



# Montague Island Seabird Habitat Restoration Project

*Proceedings of Shared Island Management Workshop  
Narooma, NSW, November 2008*

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## Preface

This report presents the proceedings of a shared island management workshop held on 17 and 18 November 2008 at Narooma on the far south coast of NSW. The workshop communicated the principles and results of the Montague Island Seabird Habitat Restoration Project to island and coastal managers and researchers. This successful weed control and habitat restoration project has been conducted on Montague Island since 2001, and is now managed by the Department of Environment, Climate Change and Water (DECCW).

The workshop featured presentations from managers, researchers and staff involved in the project. Key content included explaining the scientific background, research results which formed the basis of the project, and the management and logistical considerations of conducting an ambitious restoration project on a remote offshore island.

In addition, the workshop aimed to facilitate a shared learning experience for all participants by promoting general discussion and inquiry into the project throughout the two days.

### **Preston Cope**

Area Manager, Far South Coast Region

Department of Environment, Climate Change and Water

www.geoffcomfort.com



*Montague Island*

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**Mike Williams**, Independent Workshop Facilitator

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*Mike Williams, Facilitator with Preston Cope Area Manager.*



*Workshop attendees*

# 1. Introduction

## 1.1 Overview of the Seabird Habitat Restoration Project

The NSW National Parks and Wildlife Service, which is part of the Department of Environment, Climate Change and Water (DECCW), embarked on an ambitious habitat restoration project in 2004 on Montague Island. One of the most significant offshore islands in NSW, Montague Island is located off Narooma on the far south coast of NSW, and is colonised by several seabird species such as the little penguin *Eudyptula minor*.

The Seabird Habitat Restoration Project aims to remove kikuyu grass *Pennisetum clandestinum*, an exotic pastoral grass which smothers native vegetation, resulting in the loss of large expanses of seabird breeding habitat.

Research conducted by Charles Sturt University identified that the most suitable method of controlling kikuyu grass was to use an integrated program that included spraying the grass with herbicide, burning thick kikuyu grass clumps and revegetating the land with native plants.

Through these techniques, over 14.5 hectares of kikuyu grass have been removed from Montague Island, effectively halving the distribution of the grass. In its place, over 60,000 native seedlings have been planted to reduce any risk of reinfestation and provide suitable habitat for nesting seabird species such as the little penguin.

Extensive revegetation has been successfully achieved through a cooperative effort involving DECCW staff, Charles Sturt University undergraduate students and tourists participating in eco tours conducted on Montague Island. Eco tour participants have made a significant contribution to restoring the island's seabird habitat.

## 1.2 Montague Island description

Montague Island (36° 15'S, 150° 14'E) is located 350 kilometres south of Sydney and 9 kilometres east of Narooma, NSW (see Figure 1). Montague Island is approximately 1.5 kilometres long and 500 metres wide at its widest point. It has a total area of 82 hectares, with the highest point being 64 metres above sea level. The island is divided by a steep ravine, which effectively creates two islands, 'north island' and 'south island', which are joined by a rocky beach.

From the 1880s onwards, the island had a working lighthouse and weather recording station, and was used for coastal surveillance. In 1953, it became a wildlife sanctuary under the control of the National Trust of Australia while continuing to operate as a staffed lighthouse station. In 1987, the lighthouse was automated and management of the island was transferred to the NSW National Parks and Wildlife Service. It was dedicated as a nature reserve in 1990, except for the small precinct containing the lighthouse which remains under the control of the Australian Maritime Safety Authority.

Access to Montague Island is restricted to DECCW staff and approved researchers. Tourists are permitted only on fully escorted tours.

S. Donaldson/DECCW



Kikuyu grass smothering native vegetation on Montague Island



Montague Island supports a diverse assemblage of fauna. The island is a haul-out site for the Australian fur seal *Arctocephalus pusillus* and New Zealand fur seal *A. forsteri*. An estimated 15,000 pairs of shearwaters breed annually on Montague Island, consisting of even numbers of short-tailed and wedge-tailed shearwaters and fewer than 100 pairs of sooty shearwaters. The island also supports smaller colonies of crested terns *Sterna bergii* and silver gulls *Larus novaehollandiae*. Welcome swallows *Hirundo neoxena*, little grassbirds *Megalurus gramineus*, golden-headed cisticolas *Cisticola exilis*, Australian pipits *Anthus australis*, nankeen kestrels *Falco cenchroides*, peregrine falcons *Falco peregrines*, swamp harriers *Circus approximans*, buff-banded rails *Gallirallus philippensis* and sooty oystercatchers *Haematopus fuliginosus* also breed on the island (Fullagar et al 1993).

The vegetation of Montague Island has greatly changed since the island was occupied in 1881 as a lighthouse station. In the past, the island supported an upper canopy of trees, though these were all removed by the early 1900s (Heyligers and Adams 2004). Early lighthouse keepers' remarks suggest rabbits introduced to the island in the late 1800s undermined the trees, while goats, which were also introduced in the 1800s, ring-barked the trunks of trees and grazed on their leaves (Pacey 2001; Heyligers and Adams 2004). Timber may also have been cleared for use as an alternative fuel when coal supplies dwindled (Pacey 2001). Such large-scale upper canopy clearing was not replicated in the lower strata, which continued to contain a dense understorey of predominantly mat rush *Lomandra longifolia* (Heyligers and Adams 2004).

### 1.3 Kikuyu grass on Montague Island

Initial research conducted in the 1990s by Charles Sturt University and CSIRO researchers identified that kikuyu grass, introduced to the island in the mid 1900s, was spreading at a rapid rate throughout seabird habitat on Montague Island. In 2000, kikuyu grass covered over 45% (22.6 hectares) of the island, with most of the spread occurring across the southern half throughout the moist gullies and along mown access tracks. However, isolated patches also appeared in inaccessible and remote areas, possibly spread by seed or stems transported by wind or runoff. Large areas of previously native vegetation became dominated by kikuyu grass which, over time, increased in thickness to form a dense mat (over a metre high in some areas), subsequently reducing seabird access to breeding habitat.

As a result, large areas of such habitat, previously used by nesting little penguins, burrowing short-tailed shearwaters *Ardenna tenuirostris*, wedge-tailed shearwaters *A. pacifica* and sooty shearwaters *A. grisea*, became disused. In addition, seabirds which nested in the kikuyu grass risked becoming entangled in its thick stems. Alarming, based on the historic rapid rate of the spread of kikuyu grass (over a hectare per year), if no intervention was undertaken, the grass would have potentially spread across the entire vegetated area of the south island within 12 years.

In 2001, the National Parks and Wildlife Service sought the help of Charles Sturt University researchers to investigate ways of controlling kikuyu grass. Various methods of control were trialled on experimental plots. These included combinations of burning, spraying with the herbicide Roundup (glyphosate), shading with fast growing native plants, and revegetating with native plant species.

The experimental plots were monitored before, and for up to four years following, treatment, to determine the amount of reduction in cover and height of the grass, and the associated vegetation changes. An integrated kikuyu grass control method was also trialled across a larger area, which enabled control to be researched on a broad scale. The results revealed that an integrated method of spraying, burning and revegetating was the most effective and suitable control method for use on Montague Island. Spraying was the only method which killed the kikuyu grass systematically, including the extensive root system of the species that can extend far beneath the soil (up to three metres beneath



2001 experimental trial identifier

S. Donaldson/DECCW



the surface). Burning of previously sprayed kikuyu grass removed thick clumps and the threat of seabird entanglement. Revegetation ensured that native plant species conducive to seabird nesting, such as mat rush *Lomandra longifolia*, were reintroduced to the treated habitat.

Broadscale monitoring identified that this integrated control method must be accompanied by annual spraying of kikuyu grass regrowth to ensure effective control levels are maintained in the long term.

## 1.4 Project implementation

In 2004, DECCW formulated the Seabird Habitat Restoration Project, which aims to control and reduce the distribution of kikuyu grass across Montague Island, whilst simultaneously restoring native seabird breeding habitat. A strategic kikuyu grass control plan was formulated which divided Montague Island into a number of zones. The extent of each zone was based on the density of kikuyu grass and the area's accessibility to treatment.

On the south-western side of the south island, dense patches of easily accessible kikuyu grass which were adjacent to vehicle access tracks were divided into small zones which were roughly one hectare in size. These heavily infested zones were controlled using a successful combination of burning, spraying and revegetation previously trialled by Charles Sturt University researchers. Only one small zone would be treated annually, due to financial and logistical constraints.

The central portion of the south island surrounding the lighthouse and residential quarters was zoned as 'the lighthouse station precinct'. The remaining areas of Montague Island (i.e. the entire north island and the eastern side of the south island) were combined into a single zone as they were largely inaccessible and could not be treated using intensive control methods. The isolated patches of kikuyu grass in this zone were controlled by aerial spraying by helicopter. This method involved selective spraying of kikuyu grass with herbicide via a specialised trigger activated hose.

Aerial spraying was undertaken initially in the winter of 2004 and then as required to control any kikuyu grass regrowth. Most of the more intensive control zones formed part of the nesting area of the little penguin. This species relies heavily on a dense cover of native vegetation beneath which to nest and moult. Such cover, predominantly mat rush, allows little penguins to move between shrubs whilst providing a dense network of radiating leaves under which to nest.

To ensure suitable nest sites were available in recently treated zones, nest boxes were provided as an interim measure until the native vegetation cover increased.

## 1.5 Results

The project has proved highly successful in controlling and reducing the spread of kikuyu grass, whilst simultaneously restoring degraded seabird habitat on Montague Island. Integrated control in conjunction with aerial spraying has more than halved the distribution of kikuyu grass found before the program was implemented. To date, five zones have been treated with intensive control methods (spraying, burning and revegetating) on the south-western side of the island, and over 60,000 native seedlings have been planted as part of revegetation works. Aerial spraying has been a highly effective means of controlling inaccessible patches of kikuyu grass on Montague Island, with the grass found across only 5% of the aerially sprayed zone one year after treatment. Follow-up aerial spraying was undertaken in the winter of 2008 to control regrowth.

Revegetation has been very successful, despite the seedlings being watered only once after they were planted and no seedling protection measures being implemented, even when most planting occurred during drought years. The timing of the revegetation was crucial to the high success rate, with the late August–early September plantings coinciding with early spring rainfall on Montague Island. Restored habitats now support a dense cover of native vegetation that little penguins can easily access for nesting.

S. Donaldson/DECCW



Experimental plots on Montague Island in 2008

Over 350 nest boxes were placed in treated habitats. Little penguins readily occupied these artificial nests within weeks of their placement and stayed in them, even when suitable vegetation cover was available.

Annual monitoring of nesting pairs has identified that little penguins breed in nest boxes with the same success as pairs breeding in more naturally occurring nests, such as beneath the cover of native vegetation.

Before treatment, kikuyu grass was beginning to spread throughout shearwater breeding habitat, which is mainly on the north island and the eastern side of the south island. Controlling this spread has ensured suitable habitat remains available for these seabirds.

Work on Montague Island is not over. The program is ongoing with four additional intensive treatment zones to be treated from 2009–2012 and additional follow-up spraying to be undertaken to control kikuyu grass regrowth in all treated zones, including the aerial spray zone. The future success of the program hinges on securing funding to purchase seedlings and operationally burn and spray kikuyu grass.

## 1.6 Benefits

The project has resolved a significant environmental threat to nesting seabird species on one of NSW's most important offshore seabird islands. Rigorous strategic planning before the project's implementation, and findings and outcomes of previous research that guided the planning process, were vital for ensuring project success. Some major logistical challenges, such as planting over 60,000 seedlings, have only been met by DECCW working collaboratively with Charles Sturt University undergraduate students and tourists. Participating students and tourists have gained valuable field experience and knowledge of weed control principles and restoration, while making a valued contribution to a significant habitat conservation program. Many participants have returned to Montague Island to see the long-term changes that they have helped to create.

The project showcases many island restoration principles and processes that have not been previously trialled. Before the program, limited research had been conducted into possible methods of controlling kikuyu grass in coastal ecosystems. The project has developed a successful restoration methodology that will help control kikuyu grass and restore degraded habitats on other offshore islands around Australia. The control and restoration work that has taken place has ensured adequate suitable seabird nesting habitat is available on Montague Island, now and in the future.

## Montague Island kikuyu distribution

2001



2005



## 2. Presentations

### 2.1 Aboriginal cultural significance of Baranguba (Montague Island)

*Presented by John Mumbler*

Mythologically, Baranguba represents the eldest son of Gulaga (Mt Dromedary) and eldest brother of Najanuka (Little Dromedary Mountain). Aboriginal cultural belief classifies Baranguba as a place restricted to men, with many significant cultural sites and artefacts present across the island. Women may visit, although they must remain in unrestricted areas and be accompanied by DECCW staff.

Aboriginal Elders acknowledged the excellent job DECCW was doing in managing Montague Island, particularly in relation to the protection of resident seabirds and Aboriginal Places.

DECCW



*John Mumbler*

### 2.2 Montague Island seabird research history

*Presented by Peter Fullagar*

Chronologically, the documentation of bird life on Montague Island began with Arthur Francis Basset Hull who visited Montague Island in September 1907. Hull was interested in collecting eggs and documenting clutches of silver gulls. Visiting again in October 1911, Hull identified wedge-tailed shearwaters on Montague Island, labelling the island as the southernmost extent of their range. Major ornithological research began with Robert Carrick and his CSIRO colleagues, including Alec Costin, who studied silver gulls and crested terns.

Norman Robinson began researching the breeding success of wedge-tailed shearwaters on Montague Island in 1960 and this work has been ongoing ever since, making it the longest investigation into shearwaters in the world. The presenter's first research trip was with Robinson in 1965. In 1967, the presenter took over Robinson's research into wedge-tailed shearwaters and has returned to the island every year since to continue data collection.

In 1990, Charles Sturt University began research into Montague Island's little penguin population. Amy Harris continues this work. In addition, Charles Sturt University students are researching wedge-tailed shearwaters and short-tailed shearwaters. Other ornithological researchers who have studied on the island over the past 50 years have included David Purchase, Daphne Fullagar, Charlie Kogon, Keith Hindwood, Petrus Heyligers, Mike Crowley, Jerry van Tets, Lorne Gould, Mark Schultz, Wayne Lawler, Chris Davey, Nick Klomp, Mareka Werheim, Neil Trezise, Adam Bester and Cameron Tiller.

In the 1960s when the lighthouse was operational, permits and clearances to undertake fieldwork were laborious and involved the Department of Transport and the National Trust. Since the island has been managed by DECCW, only a single phone call to the local Narooma ranger is needed to arrange access for research.

S. Donaldson/DECCW



*Peter Fullagar*

#### Questions and answers

**Q** – Did short-tailed shearwaters ever take over the wedge-tailed shearwater population as first predicted?

**A** – No. Over the years, ongoing research has revealed no significant changes; it is likely that short-tailed shearwaters always used Montague Island as a nesting site. Presently the northernmost limit of the short-tailed shearwater is known to be Cabbage Tree Island, NSW.

## 2.3 Seabird Habitat Restoration Project – scientific research results

### Presented by Amy Harris

Over the past seven years, the presenter's research through Charles Sturt University has examined methods of controlling kikuyu grass on Montague Island and the possible impacts control methods may have on resident nesting little penguins.

Initial research on the island was undertaken between 1992 and 2000. This research documented a significant increase in the distribution and spread of kikuyu grass, demonstrated that the grass was a threat to nesting little penguins as adults and chicks became entangled in it, and identified that the increase in the density and spread of kikuyu grass contributed to the loss of seabird breeding habitat and reduced seabird access across the island.

In 2001, the presenter began researching the control of kikuyu grass through Charles Sturt University. This research was undertaken in winter (May–June), outside the spring–summer seabird breeding months and on experimental plots of 400 square metres. The research included trialling five methods of control, which were:

1. Spraying with glyphosate, i.e. Roundup, at a ratio of 1:100
2. Spraying and burning
3. Spraying, then revegetating with mat rush *Lomandra longifolia*, coastal rosemary *Westringia fruticosa*, and coastal banksia *Banksia integrifolia*
4. Spraying, burning, then revegetating
5. Shading the area using fast growing native species such as *Banksia integrifolia* and coastal wattle *Acacia sophorae*.

All treatments showed a reduction in kikuyu grass cover and height in the short term. However, the most effective long-term control was achieved through an integrated approach, namely through methods 3 and 4. Integrated approaches reduced the cover and height of kikuyu grass while increasing native species regeneration. After four years, the spray–burn–revegetate treatment resulted in a native species cover of over 80%, while non-treated areas (i.e. the do nothing option)) demonstrated an increase in kikuyu grass cover and height, leading to domination by kikuyu grass and a reduction in native vegetation cover and diversity.

Spraying with glyphosate in winter was the only method of killing kikuyu grass systematically, ensuring penetration into and death of the grass's extensive root system. Thick masses of dead sprayed kikuyu grass were burnt, eliminating the threat of entanglement for little penguins. Revegetation in the integrated control areas ensured suitable native plant species that afforded cover and protection to nesting little penguins were established (i.e. mat rush *Lomandra longifolia*, coastal rosemary *Westringia fruticosa*, coastal banksia *Banksia integrifolia* and coastal wattle *Acacia sophorae*). These species helped prevent the regrowth of kikuyu grass and other exotic species, such as rambling dock *Acetosa sagittata*, cape ivy *Delairea odorata* and coastal morning glory *Ipomoea cairica*.

Of the five methods trialled, method 3 gave greater control than method 1 and method 4 gave greater control than method 2. Methods 3 and 4 both included revegetation as a key component. Method 4 was also more effective than method 3 in increasing the regeneration of native species in terms of both cover and diversity, and controlling additional exotic species. In addition, without the removal of the dense cover of sprayed kikuyu grass through burning, using method 3 meant decomposing kikuyu grass was still present on the surface for up to two years after treatment.



Amy Harris

Revegetation involved minimal care of the seedlings after planting. The seedlings, which were on average 12 centimetres high, were only watered once after they were planted and were not protected by tree guards. Despite this, on average more than 75% of revegetated plants thrived and there was a significant cover of all species planted (i.e. more than 80% of vegetation cover). The high rate of seedling survival was influenced by seedlings spending the month before they were planted in a temporary nursery on the island to enable them to acclimatise to exposed coastal conditions, and coinciding their planting in late August with early spring rainfall.

A key finding of the research was the need for follow-up monitoring and spraying – this was required following all treatments. As with most weed control programs, this implied a long-term commitment to ensuring an effective level of ongoing treatment and efficient use of resources. In 2001, four hectares of dense kikuyu grass on the south-western side of Montague Island were burnt in an unscheduled fire. Subsequently, the same area was fully revegetated, and all kikuyu grass regrowth was sprayed. This represented an opportunity to determine the success of broadscale kikuyu grass control compared with control on smaller experimental plots. Aerial spraying from a helicopter, using a trigger activated nozzle, was also trialled for controlling remote and inaccessible patches of kikuyu grass on Montague Island.

The results of vegetation monitoring using landscape line transects revealed that up to three years after treatment, less than 5% of kikuyu grass was present along transects traversing both a four-hectare treated area and in aerial spray zones.

During five years of treating kikuyu grass across Montague Island, the extent of kikuyu grass has been nearly halved from 22.6 hectares in 2000 to 11.5 hectares in 2005, and down to 7.5 hectares in 2008.

### Implications for nesting little penguins

During the project, the presenter researched the effects of kikuyu grass control and habitat modification on resident nesting little penguins. This research demonstrated that little penguin nest density did not decline during the treatment period, due to the availability of over 350 nest boxes placed in recently treated habitats. Little penguins did not avoid treated habitats, even in the year treatment occurred.

See section 1.5 'Results' for more information on the success of little penguin breeding in nest boxes.

### Questions and answers

**Q** – Do you have early records of original vegetation types on Montague Island?

**A** – Good data on the original vegetation on Montague Island does not exist; a few photographs from the early 1900s have been helpful. Upper canopy species originally present included coastal banksia, and there is reference to oaks, possibly she-oaks, being on the island. The understorey vegetation was likely to have been scrub covered, predominately *Lomandra longifolia*.



2008 burn operation in progress



2008 area after fire



Little penguin chicks in nesting box

**Q** – What are the different success rates for little penguins breeding in nest boxes compared with naturally formed nests?

**A** – No significant differences were detected. Interestingly, one to two years after vegetation has been treated, little penguins continue to use nest boxes rather than suitable native vegetation cover adjacent to the nest boxes.

**Q** – Has there been a change in the little penguin population as a result of changes in kikuyu grass coverage?

**A** – The population increase or decrease of little penguins involves many more factors than just kikuyu grass. Food supply, breeding success and predation will also impact on the population. Our research has shown that the work has not had any negative impact on the population, and that little penguins are aggressively colonising the treated areas.

## 2.4 Seabird Habitat Restoration Project – management issues *Presented by Ross Constable*

Montague Island was transferred to the NSW National Parks and Wildlife Service as a nature reserve in 1989. This exchange of lands placed Montague Island and the National Parks and Wildlife Service in the spotlight. Initially, a 'closed shop' management approach was anticipated by the community. While vessel landing is restricted, public access is permitted to the island, albeit through fully escorted DECCW tours.

Since 1989, the National Parks and Wildlife Service has focused on a number of key management objectives including building restoration/stabilisation; access improvements (jetty, crane and trails); day tours which commenced in 1991; a little penguin census and biological research since 1992; a water and sewerage system upgrade in 1994; solar energy development and installation in 1996; research into kikuyu grass; the instigation of the Seabird Habitat Restoration Project in 2004; and the development of overnight ecotourism on Montague Island.

The Seabird Habitat Restoration Project was formally established in 2004, following the success of initial kikuyu grass control, for a number of reasons including:

- 45% of the island was infested by kikuyu grass in 2001, and this percentage was likely to increase
- summer seabird populations were exposed to three unscheduled fires – two caused by lightning since 1989 and an unscheduled fire in 2001
- up to 300 penguins per year were entangled in kikuyu grass (A. Harris 2007)
- a kikuyu grass monoculture was likely to occur across the south island within 15 years
- there was a rapid loss of pre-European seabird habitat
- there was a statutory obligation to implement the project (key corporate objective and plan of management).

The Seabird Habitat Restoration Project aims to control and reduce the distribution of kikuyu grass across Montague Island, whilst ensuring the re-establishment of native seabird habitat. As part of the project, a strategic kikuyu grass control plan was formulated that divided Montague Island into a number of manageable treatment zones. See section 1.4 'Project implementation' for more information.

S. Donaldson/DECCW



Ross Constable

The implementation of the project has involved many milestones. These include:

- preparing a review of environmental factors for the project, under Part 5 of the *Environmental Planning and Assessment Act 1979*, to assess the impacts of grazing; the use of herbicides, fire and shade; and the mechanical and biological removal of kikuyu grass
- formulating a project design based on previous Charles Sturt University research results and the logistical and financial constraints of treatment
- introducing fire as a key management tool to reduce biomass, assist in the revegetation process and minimise the risk of unintended fire
- producing a fire management strategy to meet statutory and corporate policy requirements, establish achievable treatment zones and establish a pattern of treatment
- consulting with the local community and organisations, including local Aboriginal Elders and communities, the Royal Society for Prevention of Cruelty to Animals, and seabird scientists
- dealing with intense media interest in the project
- dealing with seedling propagation requirements
- organising the supply and transportation of up to 24,000 seedlings annually for revegetation works
- gaining Environmental Trust funding for the project
- dealing with unplanned events, such as delays to the project in 2006 due to rain, that is, it was too wet to undertake any scheduled treatments.

The use of fire on Montague Island was initially controversial, yet fire has been a key component of the research trials and is essential in reducing thick clumps of exotic vegetation. Fire is restricted to the winter months outside the seabird breeding period, and involves moving considerable firefighting resources to and from the island. This procedure can be logistically difficult as it depends on sea and weather conditions, and the availability of human resources.

Firefighting resources must be able to:

- contain a burn well outside a prescription burn, if required
- undertake major and rapid suppression, if required
- mop up the burn until the fire is declared out (this can occur more than 48 hours after the fire has abated).

The burn operations plan prepared for Montague Island was peer reviewed and required:

- purchasing specialised fire equipment, e.g. high pressure pumps
- exercising strict command, coordination and control of fire

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*Kikuyu grass biomass*

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*Nesting box in treated area in 2004*

- employing a fire control plan that included back-up pumps, multiple bulk-water sources, and multiple 38–75-millimetre water delivery methods
- aerial water bombing support
- resourcing capable of moving from management to suppression instantly (20 firefighters over 2 hectares) and resourcing for 48 hours plus mop-up.

Some important questions and issues arising from the program will require further research, including:

- deciding on seedling species (i.e. use of hardy, easily propagated coastal species that provide habitat for nesting seabirds)
- working out what to do with the seedlings when conditions do not allow treatment to occur (i.e. housing and maintaining thousands of tube stock seedlings)
- deciding what influence the revegetation will have on other bird species (i.e. increase in terrestrial species)
- working out what the vegetation structure or landscape will look like in 50 years time, and whether this can be predicted using landscape modelling.

As at July 2009, the project is 50% complete, having been assisted with \$200,000 of Environmental Trust funding over four years. The project could not have achieved its present success without this external funding. Some DECCW operational funds and in-kind contributions, primarily from conservation tourism, have also assisted.

Much planning was undertaken before funding was received, but further treatment and monitoring are required. It is anticipated the project will require a further 5–7 years of regular and adequate funding (approx. \$50,000 to \$60,000 per annum) to reach completion. The keys to the project's success are the seedlings, follow-up spraying and associated labour. Without a commitment to the above minimum resources, no large-scale project should be considered.

## Questions and answers

**Q** – Did you undertake a pollen analysis before revegetating?

**A** – Yes, some pollen analysis research had been undertaken previously with minimal results. However, the aim is to revegetate the island as a remnant headland.

**Q** – How did the Charles Sturt University connection begin?

**A** – DECCW approached Charles Sturt University in 1996 during a weed spraying trial, seeking assistance in the form of management-based science; a Memorandum of Understanding was established. Later, Professor Nicholas Klomp coordinated and supervised many postgraduate students' research on Montague Island, including Amy Harris's research.

**Q** – Did you consider not using fire as a management tool?

**A** – Yes. We trialled shading plots with plastic, and fast growing native species. However the subsequent planting involved too much manual labour through digging into the mass of dead kikuyu grass. Burning has the advantage of reducing the amount of kikuyu grass on the ground, removing the threat of entanglement, reducing fire fuel levels and making planting less labour intensive.

DECCW



2008 burn operations

S. Donaldson/DECCW



Little penguin burrow in kikuyu grass



## 2.5 Ecotourism integration

### *Presented by Mark Westwood*

Ecotourism on Montague Island includes fully escorted day and overnight tours of the island and its habitats. It has benefited the management of the island in general and more recently, the Seabird Habitat Restoration Project. If visitors are staying overnight, they must work for two hours each day, as well as pay for their accommodation. This arrangement offers participants a chance to give something back whilst having an enjoyable experience. Up to 12 people can stay at any one time, and 15–20 trips are undertaken each year. Visitors stay in the restored head lighthouse keeper's cottage and are accompanied by a DECCW guide. The popularity of this rewarding experience for participants is demonstrated by the many participants who revisit the island in subsequent years.

Visitors have worked on a range of project-related activities including planting and potting seedlings when rain delayed the scheduled 2006 burn, painting nest box lids and placing nest boxes in treated areas, weeding, and identifying and marking little penguin burrows.

The ecotourism aspect of the project has involved the development of a partnership between DECCW and Conservation Volunteers Australia (CVA). CVA provides marketing, booking and volunteer registration. DECCW provides guides, logistics, and resources. The local community benefits through the employment opportunities created. The direct and measurable benefit the partnership has provided to the project is 174 days of person hours with an estimated value of \$27,840, and this will continue into the future.

The immeasurable benefits of the partnership include:

- profile raising of the project, generating positive publicity
- counteracting negative public perceptions; creating a regional iconic attraction
- providing DECCW with significant recognition for its ecotourism efforts.

Montague Island Ecotours has won many international, national and regional ecotourism awards between 1999 and 2008, including the British Airways IUCN Tourism for Tomorrow Award 1999, the NSW Tourism Award for New Tourist Development 2005, the NSW Tourism Award for Ecotourism 2006, 2007 and 2008 (now in the NSW Tourism Hall of Fame) and the Qantas National Australian Tourism Award for Ecotourism in 2007 and 2008.

*You make a difference*



*Conservation Volunteers Australia*

S. Cohen/DECC



*Mark Westwood*

S. Cohen/DECCW



*Volunteers on Montague Island*

## 2.6 Mice eradication

### *Presented by Nicholas Carlile*

The European presence on Montague Island has involved the introduction of rabbits (1870s), mice and goats (some time after 1881) and kikuyu grass (mid 1900s). The island also accommodated three families associated with the lighthouse from 1881.

The NSW National Parks and Wildlife Service began managing Montague Island in 1989. Since then, goats were removed in 1989, kikuyu grass has been progressively removed since 2001 and mice and rabbits were eradicated in 2007. Mice and rabbits were targeted by using aerial baiting with anticoagulant poison Pestoff Brodifacoum 20 ppm, supplied by Animal Control Products NZ. This was imported under an Australian Pesticides and Veterinary Management Authority (APVMA) permit, and was stored in a rodent-free environment and taken to the island on the day of the eradication. Two sets of baiting over a two-year period were undertaken and the eradication project was monitored as part of a Charles Sturt University Honours project.

Baits were dropped from a helicopter, except in the area around the historic buildings where baits were distributed manually. A test was carried out to assess the efficacy of bait size variations, that is, 10-millimetre pellets were used on the southern end of the island whilst 5.5-millimetre pellets were used on the northern end. Honours students using traps monitored and timed differences in the mice's demise between the two sorts of bait. Both sorts of bait were effective in killing the mice.

The baiting program biodiversity benefits were:

- greater seedling survival (i.e. without mice to damage them)
- higher seed retention (i.e. without mice to eat them)
- increased abundance of invertebrates and skinks
- improved preservation of historical buildings.

Following the baiting, a two-year monitoring program was undertaken. Trakka tunnels were placed around the island. These contained an attractant, and collected footprints of any visiting creatures that passed over the ink pads inside. No mice have been detected since the 2007 bait drops. Live bait stations will continue indefinitely, targeting boat landing sites to prevent mice coming ashore.

### Questions and answers

**Q** - Any advice for next time?

**A** - We are planning a second aerial baiting exercise on Broughton Island, located off central NSW. If we were doing dozens of islands, some training in use of the distribution bucket (similar to an agricultural fertiliser dispenser) would be beneficial. The Lord Howe Island Board of Management purchased the bait distribution bucket, while the helicopter belongs to DECCW. Following the Broughton Island program, the bucket will be returned to Lord Howe Island.

S. Donaldson/DECCW



*Nicholas Carlile*

S. Donaldson/DECCW



*'Trakka tunnel' monitoring station*

## 2.7 NSW Environmental Trust funding opportunities

### *Presented by Leah Andrews*

The NSW Environmental Trust operates under the *Environmental Trust Act 1998*. It is an independent statutory body administered by DECCW and provides almost \$100 million annually for advancing environmental quality and preventing environmental harm. The Chair is Carmel Tebbutt (Minister for Environment and Climate Change), the Secretary is Lisa Corbyn (DECCW), and members are Rob Pallin (Nature Conservation Council of NSW), Genia McCaffery (Local Government & Shires Associations) and Lindsey Williams (NSW Treasury).

Programs funded include the NSW City and Country Environment Restoration Program (NSW RiverBank, Marine Parks and Native Vegetation Assistance Package) and other Environmental Trust Programs (Dissemination Program, waste programs, environmental pollution clean up fund, acquisition of land and priority environmental issues).

The Environmental Trust contestable funding programs are:

- environmental education
- restoration and rehabilitation
- urban sustainability
- protecting our places
- environmental research
- eco schools
- lead environmental community groups.

Environmental Trust projects aim to contribute significant environmental benefits to NSW and increase the capacity of the community to protect, enhance and restore local environments.

In 2008, \$1.5 million was offered to state and local government and \$1.5 million to community groups for restoration and rehabilitation programs.

The Trust's Dissemination Program was established in 2004 and aims to roll out products or knowledge from successfully concluded Environmental Trust grant projects to a wider audience. Through the program, workshops, manuals, brochures, and web pages are produced which promote previous projects and can inspire state and local government, and the community, to benefit from work undertaken in other regions of NSW.

In 2003 and 2005, the Environmental Trust provided funding for the Seabird Habitat Restoration Project on Montague Island. The Dissemination Program funded DECCW to host this workshop to enable island managers to come together to learn about the success on Montague Island and share experiences from other islands.

### Questions and answers

**Q** – When is the next round of funding applications due? What are the limits and partnering opportunities?

**A** – February or March 2009. The closing dates for each program are staggered and there is a limit of three applications per department, per program. Technical committees will sometimes give a higher rank to projects that deliver outcomes in partnership with other organisations, although there is a \$100,000 limit on projects. There are also opportunities to work with local Aboriginal groups and to encourage and assist them to put in applications for environmental projects. If they are successful, other organisations can help them roll out the works.

S. Donaldson/DECC



Leah Andrews

## 3. Workshop discussion

The following section provides comments, questions and discussion points raised by workshop participants during an open discussion section. Participants at the workshop are listed in the Preface to this document.

### 3.1 Logistical issues and considerations

The management resources at Montague Island include a custom-built boat, an established jetty equipped with a fixed lifting crane and a permanent boat mooring. The island also has well-equipped staff and visitor quarters, including self sufficient solar power generation, three underground water wells and a substantial effluent/waste water management system. In addition, the island has a permanent helipad adjacent to the lighthouse keeper's quarters. These resources have been invaluable for transporting and housing personnel, seedlings and equipment required to undertake the project.

Other offshore islands suffering weed infestations do not have such substantial permanent resources available; some do not have even basic provisions. As a result, many island managers at the workshop identified that access is a problem when trying to manage islands and this is made even more difficult without boats for access or a lack of jetties on islands to land vessels.

Chartering private boats can reduce the responsibility of maintaining boats and the need to employ staff with crew competency skills (pers. comm. Ruth Armstrong, Little Broughton Island Nature Reserve, Port Stephens). Five Islands Reserve near Wollongong, NSW, has an extensive kikuyu grass infestation, although for a revegetation program to be established there, a number of issues need to be resolved. A boat needs to be provided, there needs to be a jetty on the island, accommodation has to be provided for workers, and research goals and partnerships need to be developed.

Presently, the Wollongong DECCW office has two vessels, one for Lake Illawarra and one for the Five Islands. The question was raised whether a five-metre boat can be taken offshore under WorkCover rules (pers. comm. Joanne Edney, Five Islands Nature Reserve, Illawarra). In response, Ross Constable explained that DECCW policy requires offshore boats to be greater than six metres in size, although maritime policy does allow for a five-metre boat to go offshore.

Regular services should be undertaken to ensure a boat is safe and will not place workers at risk. Larger projects require a large safe boat, as well as a helicopter for transportation of equipment and fire containment. The type of equipment used to undertake a large project cannot be transported in a 'rubber duck'.

A slip rail and carriage would provide access to an island with no jetty. Many New Zealand offshore islands have a slip rail and carriage. The slip rail can be locked so someone needs to be delivered ashore to unlock it before landing (pers. comm. Nicholas Carlile).

A further logistical issue is the maintenance of boat licences. Tony Carter (Bowen Island, Booderee National Park, Jervis Bay) explained that although they have two boats and three individuals with marine coxswains in Booderee, it is difficult to depend on DECCW work hours to build up enough hours to satisfy the ongoing requirements of the licence. Often, personal time is used to increase required boating hours.

S. Donaldson/DECCW



*Participant discussion group on Montague Island*

## 3.2 Vegetation/fauna issues and considerations

On other islands, kikuyu grass infestation has caused a considerable decline in seabird numbers. For instance, in 1968 there were several hundred breeding pairs of little penguins on Five Islands. Today, they have almost gone; they cannot continue to breed in the kikuyu grass (pers. comm. Nicholas Carlile).

However, whilst kikuyu grass is a problem for the little penguins, other species such as silver gulls can persist due to access differences. Little penguins have to walk to their nesting areas and can become entangled in the kikuyu grass, whereas gulls can fly in, avoiding the obstacle (pers. comm. Peter Fullagar).



Silver gull

## 3.3 Scientific issues and considerations

Scientific discussion centred on the vulnerability of island ecosystems to invasion by exotic species and possible alternative management options. Alec Costin explained that islands are ecosystems exposed to particular dangers depending on their size, distance from other land and age. Island flora and fauna are not well buffered to cope with stress; the smaller the island, the less complex and more vulnerable its ecosystem. In terms of distance away from other landforms, the more isolated an island is, the more vulnerable it is due to its distance from managing organisations and monitoring systems. The older an island is, the more ecologically diverse it is. In summary, the smaller, remoter and younger islands are particularly vulnerable ecologically.

An alternative management option suggested by Alec Costin is to redefine the management approach and possibly consider minimal intervention, i.e. leave the island alone and it will look after itself. Some habitats on Montague Island manage themselves (i.e. undisturbed native-dominated habitats), whereas other sections require specific, timely attention when problems arise (i.e. weed suppression). Alec Costin suggests resolving the problems when they are small, utilising well qualified and experienced staff to achieve results, and to keep the program simple.

There is also great benefit in visiting sites where weed control programs are taking place (e.g. Montague Island for other weed control managers) before commencing any related programs, as not all hands-on experience and procedures are documented. This can assist with gaining a good understanding of any successes and failures experienced (pers. comm. Nicholas Carlile).

There is also the opportunity for a comparative study to be undertaken on other offshore islands. For instance, any kikuyu grass control undertaken on, say, Five Islands would provide a good comparative study with the research undertaken on Montague Island. There is also the opportunity to gain the assistance of established birding groups for seabird research, such as the Southern Ocean Seabird Study Association (Wollongong) and engaging the support of local enthusiasts, for instance, members of the Bird Australia Association (pers. comm. Nicholas Carlile and Peter Fullagar).

## 3.4 Use of fire on offshore islands

Fire has been used to reduce kikuyu grass across over eight hectares of infested habitat on Montague Island. However, the risks and resource requirements increase when fire is used for weed control (pers. comm. Ross Constable). After the 2001 unscheduled burn, a moratorium was almost placed on the use of fire on the island. However, the scientific background DECCW used to justify the use of fire supported its ongoing use. Fire is used only on the accessible dense kikuyu grass areas on the island and will be used to treat only another three hectares of Montague Island in 2009–2010. Like mainland habitats, many offshore islands are subject to a natural fire regime (i.e. Montague Island has had numerous fires over the years due to lightning strikes and smouldering embers blown over from the mainland), but the community views burning on islands for management purposes differently

from the way they view burning on the mainland for fuel reduction purposes (pers. comm. Ross Constable). This is because fuel reduction burning occurs regularly on the mainland, whereas planned fire on islands is rare and is not undertaken to protect human life and property.

Montague Island is not unique in its use of fire for weed control programs. On Phillip Island (Victoria), fire is used selectively to clear dense kikuyu grass from little penguin habitat areas in combination with herbicidal spraying (pers. comm. Jon Fallaw). Removal of dense kikuyu grass also reduces fire fuel levels. If no burning occurred, the risk of an unprescribed burn would be greatly increased, compared with the risk associated with a controlled burn, i.e. smaller, regular fires prevent occasional larger ones (pers. comm. Jon Fallaw). The opportunity for revegetating weed infested habitats after naturally occurring fires had occurred was also suggested during the workshop.

Broughton Island is also known as 'lightning island', as it has been struck by lightning many times, causing intense fires and subsequent loss of biodiversity (pers. comm. Ruth Armstrong). No planting occurred following these fires. However, staff and resources could be allocated to this task.

Cultural heritage values need to be considered during weed control programs. Many offshore islands, including Montague and Bowen islands, were important seasonal food resources for Aboriginal people. There are archaeological middens, burials and artefacts on many offshore islands (pers. comm. Tony Carter). At all stages, all kikuyu grass control on Montague Island has been undertaken considering cultural heritage sites and artefacts.

Weed control, particularly revegetation, could also involve establishing partnerships with local Aboriginal land councils as a way of increasing jobs and cultural connections to places of heritage significance (pers. comm. Tony Carter). Further discussion progressed on how to undertake an integrated weed control program on Five Islands that included the use of fire. The main island has no established tracks to act as fire breaks, and the extent of kikuyu grass is huge (pers. comm. Joanne Edney). Ross Constable proposed dissecting the island into small manageable treatment zones, similar in size to those treated on Montague Island (approximately one hectare in size).

Tracks could be created with the use of machinery (i.e. a 'whipper snipper' and even a mower if the terrain was conducive). On Montague Island, tracks used as fire breaks consist of mown kikuyu grass and are approximately three or four metres wide.

### 3.5 Weed and pest animal control on other offshore islands in Australia

Note: These paragraphs were kindly contributed after the workshop by island managers for this report. DECCW appreciates their efforts.

#### Bowen Island, Jervis Bay NSW

Kikuyu grass is a problem on Bowen Island, Jervis Bay. Fire has not been previously used to control kikuyu grass on this island. With only low levels present, control has focused on annual spraying. In addition, managers are trying to restore the island to its original state by introducing locally native species. Pest animal control has also been undertaken on Bowen Island, with a black rat eradication program showing success, though ongoing monitoring is required through the use of tracking tunnels.

S. Cohen/DECCW



Controlling fire on Montague Island

## Phillip Island, Westernport, Victoria

There are 209 species of weed which threaten Phillip Island Nature Park including five species of national significance and 27 declared noxious species. There are 17 environmental weed species including garden escapes, non-indigenous plants and native plants that have been recorded as weedy as they are either beyond their natural range, hybridise with indigenous plants or threaten ecological vegetation communities to which they do not belong. The park has prepared a weed management strategy that can be downloaded from [www.penguins.org.au](http://www.penguins.org.au) under 'Environment'/'Wildlife Programs'/'weeds'.

Many early weeds controlled on the island were agricultural such as thistles in wool and capeweed in pasture. The Phillip Island Shire Council (now part of Bass Coast Shire Council), and the Lands Department followed by Parks Victoria all controlled noxious weeds such as blackberry, gorse, boxthorn and ragwort in coastal reserves. They were aided in their work by local conservationists, many of whom went on to form conservation groups such as the Phillip Island Conservation Society and the Phillip Island Landcare Group.

In 2000, the latter conservation group, in consultation with the Bass Coast Shire Council, Phillip Island Nature Park and community groups, released the '10 weeds in 10 years' and '10 weeds in 20 years' weed conservation programs to target both listed noxious weeds and high priority environmental weeds.

Listed weeds have been ranked in the park according to invasiveness and threat as high (40 species), medium (37 species), and low (132 species). New and emerging weeds (9 species) receive the highest priority and the aim is to eradicate infestations before they spread. In coastal areas, priority has been given to highly invasive weeds such as boxthorn, gorse and kikuyu grass that threaten little penguin and short-tailed shearwater habitat and provide habitat for foxes, cats and rabbits. In other areas, a wide range of grasses, creepers and woody weeds have invaded and outcompeted native vegetation, and limited the recruitment of shrub and tree species essential for food, shelter and nesting habitat for animals such as possums, bats and birds.

## The Hunter Region, Port Stephens and Central Coast NSW islands

Broughton Island is part of Myall Lakes National Park in the Hunter Region. The main weed problems are widespread prickly pear (*Opuntia stricta*) and vines such as morning glory (*Ipomoea cairica* and *I. indica*) and Dolichos pea (*Dipogon lignosus*). There are also infestations of bitou bush (*Chrysanthemoides monilifera*), crofton weed (*Ageratina adenophora*) and prickly pear. Cactoblastis moth and cochineal beetle have been released but have had minimal impact.

Currently, work is being done manually, applying Access herbicide and diesel with a splatter gun. This method is very effective but progress is slow and there are difficulties with getting large quantities of diesel to the island.

There are trials on the effectiveness of various herbicides sprayed on morning glory and Dolichos pea. The herbicide Roundup has been successful in killing Dolichos pea and will continue to be applied to this weed. The team are waiting for results from morning glory trials. With both bitou bush and crofton weed, success has been achieved with spraying, and cutting and painting, with Roundup. There are a number of inaccessible bitou bush plants growing on rocky cliff faces which will mean considering aerial application of herbicide.

The past four years have seen some major achievements with weed control on Broughton Island, although there are great difficulties with access (mostly by sea, necessitating the hiring of a boat large

S. Cohen/DECCW



Little penguin on Montague Island

enough to carry staff and gear) and there are no storage facilities or permanent accommodation on the island, which limits the achievements of each trip. There are currently about three three-day trips scheduled each year. Catchment management authority funding has enabled contract bush regenerators to be employed to assist with works. As this funding is ending, the team are considering ways of maintaining the gains that have been made, thinking of ways to address the issue of storage on the island and re-evaluating weed programs to assess their effectiveness.

John Gould and Boondelbah Island nature reserves (26 hectares and 9 hectares respectively), are both situated just offshore from Port Stephens on the NSW lower north coast. Rabbits were eradicated from John Gould Nature Reserve in 1997 using a combination of biocontrols and poison.

Cochineal insects were released on Boondelbah Island ten years ago to treat prickly pear, but this did not achieve effective control. There have been two aerial treatments of bitou bush in recent years, and bush regeneration targeting morning glory and prickly pear. Weed control is targeted to conserving the breeding habitat of Gould's petrel and little penguins.

## Ulladulla and Batemans Bay areas

Brush Island Nature Reserve is a 35-hectare reserve providing important habitat for many nesting seabirds and shorebirds including little penguins and sooty oystercatchers. A rat eradication program in 2005 was very successful. Five hundred and fifty bait stations were placed on the island every 25 metres. Specialised block baits were imported from New Zealand and left on the island for about three months in plastic tubes. Most rats were dead within two weeks. Recent follow-up surveys have confirmed the success of the project with no sign of rats on the island.

Three patches of kikuyu grass are present on the southern section of the island. Spaying with herbicide has been undertaken over the last three years but the kikuyu grass is very persistent and continues to resprout. Sea spurge has formed a dense covering on the only sandy beach on Brush Island. Hand pulling and the use of herbicide have reduced the infestation but will require ongoing follow-up work over the next few years. Blackberry is found across the island intertwined with the native vegetation, making it difficult to control. Due to the dense vegetation and the risk of overspray affecting native vines, no control methods have been utilised as yet. Other weeds on the island include ink weed and small patches of prickly pear.

Tollgate Islands Nature Reserve is a 23-hectare nature reserve consisting of two islands. An intense program of bitou bush control over the last five years has been undertaken. Access to the island is difficult and many bitou bush plants grow on its steep cliffs and inclines. The program has used helicopters to place spray units and personnel on the island as well as for direct spraying. Staff and contractors trained in climbing access most areas around the islands where isolated plants existed. Seedlings continue to emerge around the islands, thus follow up work will need to be continued into the future.

S. Cohen/DECCW



*Little penguin in nest*

A Simpson/DECCW



*Bitou bush is the weed of major concern on Tollgate Island.*



## Five Islands Nature Reserve – Wollongong area

Five Islands Nature Reserve is located near Port Kembla off the NSW south coast. It covers 24 hectares and was created in 1960 to provide protection for the seabirds which use the islands to breed. Weed control, weed species (kikuyu grass) and proposed control methods are similar to those on Montague Island. DECCW tried planting around 2,500 plants consisting of various native species with water crystals at the base of the holes, and left them with no follow up watering or weeding for the next 12 months, and then did the same again the following year. Kikuyu grass was sprayed before planting. In other areas, plants were planted under the established mirror bush *Coprosma repens* growing on the island. None of the methods were successful, but several lessons were learned:

- island weed management is logistically much more complex and more resource intensive than similar projects on mainland sites – these factors need to be closely examined to determine whether a project is at all feasible
- to save money and effort, the native species that seem to survive best when regeneration is carried out are westringia, acacia and lomandra
- logistical issues, especially access, at Five Islands Nature Reserve are substantially more challenging than on Montague Island.

H. Jessup/DECCW



Silver gulls on Five Islands Nature Reserve

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