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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Twenty-eighth meeting of the Animals Committee
Tel Aviv (Israel), 30 August-3 September 2015

Species trade and conservation

Snake trade and conservation management (Serpentes.spp.)

# DEVELOPING CITES NON-DETRIMENT FINDINGS FOR SNAKES: EXAMPLE PRIMARY EVALUATION

The attached information document has been submitted by the Secretariat at the request of the International Union for Conservation of Nature (IUCN) in relation to agenda item 14.1.*

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

# Annex B – Example Primary Evaluation for CITES Non-detriment Findings for snakes

Daniel Natusch, Tomas Waller, Patricio Micucci and Victoria Lichtschein

# Annex B

# CITES Non-detriment finding

## Primary Evaluation Template

*Text in italics is explanatory and should be deleted in completed documents. Please refer to the NDF Guidelines document for further explanation on how to complete this evaluation.*

| | |
|---|---|
| **Species name** | White-lipped python (*Leiopython albertisii*) |
| **Range state name** | Indonesia |
| **Report compiled by** | Indonesian CITES Scientific Authority (**example only**) |
| **Date compiled** | 2011 to 2012 (**example only**) |

**Section One: Summary**

*Please provide a short overview (1-2 paragraphs) of the trade in this species in the country of interest.*

*Leiopython albertisii* is harvested from the wild in Indonesia and is exported for the pet trade. All specimens are harvested from the wild in the provinces of Papua and West Papua. An annual harvest quota of 400 individuals is allocated. There is evidence that some wild specimens may be illegally exported as captive bred. Nevertheless, total annual exports are only 800 specimens.

**Section Two: Primary Evaluation score**

*Please score each attribute listed within the table below and sum these to provide a total.*

| | Number of points | | | Score |
|---|---|---|---|---|
| **Criteria** | 1 | 2 | 3 | |
| **Annual Harvest level** | Low (<2,000) | Medium (2,000 - 20,000) | High (>20,000) | **1** |
| **Area of occupancy** | Large (>20,000km$^2$) | Medium (2,500 – 20,000km$^2$) | Small (<2,500km$^2$) | **1** |
| **Life-history** | Fast | Medium | Slow | **2** |
| **Illegal trade** | If known, should be included under "Annual harvest level". If unknown, and suspected to be detrimental, give a **maximum score of 1 point** | | | **0** |

**Section Three: Justification – Harvest level**

*Please provide an explanation with appropriate references to justify the score given.*

A harvest quota of 400 individuals is allocated for harvest in the provinces of Papua and West Papua annually. There is some evidence that this quota may be exceeded and individuals are exported as captive-bred. Even if this is occurring, annual exports are approximately 800 individuals, which justify the harvest level score of **1** (low).

### Section Four: Justification – Area of occupancy

*Please provide an explanation with appropriate references to justify the score given.*

*L. albertisii* occurs in the Indonesian provinces of Papua and West Papua (Natusch and Lyons 2012). It primarily inhabits primary rainforest and secondary regrowth habitats below 800 m above see level (O'Shea 1996). The extent of primary and secondary rainforest in Papua is 176,750 $km^2$ (Johns et al. 2006). This extent is considerably larger than 20,000 $km^2$ and thus justified an area of occupancy score of **1**.

### Section Five: Justification – Life history

*Please provide an explanation with appropriate references to justify the score given.*

*L. albertisii* has a high reproductive output, producing 15 to 20 eggs in a clutch (Natusch and Lyons 2012; Parker 1982). Studies of closely related species inhabiting tropical areas suggest that growth rates are likely to be high. However, like closely related species, *L. albertisii* probably only reproduces every second year (Madsen and Shine, 2000). For this reason we follow a precautionary approach and give a life history score of **2** (medium).

### Section Six: Illegal trade

*Please provide an explanation with appropriate references to justify the score given.*

There is evidence of small volumes of illegal trade, where wild-caught snakes may be being mis-declared and exported as captive-bred (Natusch and Lyons, 2012). Even so, total exports of *Leoipython albertisii* from Indonesia (from all sources) is only approximately 800 individuals annually. Even if all of these individuals are taken from the wild, this level of harvest is deemed to have no impact on the species and as such is given a score of **0**

### Section Seven: Conclusion, course of action and determination on exports

*Please provide an overall conclusion on the perceived threat of trade to the species and details on whether further course of action will be taken to complete an NDF for the species.*

The sum of scores for the attributes listed above is **4.** All scores of four and below do not require that a Secondary Evaluation be completed. Based on the information presented above, we can be confident that harvesting for trade does not currently affect the viability of *L. albertisii* populations.

This primary evaluation is a sufficient NDF for *L. albertisii*. Current exports are deemed to be non-detrimental. Trade is allowed to continue and no further course of action will be taken to monitor or manage harvests.

## Section Eight: Literature Cited

*Please provide references to all the reports and literature cited in this evaluation.*

Johns, J., Shea, G., and Puradyatmika, P. (2006). Lowland vegetation in Papua. In Marshall, A.J., and Beehler, B.M. (eds.). 2006. The Ecology of Papua. Singapore: Periplus Editions.

Madsen, T., and Shine, R. (2000). Silver spoons and snake body sizes: prey availability early in life influences long-term growth of free ranging pythons. *Journal of Animal Ecology* **69**, 952-958.

Natusch, D,. and Lyons. (2012). Ecological attributes and trade of white-lipped pythons in (Genus Leiopython) in Indonesia. *Australian Journal of Zoology*. **59**, 339-343.

O'Shea, M. (1996). 'A Guide to the Snakes of Papua New Guinea.' (Independant Publishing: Port Moresby.)

Parker, F. (1982). The snakes of the Western Province. Wildlife in Papua New Guinea No. 82/1. Department of Lands and Environment, Konedobu, Papua New Guinea.

# CITES Non-detriment finding

## Primary Evaluation Template

*Text in italics is explanatory and should be deleted in completed documents. Please refer to the NDF Guidelines document for further explanation on how to complete this evaluation.*

| | |
|---|---|
| **Species name** | Boa Constrictor (*Boa constrictor constrictor*) |
| **Range state name** | Suriname |
| **Report compiled by** | Suriname CITES Scientific Authority (**example only**) |
| **Date compiled** | 2011 to 2012 (*example only*) |

### Section One: Summary

*Please provide a short overview (1-2 paragraphs) of the trade in this species in the country of interest.*

Boa constrictor is harvested from the wild in Suriname and is exported for the pet trade. They are harvested from throughout the country and approximately 200 – 300 specimens are exported annually. An export quota of 1010 individuals per annum is currently in place.

### Section Two: Primary Evaluation score

*Please score each attribute listed within the table below and sum these to provide a total.*

| | Number of points | | | Score |
|---|---|---|---|---|
| **Criteria** | **1** | **2** | **3** | |
| **Annual Harvest level** | Low (<2,000) | Medium (2,000 - 20,000) | High (>20,000) | **1** |
| **Area of occupancy** | Large (>20,000km$^2$) | Medium (2,500 – 20,000km$^2$) | Small (<2,500km$^2$) | **1** |
| **Life-history** | Fast | Medium | Slow | **2** |
| **Illegal trade** | If known, should be included under "Annual harvest level". If unknown, and suspected to be detrimental, give a **maximum score of 1 point** | | | **0** |

### Section Three: Justification – Harvest level

*Please provide an explanation with appropriate references to justify the score given.*

A harvest quota of 1,010 individuals is allocated for harvest in all of Suriname annually. There is no evidence of illegal trade and only 1/3 of this quota is realised each year (exports between 200 – 300 individuals per year). This justifies the harvest level score of **1** (low).

**Section Four: Justification – Area of occupancy**

*Please provide an explanation with appropriate references to justify the score given.*

*Boa constrictor* occurs throughout Suriname. It is a generalist species that thrives in modified and anthropogenic habitats (including cities) (Henderson et al. 1995). For this reason we deem the area of occupancy within Suriname to be the total land area of the country: 163,821 $km^2$. This extent is considerably larger than 20,000 $km^2$ and thus justifies an area of occupancy score of **1**.

**Section Five: Justification – Life history**

*Please provide an explanation with appropriate references to justify the score given.*

*Boa constrictor* is a livebearer with a high reproductive output, producing an average of 27 young in a litter and up to 65 young in large females (Bertona and Chiaraviglio, 2003; Pizzatto and Marques, 2007). They are fast growing, but probably only produce litter bi-annually (Bertona and Chiaraviglio, 2003; Pizzatto and Marques, 2007). For this reason we follow a precautionary approach and give a life history score of **2** (medium).

**Section Six: Illegal trade**

*Please provide an explanation with appropriate references to justify the score given.*

There is no evidence of illegal trade in *Boa constrictor* from Suriname. For this reason we assign a score of **0**.

**Section Seven: Conclusion, course of action and determination on exports**

*Please provide an overall conclusion on the perceived threat of trade to the species and details on whether further course of action will be taken to complete an NDF for the species.*

The sum of scores for the attributes listed above is **4**. All scores four and below do not require that a secondary evaluation be completed. Based on the information presented above, we can be confident that harvesting for trade does not affect the viability of *Boa constrictor* populations in Suriname.

This primary evaluation is a sufficient NDF for *Boa constrictor* in Suriname. Exports are deemed to be non-detrimental. Trade is allowed to continue and no further course of action will be taken to monitor or manage harvests.

## Section Eight: Literature Cited

*Please provide references to all the reports and literature cited in this evaluation.*

Bertona, M., and Chiaraviglio, M. (2003) Reproductive biology, mating aggregations, and sexual dimorphism of the Argentine Boa Constrictor (Boa constrictor occidentalis). Journal of Herpetology. 37, 510-516.

Henderson, R., Waller, T., Micucci, P., Puorto, G., and Bourgeois, R. (1995). Ecological correlates and patterns in the distribution of neotropical Boines (Seprentes: Boidae): A preliminary assessment. *Herpetological Natural History*, **3**, 15-27.

Pizzatto, L., Marques, O.A.V. (2007): Reproductive ecology of Boine snakes with emphasis on Brazilian species and a comparison to Pythons. South Am. J. Herp. 2: 107-122

# Annex C – Example Secondary Evaluation for CITES Non-detriment Findings for snakes

THE YELLOW ANACONDA MANAGEMENT PROGRAM (YAMP) OF ARGENTINA

Daniel Natusch, Tomas Waller, Patricio Micucci and Victoria Lichtschein

# CITES Non-detriment finding

## Primary Evaluation Template

*Text in italics is explanatory and should be deleted in completed documents. Please refer to the NDF Guidelines document for further explanation on how to complete this evaluation.*

| | |
|---|---|
| **Species name** | Yellow Anaconda (*Eunectes notaeus*) |
| **Range state name** | Argentina |
| **Report compiled by** | Fundación Biodiversidad Argentina (**example only**) |
| **Date compiled** | 2015 (**example only**) |

**Section One: Summary**

*Please provide a short overview (1-2 paragraphs) of the trade in this species in the country of interest.*

*Eunectes notaeus* is harvested from the wild in Argentina for its skin. Approximately 3,500 specimens are harvested and exported annually, largely from the province of Formosa in northern Argentina. No harvest quota is established, and local people are allowed to harvest as many snakes as they want between specific sizes and in a defined hunting season.

**Section Two: Primary Evaluation score**

*Please score each attribute listed within the table below and sum these to provide a total.*

| | Number of points | | | Score |
|---|---|---|---|---|
| **Criteria** | **1** | **2** | **3** | |
| **Annual Harvest level** | Low (<2,000) | Medium (2,000 - 20,000) | High (>20,000) | **2** |
| **Area of occupancy** | Large (>20,000km$^2$) | Medium (2,500 – 20,000km$^2$) | Small (<2,500km$^2$) | **2** |
| **Life-history** | Fast | Medium | Slow | **2** |
| **Illegal trade** | If known, should be included under "Annual harvest level". If unknown, and suspected to be detrimental, give a **maximum score of 1 point** | | | **0** |

**Section Three: Justification – Harvest level**

*Please provide an explanation with appropriate references to justify the score given.*

There is no fixed limit on the number of individual snakes that can be harvested annually from Argentina. As a result, annual harvests and exports fluctuate. Nevertheless, the average annual offtake is approximately 3,500 snakes (up to a maximum of 6,000 snakes per year). There is no evidence that illegal harvest or trade is taking place. Based on this information, we provide a harvest score of **2** (medium).

**Section Four: Justification – Area of occupancy**

*Please provide an explanation with appropriate references to justify the score given.*

Within Argentina *E. notaeus* occurs only in aquatic inland ecosystems, specifically swamps, seasonally flooded marshes, or riverine habitats, associated with the Paraguay River and the middle sector of the Paraná River (Strüssmann and Sazima, 1993; Henderson et al., 1995; Dirksen, 2002) The yellow anaconda's extent of occurrence in Argentina encompasses about 120,000 $km^2$ (Micucci et al., 2006). Assuming a conservative 1:3 wetland/dry land ratio throughout this wetland-dominated area, we estimate that the total area of occupancy within Argentina is not less than 40,000 $km^2$. Nevertheless, because most of the yellow anacondas captured for trade originate from the La Estrella Marsh, which covers an area of 3,500 $km^2$, we conservatively assign an Area of Occupancy score of **2** (medium).

**Section Five: Justification – Life history**

*Please provide an explanation with appropriate references to justify the score given.*

*E. notaeus* has a high reproductive output, producing a mean of 24 offspring per litter. Growth is rapid, with females reaching sexual maturity after two to three years. Data from dissections of individuals captured for trade shows that frequency of reproduction varies among populations and between years, with female snakes reproducing only every two to three years (Waller et al. 2007). Based on this information we assign a life history score of **2** (medium).

**Section Six: Illegal trade**

*Please provide an explanation with appropriate references to justify the score given.*

There is no evidence of a current illegal trade in wild specimens of *E. notaeus.* We allocate a score of **0**.

**Section Seven: Conclusion, course of action and determination on exports**

*Please provide an overall conclusion on the perceived threat of trade to the species and details on whether further course of action will be taken to complete an NDF for the species.*

The sum of scores for the attributes listed above is **6**. All scores of five or higher should result in a Secondary Evaluation being completed for the species. Although *E. notaeus* possess a number of attributes that make them resilient to harvesting, because up to 6,000 individuals are harvested annually from a relatively small area of Formosa, we require more information to confidently reject non-detriment.

This Primary Evaluation is not a sufficient NDF for *E notaeus* in Argentina. For this reason we have completed a Secondary Evaluation for this species (see below).

**Section Eight: Literature Cited**

*Please provide references to all the reports and literature cited in this evaluation.*

Dirksen, L. 2002. *Anakondas. Monographische revision der Gattung Eunectes Wagler, 1830 (Serpentes, Boidae).* Natur und Tier-Verlag, Münster.

Henderson, R.W, T. Waller, P. A. Micucci, G. Puorto, & R.W. Burgeois. 1995. Ecological correlates and patterns in the distribution of Neotropical boines (Serpentes: *Boidae*): a preliminary assessment. *Herpetological Natural History* 3(1):15-27.

Micucci, P. A., T. Waller, & E. Alvarenga. 2006. Programa Curiyú. Para la Conservación y Aprovechamiento Sustentable de la Boa Curiyú (*Eunectes notaeus*) en Argentina. Etapa experimental piloto 2002-2004, Formosa. In: M. L. Bolkovic and D. E. Ramadori (eds.) "Manejo de Fauna en Argentina: Proyectos de Uso Sustentable". Dirección de Fauna Silveste Secretaría de Ambiente y Desarrollo Sustentable, Buenos Aires, Argentina.

Strüssmann, C. & I. Sazima. 1993. The snake assemblage of the pantanal at Poconé, Western Brazil: faunal composition and ecological summary. Studies on Neotropical Fauna and Environment 28(3):157-168.

Waller, T., P. A. Micucci & E. Alvarenga. 2007. Conservation biology of the Yellow Anaconda (*Eunectes notaeus*) in Northeastern Argentina. Pp. 340-362 In R. W. Henderson and R. Powell (Eds.), Biology of the Boas and Pythons. Eagle Mountain Publishing, LC. Utah. 438pp.

# CITES Non-detriment Finding Secondary Evaluation – The Yellow Anaconda Management Program

**This document has been prepared by Fundación Biodiversidad Argentina* on behalf of the IUCN/SSC Boa and Python SG**

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## 1. Introduction

The yellow anaconda (*Eunectes notaeus*) is one of four species of anacondas that occur in South America. This boa is the largest snake and one of the three existing species of boa found in Argentina.

Yellow anacondas have been historically considered a very valuable resource and have been largely exploited for their skins. In the past, harvests of anacondas were carried out in a very informal way, sometimes illegally, and not based on scientifically sound sustainable use guidelines or biological information. According to the CITES Trade Database, up to 320,000 skins were traded worldwide between 1982 and 2001, exported mainly from Argentina and Paraguay, before a complete ban entered into force in both countries.

In 2002, Fundación Biodiversidad devised a management system for the yellow anaconda in Argentina: the Yellow Anaconda Management Program (YAMP), aimed at promoting the conservation of this species based on its value as a renewable wildlife resource. To our knowledge, the Program is the only existing management plan designed to ensure the sustainable trade of skins of a snake species; since its inception, the Program has been able to produce a total of approximately 50,000 skins in a sustainable manner.

Because a Primary Evaluation could not easily determine non-detriment for exports of *E. notaeus* from Argentina, a Secondary Evaluation is suggested. This document is the result of that Secondary Evaluation, and summarizes the main components of the YAMP to provide an example of a management plan that is being implemented. It is intended to be read as an integral part of the NDF Guidelines for Snakes document prepared under Decision 16.102 of the Sixteenth Meeting of the Conference of the Parties to CITES.

## 2. Background of the yellow anaconda trade

### *a) International trade*

Like many boa and python species, *Eunectes notaeus* is considered a valuable resource for its skin and the species is in high demand in the market for exotic leather goods (Jenkins and Broad, 1994). According to CITES import data, between years 1984 and 2013 (30 years), 296,748 whole yellow anaconda skins were traded worldwide (Fig. 1). This figure does not include a significant number of skins traded as skin pieces or reflected in the statistics by length or weight, nor does it comprise exports of thousands of skins manufactured into finished products such as belts, shoes or bags exported during the same period. Italy was the main importing country, followed by Germany and the USA (the three countries together accounting for 91% of the trade).

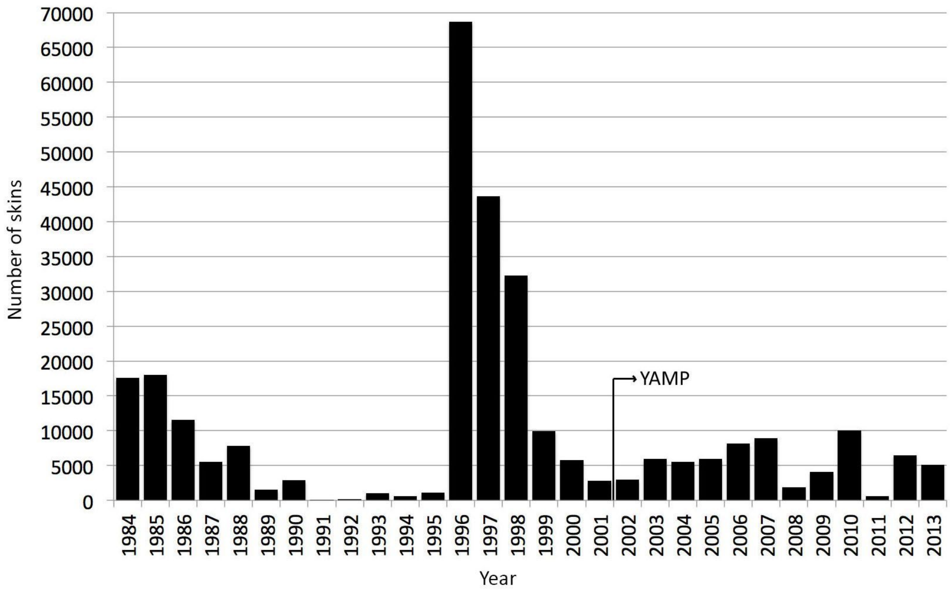


**Figure 1.** Minimum net trade for *Eunectes notaeus* whole skins between 1984 and 2013 (Source: CITES Trade Database). YAMP: Yellow Anaconda Management Program, started in 2002.

Most skins globally marketed during the last 30 years originated from Argentina, Paraguay and Bolivia. Argentina, however, accounted for 62% of the skins traded (CITES Trade Database). There are no export records from Brazil. Approximately 140,000 skins provided to the market by Argentina during the late 1990s originated from stockpiles accumulated as a result of a ban established in 1986. These skins were released for export between the years 1996 and 2000 (Micucci et al., 2006; T. Waller unpublished data). Thus, 78% percent of the trade recorded between 1984 and 2013 in fact took place before the year 2002; thereafter, the international trade in yellow anaconda skins diminished significantly due to control measures adopted by exporting countries (Micucci et al., 2006). Paraguay introduced a voluntary suspension on trade of all CITES Appendix II-listed species in 2003, while Argentina finished the export of stockpiles of yellow anaconda in 2000 and, subsequently, implemented the Yellow Anaconda Management Program (YAMP) in 2002 (Micucci et al., 2006).

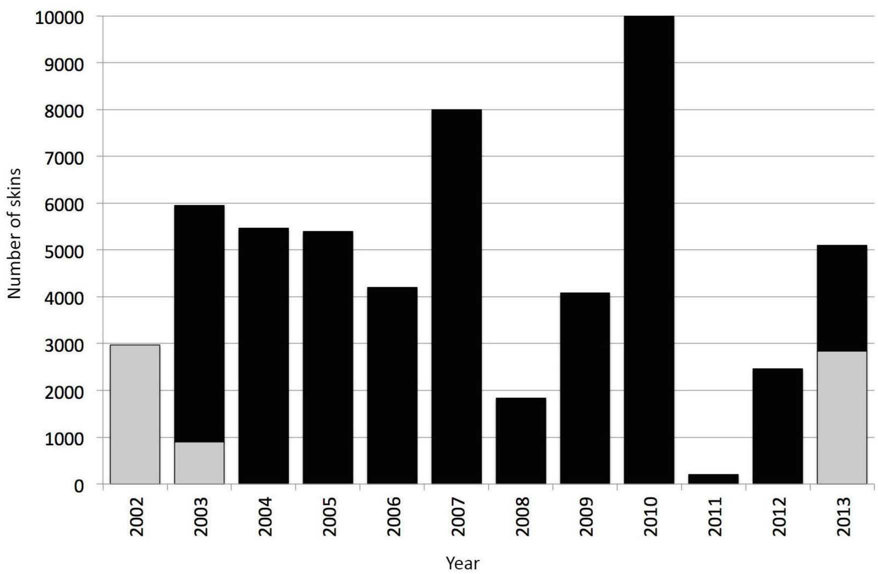


**Figure 2.** Gross exports of *Eunectes notaeus* skins from range countries between 2002 and 2013 (Source: CITES Trade Database). Black bars: Argentina; grey bars: Paraguay. *Note*: Usually YAMP skins are exported in the year following the harvest, with some exceptions. In years 2007 and 2010 skins were exported in the same year together with the skins from the previous year (2006 and 2009, respectively); this explains the peaks in 2007 and 2010 and the small number of skins exported in 2008 and 2011.

As is the case with almost all reptile species in trade (Dodd, 1993; Scott & Seigel, 1992), in the past exploitation of yellow anacondas was carried out very informally, often illegally, and not based on scientifically sound sustainable use guidelines or any biological criteria at all (Waller et al., 2007). However, from 2002 and to this day, the YAMP became the main source of yellow anaconda skins entering international trade (Fig. 2). Indeed, Argentina produced 88% of the 55,660 skins exported by range countries in recent years (2002-2013) (CITES Trade Database). The difference (12%) is due to Paraguay, yet these skins came from stockpiles obtained before 2003, when a voluntary suspension on CITES-Appendix II species was established. Most skins produced by Argentina (and Paraguay) between 2002 and 2013 were destined to tanneries in Italy (>90%; most of them imported through German ports), and the rest to the United States.

By contrast, trade in live specimens has been negligible, involving 477 specimens in 30 years, about half of them wild-sourced and exported by Paraguay before 2003. The USA has been the main importer of live anacondas. Due to their aggressive nature, anacondas in general are not particularly sought after as pets compared to other more docile constrictor snakes.

***b) Domestic utilization and trade in range States***

*E. notaeus* is occasionally collected for food or medicine by indigenous communities from northern Paraguay (Aquino-Shuster et al., 1991), Argentina (Gallardo, 1977) and presumably by some communities in Bolivia, but in general terms this is not a widespread practice (Waller, unpublished information).

Undoubtedly, obtaining skins to supply the local and international leather industry has been the main purpose for removing yellow anacondas from the wild. Nothing is known about the particulars of this trade in Bolivia. In fact, the last formal export from this country dates back to 1984, 32 years ago (2,950 skins; CITES Trade Database). In any case, Bolivia, Paraguay and possibly Brazil were directly or indirectly major suppliers of yellow anaconda skins to the international market, directly or indirectly, in particular between the 1960s the 1980s. Most of this trade took place surreptitiously across the borders, in such a way that it is difficult to establish the real origin of the skins traded internationally during those years; in fact, depending on differences in prices, regulations and law enforcement efforts, skins reaching the international market could have originated in any range country (Argentina, Bolivia or Paraguay) (Waller & Micucci, 1993).

Trade in snake skins began in Argentina possibly in the 1930s, with the establishment of the first tanneries specializing in reptiles, but peaked during the 1940s (Micucci et al., 2006). Annual exports from Argentina at that time were estimated to involve around 60,000 boa constrictor and yellow anaconda skins between 1940 and 1950, 30,000 skins in the mid-50s and 21,000 skins between 1975 and 1985 (Godoy, 1963; Gruss and Waller, 1988). These figures from official national records do not clearly distinguish exports from re-exports. In fact, in the early 1950s Argentina enacted new wildlife legislation banning the trade in this species. However, the local harvest and international trade continued uninterrupted, basically due to a sophisticated fraud mechanism involving the declaration of temporary imports and re-exports that ultimately facilitated the laundering of illegally harvested skins. This mechanism, that lasted 40 years, actually came to an end in the late 1990s, when hunting, inter-provincial movements, trade and imports of *E. notaeus* specimens and by-products were expressly prohibited in Argentina.

Furthermore, the export of a huge stockpile of approximately 140,000 skins, which had been accumulated by traders during the late 1980s, was authorized in 1996 with the requisite of tagging all the skins and a deadline to carry out the export. These stocks were exhausted by the year 2000, creating the conditions for the establishment of a management plan once the stocks had reached zero.

In 2001, and after a complete ban in trade was implemented, a field study was carried out to analyze the feasibility of establishing a harvest program for the species in northern Argentina. The study focused both on social and ecological aspects, collect information on the perception of local inhabitants about the utilization of anacondas and experimented with innovative management policies (Micucci et al., 2002). As a result of this research, in 2002 the national government commissioned a local NGO to design a management program for the species. After a three years experimental period (2002 to 2004) the Yellow Anaconda Management Program was definitely established in Argentina.

## 3. Legal framework

***a) International***

*E. notaeus* is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since February 4th, 1977, when the whole family Boidae was listed. There are no CITES quotas established for this species in any of the range countries. The yellow anaconda is included in Annex B of Council Regulation (EC) No 338/1997 of the European Union, which has since then been periodically updated (e.g. Commission Regulation (EU) No 1320/2014). It is not included in the Endangered Species Act of the United States; however, it has been recently listed as an “injurious species” under the Lacey Act, so that the introduction of live specimens of *E. notaeus* into the USA is prohibited since 2012. The yellow anaconda is the only commercial large snake species whose skins can be traded in California (this US State banned the trade in python skins in the 1970s).

***b) National***

*Argentina*: Argentina is a Party to CITES since 1981 (Ley 22344/1980). Argentina is a federal country. Provinces retain the right to administer their natural resources within their territories but the federal government has competence in exports, imports and inter-provincial movements. Further details on the legal status of the species in Argentina are provided in Section 6.d. *Bolivia*: The hunting and export of *E. notaeus* individuals (or their parts and derivatives) are currently banned. Bolivia is a Party to CITES since 1979. *Brazil*: Brazil has been a Party to CITES since 1975. Hunting and export of *E. notaeus* individuals (or parts and derivatives) are prohibited. *Paraguay*: Paraguay has been a Party to CITES since 1977. Export and hunting of wild *E. notaeus* specimens (or parts and derivatives) are currently prohibited. This country established a voluntary moratorium (suspension) on exports of all CITES species, including yellow anacondas, in 2003. It has recently lifted this voluntary suspension of trade only as relates to export of stockpiles of reptile skins collected between 2001 and 2003. The stockpiles included 5,300 yellow anaconda crust tanned skins that were exceptionally allowed for export.

## 4. Understanding the species

A thorough understanding of the species’ biology is essential to devise and implement a management system. Until recently, biologically meaningful data to use as a basis for management of the yellow anaconda (*Eunectes notaeus)* were scarce, and mainly originated from general surveys, observation, or the study of a few specimens kept in zoos or museum collections. Petzold (1982), Waller and Micucci (1993), Dirksen (2002), and Reed and Rodda (2009) comprehensively compiled and summarized most of the published information on the species. More recently, Waller et al. (2007) presented basic population and biological data for *E. notaeus* in northern Argentina as a result of the ongoing field monitoring of the species under the YAMP.

***a) Nomenclature***

Four species of anaconda are currently recognized within the genus *Eunectes* Wagler (1830), including the largest snake in the world, the green anaconda (*Eunectes murinus*; www.reptile-database.reptarium.cz/). Anacondas are aquatic snakes that occur in South America. They are members of the family Boidae, which includes species from the Americas, Europe, Africa, Asia and many islands (O’Shea, 2011). *E. notaeus* was first described by Cope (1862) and represents the southernmost species of anaconda, distributed in Bolivia, Brazil, Paraguay and is the only species of anaconda that exists in Argentina (Giraudo and Scrocchi, 2002; Henderson et al., 1995). The taxonomy of this species remains largely unchanged and includes only one synonymy (*Epicrates wieningeri* Steindachner, 1903; Waller, 2000). *E. notaeus* is locally known as “*curiyú*” in Argentina and Paraguay, “*sicurí amarilla*” in Bolivia, and “*sucurí amarela*” or “*sucuridjú*” in Brazil (Waller et al., 1995; Dirksen, 2002). Trade names include “yellow anaconda”, “southern anaconda”, “*anaconda amarilla*” and “*curiyú*”.

***b) Coloration and identification***

The background coloration of *E. notaeus* ranges from yellow to olive-brown yellow. The dorsum is covered with black 8-shaped blotches, which are separated from each other by lighter coloured scales. The sides exhibit smaller blotches and black spots. The ventral side is yellow with small black flecks. The head normally has five black stripes, three on the dorsal side and two post-ocular (Petzold, 1982; Waller et al., 1995; Dirksen, 2002; Reed and Rodda, 2009; O'Shea, 2011; Fig. 3).

*E. notaeus* is easily distinguished from other boids by their coloration and/or scale size and shape. However, it is more difficult to differentiate *E. notaeus* from two other closely related species, *E. deschauenseei* and *E. beniensis*, and demands closer scrutiny of coloration and pattern. Nevertheless, no trade has been recently reported for anaconda species other than *E. notaeus* and *E. murinus*. Unbleached *E. notaeus* skins and their by-products exhibit a very recognizable pattern (Fig. 3). More information for identification can be found in the CITES Identification Manual.

**Figure 3.** Left: *Eunectes notaeus* in the wild. Right: a bag made with three skins in parallel, exhibiting the natural pattern of *E. notaeus*.

***c) Distribution and habitat***

The known range of *E. notaeus* encompasses approximately 15 degrees in latitude throughout the Paraguay River and lower Paraná River basins, from Bolivia and Central Brazil in the north (ca. 15°S), to northeastern Argentina in the south (ca. 30°S; Henderson et al., 1995; Fig. 4). Periodical floods often carry individuals downstream to higher latitudes, some even reaching Uruguay, but there is no evidence of a reproductive population in this country (Waller and Micucci, 1993).


**Figure 4.** Left: The Approximate Extent of Occurrence (EoO) of *Eunectes notaeus* in South America (shaded area). The dark dots represent known records of occurrence. Right: *E. notaeus* is found in a variety of aquatic habitats, such as swamps, seasonally flooded marshes, lagoons and riverine habitats.

Throughout its range, *E. notaeus* occurs in aquatic inland ecosystems of the *Pantanal* and Wet *Chaco* eco-regions, specifically swamps, seasonally flooded marshes and riverine habitats, which are associated with the Paraguay River and middle sector of the Paraná River (Strüssmann and Sazima, 1993; Henderson et al., 1995; Dirksen, 2002). The majority of this region is a poorly drained plain without major geographic features. Seasonally flooded savannahs with palm trees, grasslands, and riparian forests are important landscape components (Strüssmann and Sazima, 1993; Waller et al., 2007; McCartney-Melstad et al., 2012; Kershaw et al., 2013; Fig. 4).

The Extent of Occurrence (EoO) of *E. notaeus* encompasses approximately 400,000 km$^2$ (Micucci et al., 2006). The Area of Occupancy (AoO) is difficult to define, however, assuming a conservative 1:3 wetland/dry land ratio throughout this wetland dominated area, we estimate that the total AoO for this species is not less than 130,000 km$^2$. EoO in Argentina was estimated in 120,000 km2 (Micucci et al., 2006), while AoO assuming a conservative 1:3 wetland/dry land ratio can be estimated in 40,000 km$^2$.

Sympatry with *E. murinus* occurs at the border between the *Pantanal* and the *Cerrado* regions, as well as in some of the large rivers that crosses the *Pantanal*, in Brazil and Bolivia (C. Strüssmann, pers.comm.).

***d) Size, population structure and dimorphism***

*E. notaeus* is a heavy-bodied medium sized boa that can grow to four metres in total length (Petzold, 1982; Strüssmann and Sazima, 1993; Dirksen, 2002). There are a few individuals recorded above this size, however most of these are based on the skin measurement that can stretch 25-30% more than the original length (Dirksen, 2002; Micucci and Waller, 2007). Most *E. notaeus* captured during field sampling in Paraguay and northern Argentina were on average half that size (Dirksen, 2002; Waller et al., 2007; Fig. 5).

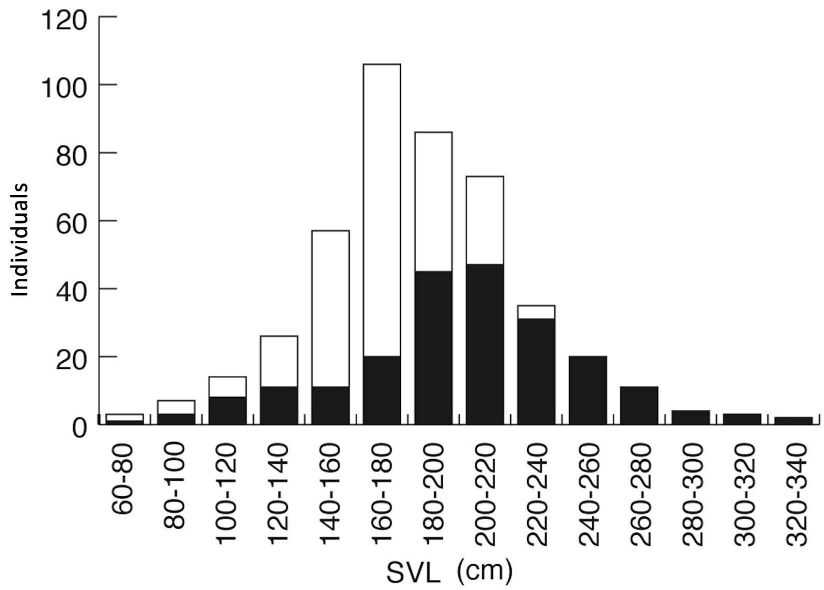


**Figure 5.** Snout-vent length (SVL) of *E. notaeus* males (black column) and females (white column) from a population in northern Argentina (N=449; Waller et al., 2007).

Sex ratio in clutches from wild populations in northern Argentina is 1:1 (Waller et al., 2007). *E. notaeus* are highly sexually dimorphic; males exhibit proportionately longer tails and larger spurs than females (Petzold, 1982; Dirksen, 2002; Waller et al., 2007). Sex can be determined by observing tail length and spur size, even in skins (Micucci et al., 2006; Fig. 6). Females can grow longer than males; the largest male and female found by Waller et al. (2007) after studying 1,555 individuals during field work in northern Argentina measured 2.6 m and 3.4 m SVL, respectively, and weighed 10.5 kg and 29 kg, respectively. The average SVL and weight for males was 1.7 m and 3.5 kg and 2 m and 6.3 kg for females.

As a result of these sexual differences in size, and the fact that the industry always seeks for medium to large skins (above 2 m), trade in *E. notaeus* indirectly relies on the harvesting of females (Micucci and Waller, 2007).

**Figure 6.** Male *E. notaeus* exhibit large spurs (left and arrow in right), which can be used to determine sex on dry skins (right).

***e) Reproductive maturity***

Age and size at maturation is a variable trait that depends on the availability of resources that directly impact on growth rates during early life stages. For this reason it is not feasible to determine an exact age at first reproduction for *E. notaeus*. Average size at physiological sexual maturity appears to be a relatively fixed trait and was established by the authors to be between 1.28 and 1.43 m SVL for males and 1.45 and 1.85 m SVL for females, approximately at the age of 2 or 3 years in northern Argentina (Waller et al., 2007);

however, this does not mean that a female will actually reproduce at that size. First reproduction for females in northern Argentina may occur between 1.5 m SVL and 2.9 m SVL; some females in this population appear to avoid reproductive opportunities until reaching a size that permits them to maximize fecundity. This means their SVL at first reproduction is the result of their individual life history trajectories (Waller et al., 2007). Individual life trajectories vary greatly and render generalizations with regard to this trait meaningless.

***f) Reproductive timing***

Populations in Argentina show great seasonality and synchronicity in reproduction (Waller et al., 2007); males and females exhibit late summer to winter gonad recrudescence (February to October). *E. notaeus* are viviparous and secondary oviductal follicles were found from early October (Waller et al., 2007). Based on semi-captive experiments with wild specimens, mating in occurs in early spring (September to October) with parturition after 160-180 days of gestation, in the autumn of the following year (March to April; Waller et al., 2007). Hatchlings are large (41 to 59 cm SVL and 61 to 135 g), very aggressive and fast growing (Waller et al., 2007). There may be variations in the reproduction timing between populations of *E. notaeus*, as is to be expected in a wide-ranging species (Reed and Rodda, 2009), however, a similar pattern to the one depicted for Argentina has also been observed for the Brazilian Pantanal (Christine Strüssmann, pers.comm.). Furthermore, unpublished datasets from different Argentinian provinces and the south of Paraguay suggest that this cycle is generalized (T. Waller unpub. data). This dataset also shows that *E. notaeus* does not breed during the winter (May to August), which is traditionally the season preferred by hunters for harvesting *E. notaeus* in Argentina (Micucci et al., 2006).

***g) Reproductive output***

Reproductive output is the result of reproductive frequency and fecundity, both of which are strongly influenced by environmental conditions. Although the majority of *E. notaeus* males studied in Argentina by Waller et al. (2007) presented a constant annual reproductive frequency (99%, N=326), females reproduced every two years on average (54%, N=515), depending on fat reserves. However, this proportion can differ among years and between regions. For example, 200 females were surveyed in 2002 from two sites in Argentina; 51% of females exhibited secondary ovarian follicles (ready to reproduce in the next season) in one site compared to 29% in another site. The proportion of reproductively able females in northern Argentina changed from 44% in 2002 (N=200) to 60% in 2003 (N=283). The literature indicates that *E. notaeus* produces 5-37 hatchlings per clutch, but sources do not always distinguish between wild and captive datasets (Dirksen, 2002; Reed and Rodda, 2009). In Argentina, mean clutch size in 11 wild females that reproduced in “semi-captive” conditions was 19.5 with a range of 7-42. Based on a large sample of 246 wild specimens from northern Argentina, oviductal scars suggests an average clutch size of 24 with a range of 7-65 (Waller et al., 2007). Female SVL was significantly correlated either with clutch size ($r^2$=0.62, P<0.01), number of oviductal scars ($r^2$=0.67, P<0.001) or number of secondary follicles ($r^2$=0.44, p<0.001) (Waller et al., 2007; Fig. 7). Reproductive output also depends upon the body condition of females; populations of *E. notaeus* that exhibited heavier individuals were more prolific compared to those composed of lighter snakes. A good body condition offers other advantages with regard to population dynamics (i.e. a higher somatic growth rate, early maturity), which results in a higher population growth rate in some sites (or periods) compared to others.

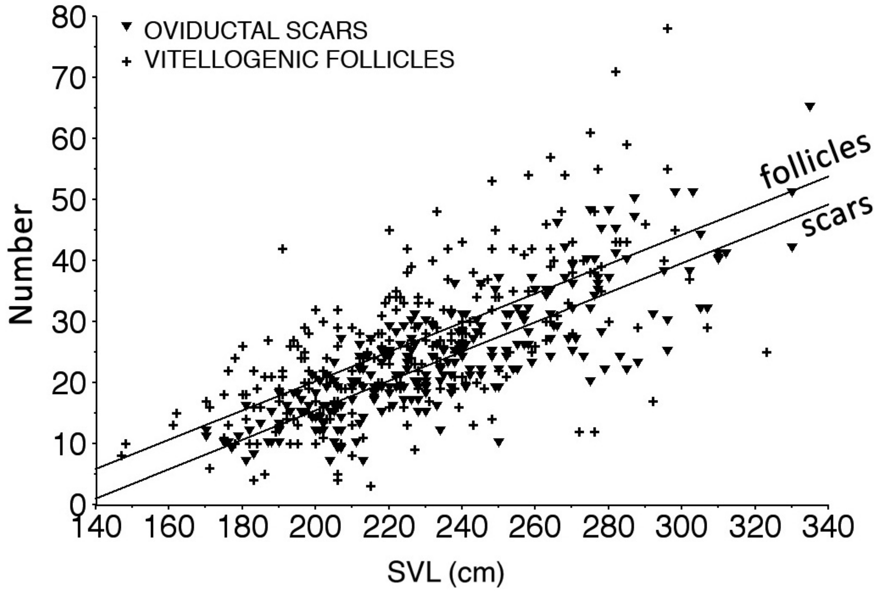


**Figure 7.** Relationship between female size (SVL) and number of oviductal scars and vitellogenic follicles (from Waller et al., 2007).

***h) Growth***

There is no conclusive data available on *E. notaeus* growth rates. This species shows rapid growth rates in captivity, with individuals increasing 40-60 cm each year depending on sex, until reaching sexual maturity, at which time growth rates diminish to 20-30 cm per year; females grew on average 20% faster than males (Petzold, 1982; Waller and Micucci, 1993; Norman, 1994; Dirksen, 2002). Growth appears to be relatively fast in wild populations from northern Argentina, with males and females capable of doubling their size in the first year of age and reaching sexual maturity in the second or third year of age (Waller et al., 2007). Consequently, this trait is expected to exhibit great spatial and temporal variations.

***i) Longevity and survivorship in the wild***

There is no data available on longevity or survivorship of wild *E. notaeus*. Captive individuals can live for more than 20 years (Snider and Bowler, 1992), but longevity is expected to be significantly less in the wild. Hatchlings are exposed to a variety of predators, however, the relatively large neonatal size, fast growth rates, and fierce temperament of this species, suggest that hatchlings and juveniles may be able to elude predation by outgrowing vulnerable offspring sizes in a few months (Waller et al., 2007). Extreme variability in wetland water levels is another potential cause of mortality. In northern Argentina, *E. notaeus* exhibited significant cyclical peaks and troughs in body condition (and reproductive frequency) in direct response to water levels (Waller, unpublished data). *E. notaeus* populations are also effected by extreme droughts and fire, local people killing snakes from fear and being killed crossing the road. Collection for the skin or live pet trade is currently negligible in most of the *E. notaeus* range.

***j) Spatial ecology***

*E. notaeus* appears to be active all year-round in most of its range. In summer, they are preferably nocturnal and become almost undetectable underwater when dispersed across seasonally-flooded savannahs. Often they are detected only when crossing roads or when they ambush prey on the shores of lagoons and creeks. Depending on the water level, they spend the majority of the time in densely vegetated water or resting on dry land near ponds during the dry season (Waller, pers.obs.). In northern Argentina, *E. notaeus* is often found concealed inside hollowed palm tree trunks or at the base of dense shrubs during droughts. In northern Paraguay, they seek shelter from the extreme summer heat in small caves in the vegetated mud banks of creeks and rivers (L. Aquino, pers. comm.). In Argentina, *E. notaeus* becomes more sedentary and detectable during the winter months (June to August), and can often be found basking to facilitate gonadogenesis and digestion (Waller et al., 2007); hunters take advantage of this (Micucci and Waller, 2007;

Waller et al., 2007). Unpublished information from radio telemetric studies shows that *E. notaeus* in the southern tip of its range in Argentina may actually stay inactive for a few days or weeks during winter, staying underwater or under dense vegetation mats particularly during extreme cold weather.

Females utilize defined home ranges; adults (~2 m) utilized a range of ~15 ha compared to larger individuals that utilize ~50 ha. During the summer, adult *E. notaeus* travel long distances (~2 km) while smaller individuals move more often. Gravid females do not move for several months during gestation. A radio-tracked gravid female remained in the same position during the final 3 months of the gestation period (Waller, unpub. data). As with other large dimorphic snakes, smaller male *E. notaeus* are less territorial and better at dispersing compared to larger, heavy females. McCartney-Melstad et al. (2012) found that rivers and their associated floodplains are important in the dispersal of *E. notaeus*. Gene flow between *E. notaeus* populations was positively correlated with distance along the rivers connecting them, rather than with the straight-line distance between populations. The low dispersal ability of females due to their size and weight and the subtle natural barriers to dispersal represented by a complex river and wetland configuration possibly explain the significant differences in population structure among populations studied in northern Argentina (McCartney-Melstad et al., 2012; Kershaw et al., 2013).

***k) Diet***

*E. notaeus* is an aquatic trophic generalist that employs ambush predation and active search for capturing its prey (Dirksen, 2002; Henderson et al., 1995). Like most boas and pythons, *E. notaeus* kills its prey by constriction. Fish scavenging has also been reported (Strüssmann, 1997). Although considered aquatic in their behavior, *E. notaeus* have also been observed to ambush prey from trees < 2.5 m (Strüssmann and Sazima, 1991), in small bushes when basking, or on the shore of ponds and creeks (Waller, unpub. data). Their diet consists of fish (not identified), snakes (*Hydrodynastes gigas*, *E. notaeus*), caimans, small turtles, aquatic birds (cormorants, storks) and their eggs, and mammals (small rodents, capybaras; Strüssmann and Sazima, 1991; Strüssmann, 1997; Dirksen, 2002; Waller et al., 2001, 2007). There is an ontogenetic shift in prey size dependent on the size of the snake; in northern Argentina, juvenile *E. notaeus* prey on eggs and small rodents, while larger individuals prey on water cobras, large birds (egrets and cormorants), and mammals (capybaras; Waller et al., 2007). Predation usually occurs during the dry period, when wetlands have reduced and the concentration of prey is high surrounding remaining water bodies (Strüssmann, 1997; Waller et al., 2007). In northern Argentina predation also occurs during the flooding season, when water rats (*Holochilus chacarius*) and other small rodents are concentrated in the top of the emergent bushes.

***l) Population abundance***

Although absolute population sizes are unknown, available data suggests that *E. notaeus* are common and abundant. This is one of the commonest snake species in the Brazilian Pantanal (Strüssmann, 1997) and represents 15.1 per cent of all snake specimens captured in a collection of snakes from that region; it was second in capture frequency only to the false water cobra (*Hydrodynastes gigas*; Strüssmann and Sazima, 1993). During the filling of the reservoir of Yacyretá dam, in the Paraná River at the border between Argentina and Paraguay, approximately 1,500 *E. notaeus* were rescued from the flooded islands (Waller et al., 2001). The sustained harvest of *E. notaeus* each year by hunters for the skin trade from a single wetland, during more than a decade under the YAMP, confirms that this species is capable of reaching high population densities in suitable habitat. Logistical and methodological constraints impede rigorous density estimates, however, Micucci and Waller (2007), based on intensive sampling during daily hunting sessions in northern Argentina, broadly suggested a density of 30-60 *E. notaeus* per $km^2$. These preliminary estimates of an average of 0.5 *E. notaeus* per ha, extrapolated to an AoO of over 12 million ha, suggests a population size of several million snakes for the entire range.

***m) Population trends, conservation threats and status***

There is no evidence on negative trends for any *E. notaeus* population. Habitat availability is very high and remains fairly stable in most of their range (Waller et al., 2007). Conversion of wetlands to cultivated land probably represents the greatest threat for the species at the local level. Land drainage and systematization for rice cultivation and livestock rearing affects some marginal habitats in northern Argentina; these processes may be less significant through the species' habitat in Bolivia, Paraguay and Brazil due to landscape complexities limiting these initiatives. It should be noted however that the species also benefits from some man-made habitats, like artificial ponds and roadside channels (Waller et al., 2007), as well as vegetated dams or water reservoirs and rice fields (Waller, pers. obs.). People often kill snakes out of fear and road kill are other threats at the local level. International trade of *E. notaeus* skins peaked in the late 1990s, but stopped almost completely throughout the whole range of the species approximately 20 years ago (Micucci et al., 2006). There is little or no demand for *E. notaeus* skins locally and the unique source of skins for the international trade is the YAMP; that occurs in a negligible proportion of the total range of the species in Argentina. Furthermore, trade is now regulated, the trade system organized and populations are being continuously monitored under YAMP. In this sense, trade on skins, legal and illegal, is not a major threat to the species anymore. With these considerations, it is reasonable to assume that the overall population of the yellow anaconda is stable. *E. notaeus* is currently being assessed by the IUCN Red List, but available information on population status and trends suggests that this species should be classified as non-threatened. *E. notaeus* is listed as CITES Appendix II.

## 5. Understanding the traditional harvest of anacondas in Argentina

*E. notaeus* have always been captured serendipitously or actively searched for in rivers, marshes and lagoons during favorable weather conditions. No traps or sophisticated methodologies have been used to harvest anacondas. *E. notaeus* were collected by hand and killed immediately by hitting the head with a blunt implement, such as a pole or stick. They were skinned in situ or at the hunter's home, and the carcass was discarded. Wet skins were sun dried then sold or exchanged locally for merchandise (Micucci et al., 2006).

*E. notaeus* were harvested mostly during the cooler winter months (June to August), when they emerge to thermoregulate (Micucci et al., 2006). Trade figures from one skin trader in the late 1980s confirmed the harvest season peaked in the coldest months of July and August (Fig. 8). Harvests extended through winter until detectability declined abruptly due to an increase in temperature from the onset of spring.

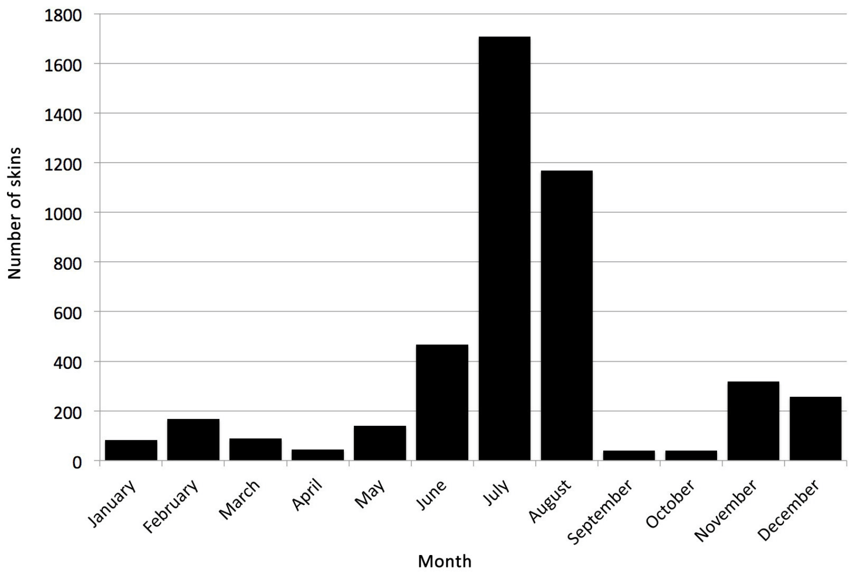


**Figure 8.** Number of *E. notaeus* skins received every month by a trader during the year 1988 (T. Waller, unpub. data).

According to local traders, the traditional harvest included skins over 15 cm in width; this corresponds to a total length of ~150 cm for dry skins and ~135 cm SVL for live snakes (Micucci et al., 2006). In 1995, approximately 500 skins were seized and measured in Paraguay and clearly included skins from immature individuals (Fig. 9). *E. notaeus* older than 1.5 years were vulnerable to unregulated hunting and market-driven demands (Micucci and Waller, 2007; Waller et al., 2007).

Skins > 20 cm wide (equating to ~200 cm for total length of dry skin and ~175 cm SVL for live snakes) commanded higher prices and were locally known as "full price"; smaller skins < 20 cm wide and poor quality skins were half the price. Fig. 9 clearly shows that the half price skins did not discourage hunting and these skins represented approximately 60% of the traditional harvest in those years.

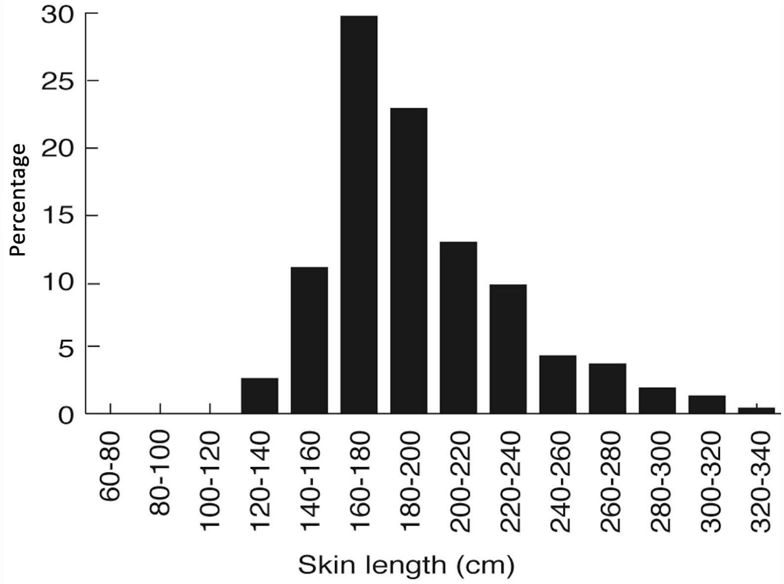


**Figure 9.** Proportion of skins for each size class in a lot of 526 commercial skins seized and measured in Paraguay in 1995 (Micucci and Waller, 2007).

Hunters were disregarded under this informal harvest system and revenue was mainly distributed among storekeepers, middlemen, transporters and exporters. Trade was not traced and the origin of skins was ignored. Skins and by-products were traded locally and circumvented local controls or were transported to neighbouring countries. Despite this, wild populations of *E. notaeus* have not presented any evidence of deterioration after years of unrestricted hunting (Micucci et al., 2006).

## 6. The Yellow Anaconda Management Program (YAMP)

***a) Aims***

The YAMP was devised in 2001 and sought to reconcile the traditional utilization of *E. notaeus* with its long-term conservation, in addition to promoting biological research and appreciation of the species and its habitat by local inhabitants. The YAMP also aims to maximize local income through sustainable harvest (Micucci et al., 2006).

***b) Conceptual framework***

The YAMP framework was developed on two basic concepts: the precautionary approach and adaptive management.

Some of the basic premises of the YAMP include the following:

- Implement operative measures. The development of a successful management plan requires concrete measures for all stakeholders involved, with clear and achievable yet fundamentally flexible obligations, which may vary with time and circumstances.

- Convene key stakeholders, such as hunters, to participate in the process. This allows managers to make realistic and just decisions and raise awareness for those in direct contact with the resource they are seeking to manage. A management plan that aims at valuing natural resources must be designed from the "bottom up"; from indigenous and rural communities to the end users, taking into account the cultural and historical relationships that may exist between the local inhabitants and the resource.

- Use the best available information. This implies that decisions are based on available scientific and technical information, including traditional knowledge of indigenous and local communities.

- Apply the principles of adaptive management. The adaptive management approach provides the ideal conceptual framework to deal with cryptic species, such as *E. notaeus*, when population monitoring by standard methods is not feasible and there are several uncertainties. Adaptive management is defined by the National Research Council (2005) as:

*"…a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders."*

The basic assumptions of adaptive management are the following:

- Supervise, based on appropriate indicators, the impacts of management decisions and actions;
- Promote research in order to reduce uncertainty;
- Warrant periodic assessment of results;
- Capitalize lessons learnt, and review and adjust, as needed, actions taken or decisions made;
- Establish an efficient and effective control system.

This method has been successfully used for other species that due to their biological features and CITES status could not be managed using traditional methods, such as fixed quotas or direct surveys. Adaptive management of *E. notaeus* has established a protocol to obtain data that guarantees the traceability and control of skins. Due to the difficulties associated with monitoring cryptic snake populations, adaptive management has become a fundamental, cost effective and reliable tool.

***c) Location***

The Province of Formosa in the north of Argentina was selected for implementing the harvest program due to the abundance of suitable habitat, a favourable governmental disposition towards sustainable use and a long stranding hunting tradition.

Formosa encompasses and area of approximately 72,066 $km^2$ and is a flat plain where the most conspicuous landscape elements are large rivers, small creeks, forests and wetlands. The entire are is within the Chaco eco-region; the weather is subtropical to tropical with a mean annual temperature of 23°C and annual rains decreasing in an east to west gradient (1200 to 600 mm). Winter is mild but occasional freezes occur during July and August.

For the purpose of YAMP, we divided Formosa in two regions (Fig. 10): a) Eastern Formosa, a 35,000 $km^2$ area characterized by the presence of savannahs with palm trees and forest patches interspersed with wetlands on one side, and the Paraguay river basin on the other; and b) Western Formosa or La Estrella Marsh, a seasonal floodplain extending over a distance of 250 km and covering an area of nearly 3,500 $km^2$. This seasonal wetland, located in western Formosa, was originated by the progressive regression of the Pilcomayo riverbed. Large grasslands, savannahs with palm trees, and standing dead Chaco forest patches that during the flooding season are covered with climbing plants (locally called "*champales*"), combine to form this landscape matrix. La Estrella Marsh represents the entire available habitat for *E. notaeus* in the dry west of the province.

*E. notaeus* is abundant in Formosa and the Eastern region offers the largest proportion of habitat for the species, potentially harboring the largest population. However, the YAMP has been particularly successful in managing *E. notaeus* in La Estrella Marsh, where a poor rural and indigenous community coexists with a highly productive and suitable habitat for the species. The more developed east region exhibits a different land tenure regime and best working opportunities for people that affect the adoption of this kind of initiatives (Micucci et al., 2007).

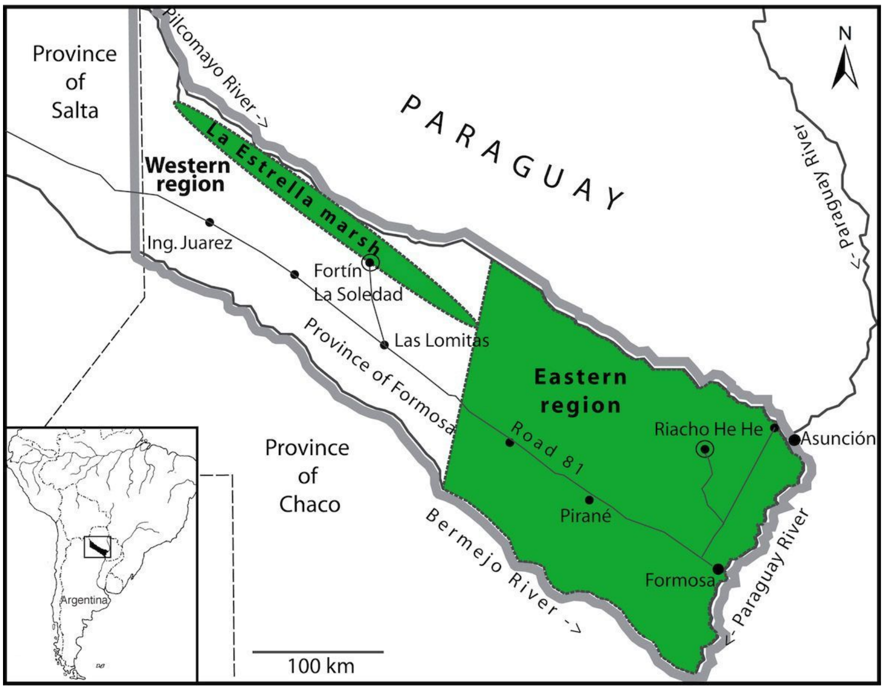


**Figure 10.** The Yellow Anaconda Management Program (YAMP) takes place in the Argentinian province of Formosa at the Chaco eco-region. *E. notaeus* naturally occurs in the eastern plains (shaded green) and the La Estrella Marsh, a 3,000 km$^2$ floodplain created by periodical flooding of the Pilcomayo River.

***d) Institutional and legal framework***

Argentina is a Federal country. Wildlife conservation and utilization is regulated at the national level by the *Ley de Conservación de la Fauna No. 22421/1981*. Importation of live *E. notaeus* and their parts and derivatives are expressly prohibited (*Resolución SAGP No. 53/1991*) to avoid local specimens laundering. Hunting, inter provincial movements, domestic trade, and exports of *E. notaeus* and their parts and derivatives have been also banned in the past to protect the species from unregulated harvest (*Resolución SAGP No. 24/1986*). With regard to YAMP, the national authority coordinates the program at the national level, providing the general framework, regulating inter-provincial movements and exports of dry skins, and controlling control compliance with CITES requirements. Since 2002, the production and exports of *E. notaeus* skins under the YAMP are excluded from the hunting and trade ban established for this species. Main provisions of the YAMP were established at the national level by *Resolución SADS* No. 1057/2002, *Resolución SADS* No. 115/2004, *Resolución SADS* No. 30/2005, *Resolución SADS* No. 204/2006, *Resolución SADS* No. 443/2009 and *Resolución SADS* No. 1173/09 (for more information see www.ambiente.gov.ar/?aplicacion=normativa&IdSeccion=3&agrupar=si). Every year the Province of Formosa establishes the procedures of the management program at the local level.

Fundación Biodiversidad (FB) was appointed under an agreement with the provincial government to lead and execute the technical aspects of the YAMP. Annual tasks and budget are detailed in operative plans submitted each year for approval by the provincial wildlife authorities. Exporters finance the YAMP under a mechanism originally established by the central government. Under federal regulations, project benefits (skins) are distributed among the exporters proportionally to the funds each one has contributed to the total fund. Depending on the results from different years, dedicated funding has been approximately US$ 6 to 12 per skin.

## 7. Harvest control and procedures under YAMP

### *a) Harvest control variables*

Harvest season.- Harvest of *E. notaeus* is permitted in winter from June to August. This corresponds to when *E. notaeus* emerge from the water to bask and are easily detectable. During the remainder of the year, *E. notaeus* usually remain underwater, which reduces detectability. This brings numerous benefits: 1) the species is protected from hunting during the breeding season; 2) the harvest season is short in duration; 3) hunters are deterred from illegal harvesting outside of the harvesting period due to extreme temperature, which reduces control costs; and 4) hunters are able to capture dormant *E. notaeus* by hand and to visually appraise their size before killing them. Depending upon the YAMP research requirements, *E. notaeus* are usually killed in situ or transported live to the hunter's home for data collection before being killed.

Minimum size requirement.- The YAMP has a minimum size requirement of 230 cm measured from the neck to the anal scale; this size corresponds to a live specimen of approximately 200 cm SVL. Since female maturity occurs on average at 165 cm SVL (Waller et al., 2007), this precautionary provision is intended to allow female *E. notaeus* to have one reproductive opportunity before being harvested. According to interviews with traders and local dealers, the production of Formosa involved ~20,000 skins per year above 15 cm wide (Micucci *et al.* 2002, 2006). This width corresponds to a dry skin length of 150 cm from a live *E. notaeus* approximately 135 cm SVL (Micucci et al. 2002). This equates to approximately 90% of *E. notaeus* older than 1 to 1.5 years of age, which were vulnerable to being hunted under a market-driven regime (Fig. 11; Waller *et al.* 2007). With the current minimum size policy (230 cm skin or 200 cm SVL live) we are able to substantially reduce overall harvest levels, for juveniles and adults, compared to the historical volume of trade. Current production, without mediation of quotas, represents a management-derived reduction of harvest to a quarter of historical values for Formosa (5,000 vs. 20,000 skins), and a 40% reduction of female vulnerability to hunting (Micucci and Waller 2007).

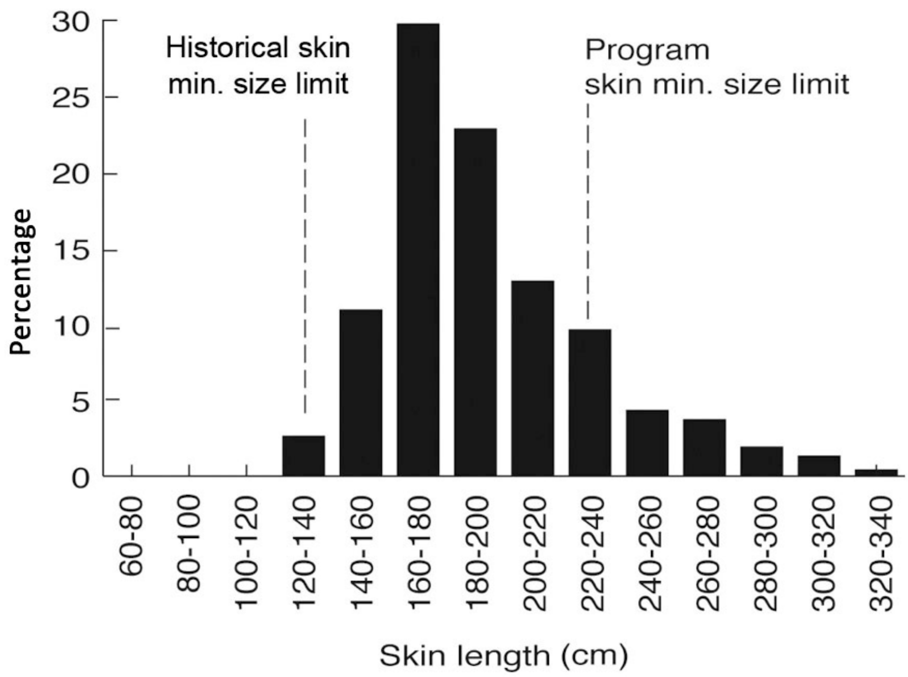


**Figure 11.** Skin length of 526 illegal dry skins seized in Paraguay (Micucci and Waller 2007). Current minimum size limits established by the YAMP are substantially more conservative than historical minimum sizes of skins in trade.

Skinning pattern.- Taking into consideration the anal spurs and other features of the skin, the YAMP skins can be recognized by altering the skinning technique and resulting pattern each year. For example, one year the skin must bear both spurs on one side and have the head skin attached or the following year one spur on each side without the head. Unique skinning patterns allow the YAMP to avoid illegal hunting and stockpiling outside of the harvest season (Fig. 12).

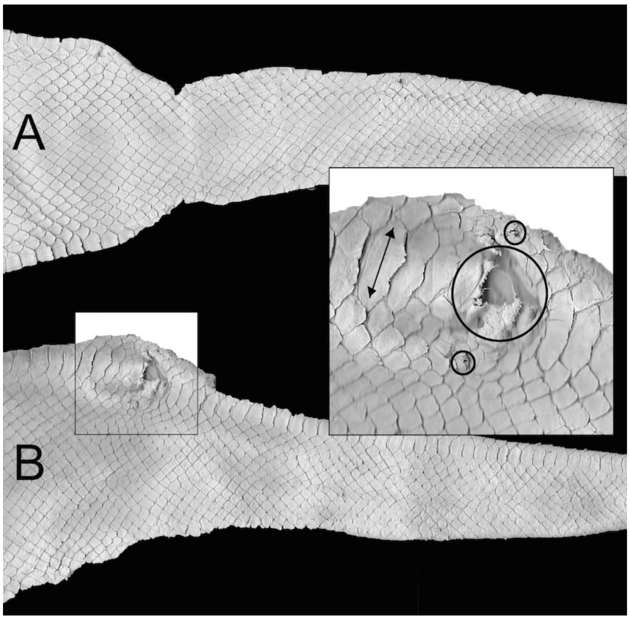


**Figure 12.** Tail region of *E. notaeus* crust tanned skins comparing two different skinning patterns: A) Traditional mid ventral cut exhibiting a symmetrical shape where mid ventral scales are divided to each side of the skin, B) Skinning pattern where all the cloaca region, including adjacent spurs (limb remnants), cloaca opening, and entire ventral scales, are left untouched at one side of the skin.

***b) Harvest control procedures***

The harvest of *E. notaeus* is strictly related to three fundamental economic stakeholders: *collectors, local skin buyers* (LSBs) and *exporters* (Fig. 13).

*Hunters.-* These are rural and indigenous community members (Pilagá, Toba) subsisting partially from livestock breeding but also from hunting and fishing. Approximately 200 to 300 families take part in hunting *E. notaeus* in Formosa, most of them (90%) from the surroundings of La Estrella Marsh.

*Local skin buyers.-* These are the people who buy the skins from the collector. They are usually a food supplier or market-man that trades basic supplies and skins (cows and goats) with the hunter and have the logistical means for transporting and stockpiling skins. Between 6 and 8 LSBs participate in a harvest season, with a mean number of 35 hunters per LSB.

*Exporters.-* These are the final acquirers of *E. notaeus* skins. They act jointly by designating a representative or purchase agent to acquire the skins from the LSBs under the YAMP supervision. They also pay for the YAMP implementation expenses.

Every year during April and May, before the start of the hunting season, a series of trips are organized to register and inform LSBs on the year's provisions and eventual modifications to the YAMP guidelines. These activities are aimed at regulating hunting effort; although the YAMP provides no limitations on the number of hunters (in reality there is a finite number), they have a close relationship with the LSBs due to economic and cultural reasons. LSBs have to pay hunters in cash for skins. According to the YAMP guidelines, the exchange of goods for skins is forbidden, unless by specific request of an indigenous community. To ensure compliance, at the end of each harvest season the YAMP carry out random polls to hunters, including specific requests on prices and payout modality.

During the last week of May, and immediately before the opening of the harvest season in June, the YAMP notify the LSBs on the *minimum skin size* limit and on the *skinning pattern* to be used in the forthcoming season. Most of the hunting requirements are implemented when the hunters bring their skins to the LSBs for sale, since the skins that do not comply with the YAMP standards are worthless for the LSBs.

Periodically the LSBs facilities are visited by the exporters' representative, a purchase agent, together with a provincial wildlife officer and a YAMP team member to buy skins. *E. notaeus* skins are examined for compliance with the year-specific skinning pattern and minimum size guidelines; skins that comply with the YAMP standards are individually tagged in situ for control and future tracking. Visits to LSBs facilities occur at an interval of two to three weeks on average. At the same time the LSBs should file an official form, called the '*effort form'*; a legal document that contains the number of skins, name of hunter, date and place of harvest. This document is needed to permit the legal transport of *E. notaeus* skins within the province. The content of the document are crosschecked with the result from periodical polls to hunters. In the case of irregularities, LSBs could be penalised with the cancellation of their license.

The purchase agent is the only person authorised to transport *E. notaeus* skins to the warehouse in Formosa city where they are inventoried. At the end of the harvesting season, and before leaving the province, skins are sexed (by their spurs and bone remnants), measured, and export tags that comply with federal regulations replace field tags. The export tag is required before transporting skins out of the province and to issue a CITES export permit. Wildlife inspectors of Formosa, and eventually from the central government, as well as a representative of the YAMP, supervise this procedure.

Once skins are tagged and all data gathered, the skins are 'released' for distribution among the exporters. In order to transport *E. notaeus* skins to tanneries or export ports, Formosa authorities must issue a Transport Guide to each exporter, that will be enclosed with the shipment to destination and, at the appropriate moment, will be required by CITES Management Authorities in order to issue the pertaining CITES export permit.

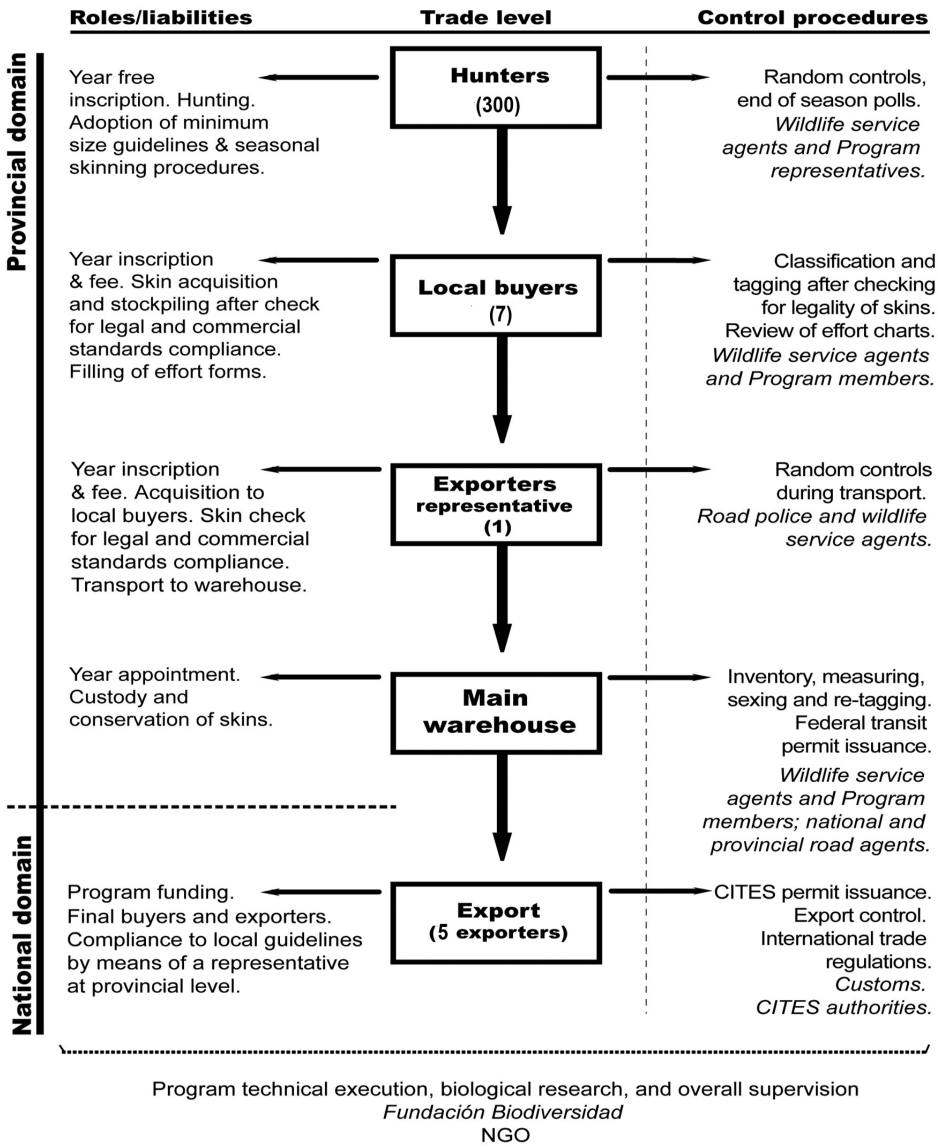


**Figure 13.** The YAMP operative scheme (modified from Micucci and Waller 2007).

# 8. Harvest monitoring under the YAMP

### *a) Monitoring effort instead of establishing a quota*

A harvest can be controlled either by placing a quota on off-take or by controlling effort, which means setting a hunting season or limiting the number of people harvesting a population or the time they spend hunting, or both. *E. notaeus* are managed under 'sustained yield' harvest theory, so the YAMP makes no attempt to directly control the number of individuals harvested. Specifically, the YAMP apply the surplus-yield production model (Schaefer, 1954; Fox, 1970), which has been successfully used for many species, including terrestrial species, but was developed for use by fisheries management. Monitoring effort is usually a safer means of regulating a harvest than a quota (Caughley and Sinclair, 1994). Harvesting a constant number of individuals each year is hazardous, particularly when the population is effected by environmentally factors, such as drought, flooding and fire, or when surveying populations is a major constraint (Caughley and Sinclair, 1994); both situations are likely to occur with *E. notaeus* as they inhabit highly seasonal savannahs. There is a maximum rate at which a reduced population can recover (the rate of increase). The maximum harvest can be obtained and sustained when the population is reduced to a level stimulating the maximum recovery (Caughley and Sinclair, 1994; Webb, 2002). These monitoring techniques are combined with direct assessments of harvest attributes and are usually compared with actual population samples obtained by researchers directly in the field (field monitoring).

***b) Monitoring harvest parameters***

A management plan for the exploitation of a natural resource requires some indicator of the impact of such an activity on the wild population. As adaptive management is selected as the YAMP theoretical framework, the use of indicators that allows managers to adjust management actions is essential. For the YAMP, the following indicators were selected:

- Effort
- Yield
- CPUE as a function of Effort applied to obtain yield curves (surplus-yield models)
- Sex ratio
- Harvested skins average size and size distribution.

***c) Yield, Effort and CPUE***

Yield is defined as the total volume or number of a resource obtained in a given year. The total number is constructed by adding partial catches, i.e., the results obtained by each hunter in a given site. Yield is influenced mainly by the environmental conditions that predominate during the hunting season and by the composition, in terms of quantity and skill, of each hunter. In this sense, an analysis of yield alone, unrelated to other factors, does not provide sufficient information on the global functioning of the system, and monitoring of trends in the mid-term is strongly recommended. Fig. 14 shows the yield of skins from the YAMP between 2004 and 2014.

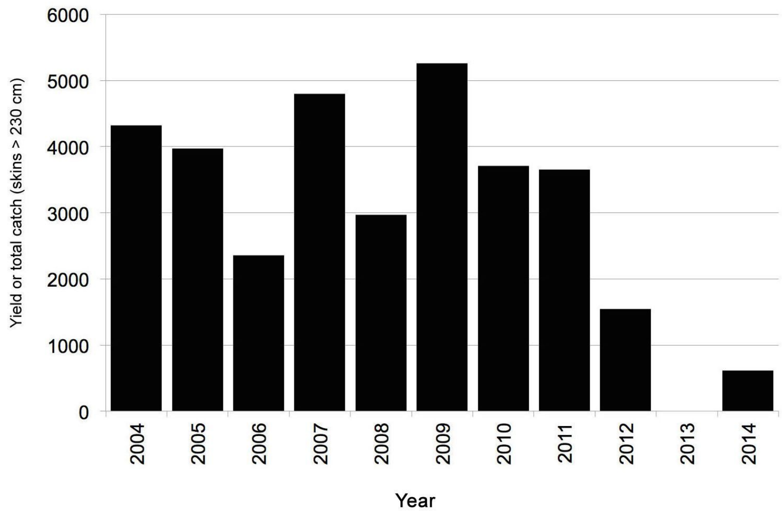


**Figure 14.** Yield of skins above 230 cm from the YAMP between 2004 and 2014. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

Since the rationale of sustained yield models implies that a harvest represents a specific proportion of the total population, a reduction of the crop would be expected, for instance, in the case of a population constraint by natural conditions (i.e. drought, fires), but this does not necessarily imply that over-harvesting has occurred in that year (Caughley and Sinclair, 1994). Temperatures play a significant role in *E. notaeus* harvested under the YAMP; they are more vulnerable to hunting, thereby increasing hunting success (Fig. 15).

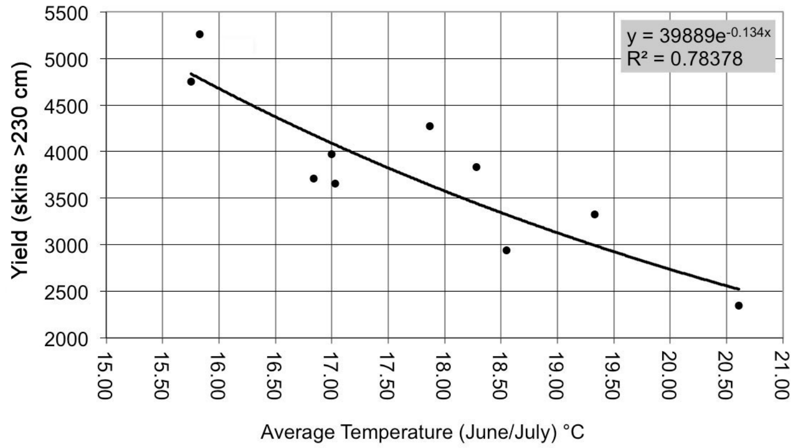


**Figure 15.** Annual yield of *E. notaeus* versus annual average winter temperatures for 2002 and 2011. High winter average temperatures reduce their vulnerability to hunting because they do not need to bask, reducing overall capture rate.

A decline in yield may not be indicative of the status of the harvested population if, for example, effort also decreases. As expected, yield and effort values are clearly related in the YAMP (Fig. 16). However, yield monitoring may provide useful information to analyze the system more thoroughly and make interventions, whenever feasible. For example, 2006 was a 'bad' year of captures in the YAMP because a low number of hunters participated in the activity, which means that the overall effort for that year diminished in relation to previous harvest seasons. This responds to an increase of traditional labor demand and to the massive distribution of unemployment benefits to hunters and their families by the government since 2003. For instance, if skin price is not continuously updated to compensate for inflation, the yield will continue dropping to new levels in which exporters' actual profits will be totally consistent with actual economic structure. If exporters do not increase skin price as a means of discouraging hunter desertion the system will tend to the commercial extinction. In an effort-mediated system a commercial collapse precedes a biological collapse. A similar situation was recorded in 2012 (low skin prices compared to unemployment benefits) that fostered an unprecedented reduction in effort aggravated by a progressive drought that peaked in 2013, when the harvest was suspended to avoid affecting the population stock. Yield in 2014 was the result of a short post-drought experimental harvest season (45 days instead of 90 days).

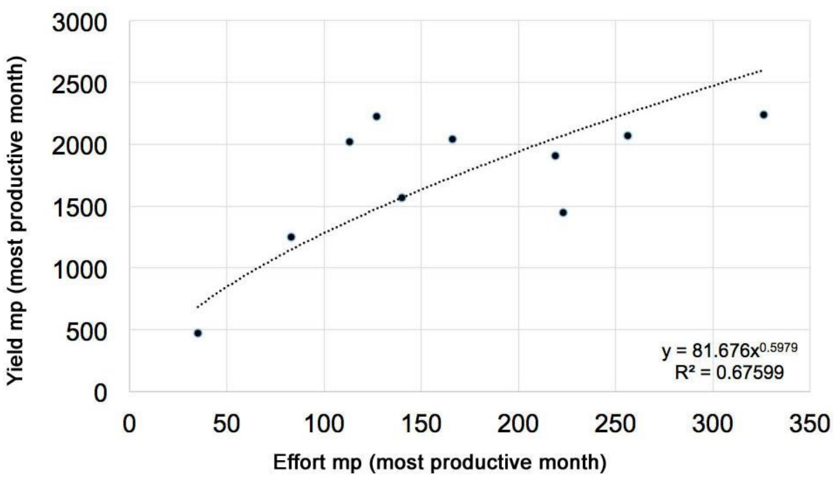


**Figure 16.** Relationship between yield and hunter effort during the most productive month of July from 2004 to 2014. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

Catch per capita is another indicator used, also known as the Capture per Unit of Effort (CPUE). Monitoring CPUE as a function of effort detects changes in abundance, particularly when active search for individuals is difficult or costly, as in the case of most snakes. Those species in which surveys are viable may be monitored using both techniques (CPUE or census), whereas in most snake species it is only possible to use the CPUE. Substantial differences between both techniques are the cost, scale or degree of resolution, and aim of monitoring. Since there is a commercial activity involved, the necessary data to assess CPUE are obtained at a low cost. The difficulty of this method is undoubtedly the impossibility of making comparisons between results obtained in the extraction area and the situation in a protected area.

The condition to obtain reliable monitoring based on catch per unit effort (CPUE) is an adequate selection of the effort unit (number of hunters, number of hunters per day of harvest, man hours, etc.) and monitoring of the ratio catch/effort units. In the early years of the YAMP, several effort units such as hours/men or days/men were used, leaving aside others such as men/boat (means of transportation) due to the great variation among hunters. As the YAMP progressed, the development of the harvest was found to follow a distribution in time with the shape of a curve (Fig. 17), with the month of July being the most intense period. In July, temperature favors detection of *E. notaeus*, i.e. vulnerability increases, and most of the hunters are active, i.e. maximum effort, and consequently the impact is also at its peak. Since the time unit is a single month, the time variable disappears and the effort unit is simplified to the number of hunters participating in the harvest. We calculate the CPUE for the most productive month (July) as the ratio between yield and the number of hunters for that month (Effort mp).

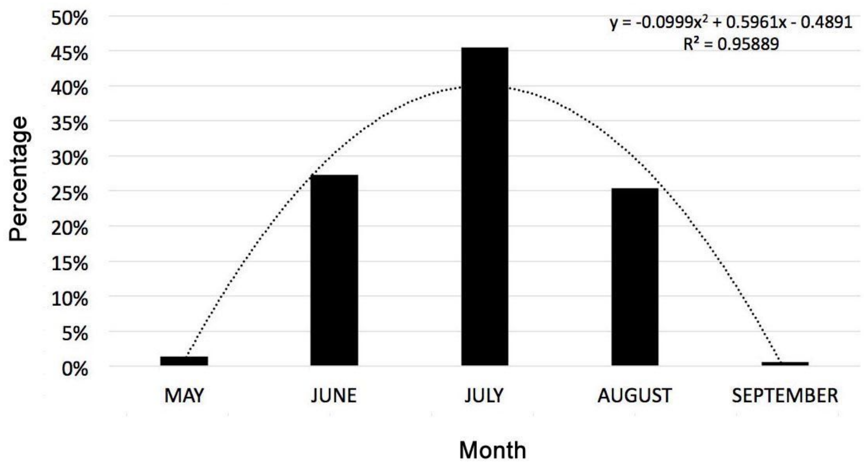


**Figure 17.** Proportion of the total capture obtained per month by hunters between 2004 to 2008, showing July as the most productive month.

As an indicator, the CPUE provides more information than yield as it is an isolated variable that allows "instantaneous" comparisons between years. However, an increase in the value of the CPUE may be explained by an increase in catch and by a decrease in effort applied (Fig. 18). After several years of monitoring, the YAMP uses the relationship between CPUE and Effort to construct the yield curves and to compare results obtained with the Fox (1970) and Schaefer (1954) model. The aim is to monitor the effort applied as a function of the MSY (Maximun Sustainable Yield) curve (Figs. 19 and 20).

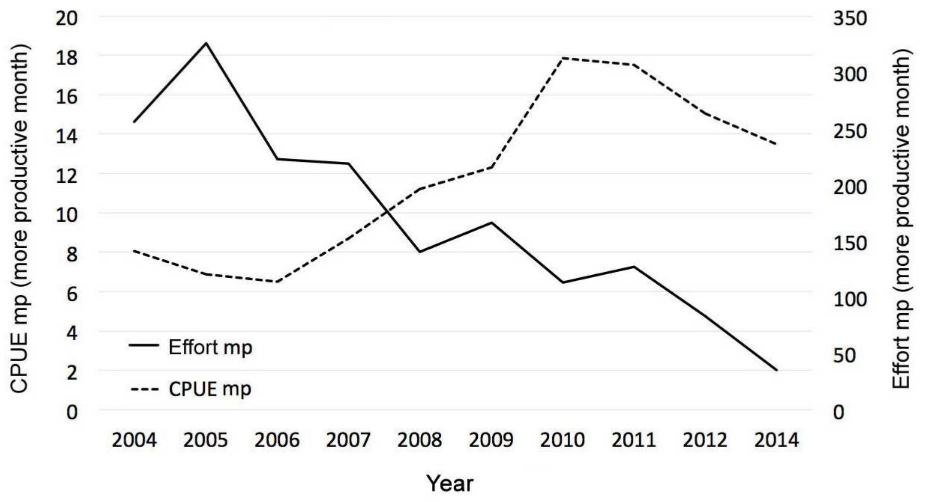


**Figure 18.** Evolution of CPUE and Effort in the YAMP between 2004 and 2014 showing the strong interaction between both variables. CPUE is the capture per hunter during the month of July and Effort is the number of active hunters during July. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

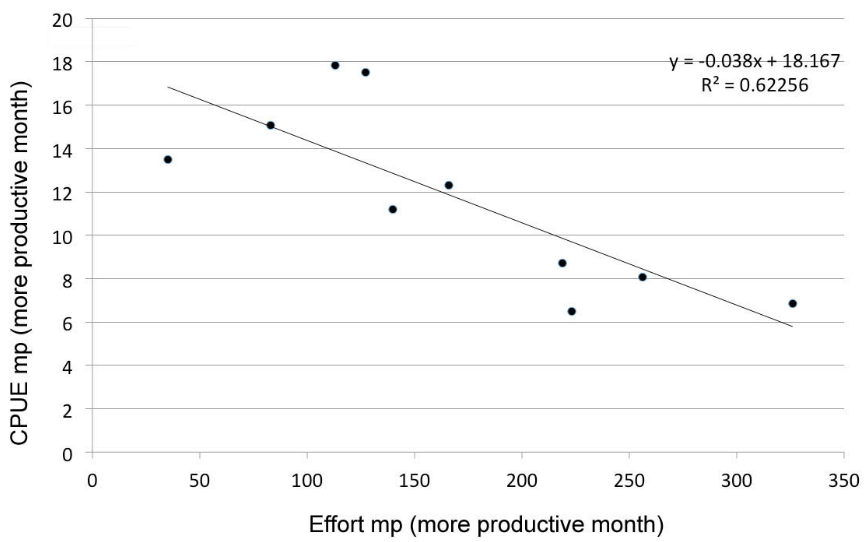


**Figure 19**. CPUE is inversely related to Effort, here for years 2004 to 2014. CPUE is the capture per hunter during the month of July and Effort is the number of active hunters during July. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

After twelve years of YAMP, a gradual decrease of catch Effort has been observed. This decrease can be attributed to several factors. The YAMP began in a highly unfavorable economic environment for the local inhabitants of the marshland; low demand for workforce, a very low income/expenses rate and an unstable currency value. This situation gradually improved and the State adopted a policy of economic assistance to rural inhabitants. On the other hand, labor demand increased as a consequence of land planning carried out by the provincial government, which permitted regularization of land tenure, intensive deforestation and cattle rearing. Many hunters who started at between the ages of 35 to 40 began to retire and younger people were not attracted by the prices offered for skins and access to education was improving as a result of provincial policies. In this context, the decline in effort (Fig. 21) has been the main cause of decrease in yields and the rise of CPUE, with this value always below the MSY predicted by the surplus-yield models (Fig. 20).

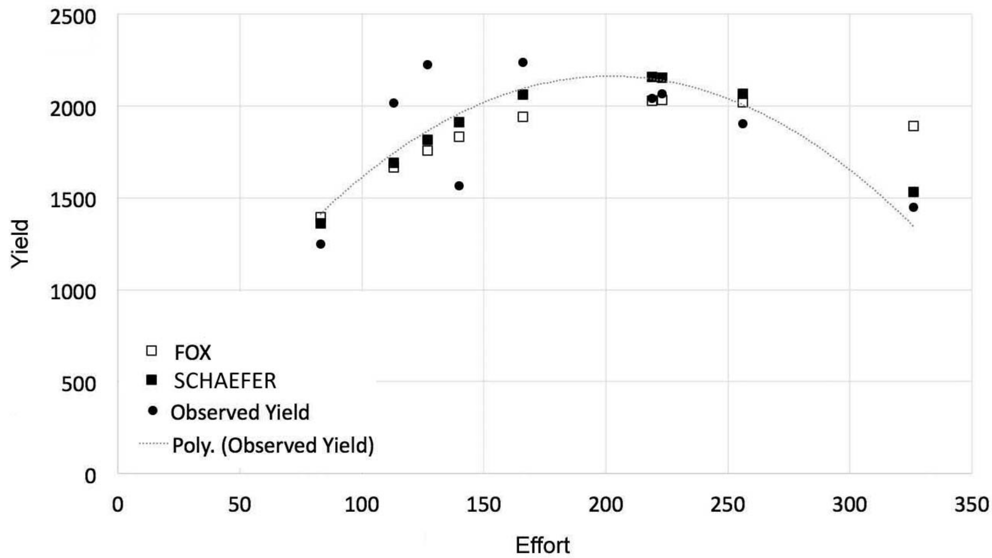


**Figure 20.** Maximum Sustained Yield curve for July for the years 2004 to 2014 based on Schaefer (1954) and Fox (1970) models. Black dots represent actual yield values; black squares represent Schaefer model prediction; white squares represent Fox model prediction; and dotted line represents the polynomial regression for actual yield values. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

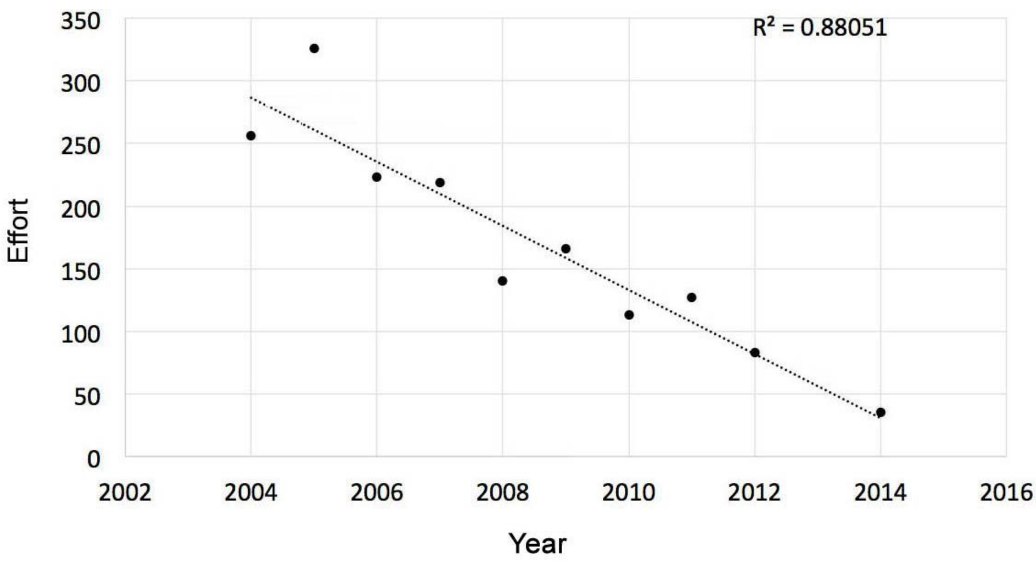


**Figure 21.** Effort (number of hunters) for the most productive month of July between 2004 and 2014. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

### *d) Size structure and average size of harvested skins*

Size structure, although often fluctuating due to natural causes (Webb, 2002), permits observation of significant changes in the natural pattern, or at least in the pattern established as natural, prior to a significant activity of extraction. A random sample of all snakes from all sizes classes is compared to that obtained from the YAMP harvest of *E. notaeus*, to detect possible differences in the relative frequency distributions. However, in the case of skins, like in the YAMP, the best approach has been to compare the evolution of the harvested skins size structure in time (Fig. 22).

Size structure fluctuated between years but exhibits a decrease in the relative frequency of larger size classes after 2011 (Fig. 22). This decline coincides with a decline in CPUE after that year (Fig. 18). Applied effort and overall harvest also diminished in the last years for reasons already explained (Fig. 21), so observed trends in size structure appear to be related to a severe dry period that affected the region between 2010 and 2013 that led to the suspension of the harvest in the latter year. Droughts are expected to affect large individuals (mostly females) more, compared to the smaller juveniles and adults (mainly males). *E. notaeus* are well suited to traverse long distances and conceal themselves in dry areas when searching for prey or awaiting better environmental conditions.

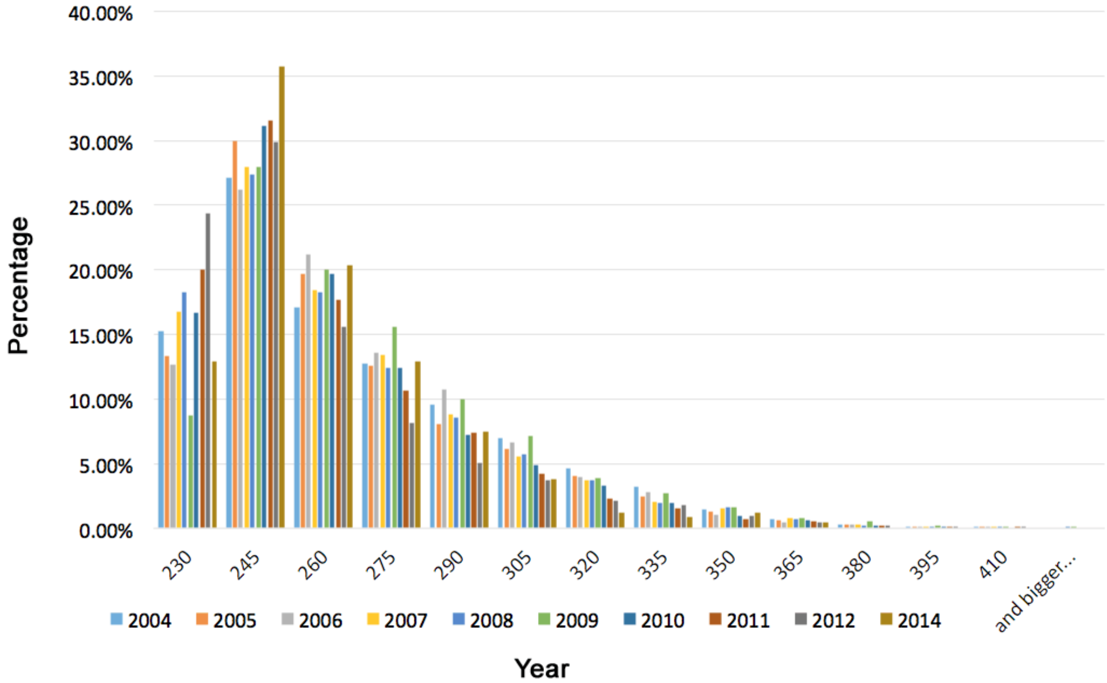


**Figure 22.** Size structure of harvested *E. notaeus* skins > 230 cm from 2004 to 2014. Relative frequency expressed as percentage of total sample for each year. Each 15 cm interval class is represented by the upper limit value. First interval exhibits the proportion of undersized skins (<230 cm) in the harvest. Harvest was not permitted during the year 2013 due to a serious drought affecting the main harvest area.

Monitoring average skin size or length, in addition to using other descriptive statistics, such as standard deviation, mode, median, etc., also provides useful information on the local effect of harvest on *E. notaeus* in the short term. However, the fact that larger individuals are normally the easiest to detect and the first to be collected should be taken into account. When the value of *E. notaeus* lies in the skin, measurements may allow the manager to forecast commercial viability of the activity in the future, when there is a minimum size that should be respected; the YAMP uses a minimum size so that all analyses are carried out on the skin population within the legal size range. Usually, however, there is a percentage of skins below the minimum size permitted, or “illegal” skins, but the proportion of such skins varies with enforcement effort and cannot be attributed to any cause of analytical value.

After twelve years of harvest data, the YAMP observed a decrease in the average value of *E. notaeus* skins by around 3%. The current value of the mean skin size (251 cm) indicates that most of the harvest affects mature individuals that may have already experienced a reproductive event (Waller et al., 2007). In this context, and assuming that there is a constant inter annual decline attributable to the harvest (which is very unlikely), commercial extinction for the *E. notaeus* population being studied in the YAMP could occur in 30 years (230 cm minimum skin size limit), whereas the breeding stock would not be affected for more than 50 years (200 cm skin, equivalent to a 170 cm live, or the age at maturity). This suggests that even in the worst-case scenario, commercial extinction would greatly anticipate (and prevent) biological extinction for this *E. notaeus* population.

***e) Sex ratio***

Sex ratio is known from the literature and is generally an excellent indicator when the species exhibits sexual dimorphism. A low impact extraction is not expected to alter the sex ratio. In the case of *E. notaeus*, differentiating skins by sex is an easy practice requiring little training; just observing the presence of spurs (Micucci et al., 2003, 2005). The size limit established in the YAMP permits the hunting of *E. notaeus* > 200 cm SVL; since females attain larger sizes than males, the harvest was expected to include more females than males, in a fairly constant and predictable proportion, according to the serendipitous nature of the hunting and sex and size structure of *E. notaeus* populations. Since both sexes are equally available (Waller et al., 2007), males and females were expected to be relatively equal in their vulnerability to capture with actual harvest sex ratio resulting from the minimum size limit established (~75% females). In the YAMP, sex ratios of harvested *E. notaeus* have been relatively constant, with slight fluctuations attributable to environmental factors (e.g., the dry period that started in 2010 that apparently diminished the survival of large individuals, mainly females).

**Conclusion**

The harvest and trade of Yellow Anaconda (*E. notaeus*) in Argentina has been transformed from historical misuse to a robust and sustainable management system. The YAMP has succeeded in designing and establishing specific management policies for a traditionally exploited snake species from the beginning, organizing the hunters, traders, and the government on a same path and with a same long term objective. The tools applied to control and monitor the harvest have been adequate and cost-effective, providing evidence that the harvest has not been detrimental to the survival of the wild population. Our knowledge of the species has increased exponentially, and legal trade is sustained through a balance simple yet robust regulation together with incentives for local people to trade legally.

The YAMP satisfies the Secondary Evaluation as part of the NDF Guidelines for CITES listed snakes. Importantly, the system is managed adaptively. Even if our monitoring system identifies population declines due to harvesting, we do not automatically move to make a negative non-detriment finding and cease trade. Instead, the framework is in place for us to make simple management interventions to ensure sustainability while continuing trade.

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# CITES Non-detriment finding

## Primary Evaluation Template

*Text in italics is explanatory and should be deleted in completed documents. Please refer to the NDF Guidelines document for further explanation on how to complete this evaluation.*

| | |
|---|---|
| **Species name** | |
| **Range state name** | |
| **Report compiled by** | |
| **Date compiled** | |

**Section One: Summary**

*Please provide a short overview (1-2 paragraphs) of the trade in this species in the country of interest.*

**Section Two: Primary Evaluation score**

*Please score each attribute listed within the table below and sum these to provide a total.*

| | Number of points | | | Score |
|---|---|---|---|---|
| **Criteria** | **1** | **2** | **3** | |
| **Annual Harvest level** | Low (<2,000) | Medium (2,000 - 20,000) | High (>20,000) | |
| **Area of occupancy** | Large (>20,000km$^2$) | Medium (2,500 – 20,000km$^2$) | Small (<2,500km$^2$) | |
| **Life-history** | Fast | Medium | Slow | |
| **Illegal trade** | If known, should be included under "Annual harvest level". If unknown, and suspected to be detrimental, give a **maximum score of 1 point** | | | |

**Section Three: Justification – Harvest level**

*Please provide an explanation with appropriate references to justify the score given.*

| **Section Four: Justification – Area of occupancy** |
|---|
| *Please provide an explanation with appropriate references to justify the score given.* |
| **Section Five: Justification – Life history** |
| *Please provide an explanation with appropriate references to justify the score given.* |
| **Section Six: Illegal trade** |
| *Please provide an explanation with appropriate references to justify the score given.* |
| **Section Seven: Conclusion, course of action and determination on exports** |
| *Please provide an overall conclusion on the perceived threat of trade to the species and details on whether further course of action will be taken to complete an NDF for the species.* <br> . |

## Section Eight: Literature Cited

*Please provide references to all the reports and literature cited in this evaluation.*