The Approach to Field Investigations of Vertebrate Fauna in Environmental Impact Assessment

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ABSTRACT

A common criticism of vertebrate fauna investigations carried out during Environmental Impact Assessment (EIA) is that they do not provide an adequate inventory of species. The argument is used that impacts cannot be assessed if the fauna is not known. Complete inventory surveys, however, are very difficult to achieve within the timeframes that apply during most development projects. Furthermore, the aim of field investigations during EIA is to provide information to decision-making agencies so that decisions can be made to protect biodiversity from impacts during the course of development projects. This requires not so much species lists as an understanding of the fauna values and ecological processes of a study area, and the nature of impacts that may occur. It is proposed that fauna investigations should be related to the assessment of impacts and target:

- Threatened and otherwise significant species;
- Significant and otherwise important habitats (habitats for significant species or that represent biodiversity hotspots);
- Ecological processes (eg. fire, hydrology, linkage, movement patterns, feral species);
- The identification of patterns of biodiversity across the general landscape;
- The collection of data for impact assessment/monitoring.

INTRODUCTION

The role of fauna investigations in Environmental Impact Assessment (EIA) is to provide information to enable government agencies to assess the significance of impacts of proposed developments upon that fauna. In Western Australia, such investigations are mostly undertaken by consultants, funded by proponents, and the information assessed by the Environmental Protection Authority (EPA) and the Department of Environment and Conservation (DEC). EIA is a fairly new and dynamic process, and it is not always clear what consultants are expected to do in their investigations.

In order to assist proponents and their consultants in carrying out investigations into fauna for EIA, the EPA has prepared position statements (e.g. EPA 2002) and guidance statements (e.g. EPA 2004). These documents review legislation, provide definitions, explain the EPA's objectives, discuss approaches to field investigations, and suggest ways in which impacts can be predicted.

The EPA (2004) states that investigations should "provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered". Based on 18 years experience in consulting,

we have observed that this statement has led to the expectation among government agencies, proponents, consultants and the conservation community, that fauna investigations for EIA necessarily involve inventory surveys in order to document the biodiversity of a project area. Current development of a new guidance statement, focussing on sampling techniques for fauna investigations, serves to reinforce the conclusion that such studies are about documenting the presence of as many species as possible.

In this paper, we would like to question this interpretation, and to argue that the purpose of EIA (to address biodiversity conservation and ecosystem values) is best served by a strategic approach to investigations. These may well produce detailed species lists, but the production of such lists is not the primary purpose of the investigations.

WHY FOCUS ON INVENTORY SURVEYS?

Three questions can be asked about the value of inventory surveys in EIA:

- Do they provide the most useful information for EIA?
- Are inventory surveys achievable? and
- Are inventory surveys economically realistic?

Are inventory surveys useful in EIA?

It might seem self-evident that a more or less complete species list is vital for the assessment of impacts of a proposed development, as surely the species to be impacted need to be known. To a large extent, however, the species to be impacted can be predicted from a literature and habitat review, and as long as errors of inclusion rather than exclusion are made, the species to be impacted will be known.

A consequence of conducting an inventory survey is that a great deal of effort is put into work such as establishing and checking traplines that catch mostly common species, whose presence can be readily predicted. This effort can prevent the field team from doing other, arguably more useful, work. For example, the zoologists' time might be better spent focussing on species of particular conservation significance, investigating rare habitats or developing an understanding of ecological processes.

Are inventory surveys achievable?

The EPA (2004) refers to a number of studies that demonstrate how difficult it is to document the vertebrate assemblage of a site. Through the use of species accumulation curves, Thompson *et al*. (2007) have shown that massive levels of trapping are required to record >80% of the predicted vertebrate faunal assemblage. In an almost 20 year study, Bamford and Bamford (unpubl. data; see references) have undertaken twice-annual surveys similar in intensity to studies on which an entire EIA report might be based. They have recorded 125 bird species but only 36-63 species per survey. They have recorded 53 terrestrial vertebrate species (frogs, reptiles and non-volant mammals), but with only 42 species at two trapping sites sampled almost annually for 18 years. These two sites, in the same vegetation type and 400m apart, share only 74% of their species and the rate of species accumulation is now extremely low. Furthermore, species

accumulation appears to be site specific even within this one vegetation type. These results suggest great temporal and spatial variability in the distribution of vertebrate fauna.

One conclusion from these sorts of observations is that fauna sampling should be much more intensive, with more sampling sites, covering more of the project area and over a longer period of time than is usually the case. The alternative conclusion is that the effort directed towards fauna sampling should be strategically deployed.

Are inventory surveys economically realistic?

Many projects are spending investors' money on the environmental investigations required to seek approval, and all projects have timetables that are generally not as flexible as the environmental conditions under which we work. Particularly in the north of Western Australia, annual variation in rainfall may mean that sampling does not take place under ideal conditions, but it is unlikely for a proponent to agree to delay a major resource development by a year so that the fauna consultant can do another season's sampling. Fauna investigations inevitably involve compromise, but this makes it all the more important that the work carried out is as effective as possible for EIA.

WHAT SHOULD SURVEYS TARGET?

While inventory surveys can do more than confirm the presence of species predicted to occur in an area (e.g. provide some basic ecological data, allow consultants to observe and understand the project area), we propose that the requirements of EIA would be best met if field investigations were strategic. The best way to develop a strategy for field investigations into fauna is to look at what impacts are likely to occur.

Impacts of development proposals essentially fall into two categories:

- Loss of habitat (leading to population declines and fragmentation); and
- Changes in ecological processes (such as hydrology, predator/prey relations, fire, isolation).

These suggest areas of investigation with respect to fauna and, on this basis, we have structured recent fauna investigations for EIA on the following:

- Threatened and otherwise significant species;
- Significant and otherwise important habitats (habitats for significant species or that represent biodiversity hotspots);
- Ecological processes (eg. fire, hydrology, linkage, movement patterns, feral species);
- The identification of patterns of biodiversity across the landscape;
- The collection of data for impact assessment/monitoring.

Threatened and otherwise significant species

Species are significant if they are listed under legislation, if they are noted as being of concern in publications or by government agencies, or if their occurrence at a site is in some way unusual and contributes to biodiversity (eg. extra-limital populations, breeding

colonies). The distribution and habitat preferences of most such species are moderately well-known, but for EIA it is important to determine their status at a proposed development site. Are they present, are they abundant, in which habitat may they occur and how might they be affected? Field surveys need to target significant species expected to be present, with sampling methodologies tailored to those species. They also need to do more than simply confirm the presence of those species; they need to collect information on the patterns of distribution and abundance of significant species on a site.

A valuable contribution to the EIA process would be the production of guidelines for the sampling of significant species. These would summarise what is known about each species, identify appropriate sampling techniques and provide advice for management should they be found. The guidelines would, in effect, be a handbook to field investigations of significant species and would enable consultants to use their field time most effectively. A common complaint about consultants is the lack of experience; such a set of guidelines would provide a useful surrogate for inexperience.

Significant and otherwise important habitats

Habitats may be significant if they support significant species or significant processes, or support unusually high biodiversity. On the precautionary principle, rare habitats should be considered significant.

Impacts upon species (or genetically distinct populations) are often proportional to habitat loss. Thus, in simplistic terms, if a habitat is small in extent, even a small development might account for a substantial proportion of its area and may impact upon a substantial proportion of any populations of species confined to it. Therefore, the identification of such habitats and the protection of them during development should be a precautionary approach that can contribute to minimising impacts upon fauna.

Locally rare habitats can be identified through information on soil and/or vegetation types. Protection of rare habitats not only protects populations of fauna that are known or predicted, but also serves to protect fauna populations that are unknown and therefore not included in EIA, for example most invertebrates.

Ecological processes

EIA is about assessing impacts, and while direct impacts upon species are important, some impacts may be indirect through disruption of ecological processes. For example, fauna may be affected by impacts upon hydrology, the obstruction of movement, changes to fire regimes or increases in the populations of introduced species. The identification of impacts associated with perturbations to ecological processes requires an understanding of those processes and familiarity with the landscape and the proposed development.

The identification of patterns of biodiversity

There may be patterns in biodiversity across the landscape that need to be identified during EIA. The identification of such landscape-scale patterns of biodiversity enables a consulting zoologist to advise a client on the location of project infrastructure that will minimise impacts to fauna. Sampling designed to detect these sorts of patterns of

biodiversity may differ from sampling designed to record the maximum number of species.

The collection of data for impact assessment/monitoring

In the commercial reality of development proposals, environmental surveys are considered to be a step towards approval. Therefore, fauna surveys undertaken as part of EIA are often viewed as the first stage in fauna studies that will ultimately become part of the Environmental Management Programme (EMP) of the project. Fauna studies in EMP are likely to be included as a requirement of project approval, and may consist of measuring impacts of a project on fauna in the region or with assessing the effectiveness of rehabilitation.

The design of fauna investigations needs to be discussed between the client, the consultant, the DEC and other authorities so that appropriate work is carried out. Monitoring fauna to detect impacts or assess rehabilitation is an ecological experiment that should be designed according to the principles of scientific method. Currently there is considerable variation in the sampling techniques used by consultants, and there is a need for guidance in the scientific application of sampling, and in the appropriate and ethical use of different sampling techniques.

THE FUTURE OF FAUNA SURVEYS IN EIA

We propose that fauna investigations in EIA should be directed towards answering questions associated with impacts and assessment. This is likely to lead to an increase in the intensity of fauna investigations compared with some current practice. The stages of fauna investigations might be as follows:

- Desktop review to identify issues that might arise with respect to a proposal (significant species, rare habitats and processes). The desktop review and the nature of the development largely determine the field investigations required.
- Site inspection to familiarise the consultant with the site, the scale of the proposal and to determine the appropriate field programme. A site inspection may be all that is required.
- An impact assessment field programme that might involve targeted sampling for significant species, sampling of species sensitive to ecological processes, sampling in rare or significant habitats and sampling to investigate patterns of biodiversity.
- A monitoring programme that targets selected significant species (or those that might be considered suitable as bio-indicators (Bamford 1999)) and thus builds upon the impact assessment field programme. The monitoring programme may eventually draw in rehabilitation areas.

The implementation of all these stages would probably represent an increase in the intensity of fauna investigations compared with what is currently practised for some projects. This approach also represents a move away from dedicated inventory surveys to a strategic approach to survey methods with an intentional bias towards significant

species, habitats and processes, and an integrated ecological approach to the interpretation of environmental impacts.

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