

# SEABIRD ISLANDS

No. 18/1

## Broughton Island, New South Wales

**Location:** 32°37'S, 152°19'E; 16 kilometres northeast of the entrance to Port Stephens, on the central coast of New South Wales (NSW).

**Status:** Broughton Island forms part of Myall Lakes National Park administered by the NSW National Parks and Wildlife Service (NPWS), Office of Environment and Heritage. No entry permit is required.

**Description:** Broughton Island is the main island of the Broughton Island Group, which also includes Little Broughton Island, Looking Glass Isle, North Rock, Inner Rock and an unnamed islet between Broughton and Little Broughton islands. Broughton Island is an irregular-shaped island approximately 2.3 kilometres long by 1.3 kilometres wide, covering 132 hectares and with a vegetated area of 117 hectares. It is the largest coastal island in NSW and is categorised as a skeleton island<sup>1</sup> due to its sprawling form with lateral spurs or ribs enclosing bays. The island rises from sea level at West End in the northwest, through a centrally located swampy environment, up to the summit of Pinkatop Head (91 metres) in the south-east, before dropping abruptly back to the sea. A peninsula, arising from mid-way along the island, terminates toward the south in a series of small islets, including Snapper Rock.

The island is composed principally of Carboniferous volcanic rhyolite rock with basalt intrusions, but includes conglomerate and indurated mudstones, with some low-lying areas overlain by aeolian sands<sup>2</sup>. Vegetation is dominated by Spiny-headed Mat-rush *Lomandra longifolia*, Kangaroo Grass *Themeda australis*, Blady Grass *Imperata cylindrica* and Bracken Fern *Pteridium esculentum*. The island once contained expansive areas of

trees and shrubs, but frequent fire and grazing by introduced European Rabbits *Oryctolagus cuniculus* and Black Rats *Rattus rattus* during the last century has reduced these stands to isolated remnants. A total of 130 species of plants have been recorded on the island, with 20 per cent of these being alien<sup>3</sup>.

**Landing:** Landing is onto sandy beaches in most sea conditions with camping permitted at Esmeralda Beach and Little Poverty Beach. A designated helicopter landing-pad is situated on the ridge between these two camping grounds.

**Ornithological History:** Lane<sup>4</sup> documented ornithological visits from October 1910 to December 1973. In 1977 Van Gessel<sup>5</sup> carried out a shearwater survey in October and Lane<sup>6</sup> a survey of gulls and terns in November. Carlile, Priddel and others visited during 2–4 April 1998 to search for evidence of Gould's Petrel *Pterodroma leuconota*. Carlile and Callaghan visited 29–30 January 2008 and surveyed for potential penguin habitat. Carlile, Callaghan and members of the Australasian Seabird Group visited 17–19 October, 11–13 November and 21–23 December 2009 to survey nesting seabirds.

### Breeding Seabirds and Status

*Pelagodroma marina* White-faced Storm-Petrel — The first recorded observation of this species on Broughton Island<sup>7</sup>, in 1911, reported them to be nesting on the central dune ‘in their thousands’. This area now contains the largest concentration of Wedge-tailed Shearwaters *Ardenna pacifica* on the island. Nine hours of nocturnal spotlighting and audio surveys (10 minute spotlight sweeps followed by five minutes of listening) throughout the island failed to find any evidence of storm-

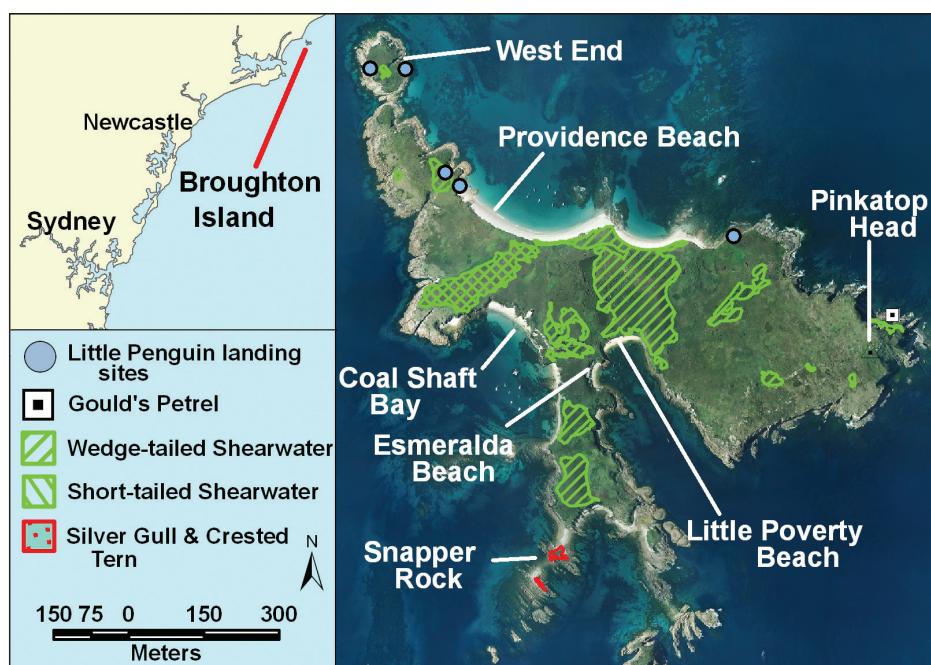


Figure 1. Broughton Island, New South Wales

petrels. They probably became locally extinct in about 1958<sup>4,8</sup>, almost certainly because of the introduction of Black Rats to the island during the 1930s. The eradication of rats in 2009 should allow White-faced Storm-petrels to recolonise from nearby populations on North Rock and Inner Rock.

*Ardenna pacifica* Wedge-tailed Shearwater — Nests in numerous colonies of varying size dispersed across the island. Occurs mostly in single-species colonies but in two colonies burrows are interspersed with those of the Short-tailed Shearwater.

Shearwater colonies were identified from diurnal ground searches to locate burrows, and nocturnal surveys to locate calling birds. The extent of each colony was delineated by walking the perimeter with a handheld GPS. Data were then mapped using computer technology (GIS), and the area of each colony calculated. Some colonies ranged over several habitats that differed in topography, soil and vegetation.

Burrow density was estimated by counting burrows within a series of 30 transects (50 m x 4 m) dispersed across the nine identified habitat types. The total area of the transects (6000 square metres) was approximately 0.26 per cent of the total area of all shearwater colonies (22.9 ha). For each colony, the number of burrows within each habitat (or colony if it contained only one habitat) was calculated as the multiple of mean burrow density for that particular habitat and area of that habitat. Numbers from each habitat were summed to estimate the number of burrows within each colony, and the numbers from each colony summed to estimate the total number of burrows on the island. The number of breeding pairs of Wedge-tailed Shearwaters ( $\pm$  s.e.) was calculated as the multiple of burrow number and occupancy rate, minus the number of Short-tailed Shearwaters (see below). Due to time constraints, occupancy rate was not estimated directly, but was assumed to be similar to that in other shearwater colonies (typically 43–56%)<sup>9,10,11</sup>.

In all, 2903 burrows were counted within the transects; a density of 5005 burrows per hectare. Assuming an occupancy rate of 50 per cent, the population of Wedge-tailed Shearwaters on Broughton Island was estimated to be  $55\,434 \pm 18\,239$  pairs. The only previous estimate of total shearwater burrow numbers was 34 000, in 1977<sup>5</sup>. From banding activities in 1972, Lane<sup>4</sup> estimated that 89 per cent of shearwaters were Wedge-tailed Shearwaters. Combining these data, and again assuming a 50 per cent occupancy rate, we calculate a past population estimate of 15 130 pairs of Wedge-tailed Shearwaters on Broughton Island. The difference between this and the current estimate suggests a significant increase in total population size. Comparing the past<sup>4</sup> and current distributions it appears that several previous western and eastern colonies are now reduced or abandoned, whereas the central colonies have expanded considerably. From observations between 1959 and 1977, Lane<sup>6</sup> concluded that the area of shearwater colonies had increased over those 18 years. The current estimate indicates that this expansion has continued over the past three decades.

*Ardenna grisea* Sooty Shearwater — In 1976, Lane<sup>4</sup> reported that Sooty Shearwaters were breeding on Broughton Island in small numbers. During the surveys (October–December 2009), we listened at night to detect vocal individuals of this species. Despite more than ten hours of listening, no calls were heard, and we found no evidence of the existence of Sooty Shearwater on the island.

*Ardenna tenuirostris* Short-tailed Shearwater — Nests in two mixed colonies with Wedge-tailed Shearwaters: one at West End, the other along a dune running from Coal Shaft Bay to Providence Beach. In both 1959 and 1972, the shearwater colony near Pinkatop contained both Wedge-tailed and Short-tailed Shearwaters<sup>4,8</sup>, but in 2009 we detected only the former. Vocalisations heard in October 2009 indicated that Short-tailed Shearwaters were only sparsely distributed throughout the dune colony (at a ratio of approximately 1:50 with Wedge-tailed Shearwaters), but were abundant in the West End colony. The ratio of species within the West End colony was determined by extracting and identifying birds from a sample of burrows within two 50 x 4 metre transects in December 2009, when adult birds were incubating eggs. A total of 13 Short-tailed Shearwaters and 60 Wedge-tailed Shearwaters were reachable within the burrows sampled.

The population ( $\pm$  s.e.) of Short-tailed Shearwaters within the Coal Shaft Bay colony was  $185 \pm 29$  pairs, calculated as the multiple of area of the colony (4.57 hectares), mean density ( $\pm$  s.e.) of burrows within this colony (4133  $\pm$  637 burrows per hectare, n = 6), presumed occupancy rate (50%) and relative proportion of this species (2.0%). The population within the West End colony was  $50 \pm 4$  pairs, calculated as the multiple of area of the colony (0.10 hectares), mean density of burrows within this colony (5575  $\pm$  475 burrows per hectare, n = 2), presumed occupancy rate (50%) and relative proportion of this species (17.8%). Thus, the total population of Short-tailed Shearwaters ( $\pm$  s.e.) on Broughton is estimated to be  $235 \pm 33$  pairs. There is no previous estimate of this species on Broughton Island, but based on the previous banding ratio<sup>4</sup> and total shearwater numbers<sup>5</sup> a past population estimate of 1870 pairs can be inferred. Many of the colonies previously identified as containing Short-tailed Shearwaters, particularly those in the western and southern parts of the island, are now reduced or abandoned. Thus, it seems that Short-tailed Shearwaters are less common on this island than they were 40 years ago.

*Pterodroma leucoptera* Gould's Petrel — We searched for evidence of Gould's Petrel breeding on Broughton Island in April 1998, approaching the end of the chick-rearing period. Although we identified an area of suitable nesting habitat (rock scree) at the seaward base of Pinkatop Head, a search for near-fledged chicks or down failed to find any evidence of Gould's Petrel breeding there. However, in October 2009 a Gould's Petrel was heard to call and, during a two-hour nocturnal search in December of that year, a nest was found containing a single bird incubating an egg. The nest was 1.5 metres deep within a rock crevice and could only be observed using a burrow-scope inserted through a narrow rocky entrance. No other individuals were observed on the ground or in the air. This is the first record of this species on the island and only the third island where breeding of the Australian subspecies (*P. l. leucoptera*) has been recorded<sup>12</sup>. The current population of Gould's Petrel on Broughton Island is unlikely to exceed a few breeding pairs.

*Eudyptula minor* Little Penguin — Nests confined to a few disjunct sites along the northern coastline. In January 2008, the entire coastline of the island was searched and landing sites identified from footprints in the sand or trails of excrement. Only four landing sites were found on this occasion—two at the western end of Providence Beach and two at West End. On 17 October 2009, we counted the number of penguins

arriving at each of these landing sites from dusk until two hours after sunset (2130 hr). A total of 39 adults were counted, indicating 20–39 breeding pairs depending on the number of partners already ashore incubating eggs or brooding chicks. We searched the nearby foreshores during the day, but failed to locate any nests, so were unable to estimate the proportion of breeding adults ashore. However, we did locate two occupied nests near freshwater pools east of the northern beaches. In December 2009, footprints east of Providence Beach indicated a fifth landing site and led to another two isolated nests. Thus, we estimate the size of the penguin population on Broughton Island to be 24–43 breeding pairs. Penguins were first recorded ashore here during the 1930s with breeding confirmed in 1947<sup>13</sup>. No census of their numbers has previously been attempted, but at no time have they been considered numerous.

*Thalasseus bergii* Crested Tern — A small population nests on Broughton Island, but the nesting site can change from year to year. In 2009, Crested Terns nested on the rocky islet southwest of Snapper Rock, surrounded by a small colony of nesting Silver Gulls. A direct count in November located 30 nests, each containing an adult incubating a single egg. The nesting location is probably the same as that documented by Lane in 1977<sup>6</sup>, when 40–50 pairs were nesting.

*Chroicocephalus novaehollandiae* Silver Gull — A small population nests on Broughton Island, but the nesting site can change from year to year. Local fishers reported that Silver Gulls occasionally nested on the headland between Esmeralda Beach and Little Poverty Beach. In 2009, they nested on Snapper Rock where, in October, a direct count located 70 nests containing eggs and chicks up to two weeks of age. The unnamed rocky islet further to the southwest also had birds present, but no nests. In November 2009, the young on Snapper Rock were either fledged or near to it, and the rocky islet to the southwest had approximately 30 nests containing chicks that were 1–2 weeks old. Thus the total breeding population of Silver Gulls on Broughton Island is approximately 100 pairs. Lane found a few nests with eggs on Snapper Rock in December 1972<sup>4</sup> and counted 80 pairs there in 1977<sup>6</sup>. Although data are sketchy, it appears that the population of Silver Gulls on Broughton Island is relatively stable.

### Factors Affecting Status

Several species of exotic plants occur on the island but there is no evidence that any species is affecting seabird populations. The most invasive species are subject to ongoing control, with biological agents being used to reduce infestations of Bitou Bush *Chrysanthemoides monilifera* and Prickly Pear *Opuntia stricta*. There are no exotic mammals on the island now that an attempt to eradicate rabbits and rats in August 2009 appears to have been successful<sup>14</sup>.

As far as can be ascertained the total number of shearwaters breeding on Broughton Island has increased significantly over the past decades. The total number of shearwater burrows on the island was estimated to be 111 000 in 2009 compared with 34 000 in 1977<sup>5</sup>. The extent of colonies has increased along with the average density of burrows (from 3310 per hectare in 1977<sup>5</sup> to 5005 per hectare currently). Interestingly, some colonies present in 1973<sup>4</sup> have either reduced in area or disappeared altogether. Whilst the Wedge-tailed Shearwater appears to have increased in both distribution and abundance on Broughton Island, there

is no evidence that the two less-abundant species have done so. From banding data collected in 1973, Lane<sup>4</sup> estimated that 11 per cent of shearwaters on Broughton Island were Short-tailed Shearwaters, whereas we estimated this species to comprise less than one per cent of the current population. However, given the coarseness of past and current population estimates, the apparent decline in Short-tailed Shearwater numbers is equivocal. It also cannot be explained readily by any land-based threat. Generally, burrow-nesting seabirds larger than 260 g are not affected by Black Rats<sup>15</sup>, so any decline of Short-tailed Shearwaters (460–800 g)<sup>16</sup> is unlikely to have been caused by rats. Although no Sooty Shearwaters were observed during the 2009 survey, their population has always been small, with birds sometimes being difficult to locate<sup>4,5,6,8</sup>. Further monitoring is needed to confirm the precise status of this species on Broughton Island.

The long-term trend towards increasing proportion and numbers of Wedge-tailed Shearwaters in mixed colonies has also been observed on Montague Island<sup>17</sup>. Wedge-tailed Shearwaters breeding on NSW islands forage in warm temperate waters, whereas Short-tailed Shearwaters forage at high latitudes in the Southern Ocean<sup>18</sup>. It is possible that global warming has favoured Wedge-tailed Shearwaters, and disadvantaged those species more dependent on colder waters<sup>19</sup>, but definitive data are lacking.

On 20 December 2008, a fire burnt out 3.4 hectares of the southern peninsula of Broughton Island before it was brought under control and extinguished by NPWS ground crews assisted by water bombing from a helicopter. As no storm or lightning activity had occurred in the days preceding the fire, it was suspected of being deliberately lit. The fire burnt 36 per cent of a colony of Wedge-tailed Shearwaters at a time when adults were incubating eggs. From a count of burrows, we estimated that  $2309 \pm 428$  breeding pairs were nesting within the area affected by fire. Some birds were forced out of their burrows by heat or smoke, and badly burnt. Thirty such birds had to be euthanased. Some burnt individuals probably returned to their burrows and died subsequently, and birds that remained in their burrows may have died through smoke inhalation. The eggs of any birds that died would also have failed. This event demonstrated that, contrary to earlier beliefs<sup>4</sup>, burrowing seabirds are not immune from the effects of wildfire.

Prior to the island becoming a national park, fishers frequently set fire to the grass, allegedly to provide greater safety from snakes when walking to favoured fishing sites<sup>4</sup>. Given the damage that fires can inflict on shearwater populations, the reduction in fire frequency and extent since the island became a national park has probably contributed to the increase in shearwater numbers. It has also resulted in the expansion of remnant stands of shrubs and trees on the island; a process that is likely to accelerate following the recent removal of rabbits and rats, leading to the eventual establishment of large tracts of woodland or forest on the island. However, recovery of the vegetation is not expected to affect seabird populations. Currently, one of the highest densities of shearwater burrows on the island (6200 per hectare) is on a sand dune that is thickly wooded with Soft Corkwood *Duboisia myoporoides*.

The discovery of Gould's Petrel breeding on Broughton Island during this survey was the first record for this species within the Broughton Island Group. It is possible that breeding may have been attempted here in previous years but failed due to predation

of eggs or chicks by rats. Now that rats have been removed this population is likely to increase, although its ultimate size will be constrained by the limited amount of rock scree available.

### Other Seabirds Recorded

<i>Microcarbo melanoleucus</i>	Little Pied Cormorant
<i>Phalacrocorax carbo</i>	Great Cormorant
<i>P. sulcirostris</i>	Little Black Cormorant
<i>Egretta sacra</i>	Eastern Reef Egret
<i>Haematopus longirostris</i>	Australian Pied Oystercatcher
<i>H. fuliginosus</i>	Sooty Oystercatcher
<i>Charadrius ruficapillus</i>	Red-capped Plover
<i>Numenius madagascariensis</i>	Eastern Curlew
<i>Arenaria interpres</i>	Ruddy Turnstone
<i>Sternula albifrons</i>	Little Tern.

### Other Vertebrates Recorded

Striped Marsh Frog *Limnodynastes peroni*, Green and Golden Bell Frog *Litoria aurea*, Striped Skink *Ctenotus robustus*, Water Skink *Eulamprus quoyii* and Marsh Snake *Hemiaspis signata* have all been found on the island (Atlas of NSW Wildlife). All exotic mammals have been removed.

### Banding

Data for all banding records (first banding 18 December 1959).

<i>Ardenna pacifica</i>	– 736 adults, 45 nestlings and 87 of unknown age, with four recoveries: 6531 km NNW at Cagayan, Philippines; 244 km SSW at Five Islands, NSW; 148 km SSW at sea 48 km E of Sydney, NSW; and 103 km SW at Toukley Beach, NSW.
<i>Ardenna grisea</i>	– three adults, one of unknown age, with no recoveries.
<i>Ardenna tenuirostris</i>	– 95 adults, 17 nestlings and six of unknown age, with no recoveries.
<i>Eudyptula minor</i>	– two adults, with no recoveries.
<i>Thalasseus bergii</i>	– 45 nestlings with one recovery 107 km SW near Kanwal, NSW.

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