Sustainability of Rat Snake (*Ptyas mucosus*) Harvests in Indonesia: A Discussion of Issues

(submitted by the CITES Management Authority of Indonesia for review by the CITES Standing Committee to consider the lifting of the trade suspension)

Executive Summary

1. When *P. mucosus* was listed on Appendix II (1990), no evidence indicating the species in Indonesia was endangered by trade, or would become so in the future, had been presented to CITES. Regardless, in order to continue exports, Indonesia was faced with the problem of ensuring that the use of a common, abundant and widely distributed species subject to harvest was "not detrimental" (Article IV of the Convention).

2. In 1992 the CITES Significant Trade Project reported that the "decline" of *P. mucosus* was suspected to be caused by international trade, and Indonesia was asked to provide the scientific basis for its harvest quotas, and to introduce a system such that exports did not exceed harvest quotas. Information provided by Indonesia at that time was not considered sufficient, and in 1993 the CITES Standing Committee recommended that imports of *P. mucosus* from Indonesia be suspended until the relevant primary or secondary recommendations of the CITES Animals Committee were implemented.

3. Concerns about the ability of tropical Asian snakes generally to sustain high harvest rates are partly due to scientists trying to explain how populations can compensate for large harvests on the basis of temperate-zone population dynamic models, rather than models based on tropical snakes (eg Shine *et al*. 1998a-c, 1999a).

4. Generally, temperate-zone snakes have low rates of growth, low rates of reproduction (partly due to low clutch sizes), high adult survival rates and late maturation; large snakes tend to be relatively uncommon in the wild. These characteristics are not conducive to sustaining large, annual harvests, but they do not apply to tropical snakes (Shine *et al*. 1998a,b,c, 1999a). Tropical snakes like *P. mucosus* tend to be common in the wild, thrive in altered habitats, have high growth rates, early maturation and relatively high reproductive output - biological characteristics that contribute to an ability to withstand high levels of annual harvest.

5. Since the trade ban was imposed on exports of *P. mucosus* from Indonesia, concerns about the establishment and maintenance of harvest quotas, and the sustainability of the harvest, have been addressed. Specifically,

   - The biology of *P. mucosus*, poorly known up to the early-1990s, is now much better known (eg Boeadi 1998a,b; Mumpuni *et al.* 2002);

   - The snake skin industry is represented by a single organization (IRATA), which takes a leading role in assisting Government with monitoring and research;

   - Stockpiles which were once extensive and confounded annual trade statistics are no longer a major problem, as few, if any, stockpiles now exist;

   - A tagging system for skins was introduced in October 1994, and could assist monitoring efforts for *P. mucosus*.

   - Indonesia established a quota system that in the first instance matched the known levels of trade, but which could later be manipulated. Skin exports for *P. mucosus* closely matched the established quotas from 1990 (when *P. mucosus* was listed on Appendix II) to 1993 (when exports ceased).

   - The current protocol for establishing annual quotas is highly precautionary. Each year, CITES Management Authority (PHKA) officers in each Province establish harvest levels in the field, which are reviewed and assessed further, in the forms of workshops, by the CITES Scientific Authority (LIPI) involving other stakeholders such as Universities and NGOs. Various parameters, including environmental conditions, are used to set quotas (e.g. quotas in 1998 were reduced due to

extensive forest fires in Indonesia the previous year). Once quotas are finalised, PHKA issues an annual decree on the national allowable harvest.

- Ongoing trade in *P. mucosus* for over 25 years, mainly from one area of distribution, suggests that a high degree of sustainability has been achieved. Some local declines may reduce the optimal annual harvest, but could have little bearing on the long-term sustainability of harvests.

6. The ban on exports of *P. mucosus* has resulted in a marked increase in illegal trade, for both meat and skins, with nearby countries becoming significant conduits for this trade [e.g. Malaysia (Chiew 2003)].

7. The absence of a legal harvest has restricted efforts to monitor the population through harvest statistics (e.g. catch per unit effort, mean size, sex ratio, reproductive status) to a much smaller domestic market. Data compiled to date suggest sustainability.

8. Resumption on legal trade will allow the harvest to be transparent, and allow monitoring of the extent of trade and the impact of the harvest on the population of *P. mucosus*. Harvest data remains the most appropriate way to monitor *P. mucosus*.

Introduction

When Rat Snakes (*Ptyas mucosus*) were listed on Appendix II of CITES in 1990, Indonesia was faced with the problem of ensuring that the use of a common, abundant and widely distributed species subject to harvest was "not detrimental" (Article IV of the Convention). This was in spite of the fact that no evidence indicating that *P. mucosus* in Indonesia was endangered by trade, or would become so in the future, had been presented to CITES.

In 1992, the CITES Significant Trade Project reported that the "decline" of *P. mucosus* was suspected to be caused by international trade, and Indonesia was asked to provide the scientific basis for its harvest quotas, and to introduce a system such that exports did not exceed the quotas. In 1993 the CITES Standing Committee recommended that imports of *P. mucosus* from Indonesia be suspended until the relevant primary or secondary recommendations of the CITES Animals Committee had been implemented.

Up to 1994, information provided by Indonesia was considered insufficient to assess the impact of the harvest, and further study was imposed by CITES on Indonesia as a precondition to lifting the ban.

To address the issue, surveys were undertaken by the Indonesian CITES Scientific Authority in 1994, 1995, 1996, 1998 and 2002.

The suspension of international trade in the species from Indonesia is currently still in effect (Notification No. 2004/028, 30 April 2004). The CITES ban has had a negative effect on the ability to monitor trade, and there has been a significant increase in illegal trade. Resumption of legal trade under the auspices of CITES can only assist the Indonesian regulatory authorities to implement a more effective monitoring system, and provide the monitoring data required to assess and maintain the sustainability of the harvest.

This document was produced by the Government of Indonesia to update the CITES Secretariat and the CITES Standing Committee on the current situation with *P. mucosus* in Indonesia, and explain why the harvests of *P. mucosus* in Indonesia are consistent with sustainability.

Chronology of Events

The following chronology briefly outlines key events associated with international trade in *P. mucosus* from Indonesia.

- Commercial harvesting of *P. mucosus* began in the late 1970s.
- *Ptyas mucosus* was listed in Appendix III of CITES by India in 1984.
- In 1986, Indonesia banned the export of raw *P. mucosus* skins, in favour of tanned skins. To facilitate the construction of tanneries, some exports of raw skins were still permitted. Demand increased as international buyers stockpiled raw skins.
- In January 1990, *P. mucosus* was listed on Appendix II of CITES.
- Exports of *P. mucosus* from Indonesia declined from around 1.9 million skins in 1986, to around 581,000 in 1989.
- Annual export quotas set by Indonesia in 1989 (915,000 skins), were reduced to 250,000 skins in 1990 and 1991, and 200,000 skins in 1992 and 1993 respectively.
- In March 1992, the "CITES Significant Trade Project" reported that the decline of *P. mucosus* was suspected to be caused by international trade (Anon 1992). The Indonesian CITES Management Authority was requested to "advise the Secretariat of the scientific basis for its harvest quotas and should introduce a system to ensure that the number of skins permitted for export does not exceed those quotas" (CITES Animals Committee 1992).
- In November 1992, the Indonesian CITES Management Authority was advised by the CITES Secretariat that the information received was not sufficient, and requested additional information.
- In July 1993, the Indonesian CITES Management Authority indicated that quotas were based on previous trade data, and that increasing amounts of habitat were being made available to *P. mucosus* through regional development. However, this was not considered by the CITES Secretariat to be a scientific basis for the quotas.
- In August 1993 this latter view was supported by the Chairman of the CITES Animals Committee, who also pointed out that import statistics for *P. mucosus* from Indonesia exceeded exports reported by Indonesia.
- In November 1993, the CITES Standing Committee recommended to all Parties that they suspend imports of *P. mucosus* from Indonesia until the relevant primary or secondary recommendations of the CITES Animals Committee had been implemented (CITES Notification 775).

- In March 1994, the Indonesian CITES Management Authority provided information on actions taken on CITES recommendations, including those relating to *P. mucosus.* Specifically, they indicated that exports in 1992 (199,844) were less than the established quota (200,000).
- In April 1994, the CITES Standing Committee again recommended to all Parties that they suspend imports of *P. mucosus* from Indonesia until the relevant primary or secondary recommendations of the CITES Animals Committee had been implemented (CITES Notification 800).
- Surveys of *P. mucosus* were undertaken by the Indonesian CITES Scientific Authority (Indonesian Institute of Sciences/LIPI) in December 1994 - January 1995.
- The study on trade in *P. mucosus,* carried out in 1994 (LIPI 1994), was considered insufficient for the purpose of assessing the impacts of trade. Further study was imposed by CITES as a precondition to the resumption of international trade in *P. mucosus* by Indonesia.
- Surveys of *P. mucosus* were undertaken by LIPI in October-November 1996.
- In April 1998, the Indonesian CITES Management Authority sought permission from the CITES Secretariat to export stockpiles of *P. mucosus* skins (tagged and frozen) held by five (5) companies.
- Surveys of *P. mucosus* were undertaken by LIPI in June 1998.
- In 1999, Indonesia was given permission to export its stockpiles of *P. mucosus* skins.
- Surveys of *P. mucosus* were undertaken by LIPI in March-April 2002.

General Biology

Ptyas mucosus is widely distributed in Asia (Iran, Afghanistan, Turkmenistan, Pakistan, India, Nepal, Sri Lanka, Bangladesh, Myanmar, China, Taiwan, Vietnam, Laos, Cambodia, Thailand, Indonesia, Uzbekistan, Tajikistan). In Indonesia, the species is mainly distributed in Java, Sumatra, Sulawesi and may be, Kalimantan, but its abundance is highest in east Java, decreasing towards central and west Java. The occurrence in Kalimantan, however, needs further confirmation because according to traders, there had never been any report on harvest from Kalimantan.

Ptyas mucosus is a non-venomous snake, reaching about 2.5 m in length and 5-10 cm in girth. Males grow longer than females, and have larger heads, longer tails greater body mass than females of the same length (Boeadi *et al.* 1998a,b).

The species is oviparous, laying an average clutch size of 13.0 eggs (range 7-25). In two samples of *P. mucosus* harvested in central Java (in December-January and October-November respectively), high proportions of females contained eggs and/or ovarian follicles (48% and 53% respectively), suggesting that *P. mucosus* may produce more than one clutch per year (Boeadi *et al.* 1998a,b). This suggestion was later confirmed by LIPI, who recorded through interviews with collectors that hatching occurs in most months of the year.

Frogs and rats are the main prey items for *P. mucosus*, and both have increased greatly in abundance as a result of human agricultural activities (Boeadi *et al.* 1998a,b). Indeed, rice fields and agricultural land appear to the "preferred" habitats of *P. mucosus*, and thus the amount of available habitat (and prey) for the species is expanding in line with agricultural development.

Examination of wild-caught, harvested individuals has allowed a number of parasites to be identified, namely nematodes in the gut, cestodes (cysts) in the abdominal cavity, and pentastomids in the lungs (Mumpuni *et al.* 2002). This indicates that the species lives in habitat that is fairly closed to human activities.

Management of Harvests

When Indonesia joined CITES in 1978, *P. mucosus* was not listed on the CITES Appendices. In 1984 it was listed on Appendix III by India, and in January 1990 it was listed on Appendix II throughout its range. Between 1984 and 1989, reported trade from Indonesia averaged some 745,000 skins per year (Table 1).

The listing of *P. mucosus* on Appendix II was to account for look-alike reasons [CITES Article II.2(b)], and not because there was any specific evidence that *P. mucosus* in Indonesia was endangered (despite general concerns about any species in trade). Thus, despite *P. mucosus* being common and widespread in Java (where harvesting occurred), the ability to export skins became dependent on Indonesia being able to satisfy Article IV of the Convention, demonstrating that the trade is not detrimental to the population.

Indonesia's approach to the problem of many other reptiles being harvested and exported, and for which population data on a national scale were lacking, was to introduce a "quota" system of management. The approach is applied to Appendix-II species that are harvested and exported. However, Indonesia also uses

the same method of assessment to set annual quotas for non-CITES listed species subject to trade and management. With an absence of wild population data at the national scale, this quota system can be considered an 'adaptive management' response that began as a harvest control mechanism.

In the late-1990s, as measures were aimed at introducing more strictly controlled and managed harvests, attempts were made to derive species-specific quotas that matched approximately the harvest levels known to occur. In circumstances where scientific information is lacking, quotas are set under very strict conditions, following a precautionary approach. This policy is followed on the basis that it is better to allow trade at precautionary levels, rather than to give a zero quota that may promote smuggling and illegal trade to supply persistent demand. Another important consideration is the socio-economic drivers of the trade under which local communities or individuals would keep collecting snakes despite Government regulations.

In the case of *P. mucosus,* which was listed on Appendix II in 1990, more conservative export quotas were established, and in collaboration with industry concerted efforts were made to ensure that harvests were maintained within the export quotas (see Table 1).

Currently, the quota setting process for all Appendix-II species subject to export from Indonesia also takes into consideration other variables and involves broad stakeholder consultations, including trader associations and non-Government organizations (NGOs). CITES Management Authority officers in each Province propose harvest levels appropriate to their field jurisdictions where harvesting takes place. These levels are then reviewed and assessed further by the CITES Scientific Authority (LIPI).

Various parameters, including environmental conditions, level of protection, level of enforcement, level of mortality during harvest and transport and levels of illegal trade are then factored into the determination of final quotas for each calendar year. In setting the quotas, the CITES Scientific Authority involves experts from a wide range of disciplines, including scientists from other research organizations, universities and NGOs. Once quotas are finalized, The CITES Scientific Authority submits them back to the Directorate General of Forest Protection and Nature Conservation (the CITES Management Authority), which compiles the final quotas into an annual decree on national totals for allowable harvest and trade.

In the final decree, in order to accommodate domestic trade, the export quota is allocated 90% of the harvest quota. However, for some species, where domestic trade is considered negligible, the export quota is the same as the harvest quota. The decree identifies the annual allowable harvest of each species at national level, allocated between various provinces. Ideally, the quota for each province should have been set according to the 'production system' potential of each province, but this is a continually evolving process that needs further study, particularly the role of captive breeding systems in supplying the trade. Harvest quotas for individual species are based on a range of available data, including: information on the biology and distribution of the species, general land-use and potential threats in specific areas. For example, as a precautionary measure, quotas for some species in 1998 were reduced in response to extensive forest fires in Indonesia the previous year.

Furthermore, following workshops (collaboration between Indonesian and Australian Governments) that focused on non-detriment finding methodologies in 2002, the Indonesian CITES Scientific Authority is now using the IUCN Guidelines (Rosser and Haywood 2002) to assist in making non-detriment findings for Appendix-II exports. Quotas are established based on non-detriment finding assessments as follows:

- In July-August every year, the provincial office of the CITES Management Authority (BKSDA) of each province provides to the CITES Scientific Authority information or data on harvesting areas, total harvests of the previous year(s), and recommendations on likely harvest levels for the coming year. When available, the BKSDA also provides quantitative data on survey results on wild population abundance;

- Around September every year, the CITES Scientific Authority organizes a workshop (consultation process) with all stakeholders, which include Government agencies (research, management, trade, industry), universities, NGOs (local, national, international) and trade associations;

- Additional information is then fed into the deliberations from the workshop process, especially from individuals or organisations undertaking field research, which helps to make appropriate adjustments to the quota amount that has been proposed. Other information such as levels of protection, mortality during harvest and transport, protected areas, population monitoring and trade monitoring are taken into consideration;

- The CITES Scientific Authority may further consult with any other organization on relevant information, and there remains an 'open door' for any further unsolicited submissions to be made to the Scientific Authority;

- From the above process, the Scientific Authority then provides recommendations to the CITES Management Authority, which then officially establish the annual quotas by a Decree of the Director General of Forest Protection and Nature Conservation (PHKA);

- At this level, the Director General will still be able to receive additional information which may lead to the reduction of the quota (usually less than those recommended by the Scientific Authority) prior to signing off on the annual checklist.

Trade Data

The trade data available for *P. mucosus* in Indonesia are from various sources (Table 1), and each may involve errors of various kinds. However, they are more than adequate for revealing the main trends in trade over time.

Table 1. Numbers of *Ptyas mucosus* skins and live snakes (numbers or kg) reported to be exported from Indonesia by IRATA (IRATA 2002) and the WCMC-CITES database (http//:sea-bov.unep-wcmc.org/citestrade/report.cfm).

Year	Export Quotas	Exported (IRATA)	Exported Skins (CITES)	Exported Live (CITES)	
1984	-		512,000	0	
1985	-	236,000	236,000	0	
1986	-		1,873,314	0	
1987	-		497,500	0	
1988	-		770,226	0	
1989	915,000		581,110	5	
1990	250,000	100,500	120,575	0	
1991	250,000	249,000	254,966	20	
1992	200,000	199,844	253,910	0	
1993	200,000	199,194	135,476	652	
1994	0	0	6654	76	
1995	0	0	3	2000	kg
1996	0	0	0	9500	kg
1997	0	0	0	3000	
1998	0	0	0	7	
1999	102,285	102,285	99,058	0	
2000	0	0	0	0	
2001	0	0	0	0	
2002	0	0	0	0	
2003	0	0	0	0	
2004	0	0	0	0	

Trends in the data (Table 1) can be summarised as follows:

1. Between 1984 and 1988, annual exports for *P. mucosus* throughout Indonesia peaked in 1986, at around 1.9 million skins. The decline in exports after 1986 was the result of decreased market demand, rather than any biological problems associated with the wild population.

2. The export quota in 1989 (915,000) was reduced thereafter to 200,000-250,000. The export quotas established by Indonesia from 1990 to 1993 were well below export levels realised in the preceding years (mean = 745,025/year), and were considered highly precautionary by the CITES Management and Scientific Authorities.

3. Over the 4-year period from 1990 to 1993, *P. mucosus* exports closely matched the established quotas (total of quotas = 900,000; exports reported by CITES = 765,599; exports reported by industry = 748,538) (Table 1), even though previous harvests had been much higher (see 2. above).

4. The 9500 kg exported in 1996 to China represents cobra, *Naja sputatrix,* not *P. mucosus* - data may have been entered incorrectly into the CITES database. The source of data relating to live exports of *P. mucosus* in 1995 and 1997 in the CITES database is unknown. Data within the Indonesian CITES Management Authority indicate that the 1995 annual report did not indicate any exports of the species. There may represent similar errors with these two years.

5. That export quotas *P. mucosus* in the last 4 years of the harvest program (1990-1993) were not exceeded is largely due to improved co-operation and collaboration between Government and the reptile skin industry. The Indonesian Reptile and Amphibian Trade Association (IRATA) has increased trader participation in the management program as a whole, and assists Government with monitoring and research of a number of species in Indonesia and other countries.

6. In 1998, Indonesia sought permission to export stockpiles of *P. mucosus* skins. These were tagged, and exported in 1999 (Table 1).

The Harvest

As with many other harvested species of snake, *P. mucosus* are mostly caught by farmers in the fields and plantations during their free time. Thus, snakes are mostly taken during the wet season, when farmers are not working in the fields (Sugardjito *et al.* 1998; Mumpuni *et al.* 2002); frogs are also collected. Whether snakes are collected or not depends in part on the price being offered. Interviewed hunters indicated that there has never been a problem finding and collecting Rat Snakes.

The harvesting and trade of *P. mucosus* in Indonesia over the last 25 years has been almost exclusively from Java. Although the species occurs in other parts of Indonesia, such as Kalimantan (needs confirmation), Sumatra and Sulawesi, it seems that due to a lack of harvesters and abundance of other target species (e.g. pythons and monitor lizards), people are not interested in harvesting small snakes such as *P. mucosus*, water snakes or cobras, perhaps due to the lower financial return relative to these other larger species. Even when export quotas for Rat Snakes were established in other Provinces, none were supplied from there - licensed exporters have always dealt with *P. mucosus* from Java.

Like many other reptile species in Indonesia, the harvest of *P. mucosus* occurs over a very large area, and involves many thousands of people. To study and monitor the entire harvest of such a common species would require inordinate resources, well beyond the reach of most countries, for a species that is common rather than endangered.

Recent assessments by the Indonesian CITES Scientific Authority indicate that Rat Snakes were distributed in almost all sub-Districts in Central and East Java (Mumpuni *et al.* 2002). Sugardjito *et al.* (1998) used catch per unit effort (CPUE) information (snakes per hunter per week) and availability of suitable habitat to estimate the total harvest of Rat Snakes throughout Central Java and Jogyakarta Provinces in 1996 (25,000-118,000 *P. mucosus*). This information forms the basis on which CPUE can be assessed in the future, although market forces are a factor that can greatly affect the extent of harvesting (see Mumpuni *et al.* 2002). During periods of high demand, up to 10 times as many Rat Snakes may be collected by hunters, compared to numbers caught during periods of low demand.

Nonetheless, although non-biological factors may influence CPUE or other population monitoring indices from year to year, regardless of the size of the snake population, estimates of CPUE within established areas are considered by LIPI to provide reasonable indices of the population. The ability to quantify CPUE since 1994 has been constrained as there has been no legal harvest of *P. mucosus* for export.

Surveys undertaken by LIPI (e.g. Boeadi 1995; Boeadi *et al.* 1998a; Mumpuni *et al.* 2002) have concentrated on providing biological data on some harvested individuals (also see above). Methods used by LIPI biologists to assess harvested snakes follow those developed in collaboration with international herpetologists working on other reptiles in Indonesia (e.g. *Python* spp., *Acrochordus* spp., *Varanus* spp.).

The results obtained to date are consistent with sustainability, even in the absence of data on the extent of illegal trade. For example, Boeadi (1995) recorded a sex ratio of 47% (% of females) in June 1995. The sex ratio of harvested snakes (mostly adults) was 46% in December-January and 36% in October-November

(Boeadi *et al.* 1998a), and more recently it was reported as 52% by Mumpuni *et al.* (2002) in March-April. It is likely that the sex ratio of harvested animals changes through the year, but available data do not indicate any changes of biological significance.

In terms of mean size of harvested snakes, Boeadi (1995) recorded mean sizes of 1.37 m and 1.29 m for male and female *P. mucosus* respectively in 1995. The mean sizes of animals sampled in 1998 were 1.90 m and 1.79 m respectively (Boeadi *et al.* 1998a), and in 2002 they were 1.37 m and 1.38 m (Mumpuni *et al.* 2002). The increase in 1998 may reflect the lower sample size in that year. Again, the ability to sample large numbers of snakes (e.g. as they go through a slaughter/processing facility) is constrained by not having a legal harvest.

During the period of legal harvest (i.e. up until the CITES trade suspension was imposed), snakes were typically sold by collectors or villagers to middlemen, who then sold them to licensed dealers (exporters). Although individuals may trade directly with exporters, this is the exception rather than the rule (Yuwono 1998). Most trade involved live snakes, with dealers processing them in small local slaughter places for their skins.

Since the CITES trade suspension was imposed:

- Harvesting of *P. mucosus* has continued, although licensed exporters have largely stopped purchasing skins (see later).
- A low number snakes are taken for domestic use. The current low price of skins relates to the inability to export skins, but there is still local trade in skins for the manufacture of products for the domestic market (Mumpuni *et al.* 2002).
- Of particular concern to the Indonesian Reptile Trade Association (IRATA), skins and meat began to be illegally shipped to other countries, and licensed exporters felt obligated to buy some skins to prevent them going into the hands of illegal traders - even though the former are aware that they cannot export them, but could use them for domestic use.
- Frozen snake meat has been illegally exported in the region, for human consumption. *Ptyas mucosus* meat is considered to taste better than other snake meat (Mumpuni *et al.* 2002), and the price may currently exceed that of the skin.
- The extent of the illegal harvest is difficult to quantify.
- There has been little stockpiling of *P. mucosus* skins.

As indicated by Chiew (2003), the pressure on producer countries to make "non-detriment findings" (Article IV of the Convention) or face trade bans has encouraged illegal operators "to seek out country of a less controversial status ". For *P. mucosus* this fact is particularly relevant, in that illegal shipments from Indonesia have been indicated to have gone through neighbouring countries, that are geographically prone to illegal trade.

As reported by Chiew (2003) and the WCMC-CITES database, prior to 1997, no *P. mucosus* had been exported from Malaysia. In 1997 and 1998, Singapore alone reported imports of 115,000 and 318,000 skins respectively from Malaysia, meanwhile Malaysia reported exports of 140,000 and 308,000 skins respectively to Singapore. In 2000, 2001 and 2002, China also reported imports of 630, 7000 and 10,000 live Rat Snakes respectively from Malaysia, while Malaysia reported export to China only 588 live snakes in 2001. Recognizing that Rat Snake is not as valuable as, for example, pythons, it is doubtful if people in Malaysia were willing to catch Rat Snakes whether targeted or by-catch for commercial purposes. Information from NGOs and reptile traders confirmed that illegal trade in *P. mucosus* increased rapidly after trade from Indonesia was suspended by CITES.

Notwithstanding the difficulty that Indonesia has to fully enforce the trade ban, and the unknown impact of the illegal harvest on the population, monitoring of the *P. mucosus* population without a legal harvest in place is difficult to achieve - monitoring data are a product of the harvest. For example, Cuba's traditional harvest of *Eretmochelys imbricata* has provided remarkable insights into the population dynamics of the species, and population monitoring data are produced from the harvest. This would not have been possible without the legal harvest.

Since the suspension of Indonesia's trade, the market price of *P. mucosus* has increased from 6000 rupiah (to the snake-catcher) to 15,000 rupiah (about USD 1.6) per snake weighing 800 grams or more. It is understood that the sender (while packing the snakes) includes other non-CITES listed snakes such as *Ptyas korros* and *Elaphe radiata*.

Whereas under the pre-1993 harvests exporters were able to exert pressure on middlemen and harvesters to target snakes of particular sizes, the illegal trade has been unselective with regard to the size of snakes. Snakes are being caught without consideration of their size, as payment is now based on the weight of the package rather than on the number of individuals in the package. The potential long-term effects of this indiscriminate harvesting are unknown.

Assessments by CITES

In 1988, desktop reviews of Appendix-II reptiles in trade were carried out by the IUCN, using trade data from 1980-85 and other available information (IUCN 1988). In these reviews, a distinction was drawn between species where trade was considered "safe" and sustainable, and those where no such guarantee could be given. The group for which no guarantee of safety could be given was further subdivided into species for which it could be concluded trade was detrimental, and those in which the available data did not allow such a conclusion to be reached; the latter group included *P. mucosus*.

These IUCN reviews provided the information base for the Significant Trade Process in CITES, which was formally adopted and institutionalised at the Eighth Conference of Parties to CITES (COP8, Kyoto 1992), in Resolution Conf. 8.9. When the CITES Animals Committee assessed *P. mucosus* under the Significant Trade Process in 1993, they concluded that some populations had been reduced as a result of excessive harvesting for the skin trade. No primary recommendations were made, and in Indonesia's case, the secondary recommendation was "The Management Authority of Indonesia should advise the Secretariat of the scientific basis for its harvest quotas and should introduce a system to ensure that the number of skins permitted for export does not exceed those quotas" (Anon 1992).

Sustainability of the Harvest

The degree to which harvests of reptiles can or cannot be sustained can only be determined confidently in hindsight - was a particular harvest sustained? There is no "scientific" formula that allows sustainability to be predicted in advance, and testing, trial and error and adaptive management are the best ways of learning (Walters 1986).

Indonesia's original goal of bringing quotas and harvest levels together over time was a sound first step when one considers the range of problems that Indonesia was facing. Unsustainable harvesting can now be detected by any gradual decline, well before any problems of extinction are likely to arise.

Small isolated studies of *P. mucosus* populations not subject to harvest may not contribute much to management security. Results from one small area generally cannot be extrapolated to the broader population with confidence.

Examination of harvested animals is a cost-effective and accurate way of obtaining a wide range of new data pertinent to discussions of sustainability (e.g. Shine *et al*. 1998a,b,c, 1999a,b). Such studies are not management experiments demonstrating "what" happens to wild populations when they are reduced below carrying capacity, but they do reveal a series of biological possibilities to help explain how this species has sustained harvesting for such long periods of time.

Like the varanid lizard *Varanus salvator* and the snake *Python reticulatus*, *P. mucosus* appears to have generally fared well in areas of human-induced habitat alteration. On the basis of the evidence to date, there is no evidence that the mean size of *P. mucosus* being captured is decreasing or that the current abundance is declining; both would be expected if harvests were unsustainable.

Nonetheless Indonesia has concerns that the legal trade has been replaced by illegal trade, and that the longer that this situation continues the more difficult it will be to reverse it. Together with Government, IRATA is committed to reinstating a legal system of management and trade. Harvest data over the last four years of trade (1990-1993; Table 1), when export quotas were reduced greatly relative to previous harvest levels, exemplify the ability of the legal traders to manage the harvest within the required quotas.

To the management and scientific authorities, maintenance of the harvest provides the basis of the population monitoring program. Monitoring of biological characteristics of the harvested population (e.g. mean size, sex ratio, reproductive status, clutch size, catch per unit effort, etc.) provide insights into the sustainability of the harvest, and thus "non-detriment".

Concerns about the sustainability of the trade in Asian snakes have been partly based on extrapolation of biological traits of temperate-zone snake species to these tropical species. Such extrapolations can lead to highly misleading conclusions, as large temperate-zone snakes are relatively uncommon, have low rates of growth and reproduction, high adult survival rates and late maturation - all characteristics which reduce the ability to sustain intensive harvesting (see Shine *et al*. 1999a). In contrast, recent studies indicate that like *P. reticulatus*, *P*. *mucosus* has different biological characteristics, including rapid growth, early maturation, and relatively high reproductive output.

Thermal constraints are also an important consideration. Temperate-zone snakes, especially large species, are more vulnerable to harvest because of their need to bask in open areas. Tropical snakes on the other hand, rarely need to bask, rely on ambush foraging, and have reduced visibility (vulnerability) to humans (Shine *et al*. 1999a) and other potential predators.

These characteristics, together with the nature of the harvest, are consistent with *P. mucosus* having the ability to withstand relatively intensive harvesting. That a significant trade in *P. mucosus* skins has been going on for 25 years suggests a high degree of sustainability at a national level.

Re-establishment of a legal harvest, coupled with ongoing monitoring can only improve management, and allow the impact of uncontrolled harvesting for illegal trade to be properly assessed over the next few years.

Historical Abundance

There are no reliable data with which historical abundance of *P. mucosus* in Indonesia can be quantified, and there are very few reports of any kind that shed light on it. Harvesting has largely been restricted to Java, and there is no evidence to suggest that its abundance has been reduced significantly - snakes are still readily caught by villagers.

That the abundance, size and age structures of a population will be altered by harvesting should be expected (e.g. Caughley and Sinclair 1994; Erdelen 1998a). Wildlife harvesting involves the deliberate reduction of target populations to extract a sustained yield. If the goal is to obtain a maximum sustainable yield (MSY), then the population must be reduced to a level at which its efforts to increase over time are maximised (Webb *et al.* 1998).

Habitat alteration (to agriculture) has actually helped *P. mucosus*, by providing additional agricultural land with associated rats and frogs, the main prey items. Combined with the species ability to breed throughout the year, and reach maturity quickly, *P. mucosus* populations appear to be able to withstand relatively intense harvesting.

So reductions in density during harvesting do not constitute a problem with sustainability, unless the population fails to stabilise. If this occurs, snakes should become more and more difficult to obtain (decreasing abundance) and the mean size of skins exported should become smaller and smaller.

Indonesia's national policy of conservation of its natural resources includes the principle of sustainable use (Siswomartono 1998), to ensure that renewable resources are used as building blocks for development for the benefit of Indonesian people. This is totally consistent with the goals of most international conservation agreements and treaties.

Harvest Controls and Internal Trade Monitoring

When international trade is re-established, regulation of the *P. mucosus* harvest will follow the current regulations, which can be summarized as follows.

Harvest permits are issued by the Head of BKSDA (Provincial office of the CITES Management Authority), based on the national quota, which is spread between specific provinces. The number of specimens permitted for collection should not be allowed to exceed the quota allocated by the central Government to the corresponding province.

Official collection permits are given to middlemen, who are registered by the BKSDA. The field collectors, who directly catch snakes in the field, usually supply the live snakes or skins to middlemen, who are likely in some cases to have given downpayments to the field collectors. Thus, field collectors operate like employees for the middlemen.

The provincial offices of the BKSDA now control and enforce harvest/collection permits, and implement quota management and monitoring, for CITES-listed species in all administrative jurisdictions. In accordance with the Decree of the Minister of Forestry No. 447 of 2003 the BKSDA office will issue permits to collect snakes in the field based on the quota allocated for each respective province. All Rat Snakes harvested from the habitat are officially registered by the BKSDA or by the Sub-provincial Section Offices of BKSDA (Seksi Wilayah BKSDA) who then, report back to the provincial BKSDA.

For domestic transport, the specimens must be covered by permits issued by BKSDA or its Section Offices. To facilitate better control, the domestic transport permit (started from January 2005) is now standardized throughout Indonesia. All permits (collection and domestic transport permits) are required to be reported to central level, which will improve monitoring of internal (domestic) trade. For international trade, there are already a limited numbers of import/export points nominated for Indonesia's CITES trade (see CITES Notification 1999/79).

Monitoring the chain of custody between source regions and collection points within Indonesia is possible to a certain degree of accuracy. Each province is divided into a number of BKSDA jurisdictions - for example, in East Java and West Java, there are two BKSDA offices respectively, but in general the jurisdiction of BKSDA is the whole province. Each BKSDA, for example of East Java I, based in the provincial capital Surabaya, has three section offices (each 5-6 people), which in turn direct their counterparts at the Section Offices of BKSDA who are operating at *Kabupaten* (district) level.

Monitoring the harvests in the field however is more difficult. This is because the collectors who register with the BKSDA are actually middlemen traders, who employ a number of 'field operators' to collect snakes from the field. Monitoring the activities of these operators is the most difficult challenge. Standardized permits are now being issued by BKSDA, in accordance with a Decree from the Director General of Forest Protection and Nature Conservation: from 2005, five separate papers must accompany internal shipments within Indonesia (see below). In addition, there should be a monthly resolution by BKSDA offices to report levels of internal transport to central PHKA (as the CITES Management Authority).

There are five copies of the permit, which allow crosschecking at different stages of transport and shipment. The first copy accompanies the specimens; the second copy stays on file at BKSDA; the third copy is sent to the central PHKA office, and used for cross-checking with the original which is enclosed with the application for export; the fourth copy is filed at the BKSDA destination and used for crosschecking with the original when the shipment has arrived; and, the fifth copy is for the Section office of BKSDA.

National Legislation and Trade Control

All CITES Appendix-II listed species in Indonesia are controlled, in terms of harvest, domestic transport and export, by the Directorate General of Forest Protection and Nature Conservation (PHKA) as the CITES Management Authority. This follows Decree of the Minister of Forestry Number 447/Kpts-II/2003 concerning the Administration Directive of Harvest and Capture and Distribution of the Specimens of Wild Plant and Animals Species**.** The annual national quota is set under this Decree by the Director General of PHKA, and the Provincial Offices of the PHKA (i.e. the BKSDA) issue harvest permits, whose totals cannot exceed the amounts which have been allocated as the provincial quota. Permits for domestic transport are also issued by the provincial office in accordance with the annual quota and with reference to harvest permits.

Rat Snakes collectors and exporters must be licensed and registered at the Directorate General of Forest Protection and Nature Conservation in order to apply for CITES export permits. Currently, 17 reptile skin and 26 "pet" companies, members of IRATA, are registered as reptile exporters who are directly under the control of the CITES Management Authority. All shipments are verified and checked by the provincial office of PHKA (BKSDA) whose officers are posted in the designated international ports.

Any violation to this regulation is sanctioned, based on the provisions of the Government Regulation No. 8 of 1999 concerning Wild Animals and Plants Species Utilization, which is the implementation of Act No. 5 of 1990 concerning Conservation of Biological Resources and their Ecosystems. Government Regulation No. 8 of 1999 provides penalties for smuggling or misdeclaration or trade that is not in accordance with the provisions of the regulation, and offenders may be liable to imprisonment (in accordance with the Customs and Excise Law) and or fines of maximum IDR 250 million (about $USD 27,000).

To curtail smuggling of CITES-listed and other species the Government of Indonesia has provided training (on an annual basis) on CITES and wildlife law enforcement for field officers and officials of Special Police

and Civil Investigators of BKSDA, Customs, Quarantine and State Police. Coordination and cooperation between the CITES Management Authority and the Customs and Quarantine agencies are in the process of formalization in the form of Memoranda of Understanding (MOU).

Proposed NDF Assessment Process

To prevent over-exploitation of open access natural resources such as snakes, and to maintain the sustainability of utilization, strong State control is crucial. Furthermore, an international treaty such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), that provides international control on the trade of species like Rat Snakes, plays an important role to the survival of the resource. Article IV of the CITES Convention directs Parties that trade internationally in specimens of species included in Appendix II must be subject to export that is not detrimental to the survival of the species. The following non-detriment finding (NDF) establishment is and will be undertaken to support exports of Rat Snakes.

a. MANAGEMENT: Species identification

The Rat snake (*P. mucosus*) is easily identified, whether in live forms or as skins. The CITES Management Authority has provided identification manuals for reptiles and other species that can be used by law enforcement officers.

b. MANAGEMENT: Quota establishment

The current process of quota setting (as described above) will still be used. Quantitative data will be utilized in order to set more realistic quota levels. In this case, the traders association (IRATA) should be able to provide support to enable Indonesia's CITES Scientific Authority to undertake scientific studies. In addition, data from BKSDA should be made more available under the renewed levels of authority for all CITES-listed species, and should link more productively with the efforts of the CITES Scientific Authority as it evolves more systematic survey methodologies to assess and monitor the wild populations of snake species.

c. MANAGEMENT: Harvest locations

As regulated in the Decree 447 of 2003, the head of BKSDA should designate permitted harvest locations within its jurisdiction. Rat snakes (*P. mucosus*) are known to occur in Sumatra, Sulawesi, Java and may be Kalimantan, but only in the provinces of Java is the *P. mucosus* harvest known to have taken place. Therefore, even though the species is more widely distributed throughout Indonesia, Java is the only place where harvests take place. This has resulted largely because of the availability of snake catchers. Unlike pythons, there have been few people, if any, willing to catch rat snakes elsewhere. Therefore, management of this species will remain focussed on Java. Therefore, Sumatra, Sulawesi and may be Kalimantan will be safe places for rat snake from harvest.

d. MONITORING: Harvest monitoring

In accordance with the Decree of the Minister of Forestry No. 447 of 2003, the BKSDA or its Sections must undertake monitoring through regular inspection of the registered collection companies (middlemen traders). Each office should produce official records, and report these records to the provincial (BKSDA) and central (PHKA) offices for data compilation. This record and report are undertaken any time the BKSDA officials undertake inspection. This inspection is undertaken to ensure that the total specimens harvested would not exceed the permitted amounts. Inspection should also be able to distinguish whether the specimens were harvested in accordance with the permits, in terms of size, etc.

e. MONITORING: Domestic and international trade monitoring

Decree No. 447 of 2003 has established a '**chain of custody**' trade management as follows:

i. BKSDA issues collection permits based on the annual quota allocated for the province. BKSDA provides reports regularly to the central office of the CITES Management Authority on permits that have been issued;
ii. BKSDA and or its Sections provide official records on the stock accumulated by collectors prior to transport from points of origin, as well as in warehouses at points of export (e.g. Jakarta and Surabaya or Denpasar, Bali);

iii. BKSDA and or Sections issue standardized domestic transport permits at points of origin. Copies of these permits are sent to BKSDA at the destination port, the central office of the CITES Management Authority and the respective trading company. Generally, the domestic transport permit identifies the scientific name of the specimen/s down to species level;
iv. Domestic transport permits are cancelled by the BKSDA at the destination port upon arrival of the specimens. The BKSDA at the port of destination then undertakes inspection of the shipment and provides official records of the inspection;
v. Based on the reports, official records and domestic transport permits the central office of the CITES Management Authority issues CITES export permits to registered exporters (members of IRATA);
vi. Officials from Customs or Plant Quarantine or BKSDA authorities at the port of export undertake verification of the permits to assure that the specimen being exported is in accordance with the permit;
vii. Customs, Quarantine and BKSDA authorities at the port of export each hold one copy of the CITES export permit;
viii. For Customs and statistical purposes the exporter is required to declare the export on the Export Declaration form, in addition to the CITES export permit. This information is compiled by the Central Bureau of Statistics (BPS), and thus provides another method of crosschecking trade statistics.

In order to facilitate the 'chain of custody' trade management, a thorough consultation and sensitisation process will be undertaken with industry (IRATA and other commercial actors), Customs, Quarantine, port authorities, Central Bureau of Statistics, BKSDA, Forestry Service and other relevant stakeholders.

It may also be necessary to monitor the amount of snakes being harvested to supply local small skin industries that produce products from reptile skins for domestic markets.

f. MONITORING: Management of currently accumulated stockpiles

Small numbers (if any) of skins, the result of bycatch, may have to be accepted by traders. To avoid ongoing problems on the accumulation of skins, the CITES Management Authority has to decide whether this stock must first be cleared, and included within the harvest quota of the respective year.

g. BIOLOGY/STATUS: Population assessment (to assess biology and status)

The Indonesian Institute of Sciences (LIPI), as the CITES Scientific Authority, will develop a standardized survey method which can be used by local authorities or institutions such as BKSDA, Universities and local NGOs (and its own LIPI staff)**.** The Reptile Traders Association (IRATA), depending on its financial status, will provide assistance to undertake field surveys and population monitoring, especially in locations where harvest takes place.

BKSDAs also have to allocate budgets for population assessment and monitoring of species in trade, including *P. mucosus.*

The results of future field studies will be used to refine the assessment of harvest and trade levels, relative to the setting of annual quotas.

h. PROTECTION: Protected areas

Harvest of any species within gazetted Protected Areas is prohibited under Act No. 5 of 1990. Anybody entering or trespassing in Protected Areas without permits may be prosecuted. Despite some reports of encroachment into protected areas by wildlife poachers, protected areas would be the ultimate hope to safeguard from illegal harvesting. Indonesia has established more than 21 million hectares of terrestrial Protected Areas (Ministry of Forestry, 2004). The protected areas in Java, Sumatra, Sulawesi and Kalimantan are of important for *P. mucosus* protection. However, as mentioned earlier, *P. mucosus* has a preference for altered, man-made habitats, so protected areas can be considered as 'reservoirs' providing protection for the 'core' population.

Protected areas are managed in several categories based on IUCN criteria, namely National Parks, Nature Reserves, Game Reserves and Recreational Parks. Other protected area categories managed by the Government of Indonesia include: Hunting Parks and Grand Forest Parks. Except Grand Forest

Parks, all categories of protected areas are managed by central government (Ministry of Forestry) therefore they are under direct control of the CITES Management Authority.

Protected Areas in Indonesia are generally well-managed in terms of the monetary and human resources that have been put in the management. However, in many instances, encroachment in the forms of wildlife poaching, illegal logging and land encroachment for shifting agriculture has become major issue in the management effectiveness of Protected Areas. Therefore, current resources have been utilized more towards enforcement activities.

In accordance with the Convention on Biological Diversity's (CBD) decision VII/28 on Protected Areas, Indonesia is in the process of developing a Management Plan on the Protected Areas Management Effectiveness.

i. MANAGEMENT: Management Plan

A Management Plan specifically for the Rat Snake has not yet been developed. However, the CITES Management Authority wishes to develop Management Plans for several CITES-listed species, including *P. mucosus*.

j. MANAGEMENT: Role of the Trade Association

As of December 2004, there were 17 companies registered by the CITES Management Authority of Indonesia for skin products, and 25 as pets exporters. All registered reptile traders in Indonesia are united within a single association, IRATA (Indonesian Reptile Traders Association). Harvest and trade monitoring and control can be enhanced through co-operation with IRATA, which was initially established to assist Government to monitor trade. Now the role of IRATA has been expanded to include providing assistance to the CITES Scientific Authority to undertake population monitoring or field surveys.

k. MANAGEMENT: Marking of skins

As with python, cobra and water monitor skins, legally-obtained *P. mucosus* skins will be individually marked with stickers issued by the CITES Management Authority, to allow monitoring of domestic and international trade through monitoring of the legality of skins and the chain of custody.

l. RESEARCH STUDIES

The considerable efforts that Indonesian authorities and the reptile skin industry (IRATA) have made over recent years to improve the monitoring and regulation of reptile harvests (e.g. Haerani 1998; Saputra 1998) should be taken into consideration when assessing the situation with *P. mucosus*.

Indonesian reptile traders are now well aware of the need to ensure harvests are sustainable, and have repeatedly demonstrated their willingness to support researchers and research programs. They have actively supported all recent work on the biology of *P. mucosus* (Boeadi 1995; Boeadi *et al.* 1998a,b; LIPI 1994; Mumpuni *et al.* 2002; Sugardjito *et al.* 1998) and other snakes and lizards [e.g. *P. curtus*, *P. brongersmai*, *Naja sputatrix, Acrochordus javanicus, V. salvator* (Abel 1998; Auliya 2000a, 2000b; Auliya and Abel 2000a,b; Auliya *et al.* 2002; Boeadi *et al.* 1998b; Erdelen 1998a,b; Iskander 1998; Mumpuni *et al.* 2002; Riquier 1998; Shine *et al.* 1995, 1996, 1998a,b,c,d,e, 1999a,b; Sugardjito *et al.* 1998; Webb *et al.* 1994, 1996; Webb and Vardon 1998)] subject to harvest. These studies have generated considerable new biological data on these and species, and are contributing to our understanding of how these wild populations sustain harvests.

In addition, the industry has provided financial support for conservation programs with species that are not of commercial interest (e.g. false gharial, *Tomistoma schlegelii*), and other species in trade (e.g. Kusrini 2002). They recognise that conservation and sustainable use must be viewed together (Webb and Vardon 1995).

Conclusions

Indonesia's national policy of conservation of its natural resources includes the principle of sustainable use (Siswomartono 1998), to ensure that renewable resources are used as building blocks for development for the benefit of Indonesian people. This is totally consistent with the goals of most international conservation agreements and treaties.

The absence of a legal harvest has restricted efforts to monitor the population of *P. mucosus* through harvest statistics (e.g. catch per unit effort, mean size, sex ratio, reproductive status) to a much smaller domestic market. Data compiled to date suggest sustainability of harvesting.

Re-establishment of a legal harvest, coupled with ongoing monitoring, can only improve management, and allow the impact of uncontrolled harvesting for illegal trade to be properly assessed over the next few years.

Resumption on legal trade will allow the harvest to be transparent, and allow monitoring of the extent of trade and the impact of the harvest on the population of *P. mucosus*. Harvest data remains the most appropriate way to monitor *P. mucosus*.

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