1 Introduction

1.1 Background

Ashmore Reef Nature Reserve, located within Australian Commonwealth waters off the coast of northern Western Australia (12°20'S, 123°0'E), is one of only three emergent oceanic reefs present within the north-eastern Indian Ocean (Figure 1). The Reserve, covering an area of approximately 583 square kilometres, was established by the Commonwealth in 1983 for the purpose of protecting its outstanding and representative marine ecosystems and for its overall high biological diversity, ecological and cultural values. Ashmore Reef provides important nesting sites for seabirds and turtles and supports a diverse range of species, including sea snakes, dugongs, and invertebrate fauna. Ecosystems of the Reserve are also recognised under international conventions and agreements, such as the Japan–Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA), and the Reserve has been designated to the List of Wetlands of International Importance under the Ramsar Convention since November 2002.

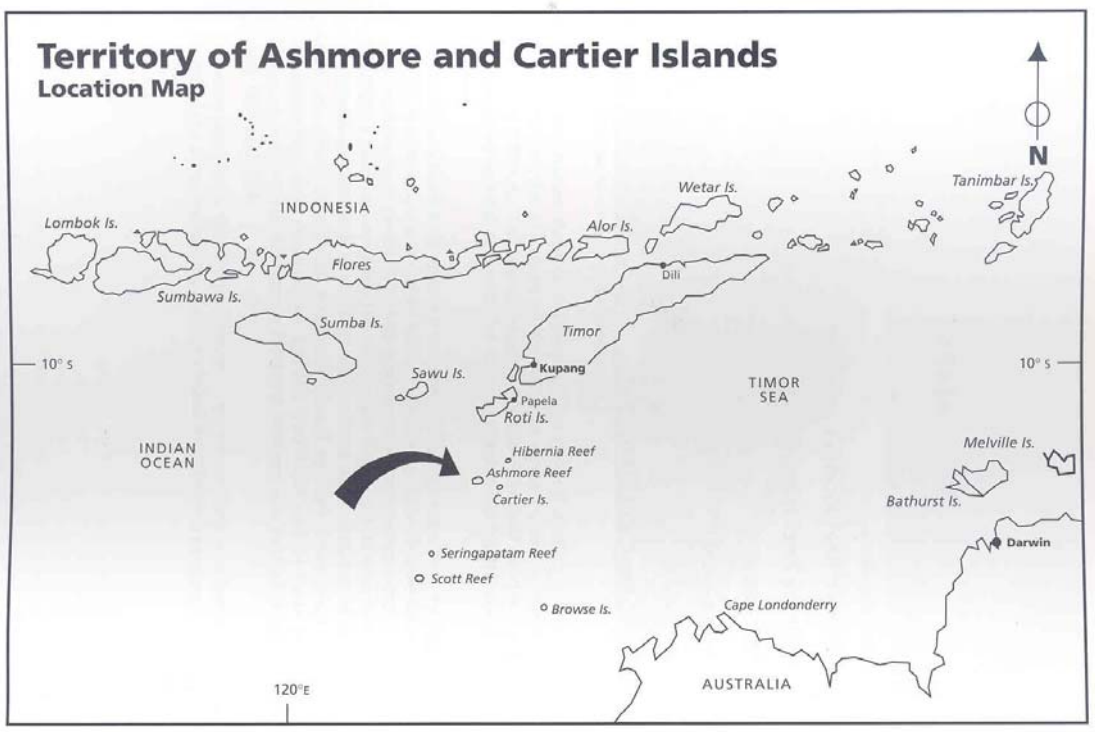

Figure 1 Location of Ashmore Reef (Pike & Leach 1997)

A recent survey carried out by the Northern Australia Quarantine Strategy (NAQS) (Curran 2003) identified that introduced marine and terrestrial species could pose a potential risk to the natural values and conservation objectives of the Reserve. As a result, the Department of the Environment and Heritage (DEH) commissioned the development of a 'Marine and Terrestrial Introduced Species Prevention and Management Strategy' for the Reserve (Russell et al 2004) and has since expressed its willingness to implement research and or monitoring to

predict, assess and potentially minimise the impact of introduced species on the natural ecosystems of Ashmore Reef.

The present research project focused on gaining an initial understanding of the potential ecological risks and impacts of the introduced tropical fire ant (*Solenopsis geminata*) on the Ashmore Reef Nature Reserve, with particular attention to impacts on colonies of seabirds. The tropical fire ant is an introduced ant to all of the islands of Ashmore Reef, with its presence first recorded in 1992 (Curran 2003). Its presence was recognised by Russell et al (2004) as being a dangerous threat to ground nesting birds, and an assessment of the impacts was recommended as a matter of priority. It is a small aggressive ant, native to North America, which feeds on insects and other animals including vertebrates. Sick, vulnerable animals are particularly susceptible to attack, and as a consequence tropical fire ants may have the potential to hinder and deter nesting birds (in particular ground nesting birds), or even attack and kill hatching young and older surviving hatchlings (Drees 1994, Lockley 1995, Giuliano et al 1996, Pedersen et al 1996). The Ashmore islands are regarded as supporting some of the most important seabird rookeries on the North West Shelf. Large colonies of sooty terns, crested terns, bridled terns and common noddies breed on East and Middle Islands. Smaller breeding colonies of little egrets, eastern reef egrets, black noddies and possibly lesser noddies also occur on the islands (Commonwealth of Australia 2002). The impacts of tropical fire ants might also not be limited to birds; nesting turtles and others communities of native insects also might be affected (Russell et al 2004).

Therefore, the collection/collation of baseline information and the development of an approach/framework to predict or assess the likely extent of impacts of tropical fire ants will aid DEH priority-setting and management planning processes for Ashmore Reef.

An initial step in any approach to assess and minimise/manage impacts of any invasive species should be an ecological risk assessment to identify key vulnerable species and key habitats, from which management actions can be guided and ongoing and new monitoring programs refined and developed, respectively.

Below, we present an ecological risk assessment framework and approach to predict the likely extent of impact of tropical fire ants on seabird colonies at Ashmore Reef.

1.2 Project aims

The major aims of the project were:

- to gain a preliminary understanding of the ecological risks of the tropical fire ant to seabird colonies of Ashmore Reef, in particular, identifying the key vulnerable species and locations;

and, using this information,

- determine the need for and value of immediate management actions to minimise risks.

1.3 Approach

1.3.1 Risk assessment framework

Ecological risk assessment is an approach that is being increasingly used to assess a broad range of environmental problems, including those associated with water quality, water quantity and invasive species. Various ecological risk assessment frameworks have been

developed, both for broad application (eg US EPA 1998) and for specific purposes (van Dam et al 1999, Curran 2003). Because Ashmore Reef is a Ramsar site, the ecological risk assessment framework developed by van Dam et al (1999), which has been adopted by the Ramsar Convention on Wetlands (Resolution VII.10; www.ramsar.org/key_res_vii.10e.htm) was used in this project. This approach has recently been used to assess the ecological risks of two invasive species in northern Australia, the cane toad, *Bufo marinus* (van Dam et al 2002) and the wetland weed, *Mimosa pigra* (Walden et al 2004). Under this model, ecological risk assessment is considered a process consisting of six major steps: *problem formulation*, *effects characterisation*, *exposure characterisation*, *risk characterisation*, *risk management and reduction*, and *monitoring* (Figure 2).

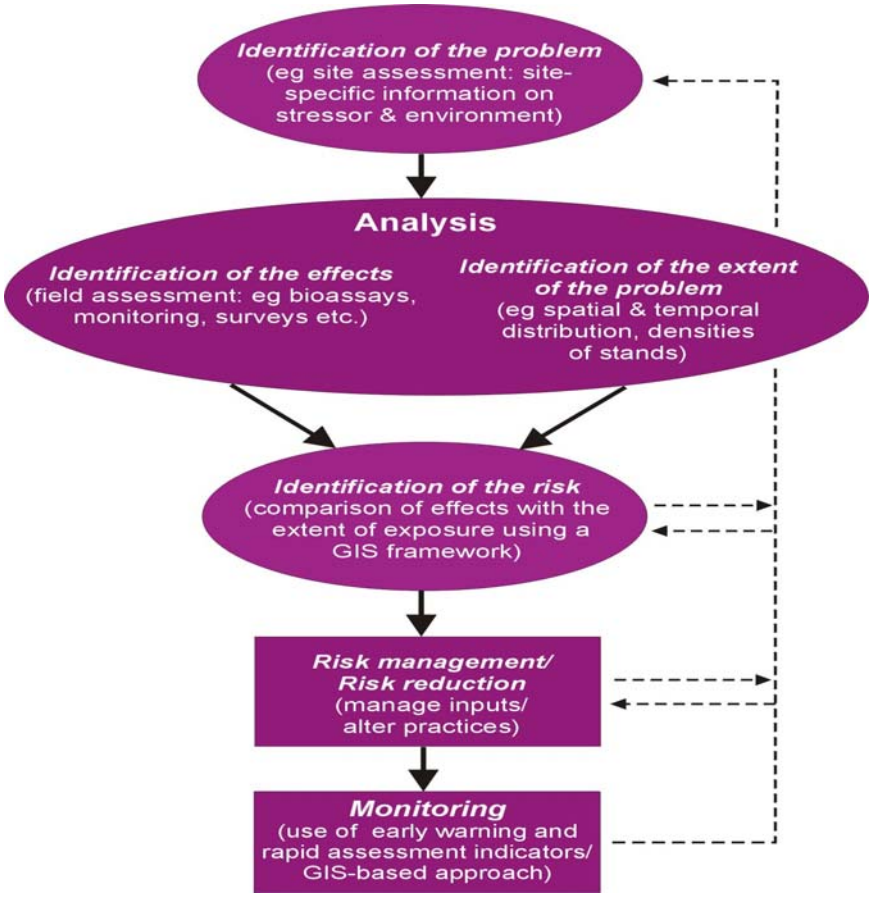

Figure 2 Wetland risk assessment framework (modified from van Dam et al 1999)

The preliminary ecological risk assessment of tropical fire ants on seabirds colonies of Ashmore Reef Reserve, brought together, analysed, and made predictions based on all relevant information on tropical fire ants in Australia and elsewhere, and on the key biophysical attributes of the Ashmore Reef islands. It considered the first four steps of the risk assessment process shown in Figure 2, in order to be able to provide relevant information and guidance for the development of strategies and programs under the final two steps.

Two field visits (September and November) were made. An assessment of the current status of the abundance and distribution of tropical fire ant was made during the visist in September. The extent of seabirds colonies breeding on the three islands was mapped, and a quantification of the number and spatial distribution of dead chicks of two seabird species (common noddy and brown booby) found on the islands was made during the visit in

November. The sampling techniques used during the field surveys, and described in detail in the relative sections (Section 3 Effect characterisation and Section 4 Exposure characterisation), were designed in order to undertake future monitoring programs and assess the efficiency of risk management and reduction. The information collected on birds were compared with previous baseline information collected by CSIRO (Milton 1999a-b) and exsisting literature.