



NDF WORKSHOP CASE STUDIES
WG 7 – Reptiles and Amphibians
CASE STUDY 4

Ptyas mucosus

Country – **INDONESIA**

Original language – English

CASE STUDY ON *PTYAS MUCOSUS* – A PROPOSED NDF METHOD FOR INDONESIA (JAVA)

AUTHOR:
TRAFFIC

This case study has been prepared by TRAFFIC and is based on a study funded by the CITES Secretariat and carried out by the IUCN Species Programme - Species Trade and Use Unit and TRAFFIC Southeast Asia. Information was collected from harvesters and those involved in sale of the species, which supplements information from previous studies on the species.

I. BACKGROUND INFORMATION ON THE TAXA

1. BIOLOGICAL DATA

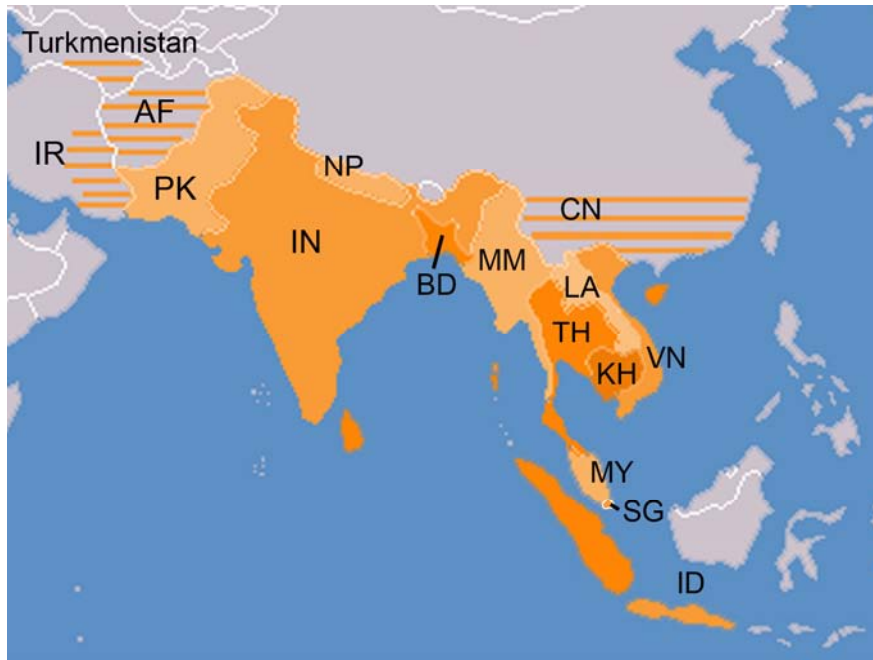
1.1. Scientific and common names

Oriental Rat Snake *Ptyas mucosus* (listed in the CITES Appendices as *Ptyas mucosus* but recent comments by David and Das (2004) highlighted the fact that the gender of the genus *Ptyas* is feminine while the name *mucosus* is masculine. In accordance with the International Code of Zoological Nomenclature (ICZN) the species name should be corrected to *Ptyas mucosa*).

1.2. Distribution

The Oriental Rat Snake has an extensive geographical distribution in Asia. From west to east, it occurs in Iran, Turkmenistan, Afghanistan, Pakistan, India (incl. Andaman Isl.), Sri Lanka, Nepal, Bangladesh, Myanmar, China (incl. Hainan and Hong Kong), Thailand, Lao PDR, Cambodia, Viet Nam, Malaysia, Singapore and Indonesia (Manthey and Grossmann, 1997). See figure 1. All range states except Turkmenistan are Parties to CITES.

Figure 1: Geographical distribution of the Oriental Rat Snake.



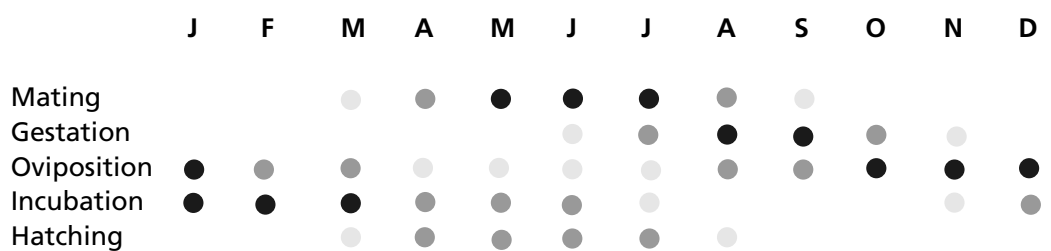
1.3. Biological characteristics:

1.3.1. General biological and life history characteristics of the species

The Oriental Rat Snake is a medium-sized, active, non-venomous, diurnal snake associated with open habitats including agricultural systems; much of the diet consists of commensal rodents and amphibians. The species has a wide distribution through much of Asia, from Iran to China and Southeast Asia.

- Medium sized 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 and greater body mass than females of the same length
- Reaches maturity at ~ 9 months ~120 cm for females
- Clutch size average 13
- May lay 2 clutches per year.
- Widespread generalist – thrives in human modified environment
- Unknown density and population trends
- No major threats known.

Figure 2: Reproduction cycle of the Oriental Rat Snake in Central and East Java. The emphasis of the reproductive behavioural traits is marked where each colour is brightest.



1.3.2. Habitat types

Oriental Rat Snakes are predominantly terrestrial and diurnal and occur in a variety of agro-ecosystems (Manthey and Grossmann, 1997). In general, the species is found in open terrain adjacent to forested areas. Arboreal behaviour is believed to be largely associated with resting.

Parts of the range of the Oriental Rat Snake overlaps with the Indo-Chinese Rat Snake (*Ptyas korros*) and where they overlap both species may share the same habitat. Both species search paddy fields for prey and hide beneath dense vegetation along river banks (van Hoesel, 1959). However, the Indo-Chinese Rat Snake is more closely associated with habitats along water courses than the Oriental Rat Snake (Herklots, 1934).

The Oriental Rat Snake is not strongly associated with wetland habitats. In the wet season, the species shifts to drier areas that do not flood. Traders in the southern part of Central Java stated that the species utilizes dry rocky and shrubby habitat in open landscapes. Traders from northern Central Java reported that the species is found in stony and shrubby habitat systems (with black soil), and according to other traders it occurs in dry rice fields, plantations and bamboo.

1.3.3. Role of the species in its ecosystem

This species is a predator of rodents and amphibians, and also to a lesser extent lizards and insects. Rodents are reportedly the favoured food but a recent study showed that amphibians (Bufonidae and Ranidae) were the predominant prey of Oriental Rat Snake populations surveyed in Central Java (Sidik, 2006). The same study revealed that in addition to amphibians and rodents, lizards, birds and even insects were also consumed. Of the 85 specimens examined, the alimentary tracts 65 contained prey items. In another study 71% of alimentary tracts contained the remains of frogs, and 14% mammalian fur, presumed to be that of rats (Boedi *et al.*, 1998). Juveniles prey on

frogs and smaller reptiles, and shift to mammalian prey as they grow larger (Lim and Lee Tat-Mong, 1989).

1.4. Population:

1.4.1. Global Population size

No quantitative population information is available for the species globally. No IUCN Red List assessment has been carried out for this species.

1.4.2. Current global population trends

increasing possibly decreasing stable unknown

1.5. Conservation status

1.5.1. Global conservation status (according to IUCN Red List)

Not assessed

1.5.2. National conservation status for the case study country

Little is known about the population status of the species in Java or other Indonesian islands. No quantitative data on the change in Oriental Rat Snake populations in Java appear to be available, nor any evidence of population increase during the period of the trade suspension recommended by the CITES Standing Committee between 1993 and 2005 (see Section 2.1.1), possibly in part because significant collection for illegal export continued.

According to CITES SC53 Inf Doc. 3, Sustainability of Rat Snake (*Ptyas mucosus*) Harvests in Indonesia: A Discussion of Issues, submitted to the CITES Standing Committee by the CITES Management Authority of Indonesia for review to consider the lifting of the trade suspension, harvesting has largely been restricted to Java, and there was no evidence to suggest that its abundance has been reduced significantly, with snakes still being readily caught by villagers.

However differing opinions were expressed during this study; some traders considered that the species is now less common than in the recent past, whereas others claimed that the Oriental Rat Snake is just as common now as in previous years. One trader said he had been unable to purchase any Oriental Rat Snakes since the beginning of 2007, as none was available in the market due to a decline of the species in the wild. One trader in southern central Java, who has been an active snake trader for around 30 years, stated that he could previously buy 300 specimens/day in the main harvesting area, but presently only buys about 25 specimens/day from within a 10km radius; he attributes

this decline to the increase of snake harvesters in the region. According to eight small-scale harvesters and collectors, who have been active between seven and 35 years, the local abundance of Oriental Rat Snakes, particularly in Central Java, has decreased noticeably. In contrast, five collectors reported that the species is still common in “in the wild” owing to a good market price, remarking that “when the price is good, there are many snakes”.

1.5.3. *Main threats within the case study country*

- No Threats
- Habitat Loss/Degradation (human induced)
- Invasive alien species (directly affecting the species)
- Harvesting [hunting/gathering]
- Accidental mortality (e.g. Bycatch)
- Persecution (e.g. Pest control)
- Pollution (affecting habitat and/or species)
- Other _____
- Unknown

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED.

(Indonesia, specifically Java)

2.1. Management measures

2.1.1. *Management history*

- 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
- In January 1990, *P. mucosus* was listed in Appendix II of CITES.
- Annual exports of *P. mucosus* from Indonesia declined from around 1.8 million skins in 1986, to around 581,000 in 1989.
- In March 1992, the CITES “Review of Significant Trade” reported that the collection for trade was the major suspected cause of decline in some populations of *P. mucosus* (globally), although given the lack of comprehensive data, particularly from Indonesia, there was no way of ascertaining if current levels of trade were having a substantial impact (WCMC and IUCN/SSC Trade Specialist Group, 1992). The Indonesian CITES Management Authority was requested by the CITES Animals Committee 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.

- In November 1992, the Indonesian CITES Management Authority was advised by the CITES Secretariat that the information received was not sufficient, and additional information was requested
- 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 recommendations of the CITES Animals Committee had been implemented (CITES Notification 775).
- The suspension of imports from Indonesia was withdrawn at SC53 (2005) after the Secretariat and Standing Committee were satisfied with the control measures proposed by the CITES Management Authority in SC53 Inf3.

2.1.2. *Purpose of the management plan in place*

No formal management plan is in place other than setting of export quotas and imposing a ceiling on exploitation.

2.1.3. *General elements of the management plan*

No formal management plan is in place other than setting of export quotas. Quotas are allocated between West Central and East Java (see Table 1).

2.1.4. *Restoration or alleviation measures*

None reported in detail; the Indonesian CITES Management Authority indicated in 1993 that increasing amounts of habitat were being made available to *P. mucosus* through regional development.

2.2. Monitoring system

2.2.1. *Methods used to monitor harvest*

Numbers of specimens exported.

2.2.2. *Confidence in the use of monitoring*

Little confidence in export permits issued as a measure of total harvest pressure as any illegal trade is not captured. The extent of illegal trade is not known.

2.3. Legal framework and law enforcement

Listed in Appendix II in January 1990.

Under Indonesian legislation, trade of all nationally non-protected species native to Indonesia, whether listed by CITES or not, is regulated by a harvest quota system. The 2007 annual quota for Oriental Rat Snake in Java was 500 specimens for the live animal trade, and 99,500 specimens for the skin trade, and for 2008 this was reduced to 89,500 skins and 450 live specimens. The annual quota represents the total number of animals which can be caught irrespective of whether these are exported or not (Nash 1993). Harvest quotas are set at the levels of district and province (see Table 1) and are based on requests submitted by the BKSDA. These quotas are established each year during the quota meeting attended by LIPI, PHKA, traders, non-government organizations and other stakeholders. Requests for annual quotas are usually forwarded by traders to regional BKSDA offices. Of the entire harvest quota, only approximately 10% may be used for domestic purposes. Animals are not allowed to be harvested for purposes other than what is stated in the annual quotas. Table 1 shows how the annual quota was allotted to the provinces/districts in Java in 2007.

Table 1: The regional quotas for the Oriental Rat Snake from Java for 2007.

	West Java (JaBar I)	West Java (JaBar II)	Central Java (JaTeng)	East Java (JaTim I)	East Java (JaTim II)
Skins	5,000	5,000	40,500	24,000	25,000
Pets	100	100	100	100	100

The harvest or capture and distribution of wild plant and animal specimens in Indonesia can only be done under a licence, issued by Directorate General of Forest Protection and Nature Conservation (PHKA) (Decree of Ministry of Forestry No. 447/Kpts-11/2003, revised from Decree of the Ministry of Forestry No. 62/Kpts-II/1998). The legal transport of protected or non-protected species within Indonesia is permitted according to Article 42, Chapter X of the Regulations of the Government of the Republic of Indonesia No. 8, 1999. Harvesters and collectors must be registered by the provincial Natural Resources Conservation Agency (Balai Konservasi Sumber Daya Alam, BKSDA) offices, who report the annual volumes harvested to PHKA. All exporters are registered with PHKA and must be members of the Indonesian Reptile and Amphibian Trade Association (IRATA) if they are to be allotted an annual quota and permission to export. *No list of registered harvesters, collectors and exporters was available to the researcher at the time of the study.*

Although appropriate national legislation to control the trade in Indonesian wildlife is in place, it appears that this legislation is not being effectively enforced. There was a lack of knowledge of quotas at the harvester and trader level, suggesting that setting of quotas has little influence on the quantity of specimens harvested.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED

3.1. Type of use (origin) and destinations (purposes)

Wild harvest for legal trade in skins and illegal meat and gall bladder trade, which may be partially a by-product of the skin trade. The main markets for skins are Europe, Singapore Hong Kong and Taiwan PoC. Singapore is also a re-exporter of skins and processed skins e.g. leather products, handbags, wallets, pairs of shoes etc to various destinations. China is believed to be the main market for snake meat (Saputra, 2008).

3.2. Harvest:

3.2.1. Harvesting regime

All specimens in trade from Indonesia are wild-caught. Snakes are either captured by experienced harvesters or opportunistically by seasonal rice farmers. Snake capture is secondary to farming activities and appears to be carried out in an ad hoc manner. Probably in no case does harvest of this species provide full time annual employment. In very rare cases, Oriental Rat Snakes are killed for local consumption, or simply out of fear.

Skins are to be exported allowed under quotas as are a small amount of live specimens for the pet trade, although there seems to be little demand for the latter and the quota has generally not been met. Currently there is no export quota for dead specimens or meat, but it appears that there has been substantial demand for and illegal export of meat, which started during the ban on skin export and apparently continues (Saputra, 2007/8).

Adult snakes are harvested for their skins. One trader said that smaller specimens are traded as the non-CITES listed lookalike species *Ptyas korros* (Saputra, 2008).

REPORTED HARVEST SEASONS

The Oriental Rat Snake is most commonly encountered during the wet season and capture rates are highest during this period. According to several traders, activity levels increase with the onset of the wet sea-

son (the first heavy rains after the dry season). In East Java the wet season typically occurs between December and April, and in Central Java between October and December and February to April, depending on the geographical location. Other traders also reported that the species is common in the field in the transition from the wet to the dry season (May and June). Higher activity levels in snakes were reported either when rainy days change to bright days or on cloudy days after several bright and hot days. Traders said that during the dry season (May to August) the species is extremely scarce, and another collector estimated that the capture of the Oriental Rat Snake decreases by 50-60% in the dry season. During the dry season the people work in the rice fields so that less manpower is available to capture snakes during the rice harvest, and so the study species is less common in trade during the dry season. Farmers harvest out of the crop growing season – mainly November to January. The number of snakes caught by dedicated harvesters vs farmers is not known.

3.2.2. *Harvest management/ control* (quotas, seasons, permits, etc.)

See section 2.3 above for quota information.

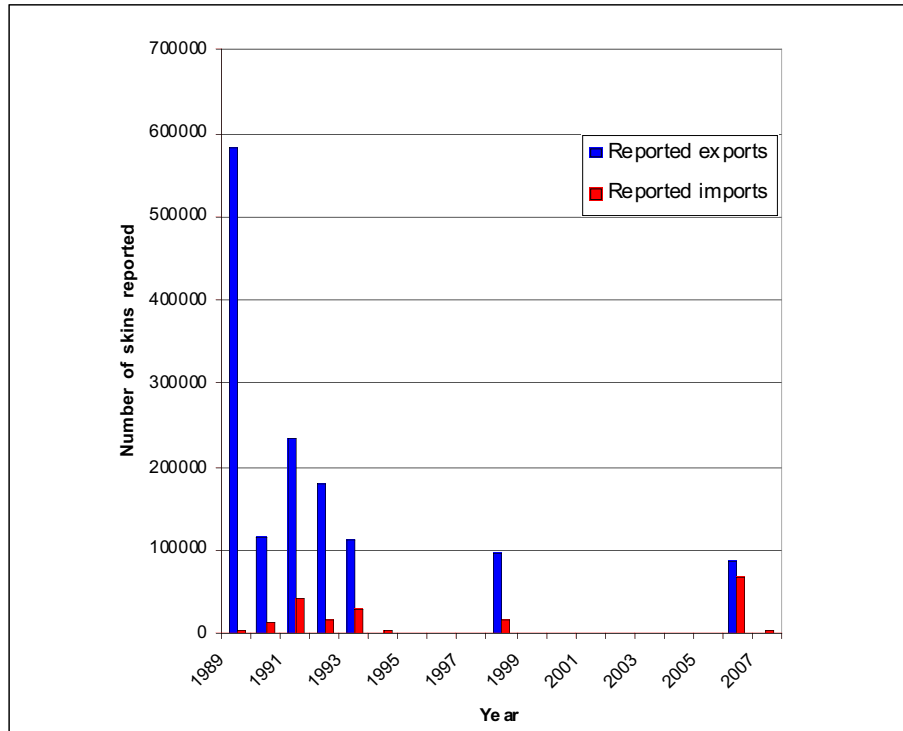
All harvesters and collectors must be registered by the regional BKSDA offices and require a license issued by PHKA. However, the study shows that most harvesters collect rat snakes and other reptiles as a side business and hence do not possess a license. One major trader who illegally exports frozen meat of Oriental Rat Snakes stated that LIPI gives a low quota for many species even though Indonesia has so many species; such statements indicates lack of understanding of the potential impact of trade and of the need to manage use and trade to ensure sustainability.

3.3. **Legal and illegal trade levels**

Commercial harvesting of *P. mucosus* began in the late 1970s.

Reported legal trade according to the CITES trade database is summarised in figure 2. Most trade from Indonesia has been in skins. According to Indonesian regulations skins must be tanned before export.

Figure 2: CITES reported imports and exports of *Ptyas mucosus* skins from Indonesia (1989 – 2007). Leather products and small numbers of live individuals have been omitted from this graph. Reports for 2007 were not complete at the time this graph was produced.



ILLEGAL TRADE

Southeast Asian snake species are commonly found in Chinese food markets, and the cross-border trade of wildlife in general is currently on a dramatic scale (Lee et al., 2004). During winter the level of snake meat consumption in China increases as many consumers believe it to have a warming effect. The demand in China for snake meat exceeds local supply during the cold season, and so additional sources of snakes, including Oriental Rat Snakes are required. Indonesia is one of the major sources supplying the demand from China for Oriental Rat Snakes and other species (Saputra, 2008).

According to Saputra (2008), the 12 year suspension of trade in skins from Indonesian populations of the Oriental Rat Snake triggered the illegal export of meat with some other traders claiming that during this time skins were stockpiled. He estimated that 50,000 to 100,000 snakes were exported annually, the equivalent of 30 to 60 tons or tonnes of meat per year and about 50,000 to 100,000 gall bladders. According to traders interviewed, illegal export of meat and gall

bladders has continued since the ban on skin and live specimens was lifted. It is believed that those involved in the meat trade may declare smaller specimens of the Oriental Rat Snake as the Indo-Chinese Rat Snake, a species not listed under CITES (Saputra, 2008); the frozen, coiled-up, skinned or whole specimens cannot be easily identified by the local authorities. As it is reported that some export of snakes is of whole (un-skinned specimens), the estimated annual volume of these illegal exports suggests that this is not solely a spin-off from the skin trade, but is a distinct branch of trade, which could have a significant impact on wild populations. Saputra (2007) stated that whole frozen snakes are sometimes declared as frozen fish.

II. NON-DETRIMENT FINDING PROCEDURE (NDFs)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFs?

yes no

During the study the elements of the IUCN checklist were considered and a risk assessment carried out using the list. These elements and the relative importance of these in making a non-detriment finding have been considered further in the proposed method.

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

Species biology & ecology (Species resilience)

- Medium sized snake
- Reaches maturity at ~ 9 months ~120 cm for females
- Clutch size average 13
- May lay 2 clutches per year.
- No correlation between body size and clutch size and frequency has been found.
- Widespread – probably most common in Central and East Java, areas with lower rainfall.
- Generalist – thrives in human modified environment
- Unknown density and population trends; further data is required.
- No major additional threats known.

Current conclusion: It is likely that due to its biology and ecology that the species has a fairly high resilience to harvesting.

MANAGING HARVEST

Ability to set correct quotas and adaptively manage harvest

- No quantitative data are available for domestic demand therefore the total offtake is unknown, although domestic demand is believed to be low. Quotas currently allow for 10% of quota as domestic use.
- Export quotas could be set for all products in demand based on the harvest quota for number of specimens. It appears that the species is not in demand for the pet trade, therefore a live trade quota is not necessary.
- Size restrictions to ensure specimens have reached maturity and reproduced could be set for export (eg minimum 140 cm total snake length). Snake skins are stretched when drying and would not be a reliable measure of snake length or maturity.
- Seasonal restrictions are not appropriate as there may be two breeding seasons and harvest takes place around agricultural activities.
- Due to lack of reliable population estimates it is essential that any harvest or export quota systems is adaptively managed based on monitoring of the species and harvest.

Conditions of harvest and ability to change these

- Widespread harvest in natural and agricultural habitat,
- Some harvesting is done by dedicated harvesters and some harvesting is done by farmers
- Farmers harvest out of crop growing season – mainly November to January. Snake capture is secondary to farming activities and appears to be carried out in an ad hoc manner.
- Dedicated snake harvesters mainly harvest the Oriental Rat Snake during the wet season when snakes are most commonly encountered.
- Cost of harvesting – low but may be increasing as there is some evidence catch per unit effort (CPUE) is decreasing. Very low for ad hoc harvesting by farm workers
- Species is effectively an open-access resource.
- Little is known on the areas subject to harvest and intensity of harvest in different areas. Intensity of collection in different areas should be mapped and monitored to show shifting patterns in harvesting, which could indicate localised depletion.

Capacity to control harvest/ trade

- Widespread harvesting in natural habitat and farmland makes it almost impossible to enforce harvesting restrictions; establishing a harvest permit system (see SC53 Inf3) would be unlikely to be effective.

- Not all products in demand are legally exported and there seems to be no effective control measure in place to combat this. There are allegations that illegal meat trade was substantial during the trade ban on skins. This is believed to have continued and currently levels of illegal international trade in meat are thought to be high. Enforcement is hampered by inability to easily distinguish meat of small *P. mucosus* from *P. korros*. Results of this study suggest that illegal trade may result in some additional harvest of the snakes rather than as a by-product of the skin trade. Some meat may be being traded as *P. korros*, which is not controlled under CITES. It is possible, although difficult, to differentiate between skins of the two species. Shipments of *P. korros* are of skinned, semi-skinned or whole specimens, usually frozen. The appearance of a skinned *P. mucosus* would be difficult to distinguish from a skinned *P. korros*. Increased enforcement is needed to reduce illegal trade.
- It appears that harvest quotas are currently not communicated through the trade chain so a reduction in export quota is unlikely to result in a reduction in harvesting. There is no evidence that there is implementation of a system of harvest permits issued by the Head of BKSDA and this is unlikely to be implementable given many of the harvesters are farmers.

Current conclusion: Currently insufficient data is available on distribution, population and harvest areas to be sure that a quota is set at a non-detrimental level; quotas should be set and adaptively managed based on field and harvest monitoring. Currently there is little knowledge about quotas at harvester and small scale collector level showing poor communication. Setting export or harvest quotas is unlikely to reduce harvest given the low cost and ad hoc nature of some harvesting (farmers) and apparent illegal trade. Without baseline and ongoing field monitoring data it would be extremely difficult to determine whether harvest is non-detrimental. However, such data would be time consuming and expensive to collect given the widespread nature of the species and differences in activity through the year. Domestic and illegal trade levels are currently unknown. If quotas were enforceable suggest revising (export quota was reduced by 10,000 for year 2008) until baseline monitoring has taken place.

MONITORING IMPACT

Species monitoring

- Ongoing field studies should be established in a sample of harvested and unharvested populations to monitor density changes through surveys for catch per unit effort (CPUE), sex ratio, size. To date there

are no reliable baselines from which to monitor change as data to date are from harvested specimens rather than field surveys:

- Density estimates – monitoring snake species through trapping or catching – may not give accurate measures, however ongoing monitoring should identify changes. Continuing decline in density would indicate detrimental harvest and lack of recruitment.
- Catch per unit effort (CPUE) estimates from Sugardjito *et al.* (1998) are for harvesters and there is no indication as to whether this represents all snakes encountered or only harvested snakes, which may have been a sub-set of the former if specimens were taken selectively. Decreasing CPUE would indicate harvest is likely to be detrimental.
- Size estimates from Sugardjito *et al.* (1998), Boeadi (2007) and this study are from different times of the year. Declining average size in the wild could be one possible indication of unsustainable harvest. Particular attention should be paid to proportion of individuals above the size of maturity and to identify problems with recruitment.
- Sex ratio changes at sites from a baseline and for times of year (so far according to Kopstein (1938) hatching ratio (m: f) = 1: 1.7 but capture ratio 1:1.4 which may be a result of differences in sex survival naturally or preference for capture of (larger) males. Further information on natural sex ratio and reproductive success/ recruitment under altered conditions of altered sex ratio would be beneficial in adaptively managing the harvest.

HARVEST MONITORING

- Harvest monitoring - a year's baseline should be established from which to monitor change for each of the following measures ensuring regular and standard monitoring systems are in place:
 - Catch per unit effort for harvesters (difficult for casual harvesters e.g. farmers). Continuing decline would indicate that the population was reducing.
 - Sex ratio changes (so far according to Kopstein (1938) hatching ratio = 1: 1.7 in captivity but wild captures 1:1.4, Sugurdjito *et al.* (1998) found sex ratio of harvested specimens 1: 0.6, which may reflect harvesters preferentially harvesting males, which are on average larger). An increase in female to male ratio might indicate a reduction in average male size and reduction in differentiation between size of females and males. However, caution should be taken when comparing sex ratios for different times of year as it is likely that there are differences in activity levels for each sex through the year.

- Size differences should be compared by sex against monthly averages. *Ptyas mucosus* growth is rapid
- Size should be well above size of mature females i.e. above 120 cm (the size at which females first reproduce according to traders interviewed). As a precaution a minimum total length could be set at 140 cm (although according to Kopstein (1938) this would still represent immature specimens). Ongoing reduction in size of harvested specimens would indicate that the population was reducing.
- Harvesting area and pressure should be mapped in order to monitor shifting patterns in exploitation which could indicate localise depletion.

Current conclusion: According to this study the average size for both male and female (ratio unknown) = 189.51 cm (n= 60) and therefore likely to be above the age of maturity according to trader's knowledge and Kopstein's estimations. If this measure was based on a much larger sample of harvested specimens from a representative sample of traders (including illegal traders) it could be concluded that offtake currently allows individuals to grow to maturity and to reproduce before harvest takes place. However given that legal export is in the order of a hundred thousand specimens and there is thought to be considerable illegal harvest and export a much larger sample would be necessary to determine non-detriment with any confidence. A much more representative sample along with additional information on CPUE would be necessary to make this finding with any confidence. Although sampling would not monitor the illegally traded specimens, sampling of size and CPUE (including harvesting area changes) should demonstrate declining population if this is the case.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

Field monitoring and harvest monitoring would be essential for making a non-detriment finding and for adaptive management of harvest of the species. See Section 2 for data to be collected through species and harvest monitoring.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

Currently there is insufficient data or data collection to set robust quotas, monitor harvest or impact of harvest on the wild population. Because of the apparently large illegal trade in the species, monitoring legal harvest and use of proxy indicators such as changes in average size of harvested specimens might mask any unsustainable harvesting

practices by illegal traders, although average size in conjunction with CPUE would give a better indication of sustainability of harvesting.

Data necessary to make a robust non-detriment finding would be time consuming and expensive but there is potential to involve Indonesian higher degree students working in collaboration with overseas students on long-term studies of biology and population.

Given the difficulties in setting and enforcing quotas, management needs to be adaptive and the impact of harvest through monitoring field populations, harvesting patterns and harvested individuals should guide future management and quota setting.

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

The lack of data available on the species and current/ past population make it difficult to assess impact of harvest in the past and to assess impact in the future. Harvest areas are poorly known.

The above proposed method of making a non-detriment finding for *Ptyas mucosus* has focused on Java, the main, or possibly only, exporting island of Indonesia. It is likely, although surveys would be necessary to confirm this, that the species occurs on other islands. In effect therefore a large proportion of the species' range in Indonesia is not subject to harvest, although these areas cannot without human intervention act as a source if Java were to be acting as a sink.

6. RECOMMENDATIONS

- Studies of the species' biology should be carried out throughout the year. Further investigation of reproductive size and reproductive status of harvested specimens would help in confirming the age of maturity to ensure that any minimum catch size is appropriate.
- Meat and gall bladder quotas could be set to the equivalent (or less for precaution) of the number of skins allowed for harvest with no additional capture. This may also increase the value to the harvester. Alternatively harvest quota for specimens could be set with no stipulations on export products.
- Increased enforcement is needed to reduce illegal trade.
- Field and harvest monitoring should be established including mapping of harvest pressure. IRATA has suggested that obtaining sound biological and monitoring data may be enabled through international cooperation, possibly with Indonesian higher degree students working in collaboration with overseas students on long-term studies.
- Consider; listing *P. korros* as a lookalike species to aid the control of the meat trade, legalising the meat trade, and trade in gall bladders

as a by-products of the skin trade. Quotas equivalent of lower than the skin trade could be set. Minimum size (length for skins and weight for meat) could be set, if there was capacity to enforce these.

CONCLUSIONS

The Indonesia Management Authority (in SC53 Inf 3) proposed a thorough method to assess harvesting and adaptively manage export quotas and harvesting in order to ensure that *Ptyas mucosus* export is not detrimental to the species on Java. In reality the harvesting and trade chain may not be conducive to the approach of export/ trade quota setting to control the harvest; the present system for allocation of quotas does not seem to be resulting in any harvest control with little knowledge of quotas at the field level. It seems that enforcement of harvest quotas and prevention of illegal trade is currently not working and may be very difficult to manage. However, the species is likely to be fairly resilient and therefore despite high levels of illegal trade it is feasible that the current level of harvesting is not detrimental to the species, although only further research can confirm whether current exploitation levels are sustainable or not. From the limited survey of snake length it would seem that snakes are harvested at sizes well after females mature. However this could be a result of harvesters travelling further to collect larger sized snakes having over-harvested in areas more easily accessible; this could be ascertained through a better understanding of collection pressure, the spatial location of collection areas, and the timing of collection. Monitoring of changes in these is necessary in conjunction with monitoring of harvested specimens.

This study has shown that monitoring (field and harvest) would be crucial in adaptively managing the species' harvest and in allowing a determination that harvest was not detrimental. Much information has come from collectors and traders and a strong collaboration with them should help facilitate monitoring as could collaboration with universities.

The above proposed method of making a non-detriment finding for *Ptyas mucosus* has focused on Java, the main, or possibly only, exporting island of Indonesia. The species occurs on other Indonesian islands, including Sumatra and Sulawesi. However, as the harvest quota is established and split between regions of Java, in effect a large proportion of the species' range in Indonesia presumably not subject to harvest, although these areas cannot, without human intervention, act as a source if Java were to be acting as a sink.

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