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# Hunting, use and Trade of Chelonians in the South of Sucre, Colombia

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## Abstract

**Objective**: To evaluate the use and trade of *Trachemys callirostris* (Colombian slider), *Rhinoclemmys melanosterna* (Colombian wood turtle) and *Kinosternon scorpioides* (Scorpion mud turtle) during the months of January to May, 2015. **Methods/statistical Analysis**: This study was carried out in the south of the Department of Sucre, Colombia, taking sample in the municipalities of San Marcos and Caimito with traditional sites of extraction, stockpiling and distribution for these turtles. 110 surveys were given to collect information on the availability, use and trade of hunted chelonians. **Findings**: The most commonly used species in both municipalities was *T. callirostris*, which had 66% commercialized and 34% subsistence consumption. The hunting effort for *T. callirostris* resulted in, on average, 66 individuals/month/hunter. The average sale price that the hunter obtained was $3,567 Colombian Pesos (COP) (US $1.20), for a monthly/hunter income of $235,422 COP (US $78.5). As for *R. melanosterna* and *K. scorpioides*, their capture rate was incidental, and their consumption was a measure of occasional and opportunistic exploitation. **Application**: The hunting of turtles and their consumption are linked to the culture of the study area and, in many cases, are a subsistence strategy that, according to economic calculations, produces temporary, insignificant income that does not justify this practice from a market perspective.

**Keywords:** Chelonians, Colombia, Commerce, Utilization, Sucre

## 1. Introduction

Wildlife is an ecosystem component that, as a renewable natural resource, is fundamental; however, it is underestimated, and its unreasonable use is widely exercised in different parts of the word[1]. Native wildlife as a whole constitutes the wealth and defines part of the genetic diversity of ecosystems, forming an integral part of the natural heritage of countries, regions and the world[1]. From pre-Columbian times until now, wildlife has occupied a prominent position in the social development of Colombians, both in symbolic and material terms, providing valuable assets that have economically sustained many of the inhabitants, especially those settled in rural and marginal areas[2].

The exploitation of wildlife for economic purposes in Colombia has deep roots, and indiscriminate use has impacted natural populations, particularly those with a strong cultural demand, whether for medicinal or gastronomic uses, to the point that some have been brought to the brink of extinction or have disappeared locally from many areas of the country[2].

Colombia, a mega-diverse country, contains at least 10% of the fauna and flora on the planet, making it rich in biological diversity, and occupies fourth place for the number of reptiles[3]. However, chelonians have suffered a drastic

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reduction in their natural populations, produced by indiscriminate hunting, destruction of their nests and habitat fragmentation, which are essentially anthropic actions[4].

Turtles are and continue to be used as food, pets and medicine all over the world[5-6]. In recent decades, this group of reptiles has suffered drastic population deterioration, whose causes are imminently anthropogenic, including: consumption, habitat destruction, and trade of eggs, neonates and juveniles for pets. In general, turtles represent great value in the diet of indigenous and rural inhabitants of many tropical countries[7]. However, there is currently no quantitative information on the harvest levels of chelonians or the effects of this activity on natural populations, except for a few studies that refer to very specific areas[4].

In order to establish broad and effective programs for the conservation of turtles, it is important to have up to date knowledge on use patterns, along with their effect on natural populations, their importance for community subsistence and how the use and intrinsic value of turtles it can be used as a tool to build sustainable projects, highlighting the need for sociocultural knowledge with basic biological and ecological research[8,9].

*Trachemys callirostris* (Colombian slider turtle) is considered low risk, but close to threatened since 1996[10], and nationally considered vulnerable[11]; *Rhinoclemmys melanosterna* (Colombian wood turtle) has the IUCN national category almost threatened[12], but the IUCN global category (version 2011.2) has not been evaluated, and CITES does not list it[13]. *Kinosternon scopioides* (Scorpion mud turtle), subspecies *K. s. scorpioides*, has not been evaluated for the IUCN national category[12], and the global category (version 2011.2) and CITES do not list it[14].

This study presents information related to the use of chelonians as food or for economic purposes in the municipalities of Caimito and San Marcos in the Department of Sucre, Colombia. An assessment was carried out for the use pattern that is culturally associated with these chelonians, highlighting the economic value of this resource as a cultural and subsistence factor and showing that these wild fauna species suffer from high regional anthropic pressure.

# 2. Materials and Methods

## 2.1 Study Area

The municipalities of Caimito (8° 47'35 '' N and 75° 23'34 '' W) and San Marcos (8° 40'35 '' N and 75° 07'04 '' W), Department of Sucre, are part of the La Mojana region, regionally recognized as the San Jorge sub-region for administrative purposes. They occupy 440 and 530 $Km^2$, respectively (Google Earth, 5.0 Free, 2010).

Environmentally, they have an average annual temperature of 28°C, are located between 20 and 25 masl[15], belong to a Tropical dry forest area (bs-T), forming an alternate tropical zonobiome[16], and have a warm and dry climate[17]. This territory is highly dependent on the environmental impact of flooding that is formed *in situ* by multiple swamps and the San Jorge River[18].

## 2.2 Sampling

During the months of January to May, 2015, a total of 20 field trips were made to each of the municipalities: San Marcos and Caimito, in the Department of Sucre. Interactive dialogues were held voluntarily with members of the communities to identify inhabitants that are dedicated to hunting, trading and/or consuming chelonians. Semi-structured surveys were applied[19].

A representative sample was used: N = 110, 95% Alpha, 1% maximum error of estimation, with 110 surveys applied to 46 hunters, 55 intermediaries and 9 traders of chelonians, identified in the previously-mentioned dialogues, with which relevant information on commercial use or subsistence consumption was obtained for each of the studied species.

Morphometrically, for the calculations, the total length of the carapace, measured in a straight line, was taken into account[20], and the state of maturity was determined taking into account the body size of each analyzed specimen[21]. Information on the purchase and sale of *T. callirostris* was taken from a representative sample according to the sizes established commercially in the study area using the carapace measured in a straight line: size 1 (7-9 cm), size 2 210-12 cm) and size 3 (13 cm or more).

The measurement of the effort used was taken with the number of individuals captured per species in relation to the time spent: (Hunting Effort) HE = NIC / T: where, NIC = Number of individuals captured by species, T = Time spent[22].

## 2.3 Analysis of Information

Using the questionnaires and records on the use of this resource, representations were created with tables. Analysis of variance and Tukey test were used; likewise, percentage, minimum, maximum and standard deviation calculations were made in the required cases[23].

## 3. Results

Table 1 presents the capture data per month for each of the studied chelonian species; Table 2 differentiates the turtle species by sex and state of maturity. Table 3 shows the state of maturity, sex and size.

**Table 1.** Capture per month according to species

| Species | January | February | March | April | May |
|---|---|---|---|---|---|
| *T. callirostris* | 303 | 636 | 4,835 | 7,708 | 3,182 |
| *R. melonosterna* | 59 | 47 | 53 | 58 | 23 |
| *K. scorpioides* | 10 | 4 | 8 | 15 | 4 |

**Table 2.** Capture by species, discriminated by sex and state of maturity

| Species | Matures | | Immature | Total |
|---|---|---|---|---|
| | Males | Females | | |
| *T. callirostris* | 1,473 | 4,193 | 10,998 | 16,664 |
| *R. melonosterna* | 28 | 72 | 140 | 240 |
| *K. scorpioides* | 16 | 18 | 7 | 41 |

**Table 3.** Total carapace length (TL) in cm according to the state of maturity and sex

| Estate | N | Media | SD | Min. | Max. |
|---|---|---|---|---|---|
| Juvenile | 10,998 | 8.24 | 0.26 | 7.5 | 8.9 |
| Male | 1,473 | 12.07 | 1.14 | 10 | 15.1 |
| Female | 4,193 | 15.12 | 3.82 | 10.1 | 26.2 |

The only chelonian species that was sold was *T. callirostris*, 66% of which was sold (10,998 samples) and the remaining 34% (5,666 samples) was used for self-consumption; *R. melanosterna* and *K. scorpioides* were used as occasional food, but not for trade.

When using Analysis of variance to compare the price with size in *T. callirostris,* it was determined that there were significant differences (gl = 4, F = 85.40, p<0.0001). When applying the Tukey test, the differences between sizes and prices were noted (Alpha = 0.05, DMS = 84.16415, Error: 92724.1395, gl: 437) (Table 4).

The variation in the average price between the different levels presented differences: hunter $3,567 COP, intermediary $5,531 COP and wholesaler $6,553 COP, representing an increase between hunter and intermediary of 55%, and between hunter and wholesaler of 83% (Table 5). The difference in the average prices received for the *T. callirostris* specimens at the different market levels presented significant differences: hunter, intermediary and wholesaler (gl = 2, F = 4.813.2, p <0.001).

**Table 4**. Tukey test to compare differences between size and market price for *T. callirostris*

| Size | Medias | n | EE | |
|---|---|---|---|---|
| 1 | 3567,01 | 147 | 25,12 | A |
| 2 | 5531,33 | 150 | 24,86 | B |
| 3 | 6553,27 | 149 | 24,95 | C |

Measurements with the same letter are not significantly different (p <0.05)

The total hunting effort/day for *T. callirostris* was 100.9 individuals, which is equivalent to an average of 2.2 Ind./day/ hunter during the 5 month hunting season, occupying an average of 100 days, which would result in 220 Ind./season/hunter. Based on the average sales according to the distribution percentage of the catch in the market, the income per hunter is $ 3,567.00 COP (US $1.20). A monthly/hunter income of $ 235,422 COP (US $78.5) is obtained. As for *R. melanosterna* and *K. scorpioides*, their capture was incidental, and their consumption was a measure of subsistence use.

**Table 5**. Calculation of average income from commercialization of *T. callirostris* per each market level

| Stratum | N | Half price $ (COP) | Media (*T. callirostris*) Marketed | Total income $ (COP) | Difference $ (COP) |
|---|---|---|---|---|---|
| Hunter | 46 | 3,567 | 10,998 | 39,229,866 | |
| Intermediary | 55 | 5,531 | 10,980 | 60,730,380 | 21,500,514 |
| Wholesaler | 9 | 6,553 | 10,980 | 71,951,940 | 11,221,560 |

## 4. Discussion

The extraction of wildlife is of greater importance in marginal areas or where access to economic resources is limited, becoming a fundamental strategy for survival, and is of great value in the diet of rural populations, even for cultural reasons, meeting a high percentage of protein requirements, as is the case with some indigenous groups and settlers in Latin America[24]. Access to wildlife by rural populations is related to socio-environmental factors, such as ease of access to extraction areas and economic income, not to mention the offer and acceptance that wildlife has in an analyzed area[25]. The extraction of wildlife, in addition to the cultural aspect, ease of access for capturing during certain times of the year, absence of alternative and domestic livestock production, low income and marginality make hunting a viable alternative for subsistence[26–29].

The use of *T. callirostris* is widespread and preferential, which typifies the study area, the region, and its area of influence for this type of extraction within the national territory, as previously recorded in similar studies[25,28,29]. This species is among the chelonian species subjected to high trafficking levels in Colombia, which, according to[21], include in decreasing order: *Trachemys callirostris, Podocnemis unifilis, Chelonoidis carbonaria* and *Podocnemis expansa.* This study reaffirmed that *T. callirostris* has a significant capture volume when compared to the other two recorded species: *R. melanosterna* and *K. scorpioides*.

For the ecoregion Mojana sucreña, it is estimated that 30% of the *T. callirostris* harvest is commercialized; the figure for the aforementioned date was broad and demonstrated a use that not only involved the use of meat as a measure of subsistence, but also showed a commercial plot that went beyond the area in question. Notably, most individuals are transported to the markets of large cities, including the capitals of nearby departments[28,30]. Extraction for just this area of the country reaches more than 1,000,000 specimens[28,31–33]. In the present study, it was shown that, comparatively (De La Ossa, 2003), the percentage sold was doubled, and subsistence consumption was halved, evidencing an increase in trafficking.

It has been established that, in the ecoregion La Mojana, a hunter can capture a total of 27 *T. callirostris*/year[34], a figure that is much lower than that established in this study where the hunting effort saw 220 ind./season/hunter. The documented extraction for the municipality of Caimito has been reported as 13,644 Colombian slider turtles during the breeding season (January-May)[35] almost double that found in this study, which included data from two municipalities: Caimito and San Marcos and observed 16,664 specimens in total.

The perception of users of this resource is that there is a capture decrease as a result of over-exploitation[29,36] which is evident when observing the recorded capture data, as well as the data in this study[35]. Another important aspect is the composition of the catch; it was observed that 66% of the individuals were immature, which allowed the inference that the population has a deteriorating proportion of adults because of anthropogenic reasons, including indiscriminate capture of this resource, and this decline has accelerated. From 2011 to 2015, the catch went from 34%[35] to 66% immature individuals.

*T. callirostris* reaches maturity with a total carapace length of 15.8 cm for females and 12.00 cm for males[37]; it can be deduced that a capture with an average size of 15.12 cm includes males, and a representative capture is related to the reproductive season. It is important to emphasize that mature females would only represent 25%, which reinforces the theory of marked population deterioration and the low possibilities of recovery if indiscriminate extraction practices persist. Furthermore, with over-exploitation, changes in genetic variability, fertility and development rates may result, which could seriously jeopardize population stability[38].

The hunting effort shows the quality of the natural reserves, and deterioration is evident when it is comparatively increased every year, while at the same time, it makes it possible to typify this specific case as an inequitable commercial system for hunters with collection costs, depending on the work, becoming increasingly high, meaning this operation is not economically profitable. On the other hand, time is required for the natural recovery of populations subjected to extraction[39], which, in the case of chelonians, is always a considerable amount of time because of their slow growth, late sexual maturation and spaced reproductive life[40].

The monthly income obtained by hunters is equivalent to $235,422 COP (US $78.5), very low income that is only 40% of the legal minimum wage for 2016. The profits of merchants are always greater and significantly differ from those obtained by hunters, as in the instant case, but this type of subsistence hunting goes beyond satisfying the community's food and economic needs and its effects are observed in a market that does not practice selectivity and

takes advantage of extraction since any Colombian slider turtle that is hunted is consumed if it is not sold[35,41,42].

It was proven that there was a so-called substitution effect, which is related to the local depletion of wild populations of species that are particularly preferred for consumption and that are replaced by others that are less desired historically[39]. Although the effect on the commercialization of chelonians of this zone cannot be confirmed, it can be affirmed that, in terms of use as subsistence food, there was an effect since the other two species of turtles: *R. melanosterna* and *K. scorpioides*, when caught, are not released, but consumed because they are not desired by the market.

## 5. Conclusions

The effects exerted by the communities are the result of strong and negative social, economic and environmental pressures; in this case, basic extraction as a subsistence alternative can lead to local extinction and then to total extinction.

In addition to over-exploitation, global warming and productive and development activities, such as hydroelectricity, the drying of marshes and pipes, agricultural production processes and pollution, cause a significant negative impact that affects the population stability of wildlife, including *T. callirostris*.

The trade of Colombian slider turtles is a lucrative business, with a massive and accentuated demand that is based on consumption rooted in cultural tradition in the distribution areas of this species. The extraction is voluminous and worsens during the week of Easter and Lent, a period that coincides with the reproduction of *T. callirostris*; additionally, the Colombian slider turtle is considered white meat, which makes its consumption more desirable, along with its taste and virtues born of popular beliefs that are attributed to it.

It should be noted that within a subsistence economy system the consequences of a population increase, the demand for natural resources and commercialization are manifested forcefully, creating devastating friction between native communities and the environment, as seen with wildlife resources that are a fast way to obtain relatively easy money.

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