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Conservation of Galliformes in the Great Himalayan National Park: A Review of Monitoring and Research Activity

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EXECUTIVE SUMMARY

This consultancy took place during 25 April-25 May 1998. My Terms of Reference were to appraise the design of the pheasant monitoring programme set up under the FREEP-GHNP Conservation of Biodiversity Project (CoBP) by WII research personnel, to advise on the appropriateness of the methods of data collection and analysis being employed, to recommend any necessary extensions to the monitoring programme, to suggest practical management policies for implementation in GHNP to improve the status of pheasants, to share my insights with WII and GHNP staff, and to prepare this report. All of these tasks have been accomplished to the fullest extent possible at this time, the end of the third year of this four year project.

The species of concern are western tragopan *Tragopan melanocephalus*, koklass *Pucrasia macrolopha*, Himalayan monal *Lophophorus impejanus*, cheer *Catreus wallichi* and white-crested kalij *Lophura leucomelanos hamiltoni*.

The establishment of eight monitoring sites in Tirthan only is entirely appropriate in making maximal use of the manpower available, whilst acquiring adequate quantities of standardised data for proper statistical analysis. Of all the possible monitoring techniques, only call playback has not yet been employed or rejected as unsuitable: I have recommended this method for rapidly determining the distribution of cheer throughout the project area. Population indices of adequate precision have been obtained by the call count method for koklass and through direct encounters with flushed birds on transects for monal. I have recommended that the former method is also used for cheer, and the latter for kalij.

In order to ensure that the future impacts of the Ecodevelopment Project (EP) in GHNP, the Sainj and Tirthan WLSs, and the ecozone, I have advocated the establishment of at least some additional monitoring sites in localities other than Tirthan, possibly at the expense of some of the eight already established there. New sites should be established jointly by WII researchers and GHNP front line staff in the final year of this project.

The CoBP monitoring programme in Tirthan covers six forest types with a total of eight sites. Because a lack of replication within forest types, it is not therefore capable of demonstrating any absolute habitat preferences by pheasant species that are distinct from other possibly unknown variables associated with the particular locations chosen as monitoring sites. This was unavoidable, given the limited manpower available. In mitigation, it is clear that details of microhabitat being recorded for each encounter with flushing birds during transect walks, will enable the relative habitat preferences between locally sympatric species to be specified. It is becoming clear that tragopan has a very distinct preference for a ringal bamboo *Arundinaria spathiflora* understorey. I recommend that an attempt is made to predict its distribution using the habitat and topographical GIS map developed at WII, in attempt to identify all potential

patches of prime tragopan habitat in the project area, thereby allowing a local Population Viability Analysis to be undertaken.

It seems probable that in recent years the number of domestic livestock in GHNP for spring and summer has been declining slowly, whilst there has been a marked increase in the intensity of gucchi mushroom *Morchella* spp. collection from the forests in spring. Since the start of pheasant monitoring in 1996 there have been significant declines in both monal and koklass at the monitoring sites, and a similar trend is evident for tragopan. It s not clear whether these changes are the result of natural fluctuations in numbers, or a consequence of human impact. With Dr Sathyakumar, I have planned a two year experimental study of the effects of gucchi collection on pheasant distribution and breeding success, together with parallel measurements on areas given temporary relief from migrant livestock. In both cases, effective bans will have to imposed on these activities in parts of Tirthan.

Because the WII research team have been accumulating site-specific species inventories for other taxa, such as insects, higher plants, fungi and passerine birds, the CoBP is a unique position to provide the first ever quantitative data through which to assess the utility of pheasants as biodiversity indicators. This is one of the 25 projects given international priority in the *Pheasant Action Plan* (1995-99).

I have suggested that the EP might provide financial support to gucchi collectors who stop collecting and police the banned areas. I also believe there is scope for inviting tenders from competent research institutes to investigate the small scale *ex situ* cultivation of gucchi in the ecozone. There is an urgent need for more education in sustainable use, conservation and wildlife law at village level.

Training of GHNP front line staff should start as soon as possible and continue until the end of the project in 1999, so that the continuing task of monitoring pheasants and other wildlife can be given over to them by WII researchers before 2000.

I shared my conclusions and recommendations with GHNP and WII staff at a joint workshop on future monitoring needs, and made a consultancy presentation on 21-22 May 1998.

ACKNOWLEDGEMENTS

First I must thank Dr. Tony Gaston for inviting me to help him coordinate the Himachal Wildlife Project (1979-80), the report on which was crucial to the creation of the GHNP. I am grateful to Mr Sanjeeva Pandey IFS, ex-Director GHNP (1990-91) and ex-PI of FREEP-GHNP, and to Mr B.M.S. Rathore (PI, FREEP-GHNP) and Dr S. Sathyakumar of WII, for recommending me to Winrock for this consultancy. Ms Erin Hughes and Ms Lana Pyburn in Morrilton, and the Winrock staff in Dehra Dun and Delhi handled the arrangements for my contract, travel, visa and per diem with great efficiency. Mr S.K. Mukherjee, Director, and all staff at the WII offered me everything possible in the way of hospitality, information and useful discussion during my brief stay on the campus in Dehra Dun. Dr Sathyakumar, K. Ramesh, T.R. Vinod and their Field Assistants were highly informed and amusing company on our subsequent trek in Tirthan. Mr Nagesh Kumar, Director GHNP, made us welcome at his Shamshi Park HQ, and provided us with much assistance through his field staff, especially Mr S.K. Guleria, R. O. Tirthan, and Mr Balak Ram, Wildlife Watcher at Karongcha. The WII research team's warm hospitality at the FREEP Base Camp in Banjar made the production of this report a relatively painless task. Discussion of its contents with Dr Sathyakumar, K. Ramesh and the audience at my presentation during the WII-GHNP workshop on 22 May, resulted in many improvements. I thank K. Ramesh for allowing me to give details of some of his unpublished data on recent pheasant population trends in Tirthan.

TERMS OF REFERENCE

This consultancy visit took place during 25 April - 25 May 1998, under the following terms of reference (slightly modified from the contract document):

- To provide technical inputs to Wildlife Institute of India (WII) researchers and scientists conducting research on species of game birds (Galliformes) in the Great Himalayan National Park (GHNP) in Himachal Pradesh;
- To suggest or develop improvements in the methodology for studying these species in GHNP;
- To advise on aspects of management of game birds involving researchers and front line staff in GHNP, with the emphasis on problems and opportunities unique to its mountain environment;
- To prepare a report including all findings and recommendations;
- To share insights with local community officials, GHNP staff, and WII faculty and researchers, at meetings designed to produce practical recommendations for the conservation of biodiversity in GHNP, in the context of the Ecodevelopment Project.

2 SPECIES OF CONCERN

The species with which this consultancy is concerned are all pheasants: western tragopan *Tragopan melanocephalus* (henceforth 'tragopan'), Himalayan monal *Lophophorus impejanus* (henceforth 'monal'), koklass *Pucrasia macrolopha*, cheer *Catreus wallichi*, and white-crested kalij *Lophura leucomelanos hamiltoni* (henceforth 'kalij'). All these occur in the area of the GHNP with Sainj and Tirthan Wildlife Sanctuaries (WLSs). Only cheer and kalij occur in the contiguous lower altitude areas to the west (Gaston et al. 1981; Gaston and Garson 1992, Gaston et. al. 1994), that now constitute the Ecodevelopment Project Area (henceforth referred to as 'the ecozone'; FREEP-GHNP 1995).

Western tragopan is classified as being 'Vulnerable' to extinction on the *IUCN Red List* criteria, and is only present in one other National Park in the world, at Machiara in NE Pakistan. Cheer is also classed as vulnerable (McGowan and Garson 1995). All these pheasant species are acknowledged to be subjects of illegal hunting activity in and around GHNP. There is also circumstantial evidence to suggest that their populations in GHNP and elsewhere are adversely affected by a number of other prevalent human activities which may have their impacts either through direct disturbance and/or via modification of their natural habitats. These activities include grazing of annual ground vegetation and browsing of scrub and forest understorey by domestic stock, the collection of fuel wood and morel *Morchella* spp. fungi (locally known as 'gucchi') from the forest floor, and some grass cutting and tree lopping to provide winter fodder (Gaston et al. 1983, Gaston and Garson 1992).

Three other species in the Gallifomes have been recorded in GHNP (Gaston and Garson 1992, Gaston et al. 1993). Chukor *Alectoris chukar* shares its typical habitats and altitudinal range with cheer (and goral *Nemorhaedus goral*). Provisionally we will assume that any conservation action designed to improve the status of cheer will have a parallel positive influence on chukor populations. In alpine areas both Himalayan snowcock *Tetraogallus himalayensis* and snow partridge *Lerwa lerwa* have been recorded. Although nothing is known in detail, these species are not believed to be casualties of damaging levels of disturbance or exploitation, and have therefore been considered beyond the scope of Conservation of Biodiversity Project (CoBP, FREEP-GHNP 1995), and of this consultancy. None of these species are considered to be threatened with global extinction (McGowan et al. 1995).

3 GAME BIRD CONSERVATION IN THE CONTEXT OF FREEP-GHNP

The ethos behind the Ecodevelopment Project (EP), focused on the area to the west of GHNP, is to improve the living standards of local people whilst simultaneously reducing the demand for all natural resources currently extracted from GHNP. The ultimate aim of these activities is to prevent the destruction or degradation of habitats, and the extinction of species, in GHNP.

The parallel CoBP, of which this consultancy forms a part, has the declared goal:
'To evaluate the floral and faunal diversity in the Great Himalayan National Park, Himachal Pradesh in relation to abiotic and biotic factors. This appraisal will include assessment of current human impacts and suggestions for approaches to integrated resource management, bearing in mind present and potential future economic needs.' (FREEP-GHNP 1995: 7).

CoBP objectives (paraphrased from pp. 7, 10-13, 33-35) that are relevant to game bird research, monitoring and conservation, include:

- designing an ecological monitoring system and the provision of baseline data from it, through which to assess the impact and sustainability of EP activities (Tasks 1d, e, f, 6f);
- determining the abundance, distribution and habitat requirements of threatened species (Task 6b, c);
- assessing impacts resulting from current levels of livestock activity, and herb, fungus, bamboo and timber harvesting, on vulnerable animal species in particular, and biodiversity in general (Tasks 6d , 7b, 8b);
- assessing the utility of certain species as biodiversity indicators (Tasks 6b, c);
- suggesting forms of ecodevelopment activity that should reduce human impacts (Task 8d);
- training GHNP front line staff in monitoring techniques so that they can continue to collect and interpret the data after project completion in 1999 (Task 1d).

In order to focus my Terms of Reference for this consultancy on the remit of the CoBP, I will address each of these objectives in the order in which they are listed above.

4 MONITORING EFFECTS OF EP ACTIVITIES ON GAME BIRD POPULATIONS

4.1 Design of the monitoring programme

If this monitoring programme is to measure all the anticipated positive effects on wildlife resulting from EP activities, it should sample habitats in GHNP, the WLSs, and the ecozone (Gaston 1997:25 et seq.). However the manpower available to the CoBP, namely one full time WII Biologist (Mr K. Ramesh) since March 1997, for initiating this task has not permitted the design and implementation of such a comprehensive scheme for pheasants (or other animals or plants).

All the pheasant monitoring plots set up under CoBP are in Tirthan, which is more accessible than Jiwa, but less disturbed by human impacts than Sainj or Palach (Gaston and Garson 1992), both of which are technically outside GHNP. I believe that the decision to monitor pheasant populations in only one valley entirely within GHNP during the development of the CoBP was correct. Any other design would have been logistically less efficient, thereby yielding fewer data with reduced precision.

A total of eight permanent transects of precisely measured length have been marked on the ground and are scheduled to be located precisely by GPS coordinates. All but one of these are all in forest above 1,800 m, and only have the potential to monitor tragopan, monal and koklas populations, but this is again appropriate as these are the species thought to be most affected by human impacts (see Section 6, p.10). The one low altitude route follows the course of the Tirthan river just outside the GHNP boundary (Karongcha-Kauncha). Two of the others are on the left (north-facing) bank of the valley (Rolla-Basu, Basu-Koilipoi), and the remaining five are on the right bank (Rolla-Dulunga, Dulunga-Grahani, Shilt-Chordhuar, Shilt-Dhar, Ghumtarao).

Monitoring work has been conducted on a year-round basis during CoBP, partly in order to determine which times of year are most suitable for data collection. Winter (December-March) fieldwork is only feasible in less remote parts of the valley (e.g. Nara, Ghumtarao and Jatoli are inaccessible), and is easier on south-facing slopes which have less snow. However I agree with K. Ramesh that in other respects winter the best season in which to monitor pheasant populations, simply because snow cover at upper altitudes concentrates the birds into a narrow band at relatively low snow-free altitudes, thereby increasing the efficiency of field work. It is not practical at any time of year to conduct systematic field work off the established trails, of which there are relatively few in the forested parts of Tirthan. Given the geography of this valley, and constraints on manpower, I cannot see how more transects could have been established within GHNP during the CoBP.

The transects vary in length from 0.7 to 1.2 km. These appear to be rather short, but an effort was made to contain them each within one forest type in order to yield data on the habitat requirements of each species types (see Section 5, p.9). This could have been done on longer transects by dividing them into sectors allocated to different habitat types, but adjacent sectors could not then be viewed as providing independent measurements, thereby compromising this alternative research design.

4.2 Transect walks

The data collected on transect walks consists of encounters with each species by sight or sound when flushing (Gaston et al. 1983, Gaston 1997), together with estimates of distance from the observer and angle with respect to the transect line. These data permit the calculation of the simple encounter rate (no.km^{-1}), as well as a density index (e.g. by King's method). The numbers of encounters recorded per kilometre of transect walked are general low (ranges: monal 0-10, koklas 0-3, tragopan 0-2). This renders the data vulnerable to considerable stochastic variation, resulting in large measurement errors.

The only solution to this problem, even for monal, is to repeat transect walks as often as possible and to pool the data. The established regime of visiting all sites twice a month for transect walks is therefore entirely appropriate, with more than this being impossible without additional manpower being available. Even so, to produce tolerably precise results, it will be necessary to combine monthly data into seasons. However some care needs to be taken in doing this for the winter (December-March) and autumn (September-November) periods when all three of these pheasant species execute altitudinal migrations of up to 1,500 m (Gaston et al. 1983), the precise timing of which depends on local snow conditions (R. Whale, K. Ramesh pers. comm.).

The paucity of encounters with tragopan and koklass suggests that this transect method cannot produce meaningful density indices without an uneconomical level of field work effort. Numbers of encounters with monal are probably sufficient to indicate density differences through space and time, however. It is important to stress that monal group size should be recorded for each encounter during transect walks, and that the product of either encounter rate or density and mean group size will yield the most meaningful population indices.

Pheasants are most active, audible and visible in the period just before and immediately after dawn, so it is important that transects are walked within this critical period, but at a time when there is enough light to identify flushed birds that do not call. The current practice of starting transects about 30 minutes after dawn is consistent with these constraints. As the existing lines take about 1 h.km^{-1} to traverse, diurnal variations in pheasant activity should not affect the measurements being taken.

This technique has also be used to monitor kalij populations in Kedarnath WLS (S. Sathyakumar pers. comm.) and in Kumaon (A. Ahmed pers. comm.). This species has a preference for a thick shrub layer, either as a forest understorey or as scrub forest, and frequently occurs in the near vicinity of running water, at altitudes up to 2,800 m, but in the project area, it principally occurs in the ecozone (Gaston et al. 1983, 1994). It has a small repertoire of complex and easily recognised calls, but these are rather muted. Calling is most frequent at dawn and dusk, but there is no well defined dawn chorus. Mild disturbance by other kalij or man appear to be two stimuli that prompt some calling, at almost any time of day. During a transect walk, all encounters should be recorded, with no attempt to score numbers of callers or birds seen.

4.3 Call counts

As an additional monitoring method for pheasants in the CoBP, call counts have been conducted from two fixed points 500 m apart on each transect, (Gaston 1980, 1997, K. Ramesh pers. comm.), on two mornings each in April and May, when access allowed. This technique has also been used effectively in the past to monitor the cheer population at Chail WS in Himachal Pradesh (Garson et al. 1993), and for determining the precise distribution of tragopan in one locality in Pakistan (Duke 1990).

Direct observations by a number of field workers in the last 20 years indicate that koklas, western tragopan and cheer all call from roost trees, or immediately after descending to the ground from them, at first light. They are especially prone to do this in the spring months (March-May) leading up to the breeding season (Gaston 1980). Anecdotal evidence also suggests that individual males or breeding units in these species have either somewhat exclusive home ranges or true, non-overlapping and contiguous territories.

Thus it appears reasonable to assume that an observer at a point may be able to distinguish how many calling sites there are in a surrounding tract of forest, thus yielding a density index for these species. However, it would be unsafe to make a similar claim for either kalij or monal, which seem to have more flexible social systems and lack a clearly defined dawn chorus.

My own unpublished findings, from a field class exercise conducted on koklass in Kumaon in April 1990, suggest that the effects of complex hilly topography on the apparent direction of sounds make it impossible for compass bearings to estimated calling sites from adjacent observers stationed at intervals along a trail to be used to determine calling site locations with any precision. This implies that the absolute density of calling sites cannot be determined in such terrain, but it does not invalidate this as a technique for obtaining a population index. If this is the only objective, it is preferable that no birds can be heard calling from adjacent points manned at the same time: I suspect that the 500 m separation adopted as standard in CoBP is adequate to satisfy this condition for koklass, the species with the loudest call of these

three. When observation points are much closer together, it is in practice difficult to be sure that adjacent observers have heard calls from the same point at precisely the same time, in order to justify a reduction in the total number of calling sites registered by the whole team.

Even if points are far enough apart to avoid overlap, some further cautions need to be stressed if the data resulting from call counts are to be used reliably for population monitoring:

1. Cheer are known to live as single males, breeding pairs, and trios (two males, one female), and call most consistently during the period from mid-May to mid-June (Young et al. 1987, Garson et al. 1992). This makes the relationship between the number of calling sites located and the number of birds present (or the prospective number of breeding attempts) highly uncertain unless counts are conducted during this short period, and will render comparisons involving counts made in other months invalid.
2. Until more is known about the social organisation of koklass and tragopan, similar complexities should be assumed in these species.
3. The calling season of the male tragopan appears to be very short, extending from late April until early June at the most (Duke 1990, K. Ramesh pers. comm.). Counts made at other times will not be comparable to these.
4. Because it is apparently easier to hear birds calling from below an observer than above, comparisons between sites which are dissimilar in this respect should be avoided. Thus it seems inadvisable to compare data from sites monitored from a ridge-top with those collected whilst standing on or facing a slope.
5. The exposure of some ridge-tops to wind causing foliage noise, and of valley-bottom sites to river noise, make these places rather unsuitable for such work.
6. As the apparent distance to a calling site increases, so an observer's ability to specify its location decreases. Because observers will differ in their hearing ability, there will be individual variation in detection efficiency within a given tract of habitat, and consequent difficulty in defining which calling sites should be included or excluded amongst a team of observers. There seems no immediate solution to this other than to hold regular sessions of collective team training to calibrate all its members to a common standard. Dr Sathyakumar has suggested the use of a simple decibel meter, consisting of a microphone and a chain of LEDs (as used in commercially available audio equipment), to set an objective call volume criterion for the inclusion of any calling site in a count. I would like to see cheap sets of such equipment being built and tried out as soon as possible.

Some acknowledgement of these problems during data analysis should allow valid comparisons to be made between years (but within sites and seasons) for the purpose of monitoring populations of cheer, koklass and tragopan. Other types of comparisons (e.g. between sites

but within seasons and years) may also be valid in some cases, but these will require more careful justification and selection in view of the above points.

Within CoBP there has also been some scope for obtaining absolute densities of monal and koklass during silent drive counts for musk deer *Moschus chrysogaster* (e.g. in subalpine scrub at Ghumtarao, Dela Thach). This should be continues in that context, but it is too labour-intensive and difficult to accomplish on all but the gentlest slopes to be considered as a routine method for pheasant monitoring.

4.4 Assessing impacts of the EP

It can be concluded from Sections 4.2 and 4.3 that population monitoring is best achieved for the five pheasant species of concern as follows:

- ***Walked transects*** : for monal and kalij, also yielding some data on koklass and tragopan;
- ***Call counts*** : for koklass and cheer, also yielding some data on tragopan.

These conclusions are entirely in accord with the recommendations of Pandey (1996) in relation to the CoBP.

In the course of time, impacts of the EP on habitats and wildlife populations may become evident in GHNP, the WLSs and the ecozone. Obviously any monitoring programme designed to detect effects in all these places needs to be wider in scope than the present pilot scheme set up for the CoBP. Koklass, monal and tragopan only occur in GHNP and the WLSs, and so can be used to measure impacts of EP activities on these areas. Cheer probably occurs in all areas where there is open grassy habitat below about 3,000 m (as will goral). Thus this species can be used to compare similar localities in the ecozone with low altitude parts of the other areas. Kalij, having only been recorded mainly in the ecozone, is a potential monitor of the effects of EP activities on wildlife in the ecozone itself.

In order to capitalise on the opportunities presented by the EP and CoBP being conducted in parallel, I recommend that at least some monitoring sites for pheasants are set up in Sainj and Tirthan WLSs, and in the ecozone. It is however well beyond the working capacity of the WII research team to collect baseline data from these additional sites. They should simply select and mark them in collaboration with GHNP front line staff, in an effort to spread the work load arising from future monitoring commitments right across the area, using all the available front line staff. In selecting these new monitoring sites, maximum use should be made of the GIS habitat map produced at WII, as well as local knowledge of wildlife distribution and abundance. The plan to conduct extensive survey work to improve the accuracy of pheasant distribution maps for the whole area before the end of 1999, should be combined with the task of selecting

and marking the new sites. The increase in monitoring sites to be used in future might require a reduction in the number in Tirthan. If so, the obvious ones to discontinue are Ghumtarao, which is inaccessible in winter, and either Shilt-Chordhuar or Dulunga-Grahani, which contour in parallel and are quite close to each other.

In the event of K. Ramesh becoming heavily committed to radio-tracking in the final year of CoBP (see Section 5, p.13), I strongly recommend that WII employs at least one additional Biologist to undertake the extensive survey work and marking of monitoring sites in areas other than Tirthan.

It is self-evident that the CoBP will only generate baseline data against which to compare future results from Tirthan, but it has successfully applied and tested simple methods for pheasant population monitoring which can be used by front line GHNP staff throughout the area in future (see Section 9, p.17)

5 ABUNDANCE, DISTRIBUTION AND HABITAT REQUIREMENTS OF THREATENED SPECIES

Several of the CoBP monitoring plots in Tirthan were positioned in localities previously known or suspected to hold tragopan (Gaston et al. 1981, Gaston and Garson 1992). Data on their presence or absence at these sites, and possibly some indication of their numbers at each, will improve our understanding of its apparently specific habitat preferences in this area. Unfortunately its fondness for a dense understorey, often of ringal bamboo *Arundinaria spathiflora*, under a virtually closed tree canopy may make the WII's GIS habitat map relatively impotent in indicating the amount and distribution of suitable habitat for it in the whole area. However an attempt should be made to produce a habitat suitability index (HSI) model with which to predict tragopan distribution on the GIS, on the basis of altitude, slope, aspect and tree canopy data, for checking and improvement by ground-truthing. This might allow an estimate of its local conservation status to be made by extrapolation, in terms of present population trend, and the number, size and degree of isolation of all suitable habitat patches (or populations). This will constitute a local Population Viability Analysis (PVA).

A planned WII project to attach a few radio-transmitters to tragopans in late 1998 or early 1999 should help to solve practical problems associated with trying to study such birds intensively in severe terrain. Live trapping will not be easy, and rocky, forested and often wet conditions are very far from ideal for radio-tracking. Hopefully, this project will begin to generate precise data on habitat preferences and altitudinal migrations in different seasons. If successfully initiated, this project will add very considerably to our knowledge of this species. For all these reasons it has been endorsed by the IUCN/SSC Pheasant Specialist Group, and is being funded by World Pheasant Association.

Although cheer was reconfirmed as present at a site just inside GHNP in Tirthan during this consultancy, no other attempts have been made to update or extend our existing knowledge of its local status (Gaston et al. 1981, Garson 1983) during CoBP. The extensive surveys soon to be undertaken as part of CoBP in the WSs, Jiwa and the ecozone should provide this information, as well as setting up some monitoring sites through which to measure the future performance of this species. I strongly recommend that the call playback method (Young et al. 1987, Sharma and Pandey 1989, Pandey 1996) is used routinely in this work, to reduce the probability of recording false absences.

I consider that the collection of data on the composition of the microhabitat at all transect encounters with pheasants has been over-elaborate, with over 40 different variables being measured on each occasion. They have been collected in a manner that will allow a valid analysis to show the nature and extent of interspecific differences (i.e. niche separation) in the different seasons of the year. Multivariate statistical techniques such as PCA and DFA will provide the simplest ways of achieving this. However no absolute habitat preference analyses can be carried out: no data on microhabitat availability have been collected, and in any case the habitat adjacent to trails will be somewhat disturbed, therefore not being representative of that available to the pheasants in the areas surveyed.

The eight monitoring sites are distributed across six habitat types in Tirthan. As a result it will not be possible to establish that any differences in pheasant abundance between sites are due to habitat preferences, as the design is unreplicated and therefore potentially confounded by other unmeasured effects of location (including disturbance level, slope, altitude, aspect, etc.). Again this should not be taken as a critical comment on the planning of this research project: it was beyond the capacity of K. Ramesh to monitor additional sites in Tirthan or elsewhere.

6 ASSESSING HUMAN IMPACTS ON VULNERABLE SPECIES

Despite suggestions by me and colleagues in the past (Gaston et al. 1983, Garson and Gaston 1989, Gaston and Garson 1992) that there are causal links between the activities of graziers and the status of pheasants and large mammals in and around GHNP, Tucker (1997: 36-37) is entirely correct in his statement that '*it [still] seems uncertain whether domestic livestock diseases spread to wild ungulates - and whether the flocks' upward migration through the forests in the spring disrupts the nesting of pheasants and other birds, or mammals' habitats. These both need more systematic, longer-term monitoring.*'

At the time of the original 1979-80 surveys in the area of GHNP and elsewhere, we saw the activities of shikaris (hunters) and graziers plus their dogs (e.g. eating pheasants and their eggs), as being the main factors having negative impacts on wildlife in the forests (Gaston et

al. 1983). Although we noted that the collection of bamboo, gucchi and alpine medicinal plants took place, there was no reason to regard them as serious forms of disturbance at that time. Hunting for pheasants was much reduced after 1882, following a ban on the wearing of male monal head crest feathers in Kullu hats (Garson and Gaston 1989), and the adoption of this bird as the Himachal 'state bird' in 1986.

By the time of our re-appraisal visit to GHNP in late 1991, it was evident that both gucchi and medicinal plant collecting had become extremely important in the local economy, as well as having the potential to disturb and disrupt the breeding of large, ground-based wildlife species (Gaston and Garson 1992). Previous consultants' reports (Tandon 1997, DeCoursey 1997) and local opinion (e.g. Balak Ram, Karongcha Wildlife Watcher pers. comm.) suggest that gucchi collection has escalated still further since then, in response to rising demand and increasing prices (up to Rs2,400.kg^{-1} dry weight), and may now constitute a serious threat to some pheasant populations in GHNP and the WLSs. This impact may have at least two facets. Frequent disturbance of huge areas of forest away from main trails by people searching for gucchi at the time when these birds are nesting (i.e. April-May), may cause desertion of nests by incubating females and subsequent chilling of the eggs. In addition, the discovery of nests by gucchi collectors and their dogs, results in consumption of the eggs by one or other party.

The only relevant measures of pheasant population trends available for the period since 1991, have been collected by K. Ramesh within the CoBP. Data from spring call counts of koklass from six sites in Tirthan indicate a 17% decline (Wicoxon $P< 0.01$) from 1997 to 1998. Similarly, encounter rates from repeated walks along three transects in winter indicate a 38% decrease for monal ($P<0.05$), and one of 46% for tragopan (N.S.) from 1996 to 1998. These findings are particularly striking because of the heavier snow fall and later snow melt in 1998 than in either of the previous two years. All other things being equal, more encounters would have been expected in 1998 as a result of the birds being held at lower altitudes by the lower snowline that year. The observed trend is in the opposite direction despite this presumed bias.

The question of whether or not these apparent declines are caused by human disturbance arising from gucchi collection activity can only be resolved through an experimental study. At present there is no information available on the amplitude of natural variations in koklas, monal and tragopan populations, and the declines in this case have so far have only been measured over one (kolkass) and two (monal) years. In addition, it is possible that most monals nest at higher altitudes and rather later than the focus of gucchi collection. Nevertheless, I believe there is an urgent need for an experimental ban on gucchi collecting in some areas of Tirthan, whilst other areas are left as controls. Only then can a careful assessment of its impact on pheasant populations be made, based upon the techniques developed and the data collected during CoBP.

As DeCoursey (1997: 39) points out, there are two ways in which persuasive evidence for the effects of human activities on sensitive wildlife species can be obtained: by the comparison of areas under measurably different levels of impact, and by the deliberate experimental manipulation of levels of impact in different areas. Although the first approach might appear to be easier in the case of gucchi collection, in practice the measurement of impact levels even at an ordinal level may prove to be difficult. For instance, counting the collectors entering and leaving an area cannot usually be done at one point, and quantifying the extent (e.g. area searched) or intensity (e.g. weight collected) of their individual efforts presents another problem.

The alternative experimental approach, although infinitely preferable on scientific grounds, also presents severe practical difficulties. The collection of gucchi is completely unregulated, but it is currently an important source of income for local families (DeCoursey 1997, P. Choudhury pers. comm.). The imposition of a complete ban of collection is neither justified scientifically, nor practical. The immediate consequence of such action would be great resentment of GHNP front line staff by local people, which could easily be transformed into a general flouting of park regulations and the widespread over-exploitation of all its marketable natural resources, in anticipation of a suspected complete closure of GHNP to local people for such purposes.

There seems no alternative but to seek the cooperation of some collectors by providing them with an alternative earning opportunity (Baviskar 1997,DeCousey 1997) . For instance, dispossessed collectors could be employed to police the ban in experimental areas.

I have discussed at length with Dr S. Sathyakumar the design of a two year study involving the monitoring of pheasant numbers and breeding success in replicated experimental (i.e. collection banned) and control areas in Tirthan and Sainj. This needs to be developed into a full research proposal, funded and initiated as soon as possible. If it is permissable, I strongly recommend that any payments required to achieve the bans required are funded by the EP (see Section 8, p.17). In the event of pheasant populations continuing to decline in all areas but those from which collection had been banned, there will be indisputable evidence upon which GHNP staff will be able to press for an immediate and complete cessation of this activity.

Returning to the problem of investigating the impact of graziers and their flocks in the forests of GHNP, I am not convinced that financial compensation will be an effective method of buying experimental and short term bans on their activities in certain areas, whilst others are left as controls (Gaston 1997). It seems to me that the comparative approach appears to be feasible in this case. Flocks follow specific and traditional routes through the forest in GHNP (and the WLSs), making it possible to assess impact in terms of numbers of both stock animal days per unit area in a range of such places, and their impact on the vegetation, relative to control plots that are off graziers' routes. It may also be possible to re-route certain flocks (possibly without compensation) so as to relieve parts of the forest of virtually all grazing and browsing pressure,

whilst increasing it elsewhere. I have discussed with Dr Sathyakumar the design of such a study, to be conducted in parallel with that relating to gucchi collection.

7 ASSESSING CERTAIN SPECIES AS BIODIVERSITY INDICATORS

The idea of using particular pheasant species as indicators of biodiversity is specified as one of 25 projects with international priority in the *Action Plan* for this group of birds (McGowan and Garson 1995). I had not appreciated the scope of CoBP before coming on this consultancy, but the various components of the work being undertaken by the WII research team (e.g. on plant and bird communities, entomology, human impacts) when combined with their work on pheasants, fulfil the requirements of this project.

To be useful, indicator species need to be simple and quick to monitor, so that several relatively untrained personnel can undertake fieldwork at a number of sites in a short time, thus making the whole exercise economical whilst being capable of generating reliable data. A good biodiversity indicator which is laborious or complicated to monitor is of no practical use. At face value, certain pheasants appear to be promising candidates for consideration as biodiversity indicators: they are conspicuous and vocal, prefer forests with a thick understorey, feed and nest on the ground and are easily disturbed.

In the case of the Western Himalayan temperate forests, koklass populations appear to be simple to monitor by the call count method (Gaston et al. 1983). It is arguable that localities holding high densities of koklass will also harbour a more diverse small bird fauna because of greater structural complexity of habitats, although the reverse might be true of the flora because of increased shading. The nature of correlations between koklass density and either fungi or invertebrates can only be guessed at present. Data collected under the CoBP can be used to investigate the relationships between the call count index of koklass density and the species richness and diversity of other components of the plant and animal community amongst the sites regularly used by the research team. This approach has the potential to determine whether or not koklass is an effective indicator of any aspect of biodiversity in its forested habitats. I consider this to be a ground-breaking piece of research of great potential importance. Given that satellite imagery data cannot ‘see’ forest understorey, finding a bio-indicator appears to be the only other approach likely to yield a rapid appraisal technique for assessing biodiversity in such habitats, so much of which is either difficult or impossible for ground survey teams to reach because of extreme topography.

It is becoming clear that tragopan has rather particular habitat requirements in GHNP (see Section 5, p.12-13) and elsewhere (Duke 1990). Subject to its presence/absence or a reliable density index indicating something about the quality of this habitat in terms of biodiversity, this species might also turn out to be a useful bio-indicator in this restricted context.

8 REDUCING HUMAN IMPACTS THROUGH ECODEVELOPMENT

It seems probable that at present the most serious threat posed to pheasants in GHNP comes in the form of disturbance and the disruption of breeding attempts by gucchi collectors and or graziers in April and May (see Section 6, p.14). I have already suggested that EP funds might be used to provide financial support to people agreeing to a selective and temporary ban on collecting, in exchange for their employment to police the banned areas.

I would also like to see some more funds being injected into research on the *ex situ* culture of gucchi, especially at a small scale on land-holdings in the ecozone. Again if it is permissable, appropriate research institutes in Himachal Pradesh, such as ICAR National Research Centre for Mushroom (Solan), CSIR (Palampur), and G.B. Pant Institute (Kullu), should be invited to tender for a such research project.

The other perceived problem for pheasants in GHNP, of disturbance and degradation of their habitat by domestic stock moving through the forests in spring and autumn, is much more difficult to mitigate via EP activities in the ecozone. There are legal rights to grazings in GHNP and the WLSs, as everywhere else, making bans and re-allocations impractical, at least in the short term. Finding equally remunerative activities in the ecozone (or in the case of long-distance migrants, elsewhere), for families currently depending on stock rearing for a substantial part of their income is no easy task, and not one upon which I am really competent to comment. In these circumstances perhaps it is fortunate that a natural solution to the grazing problem may be evolving. Such indications as there are suggest that the total number of stock being reared in the region is declining, although it is not clear at what rate (Tucker 1997: 36). Nevertheless it seems possible that this problem may decrease in severity at a rate that will not require much, if any, outside inducement via the EP.

Finally, I would recommend that more EP support is given to conservation education at village level as a means of improving levels of obedience to the laws banning or regulating all hunting and harvesting activities in GHNP and the WLSs.

9 TRAINING OF GHNP FRONT LINE STAFF FOR FUTURE MONITORING

I concur with Gaston (1997) that WII researchers should be involved in training GHNP front line staff for the last year of this project (i.e. autumn 1998-99). This will be possible because an additional project,'*Capacity Building of the Partners in Conservation at the Great Himalayan National Park*', has already been approved for funding by under the World Bank GEF scheme. It commenced with the holding of a joint WII-GHNP workshop in which I was a participant, at Sai Ropa on 21-22 May 1998. This was designed to agree a schedule of training needs and activities for front line staff during 1998-99.

10 SHARING INSIGHTS

During the Sai Ropa workshop on 22 May 1998, I gave a 30 minute presentation to WII faculty and researchers, GHNP staff and others, summarising the contents of this report. **Please note that this tight schedule at the end of my consultancy period made it impossible for me to return to Dehra Dun before leaving India. I therefore submitted a copy of this draft report and all necessary forms to the Winrock Office in Delhi instead.**

11 SELF-APPRAISAL

I consider that this report covers my terms of reference in full, as follows:

- technical inputs to WII researchers: Sections 4-7;
- methodological improvements: Section 4;
- management of game birds: Sections 6 and 8;
- report preparation;
- sharing insights: Sections 9 and 10.

12 ITINERARY AND ACTIVITY SUMMARY

25 April	Depart from Newcastle
26 April	Arrive at New Delhi; overnight train to Dehra Dun
27 April	Arrive at WII campus; report to Winrock Office, ICFRE, Dehra Dun
28-29 April	Read GHNP-FREEP documents; discuss format of 21-22 May monitoring workshop
30 April	Travel from Dehra Dun to Banjar FREEP Base Camp
1 May	Meet GHNP Director at Shamshi; plan field programme
2 May	Discuss workshop presentations with K. Ramesh & T.R. Vinod; prepare for field visit
3 May	Walk from Gushaini to Rolla
4 May	Move to Basu & Koilipoi
5 May	Call count at Koilipoi; walked survey to Chandni Thach

6 May	Call count at Koilipoi; move to Rolla
7 May	At Rolla
8 May	Move to Shilt
9 May	Call counts at Shilt & Grahani; local walked survey
10 May	Call counts at Shilt & Grahani; move to Rolla
11-12 May	Call counts at Rolla and Basu; return to FREEP Base Camp at Banjar
13-16 May	Draft Winrock report
17-18 May	Prepare workshop and consultancy presentations
19 May	Correct Winrock draft report
20 May	Receive workshop participants
21-22 May	GHNP/WII monitoring needs workshop; consultancy presentation
23 May	Fly to New Delhi; report to Winrock Office
24 May	Depart from New Delhi
25 May	Arrive at Newcastle

13 REFERENCES CITED

BAVISKAR, A. (1997). *To assess socio-economic conditions of people using the Great Himalayan National Park and Wildlife Sanctuaries*. Interim Report to WII and Winrock.

DECOURSEY, M.A. (1997). *Taming the wild plant trade in Greater Himalayan National Park, India*. Consultancy report to WII and Winrock.

DUKE, G. (1990). Using call count surveys to obtain comparative population figures for western tragopan in NWFP Pakistan. In: *Pheasants in Asia 1989* (ed. by D.A. Hill, P.J. Garson and D. Jenkins). World Pheasant Association, Reading, U.K. Pp. 116-123.

FREEP-GHNP (1995). *An ecological study of the conservation of biodiversity and biotic pressures in the Great Himayan National Park: an ecodevelopment approach.* Project Proposal to World Bank/GEF.

GARSON, P.J. (1983). The cheer pheasant *Catreus wallichii* in Himachal Pradesh, Western Himalayas: an update. *Journal of the World Pheasant Association*, **8**, 29-39.

GARSON, P.J. and GASTON, A.J. (1989). The conservation of forests and wildlife in Himachal Pradesh. In: *Conservation of the Indian Heritage* (Ed. by B. Allchin, F.R. Allchin & B.K. Thapar). Cosmo Publications: New Delhi. Pp. 39-54.

GARSON, P.J., YOUNG, L. and KAUL, R. (1992). Ecology and conservation of the cheer pheasant: studies in the wild and the progress of a reintroduction project. *Biological Conservation*, **59**, 25-35.

GASTON, A.J. (1980). Census techniques for Himalayan pheasants, including notes on individual species. *Journal of the World Pheasant Association*, **5**, 40-53.

GASTON, A.J. (1997). *Report of monitoring and evaluation consultancy*. Consultancy report to WII and Winrock.

GASTON, A.J. and GARSON, P.J. (1992). *Himachal Wildlife Project III: A Re-appraisal of the Great Himalayan National Park*. Pp. 80.

GASTON, A.J., GARSON, P.J. and HUNTER, M.L. (1981). Present distribution and status of pheasants in Himachal Pradesh, Western Himalayas. *Journal of the World Pheasant Association*, **6**, 10-30.

GASTON, A.J., GARSON, P.J. and HUNTER, M.L. (1983) The status and conservation of forest wildlife in Himachal Pradesh, Western Himalayas. *Biological Conservation*, **27**, 256-270.

GASTON, A.J. GARSON, P.J. and PANDEY, S. (1994). Birds recorded in the Great Himalayan National Park, Himachal, Pradesh, India. *Forktail*, **9**, 45-57.

MCGOWAN, P.J.K and GARSON, P.J. (1995). *Conservation Assessment and Action Plan 1995-99. Pheasants*. IUCN Species Survival Commission: Gland. Pp. 115.

SHARMA, V. and PANDEY, S. (1989). Pheasant surveys in Shimla Hills of Himachal Pradesh. *Journal of the World Pheasant Association*, **14**, 64-78.

TANDON, V. (1997). *Report on status of collection, conservation, trade and potential for growth in sustainable use of major medicinal plant species found in the Great Himalayan National Park and its environs in Kullu District of Himachal Pradesh*. Consultancy report for WII and Winrock.

TUCKER, R. (1997). *The historical development of human impacts on the Great Himalayan National Park*. Consultancy report to WII and Winrock.

YOUNG, L., GARSON, P.J. and KAUL, R. (1987). Calling behaviour and social organization in the cheer pheasant: implications for survey technique. *Journal of the World Pheasant Association*, **12**, 30-43.