

## NATIONAL PARKS AND WILDLIFE SERVICE BULLETIN No. 5

## FAUNA SURVEYS IN QUEENSLAND

By T. H. KIRKPATRICK, M.Sc., Ph.D., and H. J. LAVERY, M.Sc., Ph.D., M.Ec.

## SUMMARY

A survey programme of the fauna resource of Queensland has been established and is reviewed. The scope, locations, approach to the planning and conduct of the individual surveys involved, and the techniques to measure distribution (by habitat types) and abundance (by frequency of record) are described and discussed.

During 1964-1978, ten surveys were completed and these have provided records of some two-thirds of the State's mammal, bird and reptile species. Four other surveys are in progress which will include additional species and provide more precise data on distribution and abundance. A further four surveys over the next decade should complete the broad evaluation of most of the species in Queensland; specific searches should discover the remaining species. Repetition of the surveys after 20 years is expected to indicate significant changes before any irreparable activity is likely to have occurred, so that specific conservation attention may be accurately and fairly allocated.

## I. INTRODUCTION

Conservation of the native fauna of Queensland, by definition under the *Fauna Conservation Act* 1974-1976 including the mammals, birds and reptiles of the State, is part of the wider responsibility of the National Parks and Wildlife Service of Queensland for the total natural environment. The task was carried out until 1975 by the Fauna Conservation Branch of the Department of Primary Industries which interpreted its role as ensuring, as far as possible, the maintenance of the fauna of Queensland in the general presence of man and his activities.

One part of this responsibility of a Government instrumentality is the provision of suitable legislation (and the enforcement of this). Basic to such legislation is firstly a knowledge of the species present, and secondly an understanding of their distribution, habitat preferences and abundance. To this end, a programme of fauna surveys was initiated. This paper provides an account of the practical approach, and the underlying rationale, that has been adopted.

A number of surveys in the series have been published over the past decade (Kirkpatrick 1966, 1967, 1968, Kirkpatrick and Amos 1977, Kirkpatrick and Searle 1977, Lavery 1968, Lavery and Johnson 1968, 1974, Lavery and Grimes 1974a, 1974b, Lavery and Seton 1974, McEvoy and Kirkpatrick 1971).

## II. THE SCOPE OF FAUNA SURVEYS

The animal groups considered are the mammals, birds, reptiles and, more recently, amphibians, that are *ferae naturae* (as in Common Law) whether native, migratory or introduced.

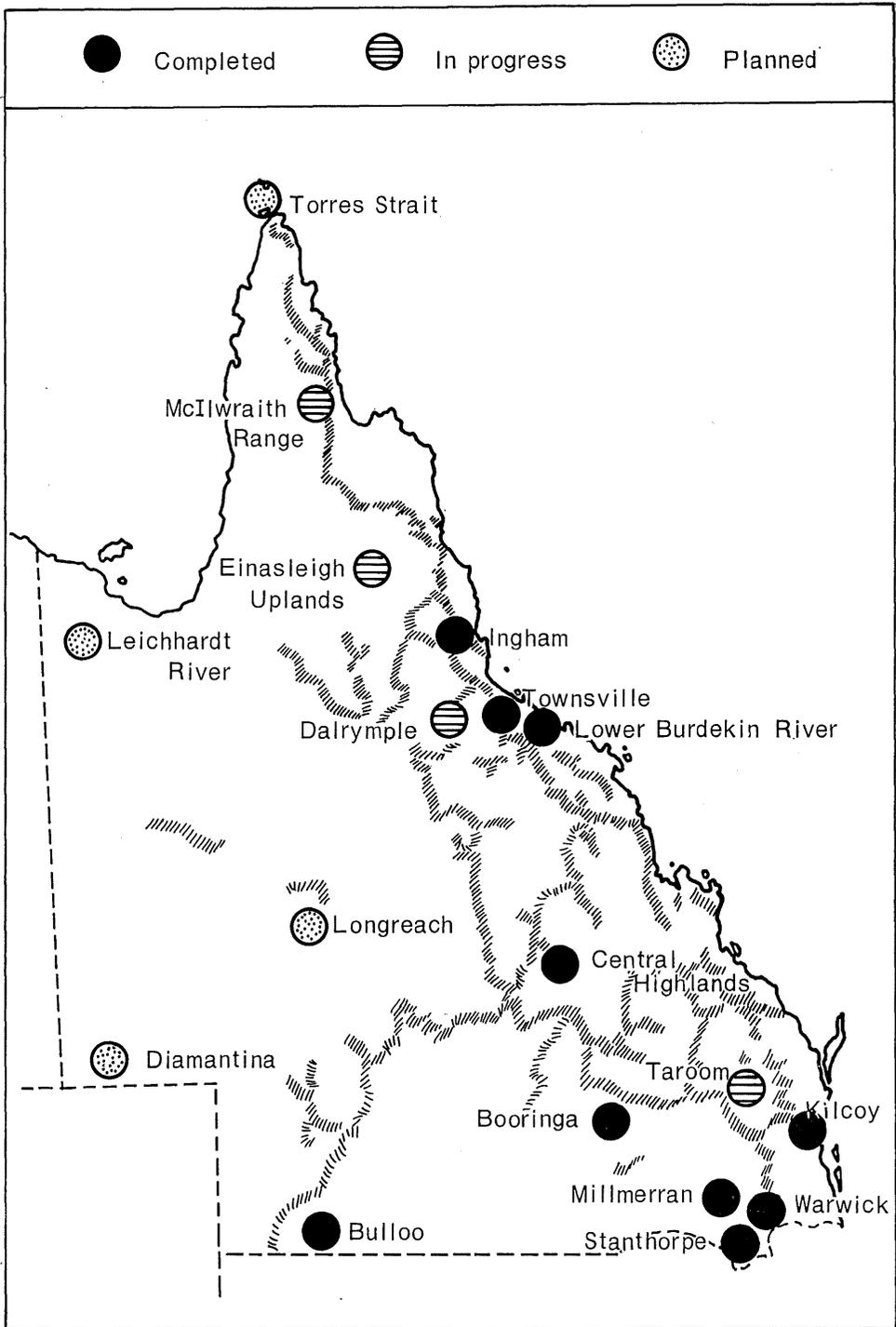


Figure 1.—The districts of completed fauna surveys, surveys presently in progress, and surveys planned in Queensland.

### III. SELECTION OF SURVEY AREAS

Selection of the initial survey areas was governed by location of available staff, which had been in the first instance deliberately placed in areas of diverse zoological interest and opportunity, that is Warwick in southern Queensland and Townsville in the north-east of the State (figure 1). This had the additional advantage that resident workers were familiar with their territories and local fauna, which was accepted as most desirable, as well as being least expensive, wherever possible in surveys.

Initially, the size of the district to be surveyed was determined after considering terrain, habitat diversity and accessibility, natural boundaries and the need to complete a survey within two years (see below). Thus the first (Warwick) was of some 5,000 km<sup>2</sup> while the second (Townsville) was of approximately 1,200 km<sup>2</sup>.

For subsequent surveys, however, it became more practical to use local government areas (Shires) to define districts; these are generally of convenient size, many are defined by natural boundaries, and maps are readily available. Further, the comprehensive series of 'Shire Handbooks' prepared by the Queensland Department of Primary Industries greatly simplifies the task of describing the features of a survey area.

### IV. PLANNING AND CONDUCTING A SURVEY

A fundamental requirement before commencing a district survey is to exhaustively review relevant records in the literature and in museums. The consequent list of species for a district represents the survey base-line; in the ensuing study every effort is made to collect all species listed. In the process, species also are collected that had not previously been suspected to occur in a district.

Next, areas of intensive study are determined from an initial review of the habitat types available within it. These areas usually range in size from 5 km<sup>2</sup> to 100 km<sup>2</sup>, although special considerations such as a locality in which some other research is being undertaken may make a smaller or larger area acceptable. Other relevant factors include accessibility and representativeness of habitat types present; it is desirable from the point of view of convenience to have as much diversity as possible present, but this can provide misleading results about abundance (see below). At least four such areas are needed in each survey. Each habitat type in the survey area must be replicated at least twice in areas of intensive study.

For record purposes, the ideal objective is that all species present are collected, authoritatively identified, and housed in accredited museums where the specimens may be checked if necessary. In practice, however, many species can be identified in the field beyond question and specimens of these are not acceptable, for one reason or another, to museums; for such species, records only are regarded as sufficient.

Trapping and collecting/observing transects are carried out regularly in each intensive study area, a minimum objective being to cover each habitat type (see below) on four separate occasions for at least one week to cover the range of seasonal conditions encountered.

Other parts of the survey area are examined opportunistically:— 'spot' trapping, observations made while travelling, inspection of road casualties, checking reports from interested persons, and so on.

Trapping and collecting techniques are those usual procedures involving traps (both live and break-back) with a wide variety of baits, shotguns, rifles, and the use of spotlights at night. Road casualties and material gathered by domestic cats, for example, are legitimate sources of data; the latter sometimes provides the first indication of the presence of a small mammal species in an area. A recent innovation has been a fence/pitfall trap with straight-sided sheet steel containers some 25-mm wide x 300-mm deep buried in the soil beside a 450-mm-high mesh fence.

Reptile and amphibian collecting is mostly by foot traverse, often at night assisted by torchlight, and includes removing bark, turning fallen trees and lifting stones.

A routine trapping session in any habitat type uses some 100 traps placed in lines; mostly these lines were 5 to 10 m apart at 8 to 20 traps 2 to 5 m apart per line, over a period of 5 days. Longer sessions, and more traps, rarely prove to be to advantage.

A district fauna survey should be completed within approximately two years both to provide the opportunity to encounter a wider range of seasonal differences and to allow the earliest collected data to remain valid. Furthermore, an average period of two years provides for a feasible time-scale for the State-wide exercise to be completed and ready for repetition, an important aspect of the scheme.

## V. DEFINITION OF HABITAT TYPES

One of the more difficult problems is establishing the breakdown of a district into habitat types involved. The principal feature of terrestrial habitat is the vegetation present, and for many species a vegetation association is adequate to describe a habitat preference. Sometimes, however, the preference of a species is for a topographical rather than vegetation feature—such as saline wetlands, soil types, caves. In establishing a list of habitat types found in a district, therefore, the main question is how to describe vegetation associations in a manner consistent with the use made of these by fauna, and which is botanically acceptable. Specht *et al.* (1974) have provided descriptions of vegetation types based on plant height and frequency while others have used less easily measured criteria; the end result has been the same, that is to recognize a larger number of plant associations than was found to be practicable for the present surveys.

The habitat types recognised so far in the surveys are as follows:

**CLOSED FOREST.** Closed canopy areas, often termed rain forest; a lesser category, "dry scrub" or dry closed forest, is sometimes recognized.

**OPEN FOREST.** Includes all tree associations not termed closed forest. A shrub layer is sometimes significant for a species and may be signified in the description of the habitat of that species. The plant species e.g. mulga (*Acacia aneura* F. Muell.) may be significant to some fauna.

**GRASSLAND.** Open grassland rather than understorey is mainly involved. Tussocks are significant for some species and may therefore be recorded.

**FRESHWATERS.** Includes rivers, lakes and swamps and other natural, permanent and seasonal wetlands, and many earth tanks and other artificial impoundments. Depth of water may be singled out in habitat descriptions for species to which this is of obvious significance.

**SALINE AREAS.** Marine, estuarine and brackish situations that are inland as well as coastal.

**CULTIVATION.** A principal man-made type of habitat. Crop type is sometimes important.

**URBAN AREAS.** The other principal artificial habitat, in which introduced species tend to dominate. Isolated buildings e.g. farms, are not generally considered in this context, while on the other hand within a town some other types may occur.\*

Heath is a recognizable type frequently identified on the coastal lowlands of southern Queensland but of doubtful special significance to the vertebrate fauna. Its inclusion as a recognized habitat type will depend on the results of surveys in an area including heathland as a significant vegetation type present.

## VI. ABUNDANCE RATINGS

The emphasis to be placed on population number assessment is related to the significance of this information to the programme. A census is out of the question, and in any event, probably the main value of a population assessment to a conservation authority is as a guide to those species that may be in need of special attention. What matters ultimately is not whether a species is abundant or not but whether it is "safe"; that it is reasonably expected to remain present in the environment into the foreseeable future. The survey abundance rating provides little more than an initial clue to the status of a species.

Thus abundance ratings for surveys were reduced to the impression of frequency of occurrence gained by the survey team during collecting throughout the study period.

The basis for such assessments was developed during early work and is based primarily on the numbers trapped or seen relative to the number of routine trapping sessions. Assessments are as follows:

**ABUNDANT:** Usually present in large numbers

**COMMON:** Nearly always present, but not in large numbers

**UNCOMMON:** Not present each visit, but more than twice during the survey

**SCARCE:** Not present more than twice during the survey.

The ratings 'uncommon' and, in particular, 'scarce' must be applied with care because standard collecting techniques sometimes are ineffective for species that later prove to be quite common. When doubtful, the rating is left open and only the number collected is recorded. A comment on the quality of the search may be in order. Flocks of birds create a special problem, and it is more reasonable to consider a single flock as a single animal in giving a frequency. Thus during 1970 a large flock of budgerygahs, *Melopsittacus undulatus* (Shaw), of possibly several thousand individuals, was observed within the Warwick district for several weeks; this unusual sighting in the light of earlier and subsequent experience hardly justifies a rating higher than scarce. Similarly, the large territories occupied by such species as the wedge-tailed eagle, *Aquila audax* (Latham), make it easy to allocate a rating of common or even uncommon to a species that is in fact abundant. Only experience can help in such matters of interpretation.

---

\* Estimated composition of habitat types in an 8.7 km<sup>2</sup> central portion of the city of Townsville in 1961 was as follows: urban (buildings, footpaths, roads), 34%; saline areas, 28%; cultivation (parks, playing fields, gardens, unformed footpaths), 24%; open forest (usually vacant Crown land), 13%; and freshwaters (weirs, ponds, reservoirs, streams), 1%.

Also to be considered are the effects of excessively wet or dry conditions on apparent abundance of many species. Careful documentation of weather conditions together with the permanent record of the species involved provides some opportunity to appreciate such effects.

## VII. DISCUSSION

So far, it has proved practical to include only terrestrial vertebrates in fauna surveys and the assumption (however flimsily based) must be made that the process of caring for these groups provides for the conservation of other units of the ecological pyramid.

While it is imperative that the whole fauna of the State be assessed, much of the country particularly in inland situations is uniform over large areas. Thus, particularly in such areas, each district may itself be considered an "area of intensive study", in the same way that areas of intensive study have been prescribed for each survey. The formulation of a final set of survey areas is progressive, depending on cumulative results. Thus present indications project the need for surveys in districts in the Diamantina, Longreach, Leichhardt River and Great Barrier Reef-Torres Strait regions (figure 1).

Within the recognized habitat types, many species may occupy some discrete part governed by some narrower feature of the environment that the broad definition indicates. However, the work needed to define such a habitat preference belongs to the biological and ecological studies of particular species rather than one of the present surveys. With greater understanding of the relationship between the fauna and the vegetation, the habitat types recognized in the present surveys may be divided into more precise units. On the other hand, the large number of niches occupied by all species present may well defy practical classification.

From the progress made in seven published surveys (table 1), it is possible to predict, using mammals and birds as a guide, that over a period of 20 years a record will have been obtained of the distribution and abundance of 90% of all species defined legally as fauna in the State of Queensland. No species has been found to be missing from the two most exploited regions of Queensland that constituted the first two surveys. Therefore, repetition of these surveys may usefully establish trends in the distribution and abundance of these fauna species.

TABLE 1  
RESULTS OF PUBLISHED FAUNA SURVEYS IN QUEENSLAND RELATIVE TO THE TOTAL RESOURCE TO BE SURVEYED

District	Number of Species		
	Mammals	Birds	Reptiles
Warwick .. .. .	56 (32%)	220 (39%)	51 (19%)
Townsville .. .. .	53 (43%)	229 (56%)	.. (19%)
Booringa .. .. .	35 (45%)	123 (60%)	.. (19%)
Lower Burdekin River .. .. .	44 (49%)	255 (65%)	.. (19%)
Ingham .. .. .	62 (58%)	266 (69%)	.. (19%)
Millmerran .. .. .	26 (58%)	125 (69%)	.. (19%)
Stanthorpe .. .. .	38 (58%)	158 (70%)	.. (19%)

(%) — cumulative percentage of State totals of 169 mammals, 557 birds and 275 reptiles (based on Lavery 1977).

Finally, although there is merit in establishing breeding status at least for some groups such as birds, the magnitude of the task involved and the considerable regional differences over such a large area of Queensland preclude its consideration in surveys. This subject is being handled separately, see for example Lavery *et al.* (1967).

The basic principles and procedures set out for the original programme have required little modification, and there is no reason yet to believe that the two-year surveys as described have produced other than dependable basic results.

The questions that remain to be examined concern the real value of the surveys to fauna conservation in Queensland and the extent to which these surveys will be required in the future, with or without modification.

The most obvious advantage of the surveys has been the improvement in the inventory of species found in Queensland. Several species have been added, including the Hastings River Mouse (*Pseudomys oralis* Thomas) and a number of bats, and some have been rediscovered, including the bridled nail-tailed wallaby (*Onychogalea frenata* (Gould)). There can be no doubt that other species remain to be located in Queensland for the first time.

Secondly, the known range of many species has been increased, in some instances dramatically, by the survey work; the list is too long to include. Similarly, the abundance of many species generally believed to be uncommon or scarce has been drastically revised. Finally in this context, the habitat preferences of a wide range of species are beginning to be appreciated for the first time.

An important additional benefit of the knowledge accumulated from the present survey work is that it is becoming easier to locate appropriate field study areas for particular species based on distribution and abundance data. This has been of great practical assistance in facilitating progress in many detailed studies of the biology and ecology of the native fauna, and it will continue to do so. Likewise, focal areas of the fauna of a district usually are recognized during a survey, and a basis is thus provided for the nomination of appropriate land reservation where this action is warranted.

TABLE 2

NUMBERS OF NATIVE FAUNA SPECIES COMMONLY AT MAN-MADE HABITAT IN SURVEY AREAS OF FAUNA DISTRICT NO. 3 (NORTH-EASTERN QUEENSLAND)

Habitat Type	Numbers of Species				
	Birds— Non-passerines	Passeriformes	Mammals— Prototheria	Metatheria	Eutheria
Cultivation* ..	33	34	Nil	6	8
Urban ..	Nil	1	Nil	1	3
Freshwaters† ..	32	Nil	Nil	Nil	1
Saline areas‡ ..	1	Nil	Nil	Nil	Nil

\* Includes cleared areas but not areas subjected to selective logging.

† Impoundments such as weirs.

‡ Earth dams over salt pans.

Anticipated to be the most significant long-term benefit to conservation, however, is the basis provided by the present surveys for examination of the impact of European man on the fauna in years to come. This should in turn provide a sounder basis for legislation to control the activities of man in view of adequate fauna conservation. In this respect it is important to note that man's effects are not always detrimental (table 2) and appropriate priorities for conservation action can be allocated accordingly. Changes in species' complex of natural and man-caused influences, and surveys coupled with studies of the biology and ecology of individual species also are calculated to provide the necessary basis to distinguish one set of factors from the other. The current programme calls for repeats of key areas at least at 20-year intervals. That they will fulfil this expectation is yet to be tested.

### REFERENCES

- KIRKPATRICK, T. H. (1966).—Mammals, birds and reptiles of the Warwick district, Queensland. 1. Introduction and mammals. *Queensland Journal of Agricultural and Animal Sciences* 23: 591-598.
- KIRKPATRICK, T. H. (1968).—Mammals, birds and reptiles of the Warwick district, Queensland. 3. Reptiles and general conclusions. *Queensland Journal of Agricultural and Animal Sciences* 25: 235-241.
- KIRKPATRICK, T. H., AND AMOS, P. J. (1977).—Mammals and birds of the Millmerran Shire, south-east Queensland. *Queensland Journal of Agricultural and Animal Sciences* 34: 123-133.
- KIRKPATRICK, T. H., AND SEARLE, A. K. (1977).—Mammals and birds of the Stanthorpe Shire, south-east Queensland. *Queensland Journal of Agricultural and Animal Sciences* 34: 109-121.
- LAVERY, H. J. (1968).—Mammals and birds of the Townsville district, north Queensland. 2. Birds. *Queensland Journal of Agricultural and Animal Sciences* 25: 243-254.
- LAVERY, H. J. (1977).—Fauna. In: '1977 Queensland Year Book No. 37' (Aust. Bur. Statistics: Brisbane), pp 33-42.
- LAVERY, H. J., AND GRIMES, R. J. (1974a).—Mammals and birds of the Ingham district, north Queensland. 1. Introduction and mammals. *Queensland Journal of Agricultural and Animal Sciences* 31: 383-390.
- LAVERY, H. J., AND GRIMES, R. J. (1974b).—Mammals and birds of the Ingham district, north Queensland. 2. Birds. *Queensland Journal of Agricultural and Animal Sciences* 31: 391-403.
- LAVERY, H. J., AND JOHNSON, P. M. (1968).—Mammals and birds of the Townsville district, north Queensland. 1. Introduction and mammals. *Queensland Journal of Agricultural and Animal Sciences* 25: 29-37.
- LAVERY, H. J., AND JOHNSON, P. M. (1974).—Mammals and birds of the lower Burdekin River district, north Queensland. 1. Introduction and mammals. *Queensland Journal of Agricultural and Animal Sciences* 31: 97-104.
- LAVERY, H. J., AND SETON, D. (1974).—Mammals and birds of the lower Burdekin River district, north Queensland. 2. Birds. *Queensland Journal of Agricultural and Animal Sciences* 31: 371-382.
- LAVERY, H. J., SEATON, D., AND BRAVERY, J. A. (1968).—The breeding seasons of birds in north-eastern Australia. *Emu*. 68: 133-147.
- MC EVOY, J. S., AND KIRKPATRICK, T. H. (1971).—Mammals and birds of Booringa Shire, Queensland. *Queensland Journal of Agricultural and Animal Sciences* 28: 167-178.
- SPECHT, R. L., ROE, E. M., AND BOUGHTON, V. H. (1974).—Conservation of major plant communities in Australia and New Guinea. *Australian Journal of Botany Supp. Ser.* 7: 1-667.

(Received for publication 7 December, 1978).

The authors are officers of Research and Planning Branch, National Parks and Wildlife Service of Queensland, stationed at the Hermitage Research Station near Warwick and at Brisbane respectively.