chapter 7

prioritisation of high conservation status offshore islands

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7 Planning Pest Management on Australia's Offshore Islands – A Best Practice Perspective

7.1 Introduction

The offshore islands of Australia range from tropical and subtropical atolls through warm temperate, cool temperate and subantarctic islands. Geology and soil type are highly variable and their interactions have a large bearing on the native biota and the ability of specific exotic biota to colonise. There are additional factors that influence the composition of native and exotic biota on islands, including the distance of an island from the mainland and/or large islands, typically the main source of native and pest biota. Increasingly, there are also many anthropogenic effects that influence the biota of all islands to widely varying degrees. Because of these wide-ranging abiotic and biotic influences, the diversity of ecosystems and species on islands is very wide-ranging, with each island or archipelago having a unique biota. Consequently, every island or archipelago will have its own particular pest management issues that require site-specific solutions.

Offshore islands are vitally important to the survival of Australia's threatened species and pest management on islands is crucial (Burbidge 1999). Pest managers normally aim for either eradication of a pest species or reduction in its numbers to prescribed levels that then enable restoration targets to be achieved. Either approach also needs to be accompanied by enhanced biosecurity. The Threat Abatement Plans (TAPs) for invasive species on Australia's offshore islands generally reflect these three approaches: eradication, reduction in pest population and enhanced biosecurity. The TAP for rodents, for example, identifies three objectives on high priority islands – eradicate exotic rodents, mitigate impacts where rodents cannot be eradicated, and prevent further invasion of islands currently free of exotic rodents.

In the medium and long-term, eradication of a pest species can achieve more for biodiversity restoration and at a lower cost than that achieved by sustained control of the same pest species. Frequently, however, eradication may require a significant level of funding during the initial pest hits. On some islands with multiple pest species, combinations of the two approaches might be considered along with doing nothing for other invasives, e.g. eradication of pest species *x*, control of pest species *y* and ignoring of species *z*, but this complex approach should be considered only after careful feasibility studies. Each of the approaches - eradication, mitigation and biosecurity - requires careful planning and needs to incorporate local social and economic considerations including into the future.

The key ingredient for successfully managing island pests anywhere is to develop a suite of clear plans for that particular situation. Key planning components are:

1. strategic objectives for an island and its biota clearly defined

2. feasibility studies completed, and

3. operational plan developed and tested.

Throughout this process, support from stakeholders needs to be continually developed.

7.2 Strategic Objectives

The restoration goals or objectives for an island or archipelago can be contained in an existing management plan or identified as a series of long-term goals in national or regional strategies. These objectives need to be clearly defined before feasibility studies and operational planning are completed. There are many examples of good strategic planning documents for pest management in Australia and overseas that have enabled a clear way forward for planning. Examples include the development of island management plans for Phillip Island (VIC), Rottnest Island (WA), and Lord Howe Island (NSW). In many cases these are backed by regionalised state/territory conservation management strategies. In New Zealand, regional conservation strategies are regularly updated with public involvement and have enabled orderly planning for the removal of rodents, browsers and predators from subantarctic Campbell Island to subtropical Raoul Island (Veitch and Clout 2002). Elsewhere, the 'Project Isabela' initiative allowed careful planning for the eradication of goats and other herbivores from the 48 000 ha tropical Santiago Island in the Galapagos Islands (Cruz et al. 2009), while on a smaller scale, many publicly-driven initiatives, e.g. Friends of Tiritiri Matangi Island in New Zealand, have also followed similar strategic planning formats and subsequently completed pest eradications and maintained effective biosecurity. The objectives of these projects may range from the security and recovery of a species population to the restoration of a particular ecological community or entire island ecosystem or ecosystems.

Broadly, the strategic objectives and priorities for Australia's offshore islands are described at three levels – national, state/territory and local.

7.2.1 National strategies

National strategies include DEWHA's TAPs (DEH 2005; DEWHA 2008b,c,d,e,f) along with other Commonwealth Government documents such as the *Australian Pest Animal Strategy* (DEWR 2007b). In addition, national strategies are provided within national species recovery plans (e.g. Woinarski 2004a,b), World Heritage plans (e.g. Shark Bay World Heritage Area, McCluskey 2008), nature reserve plans (e.g. Dampier Archipelago Nature Reserves, Morris 1990) and many other documents, such as this report which assists with the prioritisation of pest removal from Australia's larger (> 200 ha) offshore islands. Many of these documents can be accessed from the DEWHA website (www.environment.gov.au).

7.2.2 State/territory strategies

State/territory strategies include strategic plans specifically written for managing island groups (e.g. Lord Howe Island Group, Manidis Roberts 2000) or specific biota across a state/territory (e.g. Northern Quoll in the Northern Territory, Woinarski et al. 2007). State/territory strategies also include recovery plans for threatened species that are confined wholly or mainly to one state (e.g. South Australian subspecies of the Glossy Black-Cockatoo, Mooney and Pedler 2005; Lord Howe

Phasmid and Lord Howe Woodhen, draft plans in preparation, see www.lordhoweisland.info).

7.2.3 Local strategies

Local strategies include individual island strategies, or parts of islands. These local strategies are important because they engage the community in helping to develop island plans spanning the setting of visions and objectives to the implementation of tasks and ongoing monitoring and surveillance. These plans are often integrated plans that cover ecological, social and economic aspects and require input from all relevant stakeholders off and on the islands. The absence of a strategic management plan can lead to difficulties with stakeholder support, capacity development, and sometimes poor decision making at the operational planning stage for pest management.

The Lord Howe Island Management Plan (Manidis Roberts 2000) is a good example of a plan that has combined national, state/territory and local expertise in developing a locally-focused plan, and others e.g. the draft Rottnest Island Management Plan (Rottnest Island Authority 2009), are following suit. The former identified 19 objectives for the entire Lord Howe Island Group, many of these involving the management of pest species. Typically, plans at this level do not identify specific management actions, as many of these may firstly require further research (feasibility study, see below). However, they do identify desired outcomes that have been discussed and agreed upon via widespread consultation through a strategic planning committee. Agreement of the vision and objectives of these documents are vitally important for the ongoing securing of support, capacity and funding.

Another good example is the Phillip Island Management Plan (Phillip Island Nature Parks 2006) which has a clear vision and strategic goals spanning environmental sustainability, community and tourism and which was developed with the community and other stakeholders. It has enabled parallel operational planning to proceed for the eradication of foxes and management of other pests (McPhee and Bloomfield 2004).

7.3 Feasibility Study

A peer-reviewed feasibility study is essential prior to developing an operational plan. Depending on how well a particular island and its biota and issues are known, a feasibility study may be quite narrowly-focused, e.g. fine-tuning aspects of the operational approach or integrating social components. However, many islands or ecological communities are less well-known and feasibility studies need to be broader and include fairly fundamental needs. For example, these may include the need to:

- Evaluate whether it is worth managing the island or some or all of the pests at all, i.e. assess the cost and benefits of eradication and ongoing pest control compared with managing other islands or doing nothing.
- Assess the level of public support and likely funding for the project both now and also in the future.
- Determine the achievability of eradication or control, i.e. is it technically feasible to eradicate or manage a pest to desired levels, and if not, what aspects need to be refined

or further researched?

- Determine the feasibility of maintaining biosecurity after eradications, i.e. can the risk of reinvasion or invasion of other pests be satisfactorily mitigated?
- Estimate the cost of ongoing management and biosecurity work.
- Assess the level of likely non-target effects during the operation, and if unacceptably high, can this be mitigated satisfactorily?
- Assess the potential for 'ripple effects' e.g. the increases in numbers of a browser following predator-removal, or one native species gaining a detrimental competitive advantage over another native species after pest eradication.

Failure to address any one of the above needs could place an operation at significant risk.

Most feasibility studies are in support of eradication projects given that it is becoming technically feasible to remove pests from increasingly large islands. Moreover, there are many examples of how sustained pest control has failed to achieve recovery objectives for threatened species and/or faced significant ongoing costs, e.g. Red Fox control on Phillip Island (McPhee and Bloomfield 2004).

Eradication projects generally use five principles that must be met before a project is undertaken (Parkes 1990, Bomford and O'Brien 1995, DOC 2006):

1 All individuals can be put at risk by the eradication technique(s).

2 They can be killed at a rate exceeding their rate of increase at all densities.

3 The probability of the pest re-establishing is manageable to near zero.

4 The project is socially acceptable to the community involved.

5 Benefits of the project outweigh the costs.

In planning pest eradications on Australia's offshore islands, principles 1 and 2 often involve well-established eradication methods, many of them have been refined and extensively used overseas, e.g. for rodents (DOC 2006, currently under revision), rabbits (Merton et al. 2002, Torr 2002) and feral cats (Copson 2002). However, it is principles 3 - 5 that can cause considerable barriers to specific island plans and these are discussed below. Responses to principles 3 - 5 can also influence a decision to revisit the eradication approaches of principles 1 and 2.

7.3.1 Principles 1 & 2 – Involve well-established pest eradication methods

No two islands would see identical pest eradication approaches, but broad approaches have been successfully developed for eradicating several species (Table 7.1).

Table 7.1 Examples of standard approaches for pest eradication on islands

Target	Principal eradication methods	International examples

Rodents	a. Anticoagulant poison bait – hand-spread or aerial application depending on island size and terrain/foot access; two applications approximately 1-2 weeks apart. Rodent species composition and some local non-target circumstances dictate baiting density. For example, higher density on islands with terrestrial crabs, such as Vahanga atoll, as crabs may also eat the baits (usually with little or no side-effects). b. Use alternative bait stations (e.g. raised level baits) in areas with sensitive native mammalian fauna e.g. Barrow Island.	Many islands (DOC 2006, Howald et al. 2007, Veitch and Clout 2002); Barrow Island (Morris 2002); Vahanga atoll (Griffiths et al. 2008)
Rabbits	Aerial or hand-spread of bait as for rats above, followed by supplementary methods, particularly day and night hunting, trained dogs and sometimes trapping to eliminate survivors.	Mauritius (Merton 1987); Saint Paul Island (Micol and Juventin 2002); Enderby and Rose islands (Torr 2002)
Feral cats	Shooting, cage-trapping and padded jaw traps are the recommended code of practice. 1080 baits have also been successfully used followed by trapping survivors (e.g. Hermite Island). Current research is underway on new baits and toxins and integrated pest control. On islands where rats are also being targeted with brodifacoum, many cats have died of secondary poisoning following the initial rodent poisoning. Follow-up has been via the methods described above.	General review (Nogales et al. 2004); DEWHA workshop on new bait (DEWHA 2008n); Macquarie Island (Copson 2002); Little Barrier Island (Veitch and Bell 1990); Hermite Island (Algar et al. 2002); islands of The Galapagos (Phillips et al. 2005)
Goats and livestock	Hunting and supplementary techniques, e.g. dogging, 'Judas goats' (radio-tagged released animals), all methods considered humanely acceptable or conditionally acceptable (Sharp and Saunders 2007).	Ethics (Sharp and Saunders 2007); Lord Howe Island (Parkes et al. 2002); Santiago, Galapagos (Cruz et al. 2009); subantarctic islands of New Zealand (Veitch and Clout 2002)
Feral pigs	Aerial shooting, poisoning and trapping, all methods of which are considered humanely available (Sharp and Saunders undated).	Ethics (Sharp and Saunders, undated); guidelines (QPWS 2004)
Red Fox	Considerable research and adaptive management is addressing control strategies. Combinations of 1080 baiting, spotlight hunting, trapping, and using trained dogs to find dens, are identified in the Phillip Island Strategic Plan approach.	Phillip Island (McPhee and Bloomfield 2004); Red Fox TAP (Saunders and McLeod 2007)

7.3.2 Principle 3 – Reinvasion risks & biosecurity needs

Reinvasion risks are unique to the circumstances of each site and risks are often underestimated. A feral species could effectively recolonise depending on physical ability (access distances and swimming capabilities) and human-related issues, e.g. effectiveness of quarantine measures for the islands. Significant regard needs to be given to the future here, given expanding ranges of

many pests, e.g. Cane Toads and invertebrate pests, and adapt objectives and management approach accordingly. In addition the removal of a pest from an island can subsequently increase the chances of a competitor species to establish, e.g. smaller rodents may have a greater chance of surviving and establishing when large rodents or predators are removed. Risk assessments in for potential newly arriving pests have been evaluated for Australasia by Bomford (2008).

All of these issues need to be carefully considered on an island by island basis and address questions such as:

- what pests pose a risk to the island or islands and what are their likely levels of impact should they establish?
- is it feasible to maintain a pest-free island?
- can more effective biosecurity reduce the risks, are the risks acceptable to an eradication programme being considered in the first place?
- what contingency plans and responses can be put in place in the event of reinvading pests?

AusBIOSEC has developed strategies that will provide general advice on the prevention of invasions of plant and animal species and operational frameworks for dealing with invasions if they occur. These are built from specific industry- and pest-based strategies, legislation and operational procedures already in place for primary industries, and draws on these to establish arrangements for the environment sector (DAFF 2009). Once implemented, these will be applicable to islands as well as mainland Australia. Research on pest reinvasion issues including detecting and eliminating first arrivals, is ongoing e.g. Russell et al. (2005). In many cases, adaptive management will answer some of the questions of detection and elimination. For example, the ranger systems being developed for surveillance of Cane Toads and other pests arriving on some Northern Territory islands, will help refine species-specific methodology for detection and elimination.

7.3.3 Principles 4 & 5 – Is the proposal socially acceptable? Do benefits outweigh costs?

These two principles are related. Often the project will be acceptable to the community if the outcomes are achieved cost-effectively with minimal environmental damage and social disruption. This means that the feasibility studies need to address appropriate and cost-effective methods and also ways of mitigating for any potential impacts to the environment, people and their domestic animals.

Some key social and environmental aspects that need to be addressed in the feasibility study are:

- Relative benefits and costs of removing/controlling different pests for target ecosystems and species.
- Integrated pest management can include e.g. dual control of a predator and its staple

prey – classic examples include the targeting of rodents and a predator (e.g. Cat) on islands, with the method to target the rodent also proving to be effective at removing most cats. Failure to implement integrated pest management can lead to undesirable 'ripple effects' following the removal or control of a top predator, e.g. removal of feral cats can lead to higher densities of rodents and/or rabbits with subsequent impacts on the environment and non-targets, e.g. Macquarie Island and probably other less well-studied islands. The same type of ripple effect could be expected as an outcome if foxes were removed in isolation to rabbit management. In addition to this, occasionally some native species can gain a competitive advantage over other native species when a pest is removed.

- Assessment of environmental effects.

This should include assessments of effects of toxin persistence in soil, groundwater and freshwater and non-target effects. Non-targets should include threatened fauna species and other fauna that are considered potentially susceptible to the same management methods against pests. Some common examples of impacts, mitigation and needs are summarised in Table 7.2 below.

Table 7.2 Some mitigation issues and approaches for non-target species

Non-target	Method of potential management impact	Potential mitigation and needs
Waders, e.g. *Charadrius, Numenius, Pluvialis, Arenaria*	Primary poisoning (eating bait) or secondarily poisoning (eating invertebrates that have consumed bait)	Avoid baiting the feeding areas (Dowding et al. 2007). For northern hemisphere migrant waders, time operation to breeding period (adults in Holarctic); research the effectiveness of scaring remaining birds from target islands (Merton et al. 2002, Pierce et al. 2008)
Native rodents and marsupials	Primary poisoning from rodenticide baits	Research target-specific baits/toxins; research inhibitors/deterrents, e.g. netting covers prevent macropod access, and timing for minimal impact
Mammal and bird breeding sites	Dog-predation, disturbance, burrow collapse, desertion of nests and colonies	Time field operation to avoid sensitive parts of breeding season; identify low impact pathways for operators; train dogs to avoid non-targets; hand-spreading of baits - throw or catapult baits into colonies from a distance
Other mammals, reptiles, birds with incomplete risk assessments	Potential for primary or secondary poisoning	Review eradications literature, carry out feasibility studies which may include experiments with captive animals, e.g. observe palatability of non-toxic bait food; if high risk keep in captivity until declared safe for return, or explore other management approaches

If principles 1 - 5 can be met for eradicating/controlling pests on islands, the project needs to consider some more general planning requirements in relation to developing support and capacity. This includes, for example:

- that there are adequate resources and timeframes to solve issues

- that stakeholders' involvement in terms of cost and time is appropriate
- effective management of the operational planning task itself
- the early identification of pre-requisites in the planning, e.g. trials preceding key decisions on eradication design
- collectively the above considerations will determine whether the project is feasible under current resources and timeframe constraints.

If the support and capacity to complete the project is available, the operational planning is the next phase.

7.4 Operational Planning

There is no single prescription to an operational plan, but the general approach developed by New Zealand Department of Conservation (NZDOC) for rodent, principally invasive rat species, eradications has been refined over the years (Cromarty et al. 2002, DOC 2006) and has been adapted for some larger pest programmes in Australia. For example, the Tasmania Parks and Wildlife Service produced a 10 part eradication plan (Parks and Wildlife 2007, 2008) for pests on Macquarie Island which covered the following components:

Part A - The Eradication Plan. This provides an overview of the project spanning background to the overall plan and process including establishment of an eradication committee, justification for the eradication approach, methods considered and justification for the decision on specific methods, identification of operational time frames for the operation, monitoring, operational summary, and consultation and communications.

Part B - Operational Plan. This provides the operational detail of the plan which has been revised during the planning process.

Part C - Environmental Impact Assessment. This assesses the species that could be put at risk during the operation and identifies mitigating approaches, e.g. timing the operation for minimum disturbance.

Part D - Occupational Health and Safety Plan. This addresses potential hazards of which there are many when working on an isolated island with difficult terrain and weather, together with means of mitigating those hazards.

Part E – Project Biosecurity Plan. This addresses biosecurity risks (reinvasion and newly invading species) and statutory and operational means of mitigating risks.

Part F – Monitoring Plan. This addresses biota monitoring (vegetation and fauna) before, during and after the operation.

Part G - Communications Plan. This addresses communications of staff on the island and between island and mainland, and amongst the stakeholders including the public.

Part H - Project Plan. This addresses the project strategy (components and phases), together with

project management (reporting, decisions, resources, budget, work plan, risks, issues, communication management strategy, project planning quality, integration and evaluation).

Part I - Procurement Plan. This addresses the obtaining of equipment and material, including bait, and the most cost-effective means of doing that.

Part J – Staff Recruitment and Training Plan.

Smaller operations may consider merging some of the plan parts above. However, it is best if major plan components are kept separate from the actual operational approach. Thus, environmental impact, health and safety, biosecurity, monitoring, communications and others are best treated separately.

Throughout the planning phases for any pest eradication operation, the summary advice of the NZDOC best practice document for rodent eradications should be kept in mind (DOC 2006). Basically this document provides a template that can be used for all eradications and emphasizes using established (well-tested) methods, avoiding complicated approaches, conduct trials to test assumptions and new ideas, use peer review and checks, and expect the unexpected, e.g. consent requirements being more stringent than anticipated. It also contains an operational checklist which is very useful for rodent operations and is generally applicable to others.