International Expert Workshop on CITES Non-Detriment Findings

Working Group 4

Geophytes & Epiphytes
FINAL REPORT

Taxa: *Galanthus* spp **NDF GUIDANCE SHEET**

1. Information about the target species or related species

List and briefly describe the elements that could be considered when making Non-detriment findings:

1.1. Biological and species status:

Taxonomy. The accepted taxonomy for the genus *Galanthus* is the CITES Bulb Checklist (Davis et al. 1999). A copy of the checklist can be found at http://www.kew.org/conservation/CITES_Checklists/CITESBulbChecklist.pdf. This includes full distribution data and synonymy (other names). This reference should be used as a standard. Traders may use old or incorrect names.

Distribution. The following are key questions. Is the species confined to your country only? Is the taxon widespread or does it have a localized distribution? This information is likely to be available from the published literature. Additional questions such as what is the distribution of the harvested populations is likely to require field investigation or can be obtained from the traders or collectors. The former source would have higher confidence levels and therefore lower risk.

Abundance: Are the populations large throughout their range and throughout the harvested areas? Again, some of this information is likely to be available from literature and national experts. If large across the harvest range risk is low. Within populations, numbers can reach 40 plants per m^{-2} for *Galanthus elwesii* in Turkey.

Life form: All *Galanthus* are perennial geophytes which means that they survive below ground for part of the year. They can only be harvested when above ground, this limits harvest. Bulbs are harvested and some leaves need to be remaining to allow collectors to target plants.

Life cycle: *Galanthus* life spans are relatively short for perennial plants normally being less than 10 years. Individuals reproduce both sexually (by seeds) and asexually (by bulb production). Death risk is low for most of a plants life span, becoming high only in the oldest plants.

Capacity for populations to regenerate: Harvested populations of *Galanthus elwesii* are reported to recover after 3 years since harvesting adult plants (after reproduction). This is reflected in the traditional rotation period for harvesting in Turkey. This is likely to be similar for other species.

Role of species in the ecosystem: Does the collection of the species significantly impact the other wild species or habitat. Bulb harvesting could potentially involve a significant amount of disturbance given the nature of the harvest. How the harvest is carried out is therefore important.

RISK ANALYSIS: High risk- Restricted species, small populations, time of harvest, harvest intensity, harvest selection. Harvest should be after reproduction (flowering and seed set) has occurred and should preferentially select older (larger) individual bulbs.

Positive NDF for 1.1: Adequate abundance, low risk harvest

Note: CITES and Plants: A User's Guide Version 3.0 provides information on the application of CITES to plants and a list of references and resources it can be found at http://www.kew.org/conservation/cites-slidepack.html in English, French and Spanish.

1.2. Takes/uses (e.g. harvest regime):

Type of harvest. Harvesting of whole live plants. Bulbs are located by targeting visible leaves. Harvesting is only possible during the time between which they appear above ground to when they die back. The less detrimental harvest is after individuals have reproduced.

Harvest specificity: Is just the target species collected or are other species collected as well? In addition, are there other species which may be collected inadvertently? Are there rarer *Galanthus* species nearby or with an overlapping distribution? Information on distribution is available from the published literature. Data from the traders and collectors will be required to assess deliberate or inadvertent collection of other species.

Harvest regime: What life history stages are actually collected i.e. how big are the collected bulbs? Are only adults (individuals who have flowered/set seed) harvested? Is there a minimum bulb size for collection? This data can only be collected by overseeing harvest or directly from traders.

National/International use: Is the species harvested for local purposes or international trade? What are the relative quantities of these? Local trade in Galanthus is usually small, with limited material collected for gardens or national specialist collectors. Local botanists will be able to give an assessment. The risk is likely to be low.

Harvest source: Are plants harvested only from the wild or do any come from cultivated stocks Is it known whether the cultivated stocks conform to the CITES definition of artificial propagation? This is outlined in Resolution Conf. 11.11 (Rev. CoP14) which can be found at http://www.cites.org/eng/res/11/11-11R14.shtml. It is useful to develop guidelines on the national application of this definition and also carry out training to ensure that is being applied in a standardized fashion.

Are the bulbs collected from the wild and grown-on in cultivation fields prior to export? Such a process is a common method of 'storing' bulbs and this stock must be treated as wild for the purposes of an NDF. If you are uncertain whether plants are harvested from the wild or truly propagated its best to treat all of the material as wild until you can accurately assess propagation.

Harvest frequency: How frequently are the populations harvested from each collection site? For example a three year rotation period is traditionally adopted for *Galanthus elwesii* in Turkey. More frequent harvesting is likely to be detrimental.

Harvest volume: Can you estimate the fraction of the overall population and of the different bulb size/age classes removed from the collection sites? The traders will record actual harvest volume (and possibility bulb size as the market favours larger bulbs) for commercial purposes. Your local experts should be able to give a preliminary view on what percentage the harvest is of the local wild stock.

History of harvest: Is there a history of harvesting this bulbous plant? Is this a newly emerging harvest? In the absence of historical data, a precautionary approach is appropriate.

Harvest trends: Is the harvest stable or increasing/decreasing? This can be based on an estimate from the knowledge of local collectors and traders. An increasing harvest would suggest a precautionary approach is appropriate.

Regulation: Is the harvesting regulated?, i.e. government control at a regional or national level. A well regulated harvest is low risk.

Legal/Illegal use: Does the harvest conform to national or international legislation? Is there also unregulated harvesting? Is there illegal harvesting or trade? Are there any reports of illegal harvest form collectors or traders? In the case of Galanthus illegal trade is more likely the rarer the species is.

Reason for harvest: What are the forces driving the harvest? For example, to date the trade has been driven by demand for horticultural purposes at an international level with the majority of primary exports going to a limited number of countries. This has facilitated regulation of the trade and lowered the risk of detrimental trade.

Commercial destination: Are the plants being collected for specialist collections, widespread horticultural uses, scientific research, mother/parental stock? Is it for local, national or international uses?

Information quality: Where have the data originated from? How recent is it? How reliable and representative is it? Has the information originated from a national flora, from scientific literature or data, from national reports from high quality local knowledge? High quality low risk information is recent field based and obtained from reliable sources.

RISK ANALYSIS: High risk – frequent harvest, large harvest volume, all bulb sizes collected. Harvest should be after reproduction (flowering and seed set) has occurred and should preferentially select older (larger) individual bulbs.

Positive NDF for 1.2: Regulation of harvest, low volume, positive selection for bulb size.

1.3. Management, monitoring and conservation

Required for significant harvest of bulbs

Management: Is there a management plan or an equivalent? For example there may be a local/national/institutional management plan. [See Annex for template management plan]. If there is no management plan then implement a precautionary harvest quota based on the available information and export quota until such time as a formal management plan is in place. For example, a precautionary quota for 3-5 years. A medium term precautionary quota may give the CITES Authorities sufficient time to assess the impact of harvesting and establish an appropriate quota.

Monitoring: This includes the verification of the species being harvested, confirming that the correct age/sizes being harvested, and assessing the status of the source populations including the population size and the health of the habitat. Details of how to do this are given in Section 2.1.

Confidence in the harvest (legal and illegal). Is there sufficient confidence that the harvest is as reported? This can be improved by monitoring the harvest in the field and / or at the bulb holding points prior to export. For example, the bulb trade often utilizes central warehouses prior to export into international trade. In these warehouses bulbs are cleaned, graded and packed. This allows an opportunity for the CITES Authorities to inspect the consignments to verify bulb size, species and source. This can be a quick and easy way of checking for problems.

Is there legislation in place to control harvesting by bulb companies? If there is no legislation, are there guidelines approved by the CITES Authorities? The template management plan in the Annex includes elements that might be included in these guidelines.

History of harvest: Is there a history of harvesting this plant? Is this a newly emerging harvest? Historical data can assist in the setting of appropriate quotas and in adaptive management of the resource.

RISK ANALYSIS: High risk – no management plan or guidelines, no monitoring system, medium- quantitative system with medium to high confidence. Low- monitoring system

Positive NDF for 1.3: quantitative monitoring system with medium to high confidence.

2. Field methodologies and other sources of information.

List and describe examples of field methodologies and other sources of information for monitoring populations and/or regulating harvests which could be utilized to obtain data on the elements described below.

2.1. Biological and species status data:

Biological data can be obtained from a variety of literature sources.

Biological information can be obtained from national and international experts, including local knowledge. Experts should confirm the identity of species subject to collection. Field inspections will also be required. Such inspections may be qualitative; for example short visits by a local expert to visually inspect the sites to confirm that the populations are healthy. If possible, quantitative data should also be collected. Quantitative assessments of the population include the overall abundance, size / age structure of the population. For example, random samples (using quadrats) could be taken to assess the overall abundance in the population (see references and resources). Randomly dug plots can be used to assess the size structure of the bulb population. This could also be assessed by inspecting the harvested bulbs. Permanently marked areas (Permanent plots) can be used to assess the long term trends in the populations and estimate birth and death rates of different age/size categories.

Population modeling could be used to estimate long term population trends and probabilities of extinction under plausible harvest methods and quotas (see annex). A key reference here is Sutherland W.J. (ed.) (2006) Ecological census techniques: a handbook, 2nd edition. Cambridge University Press.

Population Modeling Additional Sources:

VORTEX PVA Software: http://www.vortex9.org/vortex.html

Statistical package R (useful for population modelling): http://www.r-project.org/

Caswell, H. (2001). Matrix population models, 2nd edition. Sinauer Associates, Inc.

Bolker, B. J. (2008). Ecological models and data in R. Princeton University Press.

Menges, E.S. (2000). "Population viability analyses in plants: challenges and opportunities". *Trends in Ecology & Evolution* **15**: 51–56.

2.2. Harvesting and trade data:

Harvest data can be confirmed by inspection of the harvest sites or of the annually harvested stocks held by traders in their warehouses prior to export.

The traders are likely to hold records of harvest stock for purposes of payment, and these can be used for purposes of monitoring. Records of the time taken to obtain a certain harvest level from individual populations (harvest per unit effort) can indicate the health of those populations. Again trader records can hold data that may assist you in assessing harvest per unit effort.

Records of what is actually exported: UNEP-WCMC trade data can be reviewed and compared with national records to check for inconsistencies and to confirm compliance with national quotas. Phytosanitary records can also assist in confirming the species and volumes exported.

Are there records of illegal trade in this species? This could be available from customs agencies, CITES authorities and international organizations (such as TRAFFIC). Is there any evidence of illegal collection from harvest sites, for example by local collectors or landowners?

Trade routes and ultimate destination: Large scale commercial trade in Galanthus mainly follows a restricted international trade route to The Netherlands for global distribution. Minor trade in rarer species is more likely to follow complex trade routes and be prone to illegal trade.

Population models could incorporate harvesting and trade data to allow estimates of most appropriate rotation periods, appropriate removal rates per site, the size limit for removing bulbs, and the effective area of land required to fulfill the quota.

RISK ANALYSIS: High risk is the in the case of rare species with restricted populations.

3. Data integration for NDF elaboration

List and/or describe data integration that could be helpful in formulating the non-detriment finding.

Data integration is the integration of the biological data, harvest data, trade data and local knowledge to get an overview of the trade and its likely impact. A committee of experts, that extends beyond the normal expertise of a Scientific Authority, could meet annually to consider all of the relevant biological, harvest and trade evidence as well as local knowledge and knowledge of legislation. This group shared knowledge could add value to the decision making process on NDF's and quota setting.

Population modeling (mechanistic and/ or statistical) is a useful tool to bring together the population and harvest data to obtain predictions of the population dynamics and predictions of sustainable yield. (See Annex) Detailed biological data is usually needed to parameterize a model that could predict quantities of bulbs to any reasonable level of accuracy. However, even small amounts of data could be useful in allowing highly unsustainable harvesting quantities to be identified and alternative harvesting methods to be compared. For example, models allow for a variety of harvesting regimes to be explored to assess what may be more or less detrimental without the need for field studies.

4. List and describe the ways data quantity and quality may be assessed

   How representative is the available data of the whole population? Your local expert may be able to assess this and give an informed view as a qualitative assessment. This could give a quick assessment.

   Quantitatively, this could be done by comparing data from collection sites. The area over which samples are made and the number of samples taken should be compared to the overall population distribution. Likely variation in abundance and population density can be obtained by making repeated random samples and observing how the variance stabilizes as more samples are made.

   Similarly, it is preferable to inspect as large a proportion of the harvested bulbs as possible (this could be aided if the traders use a central warehouse) to assess the status of the harvested bulbs as a whole.

   Quality of the data can also be assessed by correlating more accurate but more resource intensive quantitative measurements (such as measuring the number of bulbs per square metre for a whole population) with easier to collect, but generally less accurate measurements (such as estimating whole sites as "low", "Medium" or "high" bulb density). This could form simple basis for risk analysis.

   RISK ANALYSIS: High risk is the in the case where data quality is poor or no assessment has been made.

5. Summarize the common problems, error, challenges or difficulties found on the elaboration of NDF. Maintaining and updating expert knowledge,- frequent changes of staff, no mechanism for maintenance of institutional memory. Few quantitative records, lack of long term quantitative monitoring process, lack of data management systems Obtaining quality information from local collectors and bulb companies Obtaining qualitative information from local collectors and bulb companies Clarity of process to outside parties Understanding of the population dynamics and the variation in site productivity throughout the collection range not complete Scarcity of data, case studies, and examples. Lack of a standardized process and guidelines- need a simple manual for geophtyes linked with staff training.
6. Summarize the main recommendations which could be considered when making an NDF for this taxonomic group. **Implement an adaptive NDF setting methodology: a feedback process so that quotas can set and adjusted** Utilise all sources of information including local and trader knowledge and experience Develop a simple population and harvest monitoring process can utilize the knowledge of collectors Maintain an institutional history of monitoring and expert knowledge Acquire knowledge on what is detrimental and clearly define it for all stakeholders, ensuring that you use simple indicators in your monitoring system

Annexes

Annex A: Template CITES Management Plant for Galanthus Species

Wild Harvest

- Harvest restricted to populations in the follow areas……..,.
- Include map showing distribution of areas subject to collection
- Quota established for collection areas – portion of total quota
- Harvest rotation, harvest to be carried out on a 3 year rotation cycle, rotation to be indicated on collection distribution map

- Collection limited to x weeks in the time period a to b (may be altered in consultation with Scientific Authority, for example, in the case of unusual or extreme weather conditions).
- Collection limited to bulb size > x cm diameter, below size bulbs to left in soil or collected for planting in cultivation fields (Collector should be supplied with graded sieves to allow them to familiarize them selves with minimum size)
- Collector should fill in activity report (simple design prepared by CITES SA), indicating how long, person hours, it took them to collect quota and how far did they have to range
- X random samples taken in collection area, non collection area prior to annual harvest
- Y permanent sample plots established in collection areas and non collection areas, sampled y times per year. This may be done by local inspectors taking photographs for SA.
- Log of collection details held at sorting Warehouse, including source area, collector, weight of bulbs, number, time to collect.
- Random sampling of warehouse bulbs, seize weight, species, time taken to collect

Role of Scientific Authority

- Mapping of population distribution, delimitation of collection areas, definition of rotation times
- Selection of population sampling methods, initial sampling of populations to provide data for local quotas and national quota
- Selection and establishment of permanent plots
- Preparation of field sampling guidance, so sampling can be carried out by non specialist staff
- Preparation of Warehouse protocols and sampling guidance, so sampling can be carried out by non specialist staff
- Establishment of monitoring protocols and guidance, if required, selection of suitable population model
- Management and review of data collected
- Preparation of a simple collection plan to be agreed with quota holders. This will be key elements of the management plan relating to that quota with timetables
- Establish annual quota system, set at a precautionary level on 3 year cycle, reviewed during year 3.
- Overall management plan to be reviewed on a 5 year cycle.

- Organise scientific workshop on quota setting and management plan on a 3 year cycle

Scientific Authority role in Capacity Building

- Carry out workshops with quota holders to explain management plan and individual collection plans
- Carry out workshops with management authority regional staff to explain management plan and individual collection plans and their role in monitoring same
- Prepare generic briefing sheets for collectors on collection plan
- Carry out rolling programme of workshops for collectors to inform them and to get their input into the management programme

Role of Management Authority

- Liaison with SA over management plan and quota
- Confirmation of national quota
- Assignment of quota to traders

- Establishment of legal agreement with traders
- Organising workshops with traders and collectors
- Distribution of information to traders and collectors
- Allocation of time of regional staff to monitoring management plan implementation and population sampling if required

Annex B: The value of population modelling in making NDF's - Why do modelling?

Modelling can assist the making of NDFs in several different ways

- Concisely summarising the available knowledge on the biology of the species. We strongly recommend that a life cycle diagram is constructed.
- Revealing aspects of the species biology that are most important in determining it's population dynamics and regenerative response to different harvesting strategies
- Investigating plausible harvesting scenarios and their possible and relative impacts without having to do anything in the field that may be detrimental to the survival of the target species.
- Predicting the dynamics of populations before and after harvesting
- Predicting the change in extinction probability as a result of harvesting
- Estimating uncertainty in the predictions of population dynamics and in the response of the population to harvesting
- Identifying important data to collect to more accurately predict the population dynamics and the effects of harvesting. i.e. knowing where the gaps in knowledge exist
- Indicating where additional information would improve confidence in making NDFs
- Indicating how precautionary NDFs need to be for species with a particular set of biological characteristics

Decisions based on real data, and on models parameterised from real data, generally give a higher level of confidence than those based on educated guesswork.

What data should we consider collecting to parameterise a model?
Modelling can be performed with very little quantitative data. However, large amounts of data are usually required to be able to make meaningful quantitative predictions. In general, collecting more data and obtaining more details about the species concerned, will allow more accurate predictions to be made. The amount and type of data needed depends on the question to be answered.

Models to predict species population dynamics could incorporate data on

- Temporal changes in overall abundance
- Temporal changes in size or age or stage classes in the population
- Information on species life cycles
- Spatial data on the location and characteristics of individuals
- Data on the vital rates of the population such as birth and death rates
- The effects of environmental conditions (abiotic factors)
- The effects of other biological factors such as crowding and availability of mates
- Levels of variation in biological characteristics

Note that only collecting data on temporal changes in presence and numbers in populations can limit the insights that can be gained from models. Collecting more information about birth and death rates, and complete census data (data through time on every individual in a population), allows more information to be extracted and generally leads to more predictive models. Full population census data gives more trustworthy and accurate insights into the determinants of population change. This can be very useful in building accurate models.

Collecting sufficient data to parameterise models can be expensive and time consuming. However, this need not be the case. For example, data could be collected during harvesting or may be available from local or national records. Published information on similar taxa may be available but care must be taken as the dynamics of apparently similar species can be very different.

How is a model developed?
The precise form of a model depends on the question being asked. Standard approaches are available for most conceivable needs in relation to making NDFs.

Life cycle models can be developed by investigating the biology of the taxa through literature sources, and the collection of field data.

Models that represent the biology of a species in a simplified manner are used to estimate the impact of harvesting. This is because such mechanistic population models allow for the incorporation of the details of the harvest, e.g. the particular stages and ages of the population being removed, and the projection of their likely effects.

Transition matrix models are a commonly used formal way of modelling changes in the size/age/stage structure of the population through time. Rates of transition between the different population categories can be calculated from data and these can be used to predict future population dynamics. Note that the accuracy of such predictions depends on the quantity and quality of the data as well as the biological characteristics of a species.

Models can be continually improved as new data become available. Bayesian models allow the estimation of the likelihoods of parameters and biological mechanisms and can also be used to incorporate new data as they become available to update predictions. This could be particularly useful in developing models for species that are repeatedly sampled and / or harvested.

How do I test a model?
A variety of formal methods are used to test models. Almost all of these give an estimation of how well a given model predicts a particular situation. However if the model is being used to predict a novel scenario (such as a new level or method of harvesting), then the results of such model tests may be misleading. This is because the model may not incorporate important details that strongly affect the dynamics under the new scenario.

Naturally high variability in population behaviour will make forward projection risky for many species. Models that incorporate stochasticity in their structure can be particularly useful for such species to allow the additional estimation of uncertainty in the predictions.

Models analysed using maximum likelihood methods can be used to infer the characteristics of unknown processes and parameters.