PART IV
Guidelines to assist the Parties in making non-detriment findings

Chapter 5

5.1 CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports

Introduction

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a conservation tool of major importance, numbering some 158 signatories. It aims to protect species from the detrimental effects of over-exploitation for international trade, to ensure sustainable utilization of others, and to encourage international cooperation between signatory Parties in achieving this aim. The Convention has three appendices that provide different levels of regulation for the species listed in each. The Convention is administered at the national level by Management and Scientific Authorities.

Determining when international trade (of an individual shipment or on an annual basis) is likely to prove non-detrimental to the survival of species is essential to achieving the aims of CITES. If species become threatened with extinction as a result of use that is incompatible with their survival, Parties to CITES face the prospect of including more species in Appendix I. Indeed, every transfer of a species from Appendix II to Appendix I as a result of a lack of appropriate regulation of trade, particularly from a scientific perspective, can be considered as a failure of the Parties to fulfil their obligations under the Convention. Clearly, action is needed to improve the situation and to assist Scientific Authorities in making non-detriment findings.

An operational definition of non-detriment

Recognising the difficulties that some Scientific Authorities have in making non-detriment findings, the elements of an operational definition can be identified by examining the relevant paragraphs of Article IV of the Convention.

These paragraphs of Article IV require the Scientific Authority to determine that proposed exports will not be detrimental to the survival of species. Furthermore, once exports are underway, the Scientific Authority must monitor the actual levels of export to ensure that the species is maintained throughout its range at a level consistent with its role in the ecosystem and well above the level at which the species might become eligible for inclusion in Appendix I. In practice, the Scientific Authority must consider total national harvest levels for both new and on-going exports to make a non-detriment finding. Hence, export for international trade is not detrimental when it is part of a harvest, the sum of which is sustainable, in that it does not result in unplanned range reduction, or long-term population decline, or otherwise change the population in a way that might be expected to lead to the species being eligible for inclusion in Appendix I.

CITES Article IV, paragraph 2
The export of any specimen of a species included in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

Article IV, paragraph 2.a)
A Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species.

Article IV, paragraph 3
A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.

Adaptive management based on adequate monitoring and appropriate feedback is vital to ensure the sustainability of wildlife harvest. Current problems with making non-detriment findings result mainly from lack of capacity and of resources to implement monitoring schemes across the wide range of species in international commercial trade. More attention should be given to developing and promoting cost-effective and pragmatic methods of resource monitoring, and in providing Scientific Authorities with the skills and means to make these determinations. In many cases such monitoring schemes need not be complex nor too resource intensive. For example, monitoring can be carried out by wildlife personnel or community scouts while undertaking anti-poaching patrols. Information that should be considered for monitoring purposes includes: population size; distribution/range; population trends; management plans and protection of the populations from over-harvest. Monitoring of the harvest levels and trade patterns, as well as of population data, will allow establishment of the feedback loop necessary for adaptive management.

Assisting Scientific Authorities in making non-detriment findings – development of a checklist

A checklist of information to be monitored has been designed to help build the capacity of Scientific Authorities in advising whether exports of Appendix II-listed taxa are not detrimental to the species' survival. This checklist also allows Scientific Authorities to compare their findings with those of other countries for similar species or similar commodities in trade. Qualitative data categories have been used purposefully at this initial stage for two reasons. Firstly, because great difficulties have been met in developing hard criteria for sustainable use across large numbers of taxa and in diverse ecosystems (Allen and Edwards 1995). Secondly, with the wide range of species in international trade, it is very difficult to extrapolate quantitative data from those few species where harvesting has been studied. Unanswered questions in the checklist will serve to highlight areas where management schemes or information collection might be improved.

Furthermore, the checklist does not aim to be long or intimidating, although it may appear so at first reading. Initial testing of the checklist using species for which sufficient information was available shows that it can be completed quite quickly. However, a more concise format may be developed once the checklist has been fully tested through wide use. The relevance of some of the management questions will vary from region to region and from country to country. Furthermore, the checklist should be viewed as an early stage in an evolving process that will witness the increasing adoption of management schemes and of improvements in information collection. As the process for making non-detriment findings becomes more established, there should be merit in developing more quantitative categories tailored to particular species groups and derived from case studies in range States.

The Checklist

Introduction

The checklist comprises two tables that should be followed for each species in Appendix II that is the subject of export as a result of removal of specimens from the wild. The tables and text for plants and animals have been developed together to ensure that the format and contents are as standardized as possible for both major kingdoms. However, for some parts it was necessary to develop different text parts, but the tables have a similar underlying logic, so the similarity should reduce possible confusion for those Parties where a single individual may have to deal with both plant and animal issues.

Explanation of the tables on harvest characteristics

Tables 1. Animals (1A) and 1. Plants (1P) encourage Scientific Authority staff to make an initial review, at the national level, of the likely effects of harvesting the target species. Information is sought on the types of harvest, the degree of control over the harvest, the segment of the population harvested, the level of total harvest (for domestic and international use), the reason for the harvest, and the end users of the harvest. Scientific Authorities need to distinguish between regulated and illegal or unmanaged harvesting. Consideration of these data will begin or further assist the process of consultation between Scientific and Management Authorities. In the case of some types of harvest, it will also allow the Scientific Authority to advise quickly that harvest is not detrimental to survival.

Table 2 encourages Scientific Authorities to review in more depth more general biological and management information for those species where Table 1 has raised concerns. Information is also sought on management history and planning, harvest management, status of land on which harvesting takes place, capacity for monitoring the harvest, benefits and risks of harvest, levels of strict protection, and the relationship between ranched and captive-bred specimens to those that are wild caught.

The tables have been designed to allow use of easy qualitative checks that permit a basic assessment of the

confidence with which a non-detriment finding may be made by Scientific Authorities. Those regulated harvesting regimes where products are removed without killing the species, or where ranching occurs, are removed from further consideration, once Tables 1A and 1P have been completed. For all other harvesting regimes, Table 2 should also be completed. In the completion of Table 2, it should be noted that a high degree of uncertainty should lead a Scientific Authority to conclude that insufficient information exists on which to base a finding of non-detriment. In such a case most Parties should choose not to allow commercial trade until information quality is improved.

Table 1. Animals

The explanation for this table is arranged according to the respective columns. For each species under consideration, each type of harvesting (1.1 to 1.6) to which the national population of that species is subject should be checked, and there may be several options available. For example, wool may be shorn from live vicuñas in a well-regulated harvest, while poachers may kill vicuña for their wool and meat in an unmanaged harvest. Shading indicates where a box cannot be checked. For example, ranching does not allow for collection of adults or non-selective harvest.

Type of harvest
The types of harvest when regulated, are arranged according to their levels of impact on the wild population.

1.1 Captive breeding: this row should be used to record the numbers of specimens that are derived from captive breeding operations for export. Animals removed from the wild population for establishment or augmentation of captive breeding operations are effectively lost from the wild population, and so their numbers should be recorded under 1.5, for live capture.

1.2 Non-lethal harvesting for parts/products: this row refers to the collection of parts and derivatives that does not require the death of the individual animal. For example, this might include the live shearing of vicuña wool or the collection of down from eider ducks (this species is not included in the appendices). The main type of product derived from the harvest should be identified. Collection of eggs does NOT fall in this category; see 1.3.

1.3 Ranching: this row refers to the removal of eggs or live young for rearing in captivity, based on the premise that survival will be enhanced compared with the wild when this stage of the life history is being collected. Consequently, this surplus production can be harvested without detriment to the long-term survival of the population. This includes both ranching of Appendix II species where any export quotas are set by the range State, as well as Appendix I species that are transferred to Appendix II pursuant to a quota approved by the Conference of the Parties. This does *not* include the rearing in captivity of adult or sub-adult individuals for later export, without any habitat benefit, or the holding in captivity of captured adult individuals pending eventual export. Such cases should be considered under 1.5, live capture.

1.4 Pest or problem animal control: this row refers to specimens removed under a government-based policy of pest control. These specimens are included in trade because they would in any case be destroyed to protect human life or crops, and any potential products can be used to provide incentives to promote conservation purposes.

1.5 Live capture and **1.6 Killing of the individual:** these rows refer to removal of the live specimen from the wild population, through collection, hunting, trapping, or fishing, and may include lethally wounded, disregarded, by-catch, or incidental deaths as a result of land clearance, that do not ultimately reach international trade. Different types of collection, hunting, trapping, or fishing target different segments of the population. The main type of product derived from killing should be identified under row 1.6.

Table 1. Animals. Summary of harvest regime for animal species (or population of an animal species)

Species: . . . . . Country (if applicable State or Province): . . . . . .

Date (of making non-detriment finding):. . . . . Period to be covered by finding: . . . . . .

Name:. . . . . Position in Scientific Authority: . . . . . .

Is the species endemic, found in a few countries only, or widespread? . . . . . .

Conservation status of the species (if known): IUCN Global status: . . . . . National status: . . . . . .

Other: . . . . . .

Type of harvest	Main product	Degree of control	Demographic segment removed from wild population					Relative level of harvest (include actual number or quantity if known)				Reason for harvest			Commercial destination(s) (numbers and percentages if known)		
			Eggs	Juvs.	Adult males	Adult females	Non-selective	Low	Medium	High	Unknown	Sub-sistence	Com-mercial	Others	Local	National	International
1.1 Captive breeding		a) Regulated															
		b) Illegal or unmanaged															
1.2 Non-lethal harvesting for parts/ products		a) Regulated															
		b) Illegal or unmanaged															
1.3 Removal for ranch-ing		a) Regulated															
		b) Illegal or unmanaged															
1.4 Pest or problem animal control		a) Regulated															
		b) Illegal or unmanaged															
1.5 Live capture		a) Regulated															
		b) Illegal or unmanaged															
1.6 Killing of individual		a) Regulated															
		b) Illegal or unmanaged															

Table 1. Plants

The explanation for this table is arranged according to the respective columns. For each species under consideration, each type of harvesting (1.1 to 1.6) to which the national population of that species is subject should be checked, and there may be several options available. In the case of bulbous plants, for example, *Galanthus* spp. may be harvested under a regulated and well managed programme, while illegal collection may be conducted by specialist collectors. Shading indicates where a box cannot be checked.

N.B. Relocated wild stocks: wild plants are collected and are replanted prior to export. For example in the case of bulbs, large quantities of wild collected bulbs are frequently "stored" on agricultural fields. At time of export the bulbs are harvested from these storage fields. The assessment by the Scientific Authority should be based on the primary removal from the wild.

Type of harvest
The types of harvest when regulated, are arranged according to their levels of impact on the wild population.

1.1 Artificial propagation: Before filling in Table 1. Plants, the Scientific Authority should assess whether the plants are artificially propagated or wild collected. In the case of artificial propagation the plants must fulfil the criteria laid out in Resolution Conf. 9.18 (Rev.), which includes the definition of artificial propagation.

1.2 Non-lethal harvesting of fruits/flowers/seeds/leaves: this row should be used to record the collection of parts and derivatives that does not require the death of the individual plant.

1.3 Non-lethal harvesting of bark/roots/wood: this row should be used to record the collection of bark/roots/wood without killing the individual plant. For example, selective removal of the bark of *Prunus africana* as part of a planned management programme will ensure survival of the tree in the wild.

1.4 Removal of whole plant: this row should be used to record instances where the whole plant is collected, and is thus removed from the wild population, or killed.

1.5 Removal of whole bulb: in the case of the collection of bulbs from the wild, e.g. *Sternbergia* spp., bulbs should be treated as whole plants; however, the removal of full grown specimens only may have a different impact than when all bulbs are removed.

1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood:

Wood: this row should be used to record the harvest of wood as timber, charcoal, woodchips etc., where the plant does not survive this type of harvest.

Bark: destructive removal of the complete bark or cutting down of the tree will result in the death of the tree (e.g. *Prunus africana*).

Roots: collection of the whole root systems or significant parts of the root for medicinal use etc. almost always results in death of the plant (e.g. *Panax quinquefolius*).

Seeds: collection of seeds from, for example, certain cacti where the top of the plant is chopped off is likely to result in the death of the plant.

Table 1. Plants. Summary of harvest regime for plant species

Species: . . . . . Country (if applicable state or province): . . . . .

Date (of making non-detriment finding): . . . . . Period to be covered by finding: . . . . .

Name: . . . . . Position in Scientific Authority: . . . . .

Is the species endemic, found in a few countries only, or widespread? . . . . .

Conservation status of the species (if known): IUCN Global status: . . . . . National status: . . . . .

Other: . . . . .

Type of harvest	Main product	Degree of control	Demographic segment of population harvested			Relative level of harvest (include number or quantity if known)				Reason for harvest and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	Unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation		a) Regulated													
		b) Illegal or unmanaged													
1.2 Non-lethal harvesting of fruits/ flowers/seeds/leaves		a) Regulated													
		b) Illegal or unmanaged													
1.3 Non-lethal harvesting of bark/roots/wood		a) Regulated													
		b) Illegal or unmanaged													
1.4 Removal of whole plant		a) Regulated													
		b) Illegal or unmanaged													
1.5 Removal of whole bulb		a) Regulated													
		b) Illegal or unmanaged													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood		a) Regulated													
		b) Illegal or unmanaged													

Table 1 – Animals and plants

Degree of control: This column has two options:

a) Regulated: refers to a sanctioned (government-approved or otherwise official) harvest that is under the full control of the manager, set against scientifically-based quotas, with appropriate apportionment of the harvest to different end users.

b) Illegal or unmanaged: refers to a harvest that the manager does not have full control over, and where the harvest is apportioned to different end users by the harvester. Although illegal and unmanaged harvests differ in terms of their legal sanction, they can have the same effect on the wild population, and share the common property of not being supported by a formal system of data collection. Hence, a harvest may be legally sanctioned, but unmanaged. There are also cases where a harvest takes place without any framework of local or national legislation or regulations, and such harvests should also be considered as unmanaged.

Regulated and illegal harvests of the same or different types often occur at the same time within one population. Hence for many species, information on type(s) of harvest may include checks in two or more rows and sub-rows (e.g. *Prunus africana*, where there may be both a regulated bark harvest from live trees (1.1.4) and an illegal harvest for bark or wood that results in death of the tree (1.1.6).

Demographic segment removed from population: This column refers to the segment of the population that is harvested. The impact of the harvest on the overall population structure will depend on the life history stage that is targeted.

Animals. Natural mortality tends to be highest for eggs and/or for neonates and juveniles. Hence, a harvest of eggs, neonates or juveniles managed for ranching will have less impact on the population than the removal of reproductively-active animals. In general, a harvest based on adult males will have less impact on the population than a harvest of females for polygynous species where a small proportion of the adult males is responsible for the majority of matings. However, where a larger volume and non-selective meat harvest are the ultimate aim, there will be greater impact on the population. An appropriate combination of columns within this column heading may be checked for each type of harvest. However, if the harvest is non-selective, i.e. any of the types of harvest from 1.4–1.6, then only the column for "non-selective" should be checked. Examples of columns that could be used include: males or females; age classes; and combinations thereof.

Plants. It is important to include the range of the plants that are subject to harvest i.e. are mature and immature plants harvested? If the plants are Cycads, are just females being targeted? For these tables, mature plants are considered to be capable of reproduction while immature plants are not considered capable of reproduction. In the case of dioecious species, indicate if male or female plants or parts are targeted, if known.

Level of harvest: Where quantitative information on **numbers** or **quantity** is available for regulated harvests, this should be included to increase confidence in the assessment. Otherwise, and including for illegal and unregulated harvests, a qualitative assessment can provide some indication of the levels of harvest. The columns Low, Medium and High must be interpreted in the context of the species being harvested. For example, an annual harvest of ten giant pandas would count as high, because the wild population only numbers in the hundreds, while the panda's reproductive rate is low. In contrast, a harvest of 100 Cyclamen would be considered low, in relation to a world population numbering in the millions. Only one column should be checked for each type of harvest under this column heading.

Reason for harvest: This column heading gives an indication of forces driving the harvest. The indication of a percentage, if known, may help. Where a harvest is for subsistence purposes only, there is greater likelihood of a sustainable harvest under the management of local people. Where commercial interests prevail, there may be less incentive to harvest sustainably due to economic pressures. One or more columns should be checked, as appropriate, under this overall heading for each type of harvest.

Commercial destinations: This column heading adds to information on reasons for harvest. If the harvest is for subsistence purposes only, the end users of that harvest will be local people. If local people are using some of the harvest and selling the remainder, then both boxes should be checked. If the harvest is for commercial trade, the end users may range from local to international. Historically, the impact of trade was thought to increase from local to international uses, but this perception very much depends on the commodity. For high value items on international markets, such as some parrot species or rare orchids, international trade has certainly been the stimulus for an unsustainable harvest. Similarly, for products with local or national value, such as medicines, trade within national borders may be the driving force in stimulating an unsustainable harvest, although such national trade does not come under the purview of CITES. One or more columns should be marked, as appropriate, for each type of harvest under this column heading.

Making a non-detriment finding using Table 1A

The information collected in Table 1A can be used to advise of a high probability that exports will not be detrimental to the survival of species in three very specific situations, as follows:

- Row 1.1a, where a species is subject only to well regulated captive breeding;
- Row 1.2a, where a species is subject only to well regulated removal of products, without killing the animal and where the scale and impact of the harvest can be quantified; and,
- Row 1.3a, where a species is subject only to a well regulated ranching operation, where the scale and impact of the harvest can be quantified.

If there are checks for regulated harvests for pest control, or live capture, or killing (Rows 1.4a, 1.5a, and 1.6a), or for any type of illegal or unmanaged harvest (any of Rows 1.1b to 1.6b), or if there are checks for several types of harvest, Scientific Authorities should also complete Table 2A before proceeding with advice on whether exports are not detrimental to the survival of the species.

Making a non-detriment finding using Table 1P

The information collected in Table 1P, can be used to advise of a high probability that exports will not be detrimental to the survival of species, in three very specific situations as follows:

- Row 1.1, where a population is subject only to well regulated artificial propagation;
- Row 1.2, where a population is subject only to a well regulated removal of fruits/flowers/seeds which does not kill the plants and where the scale and impact of the harvest can be quantified; and
- Row 1.3, where a population is subject only to a well regulated harvest of leaves which does not kill the plant and where the scale and impact of the harvest can be quantified.

If there are checks in any type of pest control, collecting of live specimens, killing of specimens, illegal or unmanaged harvest, or if there are checks in more than two rows, Scientific Authorities should also complete Table 2 before proceeding with advice on whether exports could be detrimental to the survival of species.

Explanations of Table 2 on "factors affecting management of the harvesting regime"

Table 2 leads the assessor through questions arranged so as to indicate the sensitivity of the species to the impacts of harvesting and commercial use:

- the first section considers general biological characteristics of the species (these are different for animals and plants);
- the second section considers information on the status of the species at the national level;
- the third section focuses on considerations of harvest management;
- the fourth section on control of the harvest regime;
- the fifth section deals with monitoring of the harvest;
- the sixth section examines incentives and conservation benefits from harvesting; and
- the final section deals with the extent to which the species is protected from harvest.

This table is arranged such that the left hand column for each row poses a question, for which there is one of four definite answers, or a fifth answer for "uncertain" in the right hand column. Definite answers that indicate greatest confidence in sustainability of the harvest appear at the top of each numbered question. Generally, only one answer should be checked, although in some cases several answers may be relevant (e.g., see below in 2.19). However, only the most precautionary answer (i.e. worst scenario) will count when scoring information. A simple scoring system based on where ticks are placed for answers to each question will help Scientific Authorities advise whether or not that component of international trade carried out for commercial purposes is detrimental to the survival of the species (see Figure 1b for a visual representation of the scoring system).

It should be stressed that the compilation (and subsequent graphical representation) of the checklist does not necessarily in and of itself constitute a finding of non-detriment. Rather, the use of the checklist should inform the non-detriment finding, and can guide the Scientific Authority in obtaining the necessary information. When a preponderance of factors point to potential detriment, the Scientific Authority should inform the Management Authority that the proposed export should not proceed.

Biological characteristics: Animals only

2.1 Life history: Basic life history characteristics indicate the likely sensitivity of a species to harvest. For

example, r-selected species ("r-strategists") with a high intrinsic rate of increase are likely to be at less risk from harvest than K-selected species ("K-strategists"), which mature slowly and have low reproductive rates (e.g., mice versus elephants, starlings versus raptors).

2.2 Ecological adaptability: Ecological adaptability indicates the likely sensitivity to harvest and encompasses factors such as the species' breadth of habitat use, dietary breadth, and environmental tolerance (in other words, niche breadth). These factors are divided into the broad categories of generalist or specialist. Generalists can switch prey or habitat types relatively easily and are likely to be less affected by disturbances in their range than specialists that occupy a narrow ecological niche. A specialist with a low level of ecological adaptability is somewhat more likely to be negatively impacted by harvest for trade than a generalist (though not in all cases). For example, a given predator population at the top of a food chain, is likely to be more sensitive to harvest than a given herbivore population, lower in the food chain.

2.3 Dispersal efficiency: Species which have mechanisms that ensure a wide dispersal of individuals during some part of their life history may be less susceptible to the effects of harvest than similar species (depending on the life history of the species). Such species can more easily recolonize areas from which they have been locally extirpated. For example, a number of marine organisms depend on the dispersal of large numbers of widely distributed planktonic larvae, and so may be able to recolonize habitats from which the more sedentary adults have been overfished e.g. giant clams.

2.4 Interaction with humans: The tolerance of a species to human activity may indicate its likely sensitivity to the effects of harvest. Species mostly tolerant of human intervention are also likely to be the least affected by harvest. Pests, which people have difficulty in eradicating, and commensal species that benefit from the spread of human-induced environments such as agricultural land, are likely to be least sensitive to harvest. For example modified habitats in oil palm plantations in Indonesia support much higher populations of rodent prey and consequently of blood pythons than an equivalent area of natural habitat (although other species found in undisturbed habitats are absent from the oil palm plantations).

Biological characteristics: Plants only

2.1 Life form: The life form of a plant species gives some indication as to its likely sensitivity to harvest. The more long-lived a perennial plant is, the greater impact harvesting that plant may have on the overall population. Basic life form types are included.

2.2 Regeneration potential: The regeneration potential of a plant defines the capacity of the species to reproduce. Four simple basic types of regeneration potential are included. In completing this section, more than one type can be ticked. For example, *Fast vegetatively* and *Slow or irregular from seeds* would be ticked in the case of *Galanthus elwesii*, a snowdrop species subject to controlled collection in Turkey.

2.3 Dispersal efficiency: The dispersal efficiency of a species may allow it to overcome the effects of overharvest. Consequently, species which have mechanisms that ensure a wide dispersal of individuals during some part of their life history may be less susceptible to the effects of harvest as they may be able to recolonize areas from which they have been locally extirpated. For example, a number of plants depend on the dispersal of large numbers of widely distributed seeds or spores, and so may be able to re-colonize habitats from which the adults have been over-collected.

2.4 Habitat: Plants occur over a very wide range of habitats which cannot all be included in this table. However, five basic types have been included. The examples range from habitats which require a short time to reestablish to potential climax forest or other climax types (e.g. savannah) where recovery is long term or often impossible (e.g. Madagascan "Spiny bush"). This particular subject will need more extensive evaluation.

Animals and plants

National status

2.5 National distribution: The pattern of distribution of a species provides some indication of a species' sensitivity to harvest. Widespread species with a continuous distribution at the national or regional level are likely to be less sensitive to harvest or other threatening factors than species with a widespread but fragmented distribution. Population fragmentation may produce sub-populations, adapted to a specialized or restricted habitat, that are too small to be viable. Localized endemic species adapted to specific habitats that are naturally fragmented, such as mountain chains, are more likely to be at risk from habitat change and the effects of harvest. Species that are localized nationally, i.e. only occur in a few locations at the national level, could be particularly at risk from unmanaged harvest.

2.6 National abundance: Intuitively, species that are generally very abundant and occur at high densities are likely to be less sensitive to harvest than less common species occurring at naturally low densities. However, some species that occur at high densities are prone to major fluctuations in population size, either on a regular basis or due to stochastic events, and the impact of harvest in a climatically bad year (for the species) may

result in a large population reduction from which the species cannot recover rapidly, (e.g. Saiga antelope). For species that are already uncommon or rare, the margin of error associated with the harvest is likely to be low. For example, predators are generally less numerous than prey species, or mahogany trees are generally less numerous than daisies.

2.7 National population trends: Trends in national population status provide some indication about a species' likely susceptibility to harvest: species with an increasing population are likely to be less sensitive to harvest than species whose population is decreasing. Ideally, trends in the national population status should be measured over a time period independent of the harvest regime, and should recognise the "shifting baseline" phenomenon, in which each manager takes the population level first encountered as the baseline level. This phenomenon is very important for a species or population that has experienced a history of harvest and commercial use. Mathematical modelling suggests an independent time period of three generations is necessary as a minimum. However, generation time is not known accurately for a number of species in trade and, in these cases generation time should be predicted, based on known biological information from closely related species. In any event, the time period over which the population trend is assessed should be indicated in the right hand-box of 2.7. If data from actual population surveys are available, ideally results from a minimum of three censuses should be used to evaluate trends. As population monitoring improves, the age and sex structure of the population should also be assessed. Failing this, trends in measures or indices of relative abundance can also be used. In the absence of such data from the field, indices of habitat loss can be used to infer whether populations are likely to be declining.

2.8 Quality of information: The quality of data used to describe population trends is an important consideration in determining the robustness of the advice on non-detriment findings. For example, if all the data presented are recent and quantitative, then the confidence in the results of the assessment will be high. In contrast, if the majority of data are anecdotal, the chance of making a robust non-detriment finding will be lower. Consequently, more emphasis is placed on good local qualitative knowledge than on out-of-date quantitative data.

2.9 Major threats: Assessing the severity of the impact of the major threat provides a basis to weigh up the relative impact of the harvest. The major threat to the species at the national level should be indicated in the left-hand box and the severity of the threat recorded in the relevant right-hand box. For example, if habitat loss is the major threat and its impact on the species is severe and irreversible, then it may be difficult to justify a harvest at all from an area not affected by the habitat destruction. In contrast, if the effects of habitat loss are reversible, a well regulated harvest could possibly provide incentives to reverse the habitat loss (see also 2.13). It is vital to any evaluation of non-detriment that the Scientific Authority assesses the impact of trade in relation to other threats to the species.

Harvest management

2.10 Illegal harvest or trade: The total harvest to which a population is subject at the national level must be considered in assessing the impacts of a harvest. Consequently, it is necessary to try to assess the levels of both unmanaged and illegal harvest, even though reliable information is particularly difficult to collect (see also Tables 1A and 1P). Nonetheless, managers can often make an intuitive assessment of the significance of such harvest, in relation to the level of regulated legal harvest. Good local information and information from rangers and other enforcement personnel in the field is often exceedingly useful in evaluating the level of illegal harvest.

2.11 Management history: The management history of a harvest provides a good starting point to assess the likely sustainability of the harvest. A harvest with a long history of effective management, particularly well-regulated adaptive management, is more likely to be sustainable than an unmanaged harvest. A managed harvest, with adaptive management based on reliable monitoring of how harvest affects the population is the optimum situation. A managed harvest is one in which there is some degree of oversight and feedback, whether it be under a formal or an informal process. Any harvest regime necessarily contains an element of experiment, and requires feedback and monitoring for absolute safety. An ongoing but informally managed harvest may not have a nationally approved structure, but may nonetheless have a good chance of sustainability, particularly if associated with strong local resource ownership. In contrast, the necessary feedback will not have taken place in a newly established programme of harvest, so the probability of sustainability may still be open to question. An unmanaged harvest is one in which there is no oversight and the harvest is taken in a purely opportunistic manner, giving least confidence in its sustainability.

2.12 Management plan or equivalent: The development and adoption of a national management plan or equivalent is necessary to build the political will to establish the process of sustainable use. Furthermore, a harvest managed according to a nationally approved management plan is likely to have undergone a process of review and scrutiny before official adoption, and should thus have a higher chance of reliability. Ideally national management plans should be developed in

conjunction with local inputs, because the majority of harvested species are likely to be patchily rather than uniformly distributed throughout a range State, and so any harvest should be managed at the local level to avoid local extirpations. In range States with a strong federal/state or provincial system, strong management plans at the state or provincial level would be the equivalent of strong national management plans. Consequently, the optimum harvest management situation will include approved and co-ordinated local and national management plans. In cases where there is no approved plan and informal or unplanned management takes place, there will be little confidence in the probability that the harvest is sustainable or that the export is non-detrimental.

2.13 Aim of harvest regime in management planning: The aim of the harvest regime for a species has a considerable bearing on the probability that a harvest will be sustainable. Where the main aim is to generate conservation benefits, particularly on a habitat or ecosystem level, the likelihood that the harvest will not be detrimental to the wild population should be higher. For example, the encouragement of butterfly farming in Irian Jaya, Indonesia, was promoted to provide an economic incentive to maintain the natural vegetation that supports the butterfly populations. Where control of the target population is the aim, the rationale is that a managed situation is better in conservation terms than an unmanaged situation. For example, people may be more likely to tolerate crocodilians, and their habitats, if there is some visible form of management and protection of human life and economic returns. Where the aim is to maximize economic yield, the sustainability of the programme will have a lower probability, depending on the long-term strategy. Whilst maximum short-term economic yield derives from mining the resource completely, a strategy to maximize economic yield in the long-term should result in a more sustainable programme. Although this may only be true in theory, and in many cases harvesting is opportunistic and unselective, giving the low confidence in the sustainability of the harvest. Mining of the resource to commercial near-extinction is often the result, followed by exploitation of other species.

2.14 Quotas: Quotas have been used as a means of regulating and managing harvests for some time, and export quotas have become increasingly common in CITES as questions have been raised about particular harvest regimes. As in the adoption of management plans (2.12), the optimum situation is one in which: a) a national quota is based on local quotas that guard against local overexploitation, and b) the quota is based on knowledge of species' biology, life history, demographics, and reproductive capacity. Quotas can be based on the numbers of individuals removed from the wild, or on specific age or size classes within the population. A well managed, biologically-based harvest programme may involve harvest only of immature animals or plants, depending on the life history of the species concerned. For many species in trade detailed biological information is not readily available, so a system of "cautious", co-ordinated local and national quotas may be adopted. "Cautious" national quotas are those which are very small relative to the likely national population size. Finally, untried local quotas based on a biological understanding of the species would be expected to give a higher chance of sustainability than a situation in which market driven, arbitrary or no quotas are set. "Market driven" describes the situation in some countries where the traders are able to demand a given quota, or quotas are assigned based on expected commercial demand. An arbitrary quota is one based on no apparent knowledge of the species.

Control of harvest

2.15 Harvesting in Protected Areas (PA): Resource ownership and tenure can play an important role in determining the sustainability of harvests. If tenure and ownership are strong, the incentive for good management and regulation is likely to be greater. Protected areas have a variety of designations and purposes, depending on the national legal and political systems in place. The term, State Protected Area is here used to encompasses a variety of PAs and multiple use zone types, where sustainable use and harvest are allowed, including forest, game and marine reserves, and so-called "National Parks" in China and UK. Range States may have several types of such PAs which offer different degrees of protection from harvest. In general, greater confidence can be placed in the likely sustainability of the harvest if most of it occurs either in such State PAs or in other areas with strong tenure (see also 2.16).

2.16 Harvesting in areas with strong resource tenure or ownership: Strong local control over resource use may range from the local community management or private land management systems in place in southern Africa to the strong local control practised by communities surrounding oil palm plantations in Indonesia, where blood pythons are harvested. In all these cases either a local community or a private landowner is responsible for managing and regulating the harvest. In such systems, it is generally thought to be in the long-term best interests of those who own the resource to ensure that it is used in a sustainable manner. Consequently, greater confidence will be placed in the likely sustainability of the harvest if most harvest occurs in areas with strong resource ownership (see also 2.15).

2.17 Harvesting in areas with open access: When there is neither strong state, nor community, nor private

tenure, a system of open access prevails. In such cases there is no local control over the resource and a danger that there will be no incentive to regulate the harvest, resulting in a "free for all". Little confidence can be placed in the sustainability of harvest if most occurs in areas with actual or *de facto* open access.

2.18 Confidence in harvest management: This question requires a judgement on the effectiveness of harvest controls. A variety of factors such as low budgets, lack of trained staff, other capacity deficiencies, or a lack of political will, may prevent harvest controls from being implemented adequately. A response that indicates a lack of confidence in harvest management should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing deficiencies.

Monitoring of harvest

2.19 Methods used to monitor harvest: Monitoring of the harvest is vital and essential to ensuring the sustainability of any harvest. Direct population estimates of the harvested population or other measures of absolute density or abundance are generally considered the best methods, but may be very expensive and time consuming to implement, or may be impossible for the species concerned for biological reasons. In the absence of direct population measures, quantitative indices of population abundance and trend (measures of relative density or abundance) of the harvested population can be used. Alternatively qualitative indices may be used, which, if based on good local knowledge, can provide good indications of the effects of harvest. Under CITES, all Scientific Authorities are required to monitor exports, so that these can be halted or reduced if levels are thought to be detrimental to the survival of species, or the species is being used at a level inconsistent with its role in its ecosystem. CITES Annual Report data can play a very important role in monitoring, and better use of these data, along with better communication between Scientific Authorities of different countries, would allow Scientific Authorities to build up increasingly accurate pictures of the effects of international trade on population trends. This question could receive multiple ticks in answer, but only the most effective/principal monitoring system should be scored.

2.20 Confidence in harvesting monitoring: This question requires a judgement on the effectiveness of the monitoring system in use. For example a Scientific Authority may know that direct population estimates are conducted, but that budgetary, staffing and other resource constraints result in such population counts only being conducted at long intervals, insufficient to monitor the effects of an annual harvest programme. A response that indicates a lack of confidence in harvest monitoring should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing deficiencies.

Incentives and benefits from harvesting

2.21 Use compared with other threats: The major threat to the species was identified in 2.9, and this question aims to determine how use affects the species in relation to the major threat affecting the species. In some cases, use of the species may convey conservation benefits that mitigate the effects of some other major threat such as habitat destruction. In other cases, use does not affect the species detrimentally and does not have any mitigating effects on other major threats, so any use has a neutral effect. Thereafter, the harvest may become increasingly harmful in conjunction with the major threats. In yet other cases, the use may exacerbate other threats (such as disease, invasive species, or habitat deterioration), thereby necessitating a more cautious or precautionary non-detriment finding. The non-detriment finding should never be taken out of context from other impacts and conservation benefits impinging on the species.

2.22 Incentives for species conservation: In some rare cases the species derives a direct benefit from the harvesting programme. In many cases, the benefit may not be financial, but in such cases, the harvest programme may significantly reduce illegal collection.

2.23 Incentives for habitat conservation: This question looks at the broader implications of harvest to support habitat conservation. Any potential benefit to habitat conservation should be known and demonstrated. If a benefit is intended but it cannot be shown, this question should be answered as "low". If no conservation benefit is intended, this question should be answered "none".

Protection from harvest

2.24 Proportion strictly protected from harvest: Strict protection, both legally and in practice, of representative parts of a species' range, or of a portion of the population sufficient to ensure its survival, should prevent harvest threatening the whole national population of a species. This question aims to assess the percentage that is strictly protected (where strict protection is defined as a prohibition on removal from the wild). For many species, the existence of strict protected areas where harvest is not allowed, with adequate enforcement controls, is an important assurance that core areas can provide recruitment to a population subject to harvest.

2.25 Effectiveness of strict protection measures: This question requires an assessment of the effectiveness of protection measures. A number of factors including budgets and the resource ownership of such protected areas may have a bearing on how effective they are. A response that indicates a lack of effectiveness of strict protection measures should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing problems and challenges.

2.26 Regulation of harvest effort: This question requires an assessment of the effectiveness of harvest restrictions. These restrictions generally comprise closed seasons, or portions of the population which cannot be targeted (based on size, for example). Much of the success of these measures will depend on the political will for enforcement and on the degree to which harvesters are law-abiding.

Table 2. Factors affecting management of the harvesting regime

Biological characteristics: Animals only		
2.1 Life history: What is the species' life history?	High reproductive rate, long-lived	
	High reproductive rate, short-lived	
	Low reproductive rate, long-lived	
	Low reproductive rate, short-lived	
	Uncertain	
2.2 Ecological adaptability: To what extent is the species adaptable (habitat, diet, environmental tolerance etc.)?	Extreme generalist	
	Generalist	
	Specialist	
	Extreme specialist	
	Uncertain	
2.3 Dispersal efficiency: How efficient is the species' dispersal mechanism at key life stages?	Very good	
	Good	
	Medium	
	Poor	
	Uncertain	
2.4 Interaction with humans: Is the species tolerant to human activity other than harvest?	No interaction	
	Pest/Commensal	
	Tolerant	
	Sensitive	
	Uncertain	
Biological characteristics: Plants only		
2.1 Life form: What is the life form of the species?	Annual	
	Biennial	
	Perennials (herbs)	
	Shrub and small trees (max. 12m)	
	Trees	
2.2 Regeneration potential: What is the regenerative potential of the species concerned?	Fast vegetatively	
	Slow vegetatively	
	Fast from seeds	
	Slow or irregular from seeds or spores	
	Uncertain	

Table 2. Factors affecting management of the harvesting regime (cont.)

2.3 Dispersal efficiency: How efficient is the species' dispersal mechanism?	Very good	
	Good	
	Medium	
	Poor	
	Uncertain	
2.4 Habitat: What is the habitat preference of the species?	Disturbed open	
	Undisturbed open	
	Pioneer	
	Disturbed forest	
	Climax	
National status: Animals and plants		
2.5 National distribution: How is the species distributed nationally?	Widespread, contiguous in country	
	Widespread, fragmented in country	
	Restricted and fragmented	
	Localized	
	Uncertain	
2.6 National abundance: What is the abundance nationally?	Very abundant	
	Common	
	Uncommon	
	Rare	
	Uncertain	
2.7 National population trend: What is the recent national population trend?	Increasing	
	Stable	
	Reduced, but stable	
	Reduced and still decreasing	
	Uncertain	
2.8 Quality of information: What type of information is available to describe abundance and trend in the national population?	Quantitative data, recent	
	Good local knowledge	
	Quantitative data, outdated	
	Anecdotal information	
	None	
2.9 Major threats: What major threat is the species facing (underline following: overuse/habitat loss and alteration/invasive species/other: and how severe is it?	None	
	Limited/Reversible	
	Substantial	
	Severe/Irreversible	
	Uncertain	
Harvest management: Animals and plants		
2.10 Illegal harvest or trade: How significant is the national problem of illegal or unmanaged harvest or trade?	None	
	Small	
	Medium	
	Large	
	Uncertain	

Table 2. Factors affecting management of the harvesting regime (cont.)

2.11 Management history: What is the history of harvest?	Managed harvest: ongoing with adaptive framework	
	Managed harvest: ongoing but informal	
	Managed harvest: new	
	Unmanaged harvest: ongoing or new	
	Uncertain	
2.12 Management plan or equivalent: Is there a management plan related to the harvest of the species?	Approved and co-ordinated local and national management plans	
	Approved national/state/provincial management plan(s)	
	Approved local management plan	
	No approved plan: informal unplanned management	
	Uncertain	
2.13 Aim of harvest regime in management planning: What is harvest aiming to achieve?	Generate conservation benefit	
	Population management/control	
	Maximize economic yield	
	Opportunistic, unselective harvest, or none	
	Uncertain	
2.14 Quotas: Is the harvest based on a system of quotas?	Ongoing national quota: based on biologically derived local quotas	
	Ongoing quotas: "cautious" national or local	
	Untried quota: recent and based on biologically derived local quotas	
	Market-driven quota(s), arbitrary quota(s), or no quotas	
	Uncertain	
Control of harvest: Animals and plants		
2.15 Harvesting in Protected Areas: What percentage of the legal national harvest occurs in State-controlled Protected Areas?	High	
	Medium	
	Low	
	None	
	Uncertain	
2.16 Harvesting in areas with strong resource tenure or ownership: What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use?	High	
	Medium	
	Low	
	None	
	Uncertain	
2.17 Harvesting in areas with open access: What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access?	None	
	Low	
	Medium	
	High	
	Uncertain	
2.18 Confidence in harvest management: Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?	High confidence	
	Medium confidence	
	Low confidence	
	No confidence	
	Uncertain	

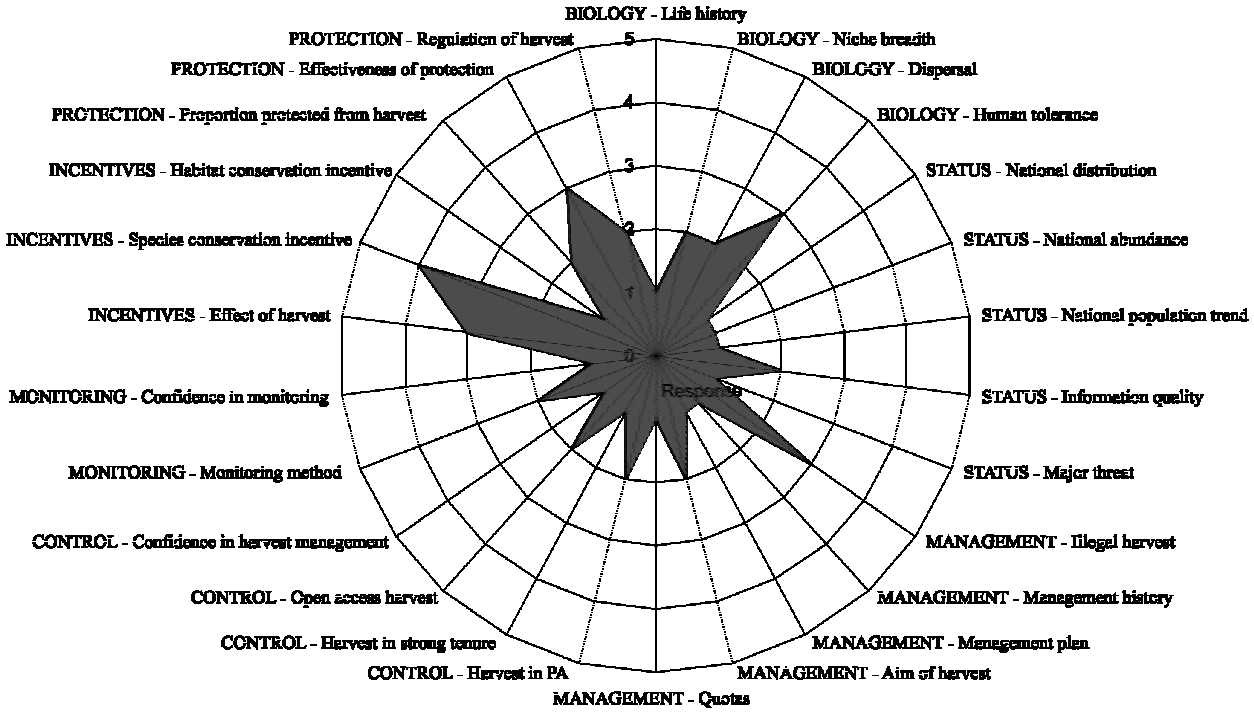
Table 2. Factors affecting management of the harvesting regime (cont.)

Monitoring of harvest: Animals and plants		
2.19 Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest?	Direct population estimates	
	Quantitative indices	
	Qualitative indices	
	National monitoring of exports	
	No monitoring or uncertain	
2.20 Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring?	High confidence	
	Medium confidence	
	Low confidence	
	No confidence	
	Uncertain	
Incentives and benefits from harvesting: Animals and plants		
2.21 Utilization compared to other threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?	Beneficial	
	Neutral	
	Harmful	
	Highly negative	
	Uncertain	
2.22 Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?	High	
	Medium	
	Low	
	None	
	Uncertain	
2.23 Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?	High	
	Medium	
	Low	
	None	
	Uncertain	
Protection from harvest: Animals and plants		
2.24 Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest?	>15%	
	5-15%	
	<5%	
	None	
	Uncertain	
2.25 Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?	High confidence	
	Medium confidence	
	Low confidence	
	No confidence	
	Uncertain	
2.26 Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse?	Very effective	
	Effective	
	Ineffective	
	None	
	Uncertain	

Fig.1a. Example of an information evaluation to assist Scientific Authorities in making non-detriment findings – plot of responses to questions in Table 2.

Question number	Question category	Question	Responses – 1 to 5
2.1	Biology	BIOLOGY – Life history	1
2.2		BIOLOGY – Niche breadth	2
2.3		BIOLOGY – Dispersal	2
2.4		BIOLOGY – Human tolerance	3
2.5	Status	STATUS – National distribution	1
2.6		STATUS – National abundance	1
2.7		STATUS – National population trend	1
2.8		STATUS – Information quality	2
2.9		STATUS – Major threat	1
2.10	Management	MANAGEMENT – Illegal harvest	3
2.11		MANAGEMENT – Management history	1
2.12		MANAGEMENT – Management plan	1
2.13		MANAGEMENT – Aim of harvest	2
2.14		MANAGEMENT – Quotas	1
2.15	Control	CONTROL – Harvest in PA	2
2.16		CONTROL – Harvest in strong tenure	1
2.17		CONTROL – Open access harvest	2
2.18		CONTROL – Confidence in harvest management	1
2.19	Monitoring	MONITORING – Monitoring method	2
2.20		MONITORING – Confidence in monitoring	1
2.21	Incentives	INCENTIVES – Effect of harvest	3
2.22		INCENTIVES – Species conservation incentive	4
2.23		INCENTIVES – Habitat conservation incentive	1
2.24	Protection	PROTECTION – Proportion protected from harvest	2
2.25		PROTECTION – Effectiveness of protection	3
2.26		PROTECTION – Regulation of harvest	2

Fig. 1 Example of scoring system to assist Scientific Authorities in making non-detriment findings. Plot of responses to questions in Table 2.



Making a non-detriment finding – a visual scoring system for decision-making

Once all the relevant information has been collected in Tables 1 and 2, the Scientific Authority staff should be in a much better position to make a non-detriment finding based on their interpretation of the assembled material. Furthermore, a visual representation of the results collected in Table 2 can be produced using radar plots as described in the next paragraph.

An example of the Excel worksheet that should be drawn up is presented in Figure 1a entitled: *Example of an information evaluation to assist Scientific Authorities in making non-detriment findings – plot of responses to questions in Table 2*. A short title for each question is presented in the third column of the figure (from left hand margin) and the response, on a scale from one to five is included in the fourth column (from the left), entitled: *Responses – 1 to 5.*

An electronic template has been developed to automatically produce a plot, once the correct values are entered into the worksheet. This template is available from the CITES Secretariat.

The radar plot produces a central area of colour. If the harvest is likely to be non-detrimental, most of the answers will fall in the precautionary areas of Table 2, and will be depicted near the centre of the circle. Outlying points may indicate a low confidence in the probability that the harvest is sustainable and should prompt the Scientific Authority to look in more detail at the responses. It may be that further investigation is needed or that insufficient information exists on which to base a finding of non-detriment. Hence, this tool will not only assist with the decision-making process of making a non-detriment finding, but it will also allow possible problems to be identified and rectified as soon as possible.

Conclusions

To determine that a harvest is not detrimental to the survival of a species, the Scientific Authority of the State of export will ideally undertake a thorough review of the whole harvest management system. However, in many cases comprehensive information is not available and in others, it is not even clear what is meant by the management system. This checklist aims to draw attention to the more important aspects of harvest management systems and to provide a means for compiling such information. The checklist is designed to provide the first step in a process which it is hoped will evolve in response to recommendations from field testers. Above all, the checklist must appeal to its potential users and should not be unrealistic in terms of the information needed to complete the tables, consequently it uses qualitative data categories. In time, these may usefully develop into more quantitative definite categories. A

major strength of the current system is the ability to represent visually the importance of factors that affect the probability that a harvest could be detrimental or not. The visual representation allows quick comparisons to be made between species, and perhaps even between years to identify factors at the national level that could be changed to improve the likelihood that resource management will result in a sustainable harvest.

5.2 Practical example of the checklist approach

This section provides some examples of how the Checklist to assist CITES Scientific Authorities in making non-detriment findings can actually be used. The examples presented here were brought to the workshop by a range of participants, from government and non-government sources, but these analyses should not be interpreted either as reflecting an official government view or as an exhaustive analysis of the situation, they are simply the opinion of individuals involved as participants in these meetings. The background information on each of the Appendix II species considered is compiled from meeting participants and other readily available sources. This information was used to complete the table on the Factors Affecting Management of the Harvesting Regime (Table 2) and the results for five species are presented in Table 3. In addition, throughout the text, where the information is relevant to a particular section of Table 2/3, the section number is included in the text in parentheses e.g. (2.3). Finally, the scores for each species from Table 3 are plotted as radar graphs to provide a graphic representation of the likely confidence in the sustainability of the harvest and to allow areas for improved management to be highlighted. It is also easy to visualise the benefits of superimposing successive charts compiled from evaluations of the management system over successive years or even longer time periods. The resulting overlay could provide an effective temporal comparison to track progress and reveal discrepancies in key areas (biology, status, management, monitoring and protection) at a glance. This feedback can then be applied to channel future effort and resources in the quest for efficient and sustainable management.

Table 3. Factors affecting management of the harvesting regime, completed for five species.

Biological characteristics: Animals only		✓	✳	✖	●	◆
2.1 Life history: What is the species' life history?	High reproductive rate, long-lived		✳	✖		
	High reproductive rate, short-lived				●	
	Low reproductive rate, long-lived	✓				
	Low reproductive rate, short-lived					
	Uncertain					
2.2 Ecological adaptability: To what extent is the species adaptable (habitat, diet, environmental tolerance etc.)?	Extreme generalist		✳			
	Generalist			✖		
	Specialist	✓				
	Extreme specialist				●	
	Uncertain					
2.3 Dispersal efficiency: How efficient is the species' dispersal mechanism at key life stages?	Very good	✓				
	Good		✳	✖	●	
	Medium					
	Poor					
	Uncertain					
2.4 Interaction with humans: Is the species tolerant to human activity other than harvest?	No interaction					
	Pest/Commensal		✳	✖		
	Tolerant					
	Sensitive	✓				
	Uncertain					

Table 3. Factors affecting management of the harvesting regime, completed for five species (cont.).

		✓	✳	✖	●	◆
Biological characteristics: Plants only						
2.1 Life form: What is the life form of the species?	Annual					
	Biennial					
	Perennials (herbs)					◆
	Shrub and small trees (max. 12m)					
	Trees					
2.2 Regeneration potential: What is the regenerative potential of the species concerned?	Fast vegetatively					
	Slow vegetatively					◆
	Fast from seeds					
	Slow or irregular from seeds or spores					
	Uncertain					
2.3 Dispersal efficiency: How efficient is the species' dispersal mechanism?	Very good					
	Good					
	Medium					
	Poor					◆
	Uncertain					
2.4 Habitat: What is the habitat preference of the species?	Disturbed open					
	Undisturbed open					
	Pioneer					
	Disturbed forest					
	Climax					◆
National status: Animals and plants						
2.5 National distribution: How is the species distributed nationally?	Widespread, contiguous in country					
	Widespread, fragmented in country		✳	✖		◆
	Restricted and fragmented					
	Localized	✓			●	
	Uncertain					
2.6 National abundance: What is the abundance nationally?	Very abundant					
	Common		✳	✖		
	Uncommon	✓			●	◆
	Rare					
	Uncertain					
2.7 National population trend: What is the recent national population trend?	Increasing					
	Stable			✖	●	
	Reduced, but stable		✷			
	Reduced and still decreasing	✓				◆
	Uncertain					

Table 3. Factors affecting management of the harvesting regime, completed for five species (cont.).

		✓	✳	✖	●	◆
2.8 Quality of information: What type of information is available to describe abundance and trend in the national population?	Quantitative data, recent		✳			
	Good local knowledge			✖	●	
	Quantitative data, outdated					
	Anecdotal information	✓				◆
	None					
2.9 Major threats: What major threat is the species facing (underline following: overuse/habitat loss and alteration/ invasive species/other: and how severe is it?	None			✖		
	Limited/reversable				●	
	Substantial	✓	✳			◆
	Severe/irreversible					
	Uncertain					
Harvest management: Animals and plants						
2.10 Illegal harvest or trade: How significant is the national problem of illegal or unmanaged harvest or trade?	None	✳			●	
	Small					
	Medium	✓				◆
	Large					
	Uncertain			✖		
2.11 Management history: What is the history of harvest?	Managed harvest: ongoing with adaptive framework				●	
	Managed harvest: ongoing but informal		✳	✖		◆
	Managed harvest: new	✓				
	Unmanaged harvest: ongoing or new					
	Uncertain					
2.12 Management plan or equivalent: Is there a management plan related to the harvest of the species?	Approved and co-ordinated local and national management plans				●	◆
	Approved national/state/provincial Management plan(s)		✳			
	Approved local management plan					
	No approved plan: informal unplanned management	✓		✖		
	Uncertain					
2.13 Aim of harvest regime in management planning: What is harvest aiming to achieve?	Generate conservation benefit				●	
	Population management/control					
	Maximize economic yield	✓	✳	✖		◆
	Opportunistic, unselective harvest, or none					
	Uncertain					
2.14 Quotas: Is the harvest based on a system of quotas?	Ongoing national quota: based on biologically derived local quotas			✖		
	Ongoing quotas: “cautious” national or local					
	Untried quota: recent and based on biologically derived local quotas					
	Market-driven quota(s), arbitrary quota(s), or no quotas	✓	✳		●	◆
	Uncertain					

Table 3. Factors affecting management of the harvesting regime, completed for five species (cont.).

		✓	✳	✖	●	◆
Control of harvest: Animals and plants						
2.15 Harvesting in Protected Areas: What percentage of the legal national harvest, occurs in State-controlled Protected Areas?	High				●	
	Medium		✳			
	Low	✓				◆
	None			✖		
	Uncertain					
2.16 Harvesting in areas with strong resource tenure or ownership: What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use?	High			✖	●	
	Medium					
	Low	✓	✳			◆
	None					
	Uncertain					
2.17 Harvesting in areas with open access: What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access?	None			✖	●	
	Low					
	Medium					
	High	✓	✳			◆
	Uncertain					
2.18 Confidence in harvest management: Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?	High confidence				●	
	Medium confidence					◆
	Low confidence		✳			
	No confidence	✓		✖		
	Uncertain					
Monitoring of harvest: Animals and plants						
2.19 Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest?	Direct population estimates		✳			
	Quantitative indices					
	Qualitative indices				●	
	National monitoring of exports	✓		✖		◆
	No monitoring or uncertain					
2.20 Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring?	High confidence		✳		●	
	Medium confidence					
	Low confidence	✓				◆
	No confidence			✖		
	Uncertain					
Incentives and benefits from harvesting: Animals and plants						
2.21 Utilization compared to other threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?	Beneficial			✖	●	
	Neutral		✳			
	Harmful	✓				
	Highly negative					
	Uncertain					◆

Table 3. Factors affecting management of the harvesting regime, completed for five species (cont.).

		✓	✳	✖	●	◆
2.22 Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?	High				●	
	Medium					
	Low		✳	✖		
	None	✓				◆
	Uncertain					
2.23 Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?	High				●	
	Medium					
	Low		✳			
	None	✓		✖		◆
	Uncertain					
Protection from harvest: Animals and plants						
2.24 Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest?	>15%	✓	✳			
	5–15%			✖		
	<5%					◆
	None				●	
	Uncertain					
2.25 Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?	High confidence			✖		
	Medium confidence				●	
	Low confidence	✓				◆
	No confidence		✳			
	Uncertain					
2.26 Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse)?	Very effective					
	Effective				●	
	Ineffective					
	None	✓				
	Uncertain		✳	✖		◆

Key: ✓ *Agapornis fischeri* ✳ *Crocodylus niloticus* ✖ *Python curtus* ● *Ornithoptera rothschildii* ◆ *Panax quinquefolius*

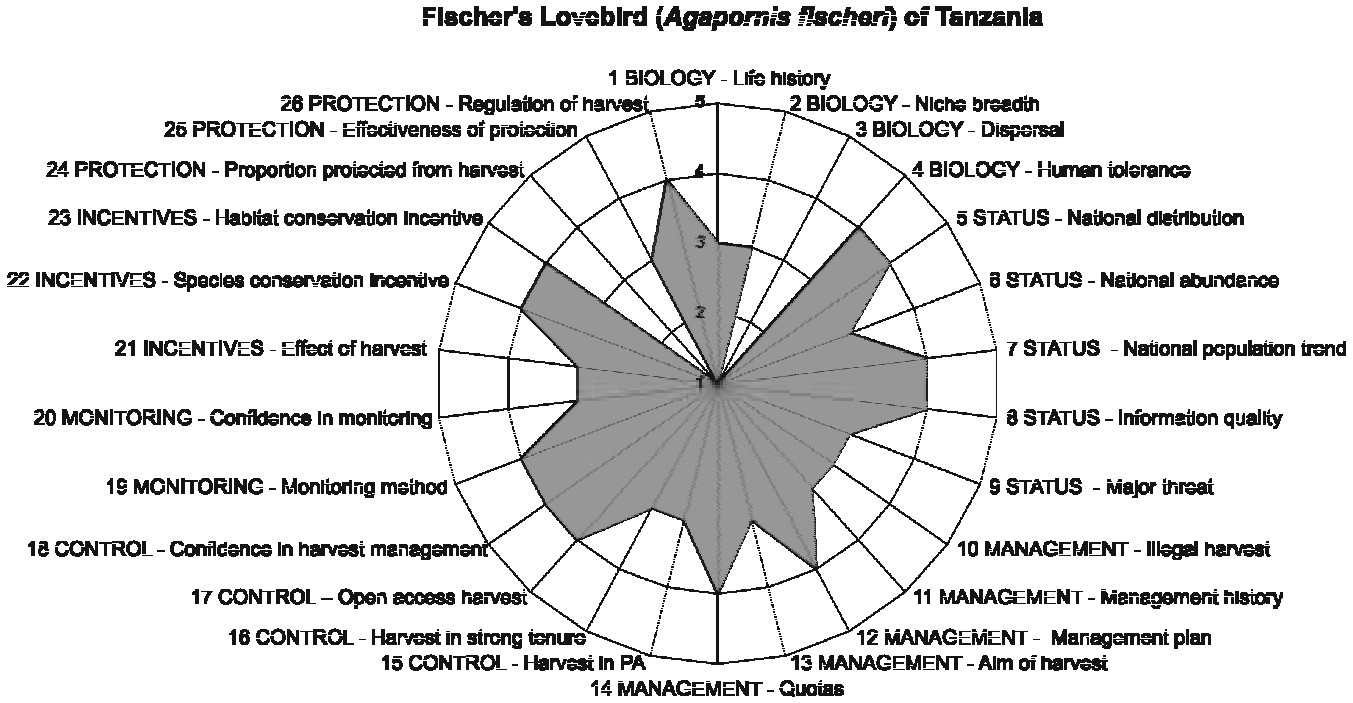
Assessment for Fischer's Lovebird *Agapornis fischeri* in Tanzania prior to 1991

This assessment of the status of trade in the Fischer's Lovebird *Agapornis fischeri*, from Tanzania, was conducted on the basis of information obtainable before the species was included in the CITES Significant Trade Review in 1991. An assessment based on data collected during that review and subsequent field project would present a different picture. *Agapornis fischeri* or Fischer's Lovebird occupies the inland plateau (1100–1700m) predominately in the North of Tanzania. Within its localized range (2.5) it resides in wooded grasslands (in the East) and heavily cultivated areas (in the West). Hence *A. fischeri* is considered a specialist with regard to habitat. The dietary niche is also rather narrow and consists solely of seeds taken from the ground (2.2). This species breeds annually between June–July or January–February (district dependent) and clutches of 4 young have been recorded (2.1). Unfortunately there is a lack of detailed information on the species dispersal mechanism(s) at key life stages (2.3); but it is assumed to be very good.

Fischer's Lovebird used to be common and widespread. Although population estimates were not available in 1991, visits to areas where the species had been common revealed evidence of a widespread and large population decline (2.6, 2.8, 2.22). The species is apparently protected under the Wildlife Conservation National Game Order (1974). However, despite such measures, the species has been subject to poaching since 1988 in the Serengeti National Park (2.25). The proportion of the population or range that occurs within these protected areas is thought to be >15% (2.24).

The recorded trade in *Agapornis fischeri* (minimum net import figures) doubled from 1983 to 1987. In addition to legal and illegal harvesting within the native range, the market was fueled by prolific captive breeding in some non-range States. Capture and export from the United Republic of Tanzania were permitted via a quota system. The quota in 1989 was 500 birds per exporter. However, there was no limit on the number of exporters (2.11, 2.12). The quota figures appear to be somewhat arbitrary and it seems that the aim of the harvest was to maximize economic yield (2.13, 2.14, 2.23). In addition, there was no strong local control over particular areas resulting in an open access situation (2.17). Aside from national monitoring of exports, there has been no attempt at population monitoring and even anecdotal feedback does not appear to have been incorporated in the management system (2.18, 2.19, 2.20, 2.26). Over-exploitation through illegal harvest, coupled with the legal harvest appeared to be the major threat to this species (2.9, 2.12, 2.15, 2.16, 2.21). The fact that *A. fischeri* sometimes aggregate in large flocks of over 100 birds to feed on grain and is a colonial nesting species renders the species particularly vulnerable to such hunting pressure.

Fig. 2. Radar Plot of the factors affecting the management of Fischer's Lovebird, *Agapornis fischeri* in Tanzania prior to 1991 (see Table 3 for data).



Assessment for the Nile crocodile *Crocodylus niloticus* in Tanzania

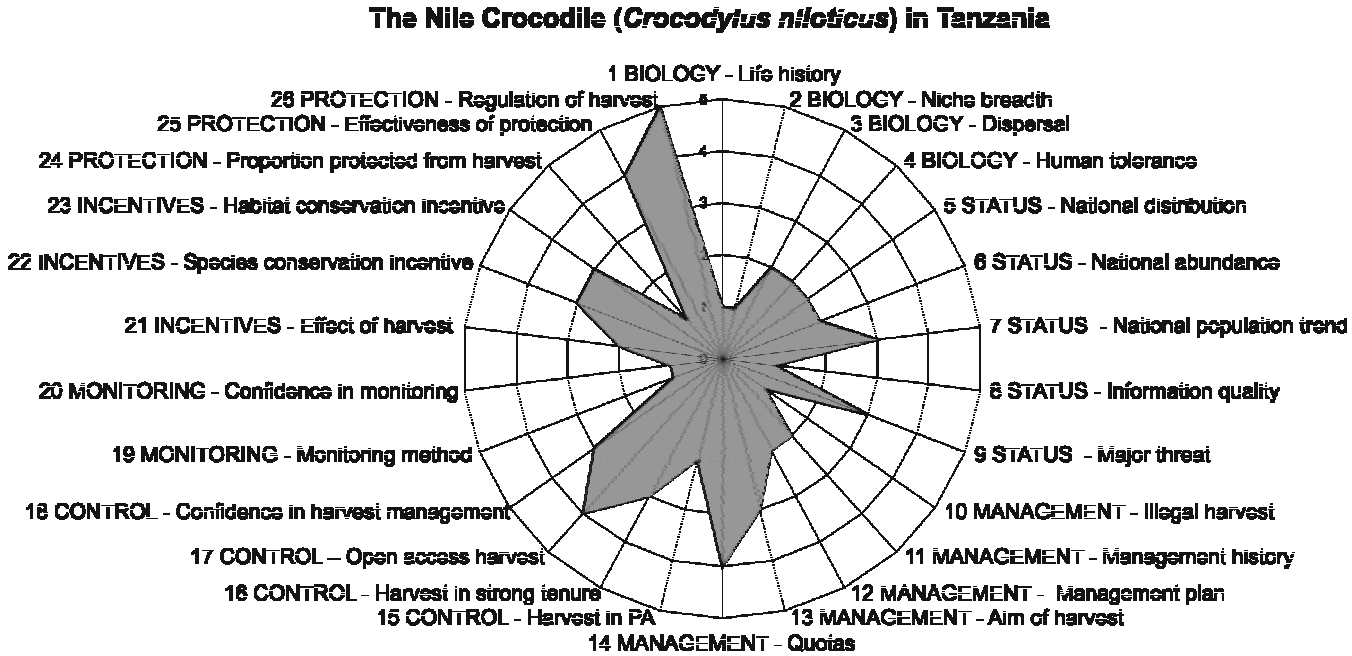
This assessment of the status of the management of the Nile crocodile *Crocodylus niloticus* harvest in the United Republic of Tanzania is based on information presented to the CITES Parties in 2000. The Nile crocodile is a large, slow growing and long-lived reptile. The female nests annually and lays between 40–60 eggs (Britton 2000) (2.1). Such high reproductive potential facilitates resistance to intense harvesting of eggs, and dampens fluctuations in population size (Webb 1999, Ross 1999) (2.2). Whilst hatchlings feed upon insects and small aquatic invertebrates, the adults are voracious predators. Although the mature crocodile is predominantly piscivorous this species is also known to take ungulates, cattle, dogs, and even young hippos (Britton 2000) (2.2). *Homo sapiens*, however, tend to be the most controversial of prey items. The resulting human-crocodile conflict has become the greatest threat to future population stability of *C. niloticus* in Tanzania (2.4).

C. niloticus is widely distributed in the waterways and wetlands of Tanzania. The population is fragmented by natural drought effects and the impact of human habitation (Woodward 1990). However, because the bulk of the population resides within protected areas (National Parks and Game Reserves) this fragmentation is likely to hold little biological significance (Ross 1999) (2.5).

After a population decline around the middle of the century due to overhunting, legal protection has resulted in significant recoveries in several areas and large populations can now be found (Britton 2000) (2.6). A combination of regular aerial and spotlight surveys have even revealed a recent localized increase within protected areas (Games and Severre 1999, Ross 1999). However, it is the unprotected populations which are considered most vulnerable in the face of uncontrolled revenge killings as human lives, property and livestock are taken (2.19, 2.20). Indeed, survey data does suggest possible decline in some unprotected areas of human habitation (Games and Severre 1999, Ross 1999) (2.7,2.8, 2.9, 2.19).

Until recently, it was thought that ranching would be the optimal solution for the conservation of this species. Theoretically, such legal ranching would meet market demand, help to conserve habitat and pose no threat to the thriving crocodile population. The Tanzanian population of *C. niloticus* was transferred in 1985 to Appendix II for ranching purposes, subject to an annual quota. The initial quota allowed the export of wild collected skins to generate income for the ranching programme (2.11, 2.12). By 1993, the annual quota of wild caught specimens had been reduced to 200 with the hope that the ranching programmes would have been sufficiently developed to replace the wild harvest or

Fig. 3. Radar Plot of the factors affecting the management of the Nile crocodile *Crocodylus niloticus* in Tanzania (see Table 3 for data).



limit it to actual problem animals through sport hunting. However, by COP10 it became evident that ranching was not a success. Prospective ranchers simply did not have the finances to employ staff, regulate water temperature or supply adequate food. Whilst ranching involves the removal of eggs from the wild, capture of wild adults as ranch stock is prohibited. Thus the only solution that ranching offers on the growing problem of human-crocodile conflict, is the incentive associated with collecting eggs for the ranches (2.21). Since 1985, figures for Tanzania alone reveal that 500 people were killed and a further 462 wounded. This is likely to be an underestimate as many incidents go unrecorded (Games and Severre 1999).

The only solution then, was to compose a management plan that could deal with "problem animals" by legal wild harvest thus providing an incentive for habitat protection and ultimately, conservation of the Nile crocodile(2.22, 2.23). Tanzania consequently devised a proposal for submission at COP11 for retention of the species in Appendix II but with an increased quota. Experts agree that on a biological basis, quotas have been conservative. The financial benefits from the harvest would then encourage local tolerance and conservation of the crocodile (2.22, 2.23). Local residents should have the power to protect themselves and their property through legal control over this resource. However, the current situation is one of open access with ranchers taking the majority of permits to meet the national quotas (2.17). For example, in 1999 permits were issued with a specific area in mind and in response to problem animal complaints. However, access was restricted to ranchers. In the future, it has been proposed that permits will be granted to ranchers on the basis of performance of the ranching operation and more permits will be allocated to landowners and local people. The wild adult harvest plan should not give cause for conservation concern as the bulk of the crocodile population is protected within the National Parks and Game reserves (Anon 1999, Webb 1999). The controlled harvest of adults may facilitate market development as the demand for adult skins is greater than for the smaller ranched skins (Anon 1999). Skins will continue to be inspected and tagged by the staff of the Wildlife Division in accordance with Res. Conf. 9.22. Such control measures have already stamped out the illegal trade that may have threatened sustainability of an increased quota (2.10). Under current management however, there is little incentive for local communities to tolerate crocodilians (2.22, 2.23).

Restrictions on harvesting include a minimum size limit of 3m (total length) and 60cm belly skin width. Hunting shall be limited to 1st July–31st December or on special permits to control problem animals. Quotas shall not exceed 5% of the non-hatchling population. In addition no hunting will be permitted in protected areas (Anon 1999) (2.24). The actual effectiveness of such measures, however, remains to be ascertained (2.26).

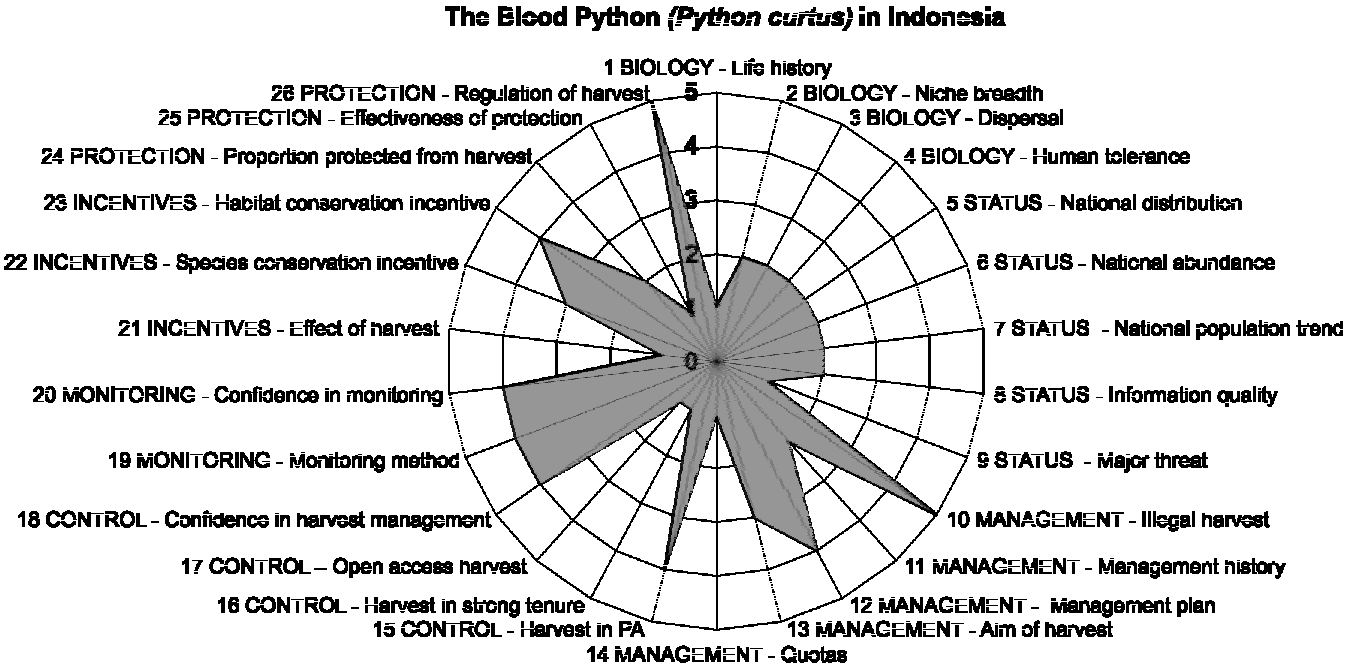
There is a general consensus that the success of the proposed management system will depend upon successful implementation, community involvement and close monitoring (2.11, 2.25).

Assessment for the blood python *Python curtus* in Indonesia

The blood python, *Python curtus* is a small, South East Asian python. This snake is restricted to, but widespread within, the Southern half of the Malay peninsula, Bangka, Borneo and Sumatra. It also occurs on certain islands of the Indo-Australian peninsula (IUCN 1988, Stuebing 1996) (2.5). Within these regions the blood python occupies a somewhat broad ecological niche (2.2). It favours lowland streams and is associated with relatively low elevations and semi-aquatic conditions (Stuebing 1996). Because of this preference for swamp forest along water courses the species is believed to have a rather sporadic distribution in some parts (2.5). However, the species also thrives in secondary vegetation and oil palm plantations (IUCN 1988; Prijono, pers. comm.). With this ability to inhabit disturbed habitats and a fondness for consuming rats (among other small vertebrates) *P. curtus* can be classified as a commensal species regarding its interaction with humans (IUCN 1988) (2.4). *P. curtus* is a relatively long-lived species with a high reproductive rate. The female lays clutches of 10–15 eggs (IUCN 1988) (2.1).

Although no major threats have been adequately documented, overexploitation of *P. curtus* is a possible threat (2.9). The volume of the skin trade increased sharply from 935 skins in 1980 to 58500 skins in 1985. This sudden and dramatic increase in trade is likely be due to protection of some larger congeners and possibly reduced availability of others. Most of the traded skins originate from Indonesia. Data on population levels, distribution and the effects of exploitation are lacking (IUCN 1988). Current information is anecdotal and derived from local knowledge (2.8). Such sources suggest that *P. curtus* is moderately common in Indonesia and the population is believed to be stable (IUCN 1988) (2.7). In addition, Stuebing suggests that this python may be more common than it appears due to its secretive behaviour (Stuebing 1996) (2.6).

Fig. 4. Radar Plot of the factors affecting the management of the blood python *Python curtus* in Indonesia (see Table 3 for data).



Despite the establishment of a hunting quota for the Indonesian population, the management system remains informal (2.14). There are no management plans and virtually no ecological data on which to base them (Stuebing 1996) (2.11, 2.12, 2.18, 2.26). The bulk of the harvest derives from opportunistic collection by villagers within local plantations (Prijono, pers. comm.). All harvesting is therefore executed in areas of strong local resource control (2.15, 2.16, 2.17). The aim of the harvest is to maximise financial benefit from the snake skin market (2.13). As a result, there are low incentives for species conservation and negligible habitat conservation benefit (2.23). Fortunately, the species' tendency to occupy natural refugia under stream banks is likely to provide considerable natural protection from over exploitation (Stuebing 1996). In addition, 5–15% of the population is strictly protected from harvest within state controlled land (2.24, 2.26) However, the volume of illegal harvest or trade remains uncertain (2.10).

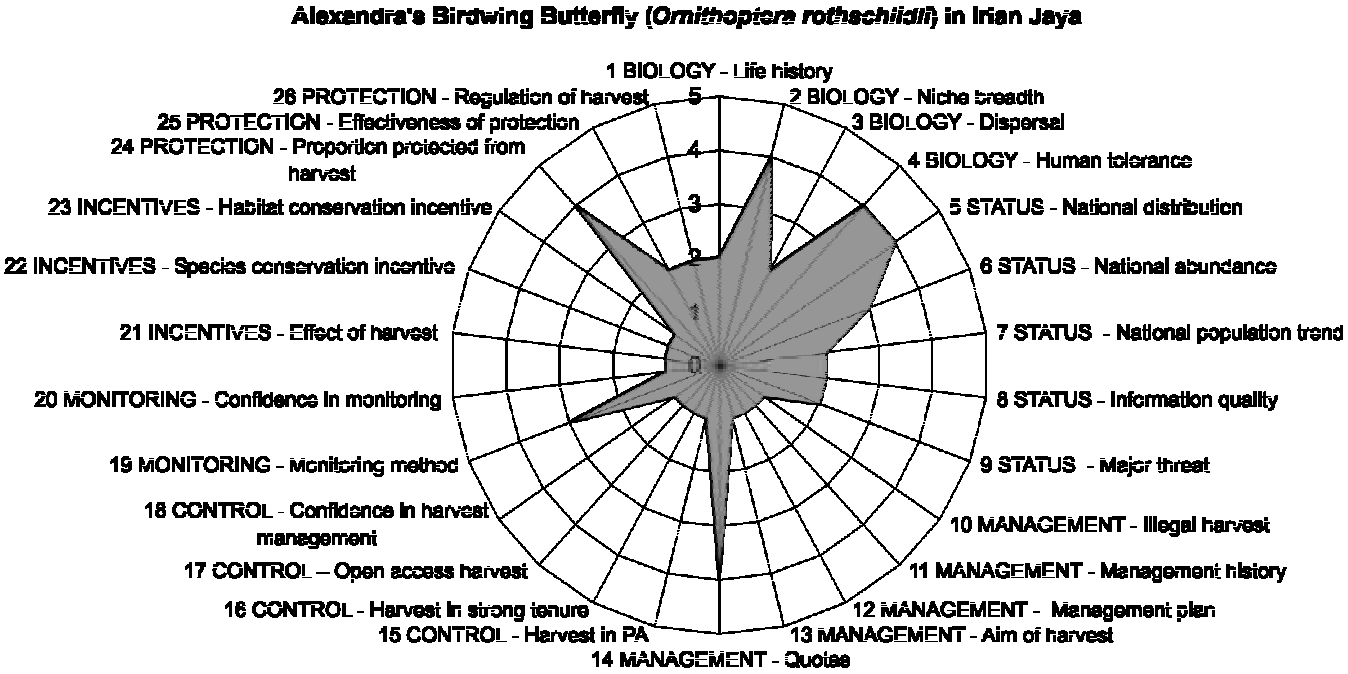
As well as the lack of confidence in the management system the harvest monitoring strategy is far from adequate. There is a need for field level studies of harvest impact. The current system of national export monitoring is likely to be relatively unreliable considering the lack of knowledge regarding levels of illegal trade (2.19, 2.20).

Assessment for Alexandra's Birdwing butterfly *Ornithoptera rothschildii* in Irian Jaya

Ornithoptera rothschildii is one of six of the Birdwing butterfly species (2.1) of the Arfak Mountains, Irian Jaya, Indonesia (2.5) (Neville 1993). Local knowledge confirms that it has a localized distribution to the west of the mountains (2.5, 2.8) (Neville 1999). Although common within its range *O. rothschildii* is a habitat specialist, restricted to sunny, sheltered valleys and ravines in high elevation zones (1800–2450m) (2.2, 2.5) (WCMC *et al*. 1999). Although population data are unavailable, the global population is considered vulnerable (IUCN 1996). This may be due, at least in part, to the host specificity of the larvae on food-plants of the Aristolochlia family (Neville 1993) (2.2). These food- plants tend to be rather sporadically distributed in both space and time. Hence, any form of habitat disturbance e.g. clearance for agriculture, is potentially disastrous (2.4, 2.9, 2.21) (Neville 1999).

However, thanks to recent management efforts, population stability is the worst case scenario (2.7). In fact, anecdotal evidence suggests that the population may be

Fig. 5. Radar Plot of the factors affecting the management of Alexandra's Birdwing butterfly *Ornithoptera rothschildii* in Irian Jaya (see Table 3 for data).



increasing (2.8, 2.19, 2.22). This is due to the link between sustainable ranching and habitat enhancement (2.13, 2.21, 2.23). This link was established with encouragement from WWF project staff who made regular visits to farmers on the western periphery of the Arfak Mountains Nature Reserve (AMNR). By 1993, almost 1500 farmers, from 47 mountain villages, had signed up for the proposed ranching initiative. The farmers agreed to collect eggs from the wild and rear the larvae in special gardens planted with *Aristolochlia* spp. Next came the establishment of a foundation called the Yayasan Bina Lestari Bumi Cendrawasih (YBLBC). Formed to manage the farming and marketing aspects, the agency was granted a farming permit (2.26), appointed staff and bought pupae from farmers. Ranching was fully underway by 1993 and has since been responsible for all legal trade in *O. rothschildii* specimens (2.12, 2.15, 2.16) (Neville 1993). This is reflected in the noticeable increase in Indonesia's export figures (WCMC *et al*. 1999). Furthermore, illegal trade appears to be decreasing as the ranched stock are generally in much better condition than wild-caught specimens. However, YBLBC cannot always buy all the stock and farmers may sell their surplus to illegal tradesmen. Nevertheless, dealers prefer legally traded specimens and favour the pristine condition of farmed stock (2.10) Although there was no quota for the period 1995–99 (2.14), it has been agreed that future implementation of quotas may help to stabilize prices (2.11) (Neville 1993, 1999).

A major factor in the continued success of the programme is the financial feasibility (2.18, 2.20). Little capital input is required to plant native species and the rearing of larvae requires little expertise. Anyone can become involved and participants have strong local control of the resource (2.17).

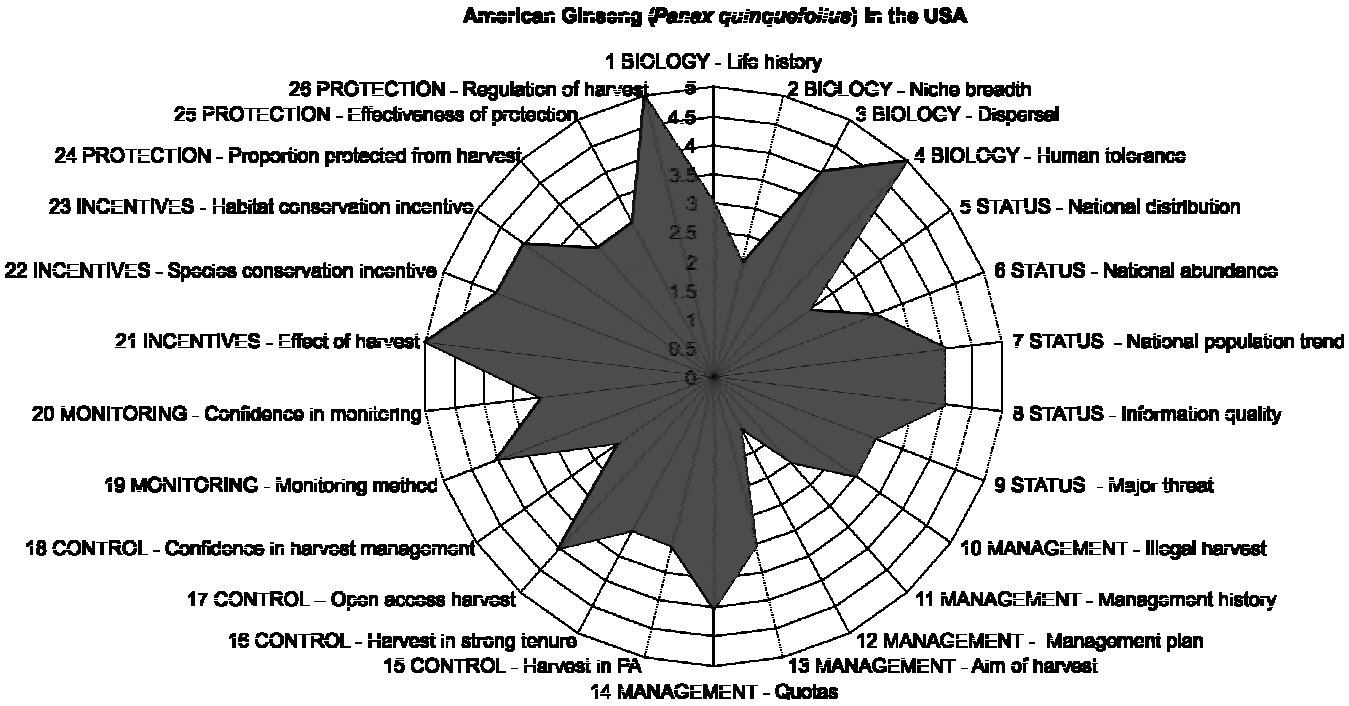
To conclude, rather than opting for (unrealistic) legal prevention of butterfly exploitation (2.24), ranching certainly seems a superior alternative as a means of sustainable harvest. The local people, their economy, the butterflies and their habitat are all beneficiaries.

Assessment for American ginseng *Panax quinquefolius* in North America

The primary source for the following information is a report on analysis of sustainability of ginseng harvesting in North America, compiled by Gagnon (1999).

American ginseng *Panax quinquefolius* is a herbaceous perennial plant endemic to the Eastern Deciduous Forest of North America (Greller 1988), where it is widespread (2.1, 2.5). The distribution range extends

Fig. 6. Radar Plot of the factors affecting the management of American ginseng *Panax quinquefolius* in North America (see Table 3 for data).



from the Great Smoky Mountains National Park in Tennessee and North Carolina, Shenandoah National Park in Virginia and also from Missouri and Ontario and Quebec in Canada. American ginseng is undoubtedly a very valuable resource. It is the most sought after plant in the entire US and its harvest from the wild brings in considerable revenue (2.13) (Gagnon 1999). The roots of *P. quinquefolius* were included in CITES Appendix II in 1975, but the listing was revised in 1985 to cover trade in the entire plant. The US regulates American ginseng harvest and export under a national programme established by the US CITES Authority, the USFWS (2.12). This contrasts with the situation in Canada where the species is classified as Threatened in Canada and no export of wild-harvested ginseng roots has been allowed since 1975 from Quebec and since 1989 from Ontario. The species prefers stable habitats and is found in the understorey of mid to late successional deciduous forests (2.4). Within such habitats, ginseng seeds may be bird dispersed, but they are small in number and large in size and most seeds fall to the ground near the parent plant (2.3). This may prevent *P. quinquefolius* from re-colonizing habitats where it used to grow. As a result, populations may become restricted and isolated as suitable habitat is being increasingly fragmented by logging (2.5). Regeneration of the species is rather slow with a pre-reproductive period of 3 years or more. Both this delayed regeneration and limited dispersal contribute to impeded recovery after harvest.

In theory, ginseng is easy to age and monitor. The total number of leaves provides a reliable index of size class. It is therefore surprising how little is known of the population dynamics of *P. quinquefolius* particularly in the US where such knowledge forms the basis for management of any harvested wild species. Population dynamics research is more advanced in Canada where detailed information is available for Southern Quebec. Whilst recent population models have not incorporated environmental variation and do not make the impact of harvest explicit they do highlight sensitive parameters (e.g. Sverdlove 1981, Charron and Gagnon, 1991). Evidence from the Quebec models reveals that population stability is most affected by the removal/loss of large, seed-producing adults (age classes 3 and 4). These are the very specimens that are targeted for the ginseng root trade. At best this leaves a post harvest population consisting only of small plants and the seeds in the soil. In this reduced state the population may have difficulty rebounding especially when subject to herbivory or a poor growing season (2.2, 2.9). Although ginseng pickers are required to plant the seeds of collected plants on site, it should not be assumed that they do so (2.18, 2.26).

Without doubting the value of such demographic data it is important to consider that the Quebec populations are at the northern tip of the species range. Thus the information may not be representative of the entire range. For example, the central Appalachian populations may possess population dynamics that would

make them less vulnerable to harvesting. Clearly, there is a need for further research, particularly in the US (2.8).

Wild exported roots are now known to be smaller in size than in previous years of the harvest. So, although the total export tonnage has declined from 300 tons in the 1800s to 65 tons in recent years, it is believed that the latter yield represents a greater number of individual plants than in the 1800s (Haber 1990). This decline in plant size is also supported by the results from one field study started in the 1980s where many of the study populations have been wiped out (Gagnon 1999)(2.8).

However, despite the qualitative nature of the information, the general consensus points to a reduction and continuing decline of North American ginseng populations (2.7). Although harvesting is allowed in many state lands (2.17), poaching of ginseng roots is widely reported outside protected areas throughout the species range (see paragraph 1) (2.25). This includes the Canadian populations in Quebec and Ontario. There are indications that protected areas may be becoming the last refuge for American ginseng (2.7, 2.10, 2.15). So, whilst it is generally agreed that ginseng has become uncommon, field verification is urgently required to support these indirect data (2.6, 2.8).

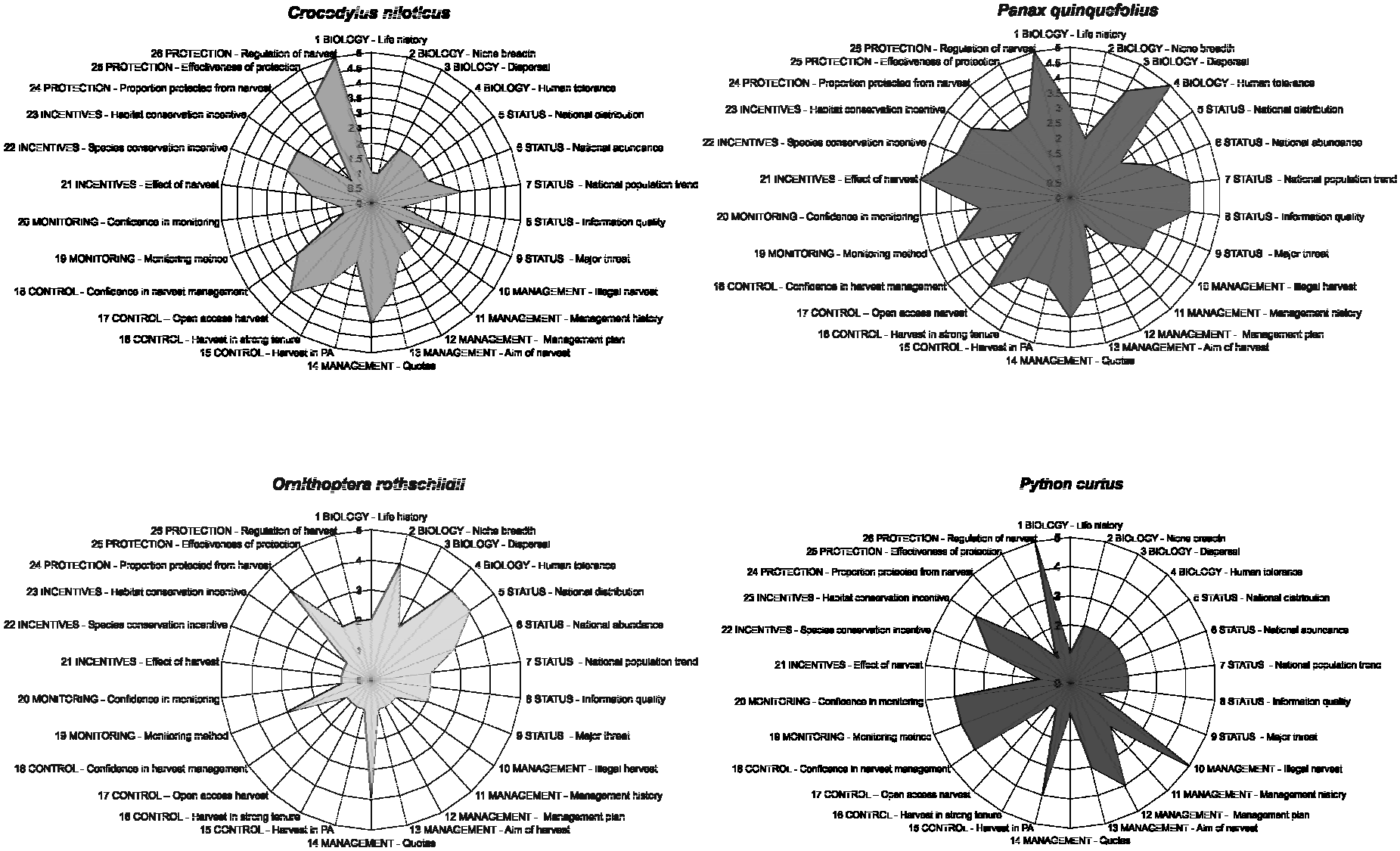
Overexploitation is definitely the most substantial threat to ginseng populations today (2.9). Compared with the situation in the eighteenth century there are many more harvesters, fewer and smaller ginseng populations and decreasing suitable habitat for the species. According to Gagnon, harvesting is generally thought to be biologically unsustainable and offers no incentive for species or habitat conservation (2.13, 2.21, 2.22, 2.23) (Gagnon 1999). Because multiple harvesters are now likely to encounter the same populations there is no longer any benefit in harvesting just enough to allow recovery. The conservative harvester is likely to lose out to the selfish exploiter (2.18, 2.25). This also makes it difficult to establish a harvest quota and to implement strict management regulations (2.14). In addition, harvesters of today do not rely on ginseng to make a living. In most cases the revenue is merely a supplement to social security benefit (2.13), hence future sustainability of the harvest is a low priority for many harvesters.

Monitoring of the impact of the harvest on population status is needed, and a three-tiered monitoring system has been proposed for the US that will map populations on the larger scale, regularly observe the progress of size-classed populations and monitor the fate of marked individuals. A similar monitoring programme is currently being implemented in Canada (Quebec and Ontario). There is concern that the present system of US export figure inspection is inadequate (2.19). Despite export levels appearing stable over the years it is possible that a recent decline has been masked by an increased export of woodsgrown roots sold as wild ginseng (2.20).

Conclusions and comparison of radar plots for species assessments

Four of the radar plots presented above have been reduced and placed together for comparative purposes (Figure 7). It is clear that the level of impact of the factors affecting the management of each of the species differ and consequently produce a differently shaped graphic in each case. Where the shaded area in each figure is close to the centre of the plot, there is a greater likelihood that the exports will be non-detrimental to the survival of the species, conversely where the area of shading is closer to the periphery of the plot the chances of exports being non-detrimental are reduced. Comparing the plots for the two reptiles, *C. niloticus* and *P. curtus*, the results for the sections dealing with the biology and status of the species are close to the centre of the plot suggesting that these species are fairly robust to harvest on account of life history and status factors. In contrast, the results for the *O. rothschildii* and *P. quinquefolius* suggest that they are more susceptible on account of their biology. Strikingly for *O. rothschildii*, the management, incentive and protected area section results are very close to the center of the plot. Thus for *O. rothschildii* one could conclude that any susceptibility to harvest on account of the biology is likely to be compensated for by the good management, incentive and protective structures in place and so the chance of the harvest being non-detrimental is high. In contrast to the other three species, for *P. quinquefolius* the plot shows that the majority of factors other than management are scored towards the periphery of the plot, suggesting that the likelihood that exports are sustainable may not be high and the system may require more oversight. Alternatively, because the scoring is qualitative, some respondents may be using a more precautionary approach than others and so the harvest of some species may appear to be more problematic. If this is the case, the checksheet does provide a means of articulating the decisions and allowing comparisons to be made between different respondents.

Fig. 7. Comparison of the radar plots resulting from the non-detriment finding assessments for four species from left to right and top to bottom, *Crocodylus niloticus*, *Panax quinquefolius*, *Ornithoptera rothschildii*, and *Python curtus*



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