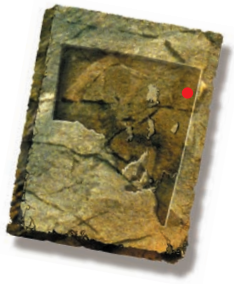

A study of the impact of seismic lines on ant communities in the Cooper Basin

— potential use as bio-indicators of ecological recovery rates

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Introduction

The Petroleum Geophysics Branch of the Office of Minerals and Energy Resources contracted the SA Museum to undertake a study of the viability of using ants as indicators of ecological damage that may have been caused by petroleum exploration. The use of ants as bio-indicators is not a new process. A large volume of academic work has been conducted in various educational and government institutions on the uses of ants to measure the rate of environmental recovery of areas that have been impacted by activities such as mining.

The main impact of seismic lines is visual rather than environmental. Flora appears to recover in ~3–7 years, depending on environmental conditions, but the full impact on the ecology may not be visibly discernible. The objective of the project is to provide rigorous statistical evidence of the level of impact on ant communities and their rate of recovery from such impacts. PIRSA hopes that this group of invertebrates will be an effective indicator of impacts to ecological systems and native fauna in general.

Archie McArthur of SA Museum pointing out an ant trail mound across a dune. (Photo 47908)

Background

Since 1957, 100 000 km of seismic data have been recorded in the Cooper–Eromanga Basin region of SA to explore for petroleum. Seismic line preparation techniques (e.g. bulldozer, grader and roller) and seismic energy sources (e.g. dynamite and vibrator trucks) have varied over this time. The bulldozer is considered to be the most damaging form of line preparation in certain terrains (e.g. gibber plains), but was the accepted standard of the early 1980s. Recent studies have indicated that the impacts of current exploration methods are not significant, but most of these studies have concentrated only on the visual assessment of plant and soil parameters. The use of small animals to measure impacts has been non-conclusive because of the low capture rates and large territorial ranges. Ants were chosen because of their good potential for sampling, being abundant and diverse in terms of species and function.

Procedures and field techniques

The project included seismic lines recorded in the dunefield (red, orange or yellow dunes) and gibber plain land units, and comprised the following:

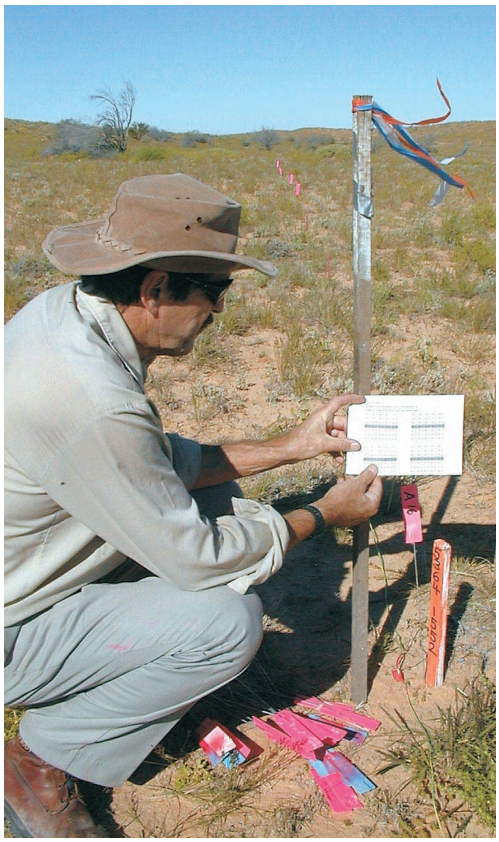
- A pilot study to derive the size of the sampling grids and numbers of traps; the veracity of the sampling method was also tested.
- A before and after line preparation study to investigate the real time impact of a seismic survey on ant colonies. The ants were sampled just prior to commencement of line preparation and recording, and immediately after. The sites will be re-sampled 12 months after seismic line preparation and recording. It is hoped that the ant populations will have returned to a similar density and

Preparing an ant pitfall trap for insertion of a test tube. (Photo 47909)

Sampling grid in a swale site. Note pinflags marking test tubes in the centre of the seismic line. (Photo 47910)

distribution as that sampled prior to the seismic activity.

- A vintage line study to investigate the condition of seismic lines from the period 1982–85. Seismic survey preparation methods from this period are considered to have had the greatest impact on the environment.



Setting out a sampling grid on a seismic line. (Photo 47911)

The Petroleum Geophysics Branch had an active involvement in this part of the project, providing field assistance to Archie McArthur — one of Australia's leading ant researchers — and hence has gained valuable hands-on knowledge of ecological field sampling techniques. The analysis of samples gathered, taxonomic grouping and statistical analysis formed a major part of the program.

Pilot study

Twenty lines of 11 test tubes at a spacing of 3 m were placed at two sand dune and two swale sites. The test tubes were filled with a solution of alcohol and water and installed as pit-fall traps. Over 12 000 ants of 11 different genera were collected and identified during the study.

Before and after study

For this element of the project, analysis of data from the pilot study resulted in the recommendation for four sand dune and four swale sample sites. Each site comprised a grid of seven lines of five traps, with a line spacing of 6 m and a spacing of 3 m between test tube pit-fall traps. The most significant finding from this study was that the ant species *Pheidole* appeared to be attracted to the newly prepared seismic line. This species may well prove to be a useful indicator of ecological recovery.

Vintage line study

Eighteen sites were established — six each in gibber, sand dune and swale terrain types. On the advice of the project bio-statistician, the grid size was increased to eight lines of five traps. Over 20 000 ants were collected from this study, and included examples of over half the known genera of ants found in SA. Results indicate that there is no difference in distribution on or off the seismic line.

Outcomes

The SA Museum will produce a report detailing the findings of its research by December 2001. Archie McArthur has also indicated that further papers on the territorial interaction between ant species based on the data gathered during this project could be forthcoming.

The Branch anticipates that the outcome of the study will give the community confidence in the management of seismic exploration activities, particularly relating to diligence in minimising the environmental impact of such activities by:

- investigating the use and applicability of ants as indicators of impacts to ecological systems and native fauna in general
- providing rigorous statistical evidence of the level and rate of recovery from such impacts
- validating the observations of recent seismic audits which concluded that impacts were primarily visual (rather than ecological)
- providing a check of the veracity of existing environmental objectives and criteria
- indicating a revision of the existing environmental objectives and criteria (where appropriate).

A bonus will be the production of an illustrated identification manual of arid zone ants in the sample region to assist with future identification of the region's ants.

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