An assessment of the impact of the pet trade on five CITES-Appendix II case studies

Summary report
(5 case studies annexed)

IUCN SSC Boa and Python Specialist Group (BPSG)

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Introduction

Millions of snakes are harvested every year and traded locally or internationally for their skins, meat, medicine, or to be sold as pets. In the past five years, the trade in CITES-Appendix II listed snakes for pets involved approximately 200,000 specimens (CITES Trade Database, 2009-2013 data). As with many other forms of trade, serious concerns have been raised in the CITES community about the conservation impacts that harvesting for pets may be having on wild populations of snakes, particularly those that are highly sought after for their bright colors or rarity. In effect, Paragraph a) iii) of CITES Decision 16.102, adopted at the Sixteenth Meeting of the Conference of the Parties (CoP16), instructed the CITES Secretariat to "*undertake a study of one or more high-value snake species in the pet trade (e.g. unique color or morphological forms, or range-restricted endemics) to determine the impacts on wild populations of legal and illegal harvest for international trade, and to provide information required for making non-detriment findings for trade in these species; and propose actions to enforce the Convention as it relates to trade in these species*". This study was commissioned to the IUCN/SSC Boa and Python Specialist Group (BPSG) and the results are presented here.

Five species of snakes were selected for analysis, taking into account expertise available to carry out the assessments and were based on the following criteria: a) reported high levels of international trade, and/or b) unique coloration/morphology, and/or c) uncommon life habits or biological traits, and/or d) restricted range. BPSG specialists prepared the species accounts (annexed), summarizing information on the distribution, status, trade and potential impact of trade on wild populations for the following species:

1. Cayos Cochinos (Honduras) Boa (*Boa constrictor imperator*) (by Chad Montgomery et al.)
2. Ball python (*Python regius*) (by Christian Toudonou)
3. Calabar ground python (*Calabaria reinhardtii*) (by Luca Luiselli)
4. Green python (*Morelia viridis*) (by Tomás Waller & Victoria Lichtschein)
5. Boelens python (*Morelia boeleni*) (by Damian Lettoof)

In this report, we summarize the general context and potential impact of the pet trade on CITES-Appendix II listed snake species, and outline key findings, conclusions and recommendations for each case study. This summary report should be read jointly with the species accounts in the Annexes, where relevant references and supporting data (omitted here) may be found.

Justification for selected case studies

1. The Cayos Cochinos (Hog Islands) Boa (*B. c. imperator)* is an island endemic morph of *B. constrictor imperator* inhabiting a very restricted insular range in Honduras that is in high demand for the pet market due to its small body size and distinctive coloration compared to mainland specimens. *B. constrictor* has not been evaluated for the IUCN Red List yet. The case represents a good example of demand for and trade in a *range-restricted endemic*.

2. The Ball python *(P. regius)* is a common and widely distributed snake in west equatorial Africa (IUCN Red List Category: *Least Concern*). Although Ball python trade has received significant attention in the past, it was included here because it is the most heavily traded CITES-Appendix II snake species exported from Africa (*highly-valued species* criterion).

3. The Calabar ground python *(C. reinhardtii)* is a widely distributed snake from west equatorial Africa (not evaluated by IUCN). This burrowing and attractively colored python is modestly but consistently traded internationally. Due to its particular habits and *distinctive morphology* the species represents an interesting case for evaluation.

4. The Green python *(M. viridis)* is a very attractive species restricted to tropical forests in Cape York, Australia, Papua New Guinea and Indonesia (West Papua and Papua) (IUCN Red List Category: *Least Concern*). Due to its variable coloration and arboreal specialization (*unique color and morphological form* criterion) the Green python is highly sought after by the pet trade.

5. The Boelens python *(M. boeleni)* is a rare *range-restricted endemic* inhabiting the highlands of the island of New Guinea (Papua New Guinea and Indonesia) (not evaluated by IUCN). Its biology in the wild is unknown. A modest trade based on alleged captive bred specimens from Indonesia supplies the demand for this highly valued species.

General context of the snake pet trade for CITES-listed species

Approximately 200,000 snakes are exported every year from range countries to satisfy the pet trade market. Because of historically high volumes of trade in several species of boa and python, when CITES came into force in 1975, all boas, pythons and similar species were listed on CITES Appendix II due to look-a-like provisions. Since most other snake families are poorly represented in the CITES Appendices, 93% of the recorded pet trade corresponds to boas and pythons.

According to the trade information above, the pet trade does not equally affect all CITES-listed species. Although most CITES-listed snake species have historically been traded for pets at some level, only 32 of the 132 snake species listed in Appendix II have been consistently traded (>50 per year) in recent years (CITES Trade Database, 2009-2013 data)[1].

The common Ball python (*P. regius*) is by far the most heavily traded CITES Appendix II-listed species, comprising 80% of all exports during recent years, with an average of 160,000 specimens exported every year, followed by Boa constrictors (6%; *B. constrictor*) and Green pythons (2.6%; *M. viridis*). Conversely, 29 species of lesser known snakes are consistently traded in more modest numbers, accounting altogether for the remaining 11% of CITES-Appendix II listed snakes traded for pets.

Considering an average figure of 1,000 specimens exported per year as a threshold for significant trade in a given species of snake, only 11 species surpassed that threshold (8.3% of all CITES-Appendix II snake species) (Table 1). In fact, and with only few exceptions, most CITES-Appendix II snake species are traded

[1] A major drawback of trade information is that it is not possible to distinguish accurately the proportion of snakes traded alive for the pet trade from those traded alive for other purposes (e.g. to supply farms, for meat). However, a fairly confident approach we used for preparing Table 1 was to review the few countries and species usually involved in the meat trade to discard those cases and species involved (e.g. Most transactions with species of the Genus *Naja*).

in amounts that *a priori* can be deemed non-significant. In other words, for most widespread species their harvest for trade would not be significant enough to impact their conservation status.

Table 1. CITES-Appendix II listed snakes internationally traded for the pet industry, with an annual export level above 1,000 specimens (Source: CITES Trade Database).

Snake species	Average gross export per year (2009-2013)
Python regius	163,278
Boa constrictor	12,279
Morelia viridis	5,306
Python reticulatus	3,356
Python brongersmai	3,218
Corallus hortulanus	2,079
Python sebae	1,824
Corallus caninus	1,349
Python breitensteini	1,203
Candoia carinata	1,165
Candoia aspera	1,117

Impact of the pet trade on snakes

The vast majority of snake species traded for pets are subjected to low levels of harvest (a few hundred individuals each year). Demand is not high because live snakes need to be kept in particular conditions, limiting the number of species and individuals that an amateur can own at a time. Although harvesting results in individuals being removed from the population, the rate at which harvesting occurs and the volumes of trade is in many cases expected to be insignificant compared to the net recruitment of new individuals into the population. Trade does become a concern, however, for species with very limited distributions (range restricted endemics), which by default also have small absolute population sizes. To our knowledge it is mainly in these cases that harvesting for pets (and associated habitat destruction) has resulted in potentially unsustainable long-term population declines.

Three of the five species selected for review actually exhibit (or exhibited) evidence of impact due to legal or illegal trade. In the case of *P. regius*, a link between the legal pet trade and the unaccounted illegal trade for bushmeat appears to be driving a population decline in Benin, but there is no clear evidence of impact in the other range countries. In this sense, current trade does not seem to represent a risk for the species at a global scale, considering the fact that ranching operations provide most of the exported animals, the species' population size is high, the species' reproductive rate is medium, and the range of habitats where it occurs is broad. Furthermore, the species is able to adapt well to different habitats as well as still being found in its original range. Cayos Cochinos *B. constrictor* populations were seriously reduced by illegal trade in the past, but after improvement of illegal trade controls, they are recovering and even sustaining some degree of ongoing illegal trade; this suggests the existence of some resilience to harvest in this highly range-restricted form. Finally, harvesting of *M. viridis* from small insular populations has resulted in shifts in population demographics (to more juvenile individuals, the significance of which is unknown), although trade does not threaten the species at the national level. In the other two cases of *C. reinhardtii* and *M. boeleni* there is no substantive evidence that current trade levels represent a threat to wild populations.

Knowledge of the biological attributes of harvested species may contribute to the understanding of species resilience to harvest. Parameters that are commonly used to determine whether a species can sustain high or low levels of harvest and their relation to the five species analyzed are presented in Table 2.

Only one species studied exhibited a very restricted or narrow distributional range (Cayos Cochinos boa), and the endangerment observed in the past can probably be explained by its low absolute population size

on the small islands on which it is found (in the order of the thousands). On the contrary, all the other species exhibit either medium or broad ranges as well as medium or broad habitat specificity. For instance, Ball and Calabar pythons are distributed across several countries, with their overall extent of occurrence and overall population numbers likely to be in the order of millions of hectares and individuals, respectively. Furthermore, both species adapt to disturbed habitats and in the case of *P. regius* in Ghana, may achieve high local densities in farmlands. With regard to *M. viridis* and *M. boeleni,* more restricted to tropical forests, limited access by humans to their habitat combined with the low impact of opportunistic harvest methods result in minimal impacts of collection.

Table 2. Variables that influence a species' resilience to use and the attributes of five selected species.

Variable	Use resilience key[2]		Green pythons	Boelens pythons	Calabars pythons	Ball pythons	Cayos Cochinos Boa
	High	**Low**					
Distribution	Broad	Narrow	Broad	Medium	Broad	Broad	Narrow
Habitat specificity	Broad	Narrow	Medium	Medium	Broad	Broad	Broad
Dietary specificity	Generalist	Specialist	Generalist	Generalist	Generalist	Generalist	Generalist
Reproductive output	High	Low	High	Medium	Low	Medium	Low
Growth rate	High	Low	High	High (in captivity)	Low	High	High
Reproductive rate	High	Low	Medium	Unknown	Medium	Medium	Unknown
Time until maturation	Short	Long	Short	Short (in captivity)	Unknown	Short	Short
Population size	High	Low	High	Unknown	High	High	Low
Population density	High	Low	High	Unknown	Low	Medium	High
Population connectivity	High	Low	High	Medium	Medium	Medium	Low
Dispersal ability	Good	Poor	Medium	Medium	Poor	Medium	Poor
Genetic variability	High	Low	High	Low	Unknown	Low	High

Key findings by species (full species accounts annexed)

Cayos Cochinos boa constrictor, *Boa constrictor imperator,* population

- The *Boa constrictor* is a wide-ranging snake species that is common in the pet trade and is currently listed in CITES Appendix II. Hog Island boas, or Cayos Cochinos boas, are a dwarf, insular race of *B. c. imperator* endemic to the Cayos Cochinos Archipelago, Honduras, with an extent of occurrence of barely 2.28 km^2 (228 ha).
- Cayos Cochinos boas are prized in the international pet trade for their light pink dorsal coloration, as well as for being much smaller and more docile than mainland boas. This boa was heavily exploited for the pet trade from 1979 to 1993, impacting the populations by significantly reducing overall numbers.
- The Honduran Coral Reef Foundation (HCRF) is in charge of managing the Cayos Cochinos Archipelago Natural Marine Monument since 1994, but lacks the resources and staff needed to eliminate poaching entirely. In addition, some members of the local *Garifuna* communities do not collaborate with HCRF because of the implementation of management practices within the Cayos Cochinos Archipelago that they claim have affected their way of life.

[2] Modified from Erdelen, 1998 and Primack, 2010. For example, if a species' reproductive output is high then it is more likely to have a high resilience to use than a species that has a low reproductive output.

- No data are available to estimate the current level of poaching and therefore the effects of ongoing poaching on population recovery cannot be determined.
- The apparently high population density and the current high level of genetic diversity after twenty years of intensive poaching indicate that the Cayos Cochinos boa are resilient to some level of harvest. Conversely, the low reproductive output, unknown reproductive frequency, restricted range, and population isolation will make these populations less resilient to harvest.
- If government authorities would like to benefit local livelihoods by developing a management plan for Cayos Cochinos boas in the future, research on reproductive frequency, reproductive output (currently known from one litter), and mortality rates is needed. Only by understanding these aspects of the basic biology of these populations and developing more precise population size estimates will we be able to develop models for predicting future population sizes and the effect of harvest on these populations.
- In order for legal, sustainable harvest to be successful, the level of illegal harvest has to be understood and accounted for. If illegal harvest is not considered when determining harvest levels, then the added pressure of legal harvest on populations may negatively impact them.
- Furthermore, a regulated, sustainable harvest needs the full involvement and support of the local communities in addition to regulatory measures established by government authorities.
- The recent drop in market price of Cayos Cochinos boas in the international pet trade has reduced the economic incentive for local snake hunters. With only a few thousand animals (3,000) in the wild, even a harvest involving 300 individuals (10% harvest) at $15 (10% of market value) would result in only US$4,500 annual income to the local community. However, the management of such an enterprise would likely cost more in terms of staff and logistics.

Ball python, ***Python regius***

- Ball pythons occur over sub-Saharan West and Central Africa, from Senegal and Sierra Leone to southeastern Sudan and northwestern Uganda. They are among the most favored pet snakes in the world. Benin, Ghana and Togo provided almost 100% of the specimens exported mainly to the USA and the EU since 1976.
- Specimens are exported under CITES source codes “C” (animals bred in captivity), “R” (animals originating in ranching operations) and “W” (animals taken from the wild): 0.5%, 93.5% and 6%, respectively.
- Illegal trade circuits are still active and increasing for this species, and a link with the food trade was discovered in Benin, leading to prohibition of ranching in the country. Current harvest practices target the most vulnerable biological stages (i.e. gravid females and neonates), while hunting techniques and methods (e.g. digging and destruction of burrows) impact the nesting habitat.
- The species appears to be locally threatened in Benin due to intense collection driven by the pet trade and demand for bushmeat. A reduction in population levels and in both the area of occupancy and extent of occurrence have been suggested for this country. In addition, agriculture mechanization, use of chemicals and climate change (e.g. warming, flooding) threaten the species.
- Thus, in Benin, where concerns are highest, the species should be considered threatened and updated population information is needed.
- Local traditions and taboos associated with snake cults in Ball python range are very effective in controlling harvests and keeping the hunting pressure near zero in worship areas.

Calabar ground python *Calabaria reinhardtii*

- The Calabar ground python is a species ranging in West and Central Africa, from Liberia in the east as far as Kivu in the Democratic Republic of Congo in the west.
- Ghana and Togo, and to a lesser extent Benin, provided more than 80% of the live specimens exported for the pet trade, mainly to USA and to the EU since the 1990s, with occasional exports from countries such as Cameroon and Cote d’Ivoire.
- Specimens are exported under CITES “R” (animals originating in ranching operations) and “W” (animals taken from the wild) source codes, but it seems clear to the authors that all traded individuals are actually captured in the wild as no effective ranching operations were confirmed.

- Usual illegal circuits of regional trade (for instance, animals are traded from Nigeria to the three main exporting countries) are probably still active, but the magnitude is unknown.
- Preliminary data suggests that the species is generally occurring at low density all throughout its West African range, however, abundance of these animals can be heavily underestimated because of the subterranean habits of the species.
- The number of exported animals (about 1,000 per year, with no indication of increase in recent years) is very low compared to the expected population size that may be millions of individuals over its range.
- There is no evidence of a decreasing trend in average body size of animals studied according to the species account author.
- It may be concluded that the trade of *C. reinhardtii* is sustainable in the mid and long term, under the present quotas and regulations.
- The species may be at risk of local extirpation because of agricultural mechanization and chemical pest controls.

Green python, *Morelia viridis*

- The green python is restricted to tropical rainforests in Cape York Peninsula, Australia, and the island of New Guinea, which is divided politically between the independent nations of Papua New Guinea (PNG) (eastern half of New Guinea) and Indonesia (western half of New Guinea, represented by the provinces of West Papua and Papua).
- Green pythons are one of the CITES-listed species of snakes most heavily traded as pets. Indonesia is presently the only range State that allows international trade in green pythons, but only captive-bred individuals can be exported because the species is protected under Indonesian national legislation. Despite this, large numbers of green pythons are still collected from the wild in Indonesia and exported under CITES “C” (Captive bred) source code.
- The opportunistic nature of green python collection at most sites does not result in collection biases based on sex or size. However, the large number of juveniles collected from Biak Island (Indonesia) suggests that harvesting may have skewed the age composition of the green python population at that site. In support of this view, the single trader on Biak indicated that when harvesting first began more than 10 years ago, a substantial number of large green snakes were collected. More recently, however, juveniles are most commonly encountered.
- Nevertheless, this does not necessarily indicate that the harvest of green pythons from Biak Island is unsustainable. It is feasible that the population has stabilized and trade is sustainable, but the harvest is now skewed towards juvenile snakes. Although the opposite may also be true, long-term data on the demographic composition of the harvest and the number of snakes collected are required to evaluate sustainability with any certainty.
- It should be acknowledged that as long as the cost of exporting wild green pythons is lower than keeping and breeding captive individuals, wild collection in Indonesia will continue. Nevertheless, based on the evidence above (and other publications on the harvest of Indonesian reptiles) the best solution for preventing illegal harvest and mis-declaration of wild green pythons may be to allow trade in wild specimens.
- Given the broadly generalist life-history traits of green pythons, the opportunistic methods of harvest and their very wide distribution within intact habitats, present levels of trade are not a threat to green pythons. Because wild collection is already occurring, permitting some wild harvest will in reality have little additional impact on wild populations.
- A more intractable problem than the effect of trade on wild populations may be that captive-bred specimens are often more attractive for the hobbyist market, as they are more resistant to health complications and hence easier to keep than wild-caught animals. It is thus difficult to anticipate whether consumer demand will be great enough to support a trade in green pythons known to be wild-caught. Nonetheless, because “locality specific” forms of green pythons are coveted within the reptile keeping community, it may be possible to allow the collection of specific geographic forms for premium sale to private collections. Income from the sale of these snakes could be reinvested in the management of the resource.
- Regardless of the path the trade in this species takes, harvesting has been shown to impact this species on small islands. Although not a threat to the overall population, this is of concern because of known diversity within island reptiles in Indonesia. It is therefore of paramount importance that

monitoring of harvest demographics be undertaken on a regular basis to ensure these island populations are not depleted beyond recovery.

Boelens python, *Morelia boeleni*

- Boelens pythons occur only in the highlands of Papua New Guinea and the Indonesian Province of Papua. They are fully protected in Papua New Guinea but not in Indonesia, which has exported between 50 – 400 individuals per year since 1989. Prior to 2001, Indonesia allowed an annual harvest of 120 wild individuals, but no quota for wild specimens has been allocated since that time. Seemingly in response to this, all subsequent exports of *Morelia boeleni* from Indonesia have been declared as farmed or captive-bred.
- This species was once a species of high market value; however, due to the notorious difficulty to maintain and breed specimens in captivity, it is only in high demand for a small number of individuals worldwide.
- Private breeders have bred the species in captivity on fewer than 10 occasions. Because Boelens Pythons are potentially highly uniform from a genetic standpoint and are thus susceptible to inbreeding depression, breeding programs require detailed and accurate pedigree management to maintain genetic diversity.
- There is little or no reason to suggest that current levels of illegal wild harvest are negatively impacting wild populations of this snake. The species inhabits difficult to access habitats and has a very small trade focused on juvenile individuals.
- Illegal laundering of wild-caught *M. boeleni* as captive-bred began directly after the suspension of trade in wild specimens by the European Scientific Review Group (ESRG) of the EU (details in Annex), suggesting that mis-declaration of exports is a result of the ban. The basis upon which the ESRG's decision was made is unclear given that the conservation status of the species has never been in question.
- The source code used for exports based on the current method of harvest (juveniles collected after hatching in wild protected nests) should be W (wild), rather than C (captive-bred). Because collection of juvenile stages that have a high risk of mortality is biologically safe, NDFs made under Article IV may be relatively straightforward.
- Continuation of a legal wild harvest using the same methods currently being employed is a suitable option for conservation and trade in this species. Restricting exports to specimens under a certain size may be one way to easily regulate take of wild individuals and would be welcomed by an industry demanding small, parasite-free animals.
- If wild harvest was conservatively permitted for premium sale to private collectors, income from the sale could be reinvested in suitable monitoring research. The conservation community should also consider promoting proactive, incentive-based approaches to aid Indonesian authorities with these tasks.
- Regardless of Indonesia allocating a zero harvest quota for wild caught animals, wild harvesting is still the only way of acquiring *M. boeleni* given the issues with breeding the species in captivity. Suspension of trade in wild specimens has resulted in the stimulation of illegal trade given that demand has remained unchanged. Acknowledgement of this and remediation through a well-managed and legal ranching program may be a positive step towards eliminating illegal trade and increasing biological knowledge of this species.

Recommendations by species

Cayos Cochinos boa constrictor, ***Boa constrictor imperator, population***

It is clear that poaching of Cayos Cochinos boas is ongoing at an unknown level, although the effect of ongoing poaching on the two populations of Cayos Cochinos boas is also unknown. It would be desirable to have a better knowledge of current poaching levels. Furthermore, in order to fully understand the effect of illegal harvest on these populations, there needs to be a more complete understanding of the reproductive biology, demography, and survival of each population so that sustainable annual harvest limits could be eventually determined. Gaining a more complete understanding of the basic biology of these populations will require a greater number of staff gathering data in the field. Developing accurate estimates of the level of sustainable harvest may be difficult and will likely require increased monitoring. Increased personnel

would also be necessary for management and enforcement of any sustainable harvest program authorities might like to develop in the future.

No NDF is required for this species at this moment, as exports are not allowed.

Ball python, ***Python regius***

The following actions can help improve the overall conservation status of this species and reverse the current negative conservation impacts from illegal trade of wild specimens in Benin:

1. Develop captive breeding strategies in order to reduce pressure on wild populations. To this end, trade stakeholders (i.e. exporters, collectors, middlemen, snake meat vendors) in exporting countries, especially Benin and Togo, should receive adequate training.
2. Promote python ecotourism with the assistance of collectors and other breeders, as well as worship communities (e.g. “Temple de python” in Ouidah – Benin). In addition, traditions and taboos in favour of the species conservation should be encouraged by assisting the concerned localities in improving the management of sacred forests, organizing awareness campaigns, etc.
3. Strengthen national regulation authorities in trade control and monitoring including stricter control policies for alleged ranching operations.
4. Design and implement a management program for the Ball python at the regional or subregional level, mainly in countries that host the most vulnerable populations.
5. Non-detriment findings for Ball pythons should focus on conducting yearly surveys of snakes at common collection sites (as in Gorzula, 1997). Monitoring of the number of gravid females collected should also be improved to better understand collection trends.

Calabar ground python, *Calabaria reinhardtii*

The following actions can contribute to the sustainability of the trade on Calabar ground boas:

1. Extend breeding of this species to major exporting countries in order to reduce the impact on wild stocks. In this regard, these snakes require small cages and are easily kept in captivity, so breeding programs should not be very expensive or logistically difficult.

2. To date, nothing is known about the impacts of trade/harvest on wild populations of the species. Thus, it would be desirable to devise sound demographic studies in the sites that are regularly used by hunters for catching these snakes for the pet trade. For instance, the localities of Kpalimé and Badou (south-western Togo) are potentially very useful for such an assessment, as these sites are regularly surveyed for snake harvesting. The results of these assessments would form the basis for non-detriment findings for these species.

3. Promote python ecotourism with the assistance of hunters, collectors and breeders, as well as with worshiping communities.

4. Improve the monitoring system carried out by national regulatory authorities.

Green python, *Morelia viridis*

The most important recommendation is for Indonesia to consider that despite legislation in force preventing the export of wild specimens, harvesting is still occurring. Indonesia can then begin to rectify the problem of illegal trade and implement positive solutions. Aid from the international community is paramount to assist Indonesia with this endeavor.

There are two major ways forward for improving this trade which are, to some degree, mutually exclusive (requiring a choice between recommendations):

1. The first recommendation is for the Indonesian Government to allow a legal harvest of wild individuals for trade. With exports of green pythons from Indonesia continuing, it is unlikely that wild collection will stop. It may thus be more beneficial to allow legal trade of wild specimens, particularly given that according to this review the current trade does not appear to be negatively impacting the species.

2. The second recommendation involves maintaining the prohibition of wild collection but increasing monitoring and enforcing current legislation. This may include increased monitoring of breeding farms and wildlife traders in source areas, together with the development of methodologies to distinguish between captive-bred and wild-caught green pythons.

Considerations for the two broad recommendations above are presented in Table 3 of the annexed species accounts, together with tools that may assist in the implementation of each scenario.

If the problem of mis-declarations of captive-bred specimens is addressed, then non-detriment findings for exports of this species are not necessary

Boelens python, *Morelia boeleni*

The first and most important recommendation is for the Indonesian authorities to acknowledge that mis-declaration of wild *M. boeleni* as captive-bred animals may be occurring. Once this fact is acknowledged, there are several steps for improving the trade of this species, although they are, to some degree, mutually exclusive (so that one or the other may need to be implemented):

1. The first recommendation is for the Indonesian authorities to allow legal harvest of wild individuals for trade. Exports of wild-caught individuals are already suspected to be occurring. When harvesting and trade is illegal, individual animals are transported covertly, resulting in higher mortality rates than if they were to be harvested and transported legally. Harvesting is unlikely to have a negative impact on wild populations, but the following points should be considered for a successful wild harvest program to be implemented:

    a. It is recommended that only gravid females or clutches from brooding females are removed from the wild, and females are returned to where they were collected from (thus juveniles would be exported as “Ranched”).
    b. Accurate data should be collected on the location of where each snake was found, and this should be available to the distributor and customers.
    c. If the snakes are of high market value and sold for a premium price, levies should be obtained and reinvested into a monitoring program for the species.

2. The second possible recommended course of action is to maintain a zero harvest quota for wild specimens and instead increase monitoring and enforcement. This should include:

    d. Increased monitoring of breeding farms, exporters and wildlife traders.
    e. Development and implementation of techniques to differentiate between wild and captive-bred specimens (e.g., parasite loads, stable isotopes).
    f. Cooperation and capacity training by proven *M. boeleni* breeders on how to maintain and breed captive stock.

All else being equal, this report suggests that legalizing trade for this species may be the most suitable option. Wildlife trade enforcement capacity is low in Indonesia and may be ineffective if mis-declaration of source continues to occur. Laundering of wild-caught snakes through Indonesian breeding farms is a symptom of outlawing trade in wild specimens. Legalizing trade would solve this problem, and with no foreseen detriment to wild stocks.

Non-detriment findings for Boelens pythons should involve a survey of traders in the highlands of Papua to determine trends in number of snakes harvested.

Acknowledgements

This report was made possible with the help of financial support from the CITES Secretariat. Several members of the CITES Animals Committee Intersessional Working Group on Snakes and other reviewers provided comments that enriched the outcome of our work. We thank Jessica Lyons, Daniel Natusch, Dena Cator and Richard Jenkins, who contributed to improve the quality of this report.