernidad y tradición. ed. A., Carrillo, M.A., Pereira, pp. 228-247. SADA-Amazonas y Deutche Gesellshcaft für Tecnische Zusammenarbeit, Caracas.

Hernández O., Espín R., 2006. Efectos del reforzamiento sobre la población de tortuga arrau (Podocnemis expansa) en el Orinoco Medio, Venezuela. Interciencia. 31(6): 424-430.

Humboldt, A., 1991. Viaje a las regiones equinocciales del nuevo continente. 1820. Tomo III. Monte Ávila Editores. Caracas, Venezuela.

Klemens M.W., 2000. From information to action: developing more effective strategies to conserve turtle. In Turtle conservation, ed. M., Klemens, pp 239-258. Smithsonian Institution Press, Washington and London.

Licata L., Elguezabal X., 1997. Management plan for the giant Amazonian turtle, Podocnemis expansa, in De La Tortuga Arrau Wildlife Refuge, Orinoco river, Venezuela. In Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles, ed. J., Van, pp 171-173. An international Conference. New York Turtle and Tortoise Society:171-173.

Mitchell, J., Klemens, M.W., 2000. Primary and secondary effects of habitat alteration. In Turtle Conservation, ed. M., Klemens, pp 5-32. Smithsonian Institution Press, Washington and London.

Moll, E.O., Moll, D., 2000. Conservation of river turtle. In Turtle Conservation, ed. M., Klemens, pp 126-155. Smithsonian Institution Press, Washington and London.

Ojasti, J., 1995. Uso y conservación de la fauna silvestre en la Amazonía. Secretaría Pro-Tempore-Tratado de Cooperación Amazónica, Lima. Nº 35.

Rueda-Almonacid, J.V., Carr, J.L., Mittermeier, R.A., Rodríguez-Mahecha, J.V., Mast, R.B., Vogt, R.C., Rhodin, A.G.J., Ossa, J., Rueda, J.N., Mittermeier, C. G., 2007. Las Tortugas y cocodrilianos de los países andinos del trópico. Serie de Guías tropicales de campo Nº 6.Conservación Internacional. Editorial Panamericana, Formas e Impresos . Bogotá, Colombia.

Thorbjarnarson J, Lagueux C, Bolze D, Klemens M, Meylan A (2000) Human use of turtle: a worldwide perspective. In Turtle Conservation, ed. M., Klemens, pp 33-84. Smithsonian Institution Press, Washington and London.

Thorbjarnarson JB, Pérez N, Escalona T. 1997. Biology and conservation of aquatic turtles in the Cinaruco-Capanaparo National Park, Venezuela. Proceedings: Conservations, Restoration, and Management of Tortoises and Turtles. An International Conference. New York Turtle Tortoise Society. 109-112.

Turtle Conservation Fund (2002) A Global Action Plan for Conservation of Tortoises and Freshwater Turtles. Strategy and Funding. Prospectus 2002–2007. Washington, DC: Conservation International and Chelonian Research Foundation.