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DISTRIBUTION, ABUNDANCE AND CONSERVATION STATUS OF SHORT-TAILED SHEARWATERS *PUFFINUS TENUIROSTRIS* IN TASMANIA, AUSTRALIA

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SUMMARY

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The Short-tailed Shearwater *Puffinus tenuirostris* is a circum-Pacific migratory petrel that breeds in 209 colonies in Tasmania covering 1813 ha containing an estimated 11.5 million burrows. The largest colony is Babel Island in Bass Strait with 2.86 million burrows. Overall, five colonies hold 52% of all burrows. Protection of breeding colonies is by a system of reserves in which 70% of colonies are reserved from the harvesting of chicks. The conservation of the shearwater is secure, but only because of its large population size.

INTRODUCTION

The Short-tailed Shearwater *Puffinus tenuirostris*, also known as the Tasmanian muttonbird, is a circum-Pacific migrant ranging to 65°S in the Antarctic zone in the breeding season (Kerry *et al*. 1983) and to the far North Pacific Ocean in the non-breeding season (Serventy 1956, Shuntov 1974, Maruyama *et al*. 1986, Gould & Piatt 1993). The breeding population is restricted to southern Australia and is most abundant in Tasmania where colonies are widely distributed around the state (Fig. 1). Because of its great abundance in Tasmania, the unfledged young are subject to annual harvests in March–April, popularly termed 'muttonbirding' (Skira 1987, 1990, 1995, Skira *et al*. 1985). Commercial operators sell the meat for human consumption, and feathers and oil for commercial use. There is no quota on the size of the catch because of the very large size of the colonies open to commercial muttonbirding. Contemporary muttonbirding is one of the best examples in the world of a traditional culture with commercial outcome for indigenous people (Diamond 1987, Meek & O'Brien 1992). This exploitation shows no indication of significant increase in the future. In contrast non-commercial muttonbirders are allowed to take chicks for personal consumption only and are subject to a bag limit of 25 birds per day. About 650 non-commercial licences are sold each year, predominantly to the inhabitants of King and Flinders Islands (Fig. 1).

This paper lists the known colonies and their size and discusses briefly the current knowledge of the biology of the Short-tailed Shearwater and factors affecting its abundance. To our knowledge, between 1975–95, we have visited every Short-tailed Shearwater colony in the political division of Tasmania. To measure burrow density the number of burrows were counted along straight line transects (Skira & Wapstra 1980) or 5×5-m plots placed at random. Areas with no burrows were excluded from density calculations. For transects, generally two people each with a metre rule counted every burrow within 1 m of a surveyor's chain. Burrows that touched the outer end of the rule were included only if the highest point of the entrance was within 1 m of the chain. Burrows with more than one entrance were recorded as one. Incidental counts of burrow occupancy by incubating birds (Skira & Wapstra 1980) indicate that only between 75–90% are occupied. The percentage of burrows occupied varies annually and less than full occupancy is probably a natural phenomenon and not an indication of a decreasing population. Recent research on burrow occupancy in Wedgetailed Shearwaters *Puffinus pacificus* indicates that a census approach to monitoring burrow occupancy requires detailed planning and analysis in order to reflect the degree of usage (Dyer & Hill 1995).

RESULTS

Habitat description

The Short-tailed Shearwater breeds on islands, and on headlands and promontories of Tasmania. It burrows where soft soil of at least 30 cm depth occurs, usually stabilized by vegetation in native and modified grasslands, herbfield, bracken fern, scrubland and open forest. Occasionally it nests in cliffs of consolidated sand or on bare ground (Naarding 1980, White 1980, Harris & Norman 1981). Some breeding colonies close to human settlement have been eliminated (Lord 1908) or breeding habitat has been modified by introduced pasture grasses and weeds. The annual weeds die back leaving areas susceptible to erosion and collapse of burrows (Harris & Norman 1981, Fitzherbert 1985). On some colonies, areas are

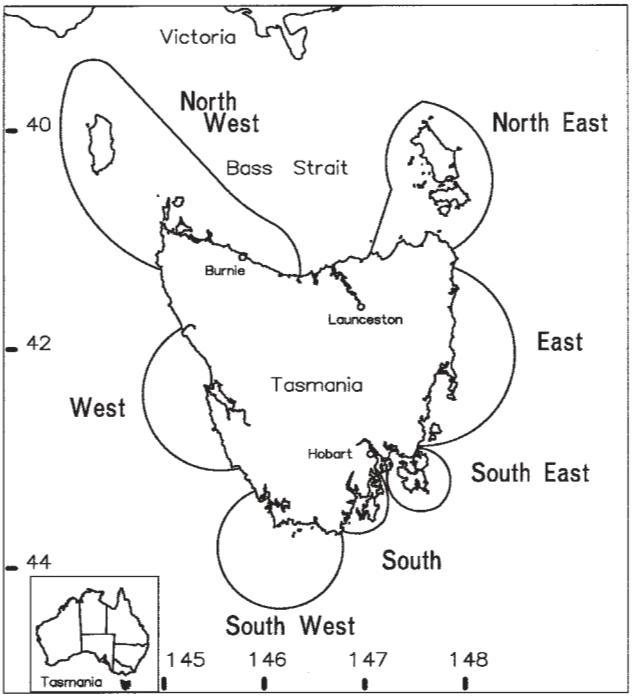

Fig. 1. *Location of geographical regions in Tasmania.*

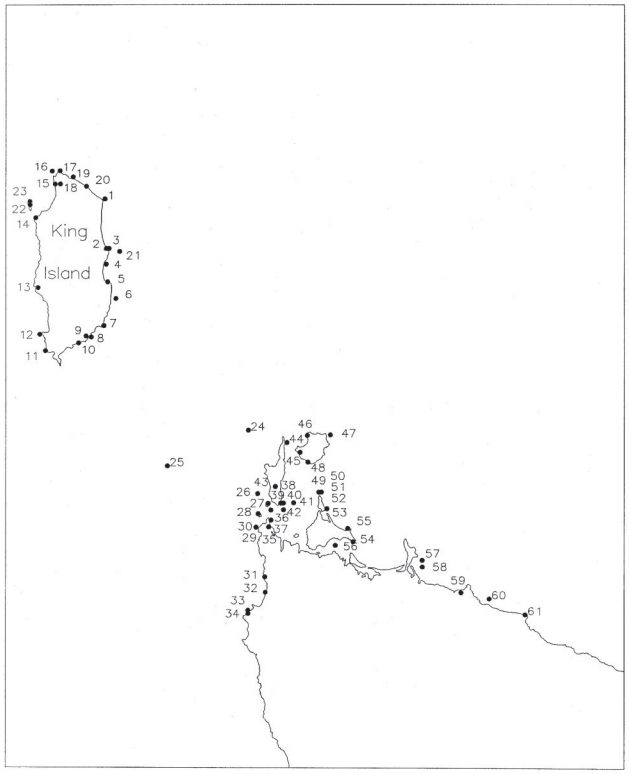

Fig. 2. *Distribution of Short-tailed Shearwater* Puffinus tenuirostris *colonies in Tasmania: North West region.*

vacated that are covered by densely growing introduced plants like African Boxthorn *Lycium ferocissimum*, Blackberry *Rubus fructicosus* and Kikuyu Grass *Pennisetum clandestinum*, or pasture unsuitable for burrowing (Brothers & Milledge 1979, Bowker 1980, Brothers 1983, Skira & Brothers 1988a, 1988b).

In the past, physical damage during the non-commercial season by muttonbirders has been of concern but is now more controlled due to the reduction in their numbers. Grazing (cattle, rabbits), fires and trampling by stock denude vegetation and cause erosion and sand-drifts (Harris & Bode 1981, Harris & Norman 1981). These have been perennial problems on the commercial colonies in the Bass Strait islands ever since muttonbirding commenced. Grazing by sheep is said not to have affected breeding success (the ratio of chicks fledged to eggs laid) on Big Green Island in the Furneaux Group (Norman 1970), although trampling by sheep is a problem at colonies generally. After programmes to control rabbits on breeding islands, birds recolonize revegetated areas (Norman *et al.* 1980, I.J. Skira unpubl. data). Predation by feral cats and occasionally by domestic dogs is a problem at many colonies. In particular, damage by feral cats can be severe, as witnessed by the extermination of 193 cats from Great Dog Island in 1991–92 (I.J. Skira unpubl. data). During the period October to April when shearwaters are present, they were a major component in the diet of the cats (Hayde 1992).

Winter firing of Silver Tussock *Poa poiformis*, usually on islands subject to commercial harvesting, exposes the soil to westerly gales, reduces soil depth for burrowing and allows fire-invading plant species to colonize. The principal invader is *Senecio capillifolius* which is endemic to the islands of the Furneaux Group. It has good soil-holding qualities and eventually allows Silver Tussock to recolonize. *Senecio* dries out in summer and splinters, but this does not appear to affect the shearwaters, although it makes it uncomfortable for muttonbirders to reach inside burrows for chicks. The practice of winter firing is not encouraged by the Parks and Wildlife Service on government-owned land and last occurred in 1985 on Great Dog Island. The Government has no control over management practices on private land, but generally, fires occur infrequently. In natural situations, shearwaters themselves influence and modify the habitat (Teh 1974, Pemberton 1992, Brown *et al.* 1993).

The burrow density for the majority of colonies has been measured (Appendix 1). It varies according to vegetation type, with highest densities recorded under *Poa* tussocks (Skira & Wapstra 1980) and *Tetragonia* succulent vegetation (Norman & Gottsch 1969). The maximum density recorded is 2.4 burrows.m^{-2} in Victoria (Norman & Gottsch 1969).

TABLE 1

AREA CATEGORIES OF SHORT-TAILED SHEARWATER *PUFFINUS TENUIROSTRIS* COLONIES IN TASMANIA

	Size range (ha)			
	<1	**1–10**	**11–100**	**>100**
Number of colonies	85	96	25	3
Total area (ha)	23.1	371.8	708.3	710.0

Distribution of colonies and abundance

The Short-tailed Shearwater breeds only in Australia with 23 million birds breeding in about 285 colonies. Victoria has 1.45 million burrows in about 30 colonies (Harris & Norman 1981), South Australia 630 000 burrows in 33 colonies (Robinson *et al.* no date), New South Wales 25 700 breeding pairs in 13

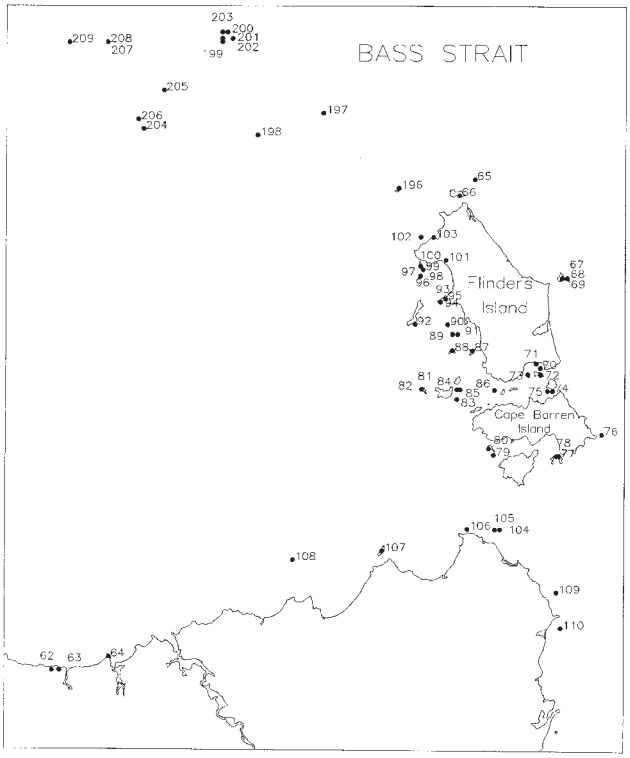

Fig. 3. *Distribution of Short-tailed Shearwater* Puffinus tenuirostris *colonies in Tasmania: Bass Strait and North East regions.*

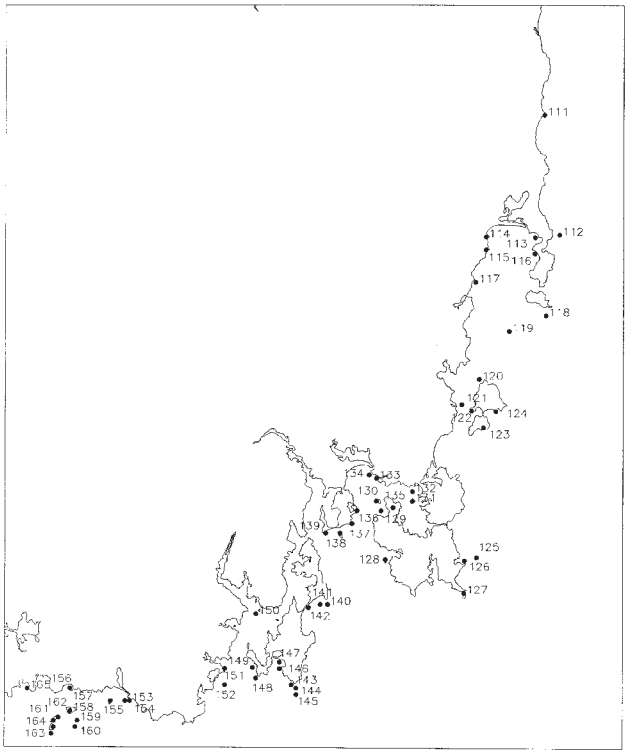

Fig. 4. *Distribution of Short-tailed Shearwater* Puffinus tenuirostris *colonies in Tasmania: East, South East, South and South West regions.*

colonies (Lane 1979) and Western Australia 10 000 burrows in several colonies (Johnstone *et al.* 1990a, 1990b, Lane 1983).

There are known to be 209 colonies in the political division of Tasmania, distributed around the coast of Tasmania and its offshore islands as far north in Bass Strait as Rodondo Island just off Wilson's Promontory in Victoria (Tables 1 and 2, Figs. 2–5). It is unlikely that many more colonies remain to be discovered. The largest colony is Babel Island with 2.86 million burrows (Towney & Skira 1985a). Other large colonies include Trefoil and Great Dog Islands with 700 000 and 952 000 burrows, respectively (Skira & Brothers 1988b, I.J. Skira unpubl. data). An earlier estimate for Trefoil Island of 1.54 million burrows (Towney & Skira 1985b) has had to be modified after recent more accurate surveys. The total area of colonies is 1813 ha, containing an estimated 11.5 million burrows (Table 2), which figures are likely to be modified slightly as ongoing surveys of colonies are carried out.

The distribution of Short-tailed Shearwater colonies in the past appears to have been vastly different to that of today. The interval from 25 000 to 10 000 Before Present (BP) was a period of great faunal and climatic change in Australia. At times the coastline was up to 50 km away from its current position (Jennings 1971, Blom 1988). Climatic disruptions would have affected the location of shearwater colonies through changes in sea levels which reached their present level 6000 to 7000 BP (Jennings 1971, Blom 1988). There is some dispute whether fluctuations have occurred in sea levels since (Sutherland 1973). Falls of only one or two metres would serve to connect several offshore islands to Flinders Island in the Furneaux Group and Robbins and Walker Islands in the Hunter Group. At present, these last two islands are joined at low tide. Specifically, most extant colonies originated within the last 10 000 years, and may have arisen from a restricted breeding

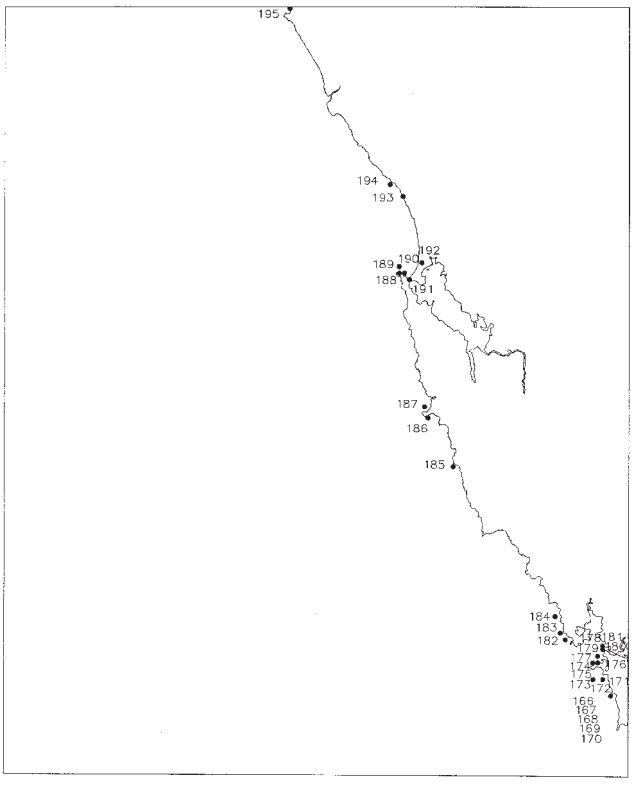

Fig. 5. *Distribution of Short-tailed Shearwater* Puffinus tenuirostris *colonies in Tasmania: South West and West regions.*

TABLE 2

STATUS OF SHORT-TAILED SHEARWATER *PUFFINUS TENUIROSTRIS* COLONIES IN VARIOUS REGIONS OF TASMANIA

Region and land status	Number colonies	Area (ha)	Number of burrows	Range (±2SE)
BASS STRAIT				
Crown Land	11	29.2	161 140	117 455–204 830
Nature Reserve	3	60.1	467 100	373 075–561 125
EAST COAST				
Crown Land	5	3.5	13 895	10 590–17 200
Nature Reserve	1	0.1	75	50–100
Private	4	1.1	4770	3760–5780
State Reserve	5	2.1	8035	5845–10 235
NORTH EAST				
Conservation Area	3	10.2	56 145	31 120–81 170
Crown Land	16	29.6	209 375	164 095–253 780
Crown/Private	1	10	97 000	73 000–121 000
Game Res/Private	1	40	184 000	150 000–218 000
Muttonbird Reserve	5	600.6	4 012 508	3 383 572–4 618 244
Nature Reserve	8	176.3	688 895	543 985–833 795
Private	3	7.5	53 525	48 490–58 555
State Reserve	2	9.4	48 050	41 125–53 975
Wildlife Sanctuary	6	24.6	140 440	112 280–168 570
NORTH WEST				
Conservation Area	3	43.1	202 570	167 340–229 160
Crown Land	15	18.2	75 280	62 680–95 613
Game Reserve	8	45.2	379 585	328 540–430 580
Nature Reserve	12	62.8	244 726	193 586–301 772
Private	24	217.4	1 349 385	942 230–1 598 534
State Reserve	2	29.4	95 926	79 532–115 896
SOUTH EAST				
Conserv/Private	1	7	4130	3850–4410
Crown Land	6	9.4	47 110	38 520–56 100
Nature Reserve	3	35.1	159 150	137 300–181 000
Private	5	7.4	45 130	35 375–54 875
SOUTH				
Crown Land	8	30.3	226 570	190 790–262 350
Game Reserve	3	14.4	62 875	42 125–84 125
Private	1	0.3	400	300–500
State Reserve	1	3	15 000	13 000–17 000
SOUTH WEST				
State Reserve	33	277.3	2 431 116	2 054 430–2 805 193
WEST COAST				
Conservation Area	6	4.4	22 809	16 396–29 226
Crown Land	4	4.3	26 170	19 000–33 340
TOTAL	209	1813.3	11 532 885	9 383 436–13 506 033

population during the Pleistocene glaciation, as based on mtDNA diversity in current breeding populations (Austin *et al*. 1994). The DNA evidence suggests a lack of population-genetic structure, and therefore discrete breeding populations.

There is anecdotal evidence that prior to the arrival of Europeans in Australia there were no colonies on the Tasmanian mainland. The first part of the twentieth century corresponds with a general expansion of the breeding range of the shearwater in Tasmania (Sharland 1956, Austin *et al*. 1994). The present day commercially exploited colonies on Walker, Robbins and Three Hummock Islands were non-existent or very small until the turn of the century (P. Maguire, ex-lessee of Hunter Island pers. comm., Burnie *Advocate* 26 March 1977,

TABLE 3

AREA AND SIZE OF SHORT-TAILED SHEARWATER *PUFFINUS TENUIROSTRIS* COLONIES IN TASMANIA ACCORDING TO LAND STATUS AND HARVESTING USE

Land Status	Commercial			Non-commercial			Prohibited		
	Number colonies	Area (ha)	Number burrows	Number colonies	Area (ha)	Number burrows	Number colonies	Area (ha)	Number burrows
Conservation Area	2	28	142 570	3	3	14 620	7	27	124 334
Conservation/Private							1	7	4 130
Crown Land	0			23	43	269 850	42	81	489 690
Crown Land/Private	0			0			1	10	97 000
Game Reserve	1	20	236 000	7	25	143 585	3	14	62 875
Game Reserve/Private				1	40	184 000	0		
Muttonbird Reserve	2	550	3 809 600	3	51	202 908	0		
Nature Reserve	2	27	100 724	2	11	57 000	23	296	1 402 222
Private	1	81	698 262	16	137	675 838	20	16	79 110
State Reserve	0			1	27	82 650	42	294	2 515 477
Wildlife Sanctuary	0			0			6	25	140 440
TOTAL	8	706	4 987 156	56	337	1 630 451	145	770	4 915 278

The Coastal News and North-Western Advertiser 11 May 1892). The colonies at Green Point on the West Coast and Point Sorell near Devonport are also of recent origin. Those on Betsey Island in southeast Tasmania were first noticed about 60 years ago (Bryden 1966), whereas there was none on Sloping Island last century (Hobart *Mercury* 18 January 1876). There is evidence that the colonies at The Neck and Cape Queen Elizabeth on Bruny Island are also of recent origin, as a Tasmanian Field Naturalists' excursion in 1907 did not report seeing any (Lord 1907). The cause of the expansion is not known.

Reserve system in Tasmania

In Tasmania, of the 209 colonies, 106 (1445 ha) are legally protected under the reserve regulations of the *National Parks and Wildlife Act 1970*, to protect habitat and to control, where necessary, land use and activity of visitors (Table 3). Of these, commercial harvesting is permitted in seven colonies (625 ha); non-commercial harvesting in 17 (156 ha), and harvesting is not permitted in the remaining 82 (663 ha). Most of the 103 colonies (368 ha) not legally protected are <5 ha in size.

State Reserves provide the highest form of land protection in Tasmania. State Reserves include National Parks, Nature Reserves, Historic Sites and Aboriginal Sites. Muttonbirding is permitted in these Reserves by ministerial approval providing it was a traditional activity before proclamation. Game Reserves have equal status to State Reserves except that the land is protected to enable the taking of wildlife, including shearwaters. The next level of protection is provided by Conservation Areas, in which all wildlife is protected but not necessarily the habitat. A Muttonbird Reserve is a Conservation Area where the taking of Short-tailed Shearwaters is permitted in set hunting seasons. Muttonbirding is prohibited in other Conservation Areas, except where it was a traditional activity prior to proclamation and now allowed to continue through ministerial approval, provided harvesting is at safe levels. Wildlife Sanctuaries are Conservation Areas, and in them, any interference with wildlife is prohibited, including muttonbirding. On private land in northwest Tasmania and on the Bass Strait islands, muttonbirding is permitted with the owner's approval. Elsewhere on private land in Tasmania the muttonbird season is closed and no muttonbirding is permitted.

DISCUSSION

The Tasmanian Parks and Wildlife Service has ongoing Short-tailed Shearwater programmes of biological research, population monitoring and surveys on the distribution and size of colonies. This seabird has long fostered scientific fascination (Davies 1845, Elwes 1859, Gould 1865, Montgomery 1891, Littler 1910, Wood Jones 1934), and was one of the first Australian birds to be banded in large numbers (Serventy 1956, 1957, 1961) and to be subjected to a long-term scientific study (Serventy 1967). This study was commenced on Fisher Island in the Furneaux Group in March 1947 by the late Dominic Serventy and continues today (Serventy 1977, Bradley *et al*. 1991). Due to the long-term nature of the study, together with the banding of some 92 000 birds in Australia, the life history of the muttonbird is one of the best documented of any bird in the world (Serventy 1974, Serventy & Curry 1984, Bradley *et al*. 1989, 1990, 1995, Wooller *et al*. 1988, 1989, 1990, 1992, Skira 1991).

At present, the conservation of the Short-tailed Shearwater seems secure only because of their large numbers. Natural causes of mortality are predation, disease, starvation and flooding of low-lying nesting areas. Flooding in particular, is regularly experienced on Fisher Island and is common to the *Puffinus* genus (Thompson & Furness 1991). Chick mortality of 1–3% occurs in some years due to a condition known as 'limy-bird disease', caused by blockage of the lower part of the alimentary canal by concretions of sodium urate (Mykytowycz 1963). Human threats include gillnet fisheries in the North Pacific. Currently, shearwaters are being drowned in driftnet and hook fisheries in both the northern and southern hemispheres (Everett & Pitman 1993, Johnson *et al*. 1993). Since December 1992 driftnet fishing has been banned on the high

seas outside the 300-km Exclusive Economic Zone (EEZ) of individual countries. The Short-tailed Shearwater is the dominant seabird on the salmon driftnet fishing grounds, and it is estimated that more than 40 000 are drowned annually in all the driftnet fisheries in the North Pacific (Ogi *et al*. 1993). In one of these fisheries, 70–80% of incidental kills are of fledgling birds. On account of this mortality, the average rate of decrease in the shearwater population is estimated at 0.02% a year (DeGange *et al*. 1993, Ogi *et al*. 1993). Although considered negligible, the effects of past bycatch mortality were greater (DeGange & Day 1993). Prior to the banning of driftnetting on the high seas, it is estimated that between 132 000 and 281 000 Short-tailed Shearwaters were drowned annually (King 1984, Ogi 1984). This equates to a population decrease of around 0.2% a year. If the present level of mortality continues, the cumulative effects over the years would be somewhat greater. In the southern hemisphere, unknown, but large numbers of shearwaters are a bycatch of the Southern Bluefin Tuna *Thunnus maccoyii* fisheries which operates within Australia's 300-km EEZ. Most of these birds are breeding adults (R.P. Gales, Tasmania Parks and Wildlife Service pers. comm).

Small plastic particles are commonly found in stomachs of seabirds (Azzarello & van Vleet 1987). A high proportion of Short-tailed Shearwaters contain plastic particles in their stomachs on their return to the southern hemisphere but lose them as the season progresses (Skira 1986). The effects of plastic ingestion suggest a link between high amounts of plastic ingested and decreased physical 'health' in shearwaters, particularly when in the northern hemisphere (Day *et al*. 1985). This 'impairment' is difficult to measure as it may also be affected by chemical pollution loads in seabirds at different stages of their breeding season (Ryan 1987, Ryan *et al*. 1988). Short-tailed Shearwaters also accumulate more PCBs and DDE mainly during their period of stay in the northern North Pacific feeding grounds than do birds in the southern South Pacific, reflecting on the status of global marine pollution by PCBs (Tanaka *et al*. 1986). This is an insidious world-wide problem that has been present since at least the early 1970s, as evidenced by high levels of chemical contamination in Sooty Shearwater *Puffinus griseus* chicks in that period (Dacre 1974). The toxic effects of the chemicals could be manifested under specific biological processes, such as migration.

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REFERENCES

AUSTIN, J.J., WHITE, R.W.G. & OVENDEN, J.R. 1994. Population-genetic structure of a philopatric colonially nesting seabird, the Short-tailed Shearwater (*Puffinus tenuirostris*). *Auk* 111: 70–79.

AZZARELLO, M.Y. & VAN VLEET, E.S. 1987. Marine birds and plastic pollution. *Mar. Ecol. Prog. Ser.* 37: 295–303.

BLOM, W.M. 1988. Late Quaternary sediments and sea-levels in Bass Basin, Southeastern Australia - a preliminary report. *Search* 19: 94–96.

BOWKER, G.M. 1980. Seabird islands No. 99. Griffiths Island, Victoria. *Corella* 4: 104–106.

BRADLEY, J.S., WOOLLER, R.D. & SKIRA, I.J. 1991. A long-term study of Short-tailed Shearwaters *Puffinus tenuirostris* on Fisher Island, Australia. *Ibis* 133 *Suppl.* 1: 55–61.

BRADLEY, J.S., WOOLLER, R.D. & SKIRA, I.J. 1995. The relationship of pair-bond formation and duration to reproductive success in Short-tailed Shearwaters *Puffinus tenuirostris. J. Anim. Ecol.* 64: 31–38.

BRADLEY, J.S., WOOLLER, R.D., SKIRA, I.J. & SERVENTY, D.L. 1989. Age-dependent survival of breeding Short-tailed Shearwaters *Puffinus tenuirostris. J. Anim. Ecol*. 58**:** 175–188.

BRADLEY, J.S., WOOLLER, R.D., SKIRA, I.J. & SERVENTY, D.L. 1990. The influence of mate retention and divorce upon reproduction success in Short-tailed Shearwaters *Puffinus tenuirostris*. *J. Anim. Ecol.* 59: 487–496.

BROTHERS, N.P. 1983. Seabird islands No. 134. Southport Island, Tasmania. *Corella* 7: 85–86.

BROTHERS, N.P. & MILLEDGE, D.R. 1979. Seabird Islands No. 69. Goose Island, Tasmania. *Corella* 3: 46–47.

BROWN, M.J., MARUYAMA, N. & WILLIAMS, K.J. 1993. Ecological studies of vegetation in Short-tailed Shearwater colonies in Tasmania. *Pap. Proc. Roy. Soc. Tasmania* 127: 11–16.

BRYDEN, W. 1966. Historical Notes. *Pap. Proc. Roy. Soc. Tasmania* 100: 21–26.

DACRE, J.C. 1974. Residual organochlorine pesticides in the fat of muttonbirds of New Zealand. *Bull. Environ. Contam. Toxicol.* 11: 517–522.

DAVIES, R.H. 1846. Some account of the habits and natural history of the Sooty Petrel (Muttonbird). *Tasmanian J. Nat. Sci.* 2: 13–16.

DAY, R.H., WEHLE, D.H.S. & COLEMAN, F.C. 1985. Ingestion of plastic pollutants by marine birds. In: Shomura, R.S. & Yoshida, H.O. (Eds). Proceedings of the Workshop on the Fate and Impact of Marine Debris. Washington: United States Department of Commerce, NOAA Technical Report. pp. 344–386.

DEGANGE, A.R. & DAY, R.H. 1993. Mortality of seabirds in the Japanese land-based gillnet fishery for salmon. *Condor* 93: 251–258.

DEGANGE, A.R., DAY, R.H., TAKEKAWA, J.E. & MENDENHALL, V.M. 1993. Losses of seabirds in gill nets in the North Pacific. In: Vermeer, K., Briggs, K.T., Morgan, K.H. & Siegel-Causey, D. (Eds). The status , ecology, and conservation of marine birds of the North Pacific. Ottawa: Canadian Wildlife Service Special Publication. pp. 204–211.

DIAMOND, A.W. 1987. A global view of cultural and economic uses of birds. In: Diamond, A.W. & Filion, F.L. (Eds). The value of birds. *Internat. Council Bird Preserv. Tech. Publ*. 6: 99–109.

DYER, P.K. & HILL, G.J.E. 1995. An integrated mapping approach to monitoring burrowing birds: Wedge-tailed Shearwaters on North Stradbroke Island, Queensland. *Emu* 95: 62–66.

ELWES, R. 1859. Note on the breeding and mode of capture of the Short-tailed Petrel, or Mutton Bird (*Puffinus obscurus*), in the islands in Bass's Straits. *Ibis* 1: 397–399.

EVERETT, T.E. & PITMAN, R.L. 1993. Status and conservation of shearwaters of the North Pacific. In: Vermeer, K., Briggs, K.T., Morgan, K.H. & Siegel-Causey, D. (Eds). The status, ecology, and conservation of marine birds of the North Pacific, Ottawa: Canadian Wildlife Service Special Publication. pp. 93–100.

FITZHERBERT, K. 1985. The role of energetic factors in the evolution of the breeding biology of the Short-tailed Shearwater (*Puffinus tenuirostris* Temminck). Ph.D. Thesis.

Melbourne: Department of Zoology, Monash University.
GOULD, J. 1865. Handbook to the birds of Australia, Vol. 2. London: Author. pp. 459–465.
GOULD, P.J. & PIATT, J.F. 1993. Seabirds of the central North Pacific. In: Vermeer, K., Briggs, K.T., Morgan, K.H. & Siegel-Causey, D. (Eds). The status, ecology, and conservation of marine birds of the North Pacific. Ottawa: Canadian Wildlife Service Special Publication. pp. 27–38.
HARRIS, M.P. & BODE, K.G. 1981. Populations of Little Penguins, Short-tailed Shearwaters and other seabirds on Phillip Island, Victoria. *Emu* 81: 20–28.
HARRIS, M.P. & NORMAN, F.I. 1981. Distribution and status of coastal colonies of seabirds in Victoria. *Mem. Nat. Mus. Victoria* 42: 89–106.
HAYDE, K.A. 1992. Ecology of the feral Cat *Felis catus* on Great Dog Island. Honours Thesis. Hobart: Department of Zoology, University of Tasmania.
JENNINGS, J.N. 1971. Sea level changes and land links. In: Mulvaney, D. J. & Golson, J. (Eds). Aboriginal man and environment in Australia. Canberra: Australian National University Press. pp. 1–13.
JOHNSON, D.H., SHAFFER, T.L. & GOULD, P.J. 1993. Incidental catch of marine birds in the North Pacific high seas driftnet fisheries in 1990. *North Pacific Commission Bull.* 53 (III): 473–483.
JOHNSTONE, R.E., SMITH, L.A. & KLOMP, N.I. 1990a. Seabird islands No. 203. Wickham Island, Archipelago of the Recherche, Western Australia. *Corella* 14: 131–132.
JOHNSTONE, R.E., SMITH, L.A. & KLOMP, N.I. 1990b. Seabird islands No. 204. Gulch Island, Archipelago of the Recherche, Western Australia. *Corella* 14: 133–134.
KERRY, K.R., HORNE, R.S.C. & DORWARD, D.F. 1983. Records of the Short-tailed Shearwater *Puffinus tenuirostris* in Antarctic waters. *Emu* 83: 35–37.
KING, W.B. 1984. Incidental mortality of seabirds in gillnets in the North Pacific. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the World's seabirds. *Internat. Council Bird Preserv. Tech. Publ.* 2: 709–715.
LANE, S.G. 1979. Summary of the breeding seabirds on New South Wales coastal islands. *Corella* 3**:** 7–10.
LANE, S.G. 1983. Short-tailed Shearwater on Figure of Eight Island, Archipelago of the Recherche, Western Australia. *Emu* 83: 37–38.
LITTLER, F.M. 1910. A handbook of the birds of Tasmania and its Dependencies. Launceston: Author.
LORD, C.E. 1907. Camp-out of the Tasmanian Field Naturalists on Bruny Island. *Tasmanian Naturalist* 1: 13–14.
LORD, J.E.C. 1908. Furneaux Islands: report upon the state of the islands. *Tasmanian Parliamentary Paper* 57.
MARUYAMA, N., OKA, N., WATABE, Y., KURODA, N. & SKIRA, I.J. 1986. Migration route of Short-tailed Shearwater in North Pacific. In: Kuroda, N. (Ed.). Synthetic study of the mass-mortality of Short-tailed Shearwaters. Abiko, Japan: Yamashina Institute for Ornithology. pp. 36–42 (in Japanese).
MEEK, P.D. & O'BRIEN, P.H. 1992. Wildlife Use and Management: Report of a Workshop for Aboriginal and Torres Strait Islander People. Bureau of Rural Resources Report No. R/2/92. Canberra: Australian Government Publishing Service.
MONTGOMERY, H.H. 1891. Some account of the Mutton Birds, or Sooty Petrels (*Nectris brevicaudus*), as seen in their homes among the Furneaux Islands, Bass Straits, Tasmania, from notes taken during a visit to the locality in March, 1891. *Pap. Proc. Roy. Soc. Tasmania* 1891, 1–10.
MYKYTOWYCZ, R. 1963. 'Limey-bird disease' in chicks of the Tasmanian Mutton-bird (*Puffinus tenuirostris*). *Avian Diseases* 7: 67–69.
NAARDING, J.A. 1980. Study of the Short-tailed Shearwater, *Puffinus tenuirostris* in Tasmania. *Special Report Tasmanian National Parks and Wildlife Service and Australian National Parks and Wildlife Services*.
NORMAN, F.I. 1970. The effects of sheep on the breeding success and habitat of the Short-tailed Shearwater, *Puffinus tenuirostris* (Temminck). *Aust. J. Zool. 18*: 215–229.
NORMAN, F.I. & GOTTSCH, M.D. 1969. The Phillip Island colonies of the Tasmanian Muttonbird, with special reference to those at Cape Woolamai. *Emu* 69: 137–144.
NORMAN, F.I., HARRIS, M.P., BROWN, R.S. & DEERSON, D.M. 1980. Seabird islands No. 87. Rabbit Rock, Wilson Promontory, Victoria. *Corella* 4: 77–78.
OGI, H. 1984. Seabird mortality incidental to the Japanese salmon gill-net fishery. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the World's seabirds. *Internat. Council Bird Preserv. Tech. Publ.* 2: 717–721.
OGI, H., YATSU, A. & HATANAKA, H. 1993. The mortality of seabirds by driftnet fisheries in the North Pacific. *North Pacific Commission Bull.* 53(III): 499–518.
PEMBERTON, M. 1992. The influence Short-tailed Shearwaters (*Puffinus tenuirostris*) have on soil development at Maatsuyker Island, South West Tasmania. In: Maruyama, E. (Ed.). Comparisons of 'coastal vegetation-shearwater' relationships on the islands, Japan, Tasmania and New Zealand, of the temperate western Pacific Ocean, from an aspect of human impact, Interim Report to Toyota Foundation, Tokyo. Department of Environmental Science and Resources, Tokyo University of Agriculture and Technology.
ROBINSON, A.C., CANTY, P.D., MOONEY, P.A. & RUDDOCK, P.M. no date. South Australia's offshore islands. *National Parks and Wildlife Service South Australia Special Publication Number*: 130–132.
RYAN, P.G. 1987. The effects of ingested plastic on seabirds: correlations between plastic load and body condition. *Environ. Poll.* 46: 119–125.
RYAN, P.G., CONNELL, A.D. & GARDNER, B.D. 1988. Plastic ingestion and PCBs in seabirds: is there a relationship? *Mar. Poll. Bull.* 19: 174–176.
SERVENTY, D.L. 1956. A Japanese recovery of an Australian-ringed *Puffinus tenuirostris*. *Ibis* 98: 316.
SERVENTY, D.L. 1957. The banding programme on *Puffinus tenuirostris* (Temminck). I. First report. *CSIRO Wildl. Res. 2*: 51–59.
SERVENTY, D.L. 1961. The banding programme on *Puffinus tenuirostris* (Temminck). II. Second report, 1956–1960. *CSIRO Wildl. Res.* 6: 42–55.
SERVENTY, D.L. 1967. Aspects of the population ecology of the Short-tailed Shearwater *Puffinus tenuirostris. Proc. 14th Internat. Orn. Congr.*: 165–190.
SERVENTY, D.L. 1974. The biology behind the mutton-bird Industry. *Pap. Proc. Roy. Soc. Tasmania* 107: 1-9.
SERVENTY, D.L. 1977. Seabird islands. No. 49. Fisher Island, Tasmania. *Corella* 1: 60-62.
SERVENTY, D.L. & CURRY, P.J. 1984. Observations on colony size, breeding success, recruitment and inter-colony dispersal in a Tasmanian colony of Short-tailed Shearwaters *Puffinus tenuirostris* over a 30-year period. *Emu* 84: 71–79.
SHARLAND, M. 1956. Population rise in two sea-birds. *Emu* 56: 75–79.
SHUNTOV, V.P. 1974. Seabirds and the biological structure of the ocean. Springfield: United States Department of Commerce National Information Services.
SKIRA, I.J. 1986. Food of the Short-tailed Shearwater,

Puffinus tenuirostris, in Tasmania. *Aust. Wildl. Res.* 13: 481–488.

SKIRA, I.J. 1987. Socio-economic aspects of muttonbirding in Tasmania, Australia. In: Diamond, A.W. & Filion, F.L. (Eds). The value of birds. *Internat. Council Bird Preserv. Tech. Publ.* 6: 63–75.

SKIRA, I.J. 1990. Human exploitation of the Short-tailed Shearwater. *Pap. Proc. Roy. Soc. Tasmania* 124: 77–90.

SKIRA, I.[J.] 1991. Australasian bird reviews - Number 3. The Short-tailed Shearwater; a review of its biology. *Corella* 15: 45–52.

SKIRA, I.[J.] 1995. A muttonbird in the hand. *Natural History* 104: 24–35.

SKIRA, I.J. & BROTHERS, N.P.B. 1988a. Seabird islands No. 183. Little Green Island, Furneaux Group, Tasmania. *Corella* 12: 80–81.

SKIRA, I.J. & BROTHERS, N.P.B. 1988b. Seabird islands No. 184. Great Dog Island, Furneaux Group, Tasmania. *Corella* 12: 82–84.

SKIRA, I.J. & DAVIS, G. 1987. The Short-tailed Shearwater colonies of King Island. *Tasmanian Naturalist* 90: 1–6.

SKIRA, I.J. & WAPSTRA, J.E. 1980. Occupation of burrows as a means of estimating the harvest of Short-tailed Shearwaters in Tasmania. *Emu* 80: 233–238.

SKIRA, I.J., WAPSTRA, J.E., TOWNEY, G.N. & NAARDING, J.A. 1985. Conservation of the Short-tailed Shearwater *Puffinus tenuirostris* in Tasmania, Australia. *Biol. Conserv.* 37: 225–236.

SUTHERLAND, F.L. 1973. The geological development of the southern shores and islands of Bass Strait. *Proc. Roy. Soc. Victoria* 85: 133–144.

TANAKA, H., OGI, H., TANABE, S., TATSUKAWA, R. & OKA, N. 1986. Bioaccumulation and metabolism of PCBs and DDE in Short-tailed Shearwater *Puffinus tenuirostris* during its transequatorial migration and in the wintering and breeding grounds. *Mem. Nat. Inst. Polar Res. Spec. Iss.* 40: 434–442.

TEH, T.S. 1974. An ecological study of the Cape Woolamai Faunal Reserve: some factors influencing the breeding success of the Short-tailed Shearwater, *Puffinus tenuirostris*. *Geographica* 9: 19–29.

THOMPSON, K.R. & FURNESS, R.W. 1991. The influence of rainfall and nest-site quality on the population dynamics of the Manx Shearwater *Puffinus puffinus* on Rhum. *J. Zool., Lond.* 225: 427–437.

TOWNEY, G.N. & SKIRA, I.J. 1985a. Seabird islands No. 139. Babel Island, Furneaux Group, Tasmania. *Corella* 8: 103–104.

TOWNEY, G.N. & SKIRA, I.J. 1985b. Seabird islands No. 143. Trefoil Island, Tasmania, *Corella* 8: 111–112.

WHITE, G. 1980. Islands of South West Tasmania. Sydney: Author.

WOOD JONES, F. 1934. Unscientific excursions. London: Edward Arnold & Co.

WOOLLER, R.D., BRADLEY, J.S. & CROXALL, J.P. 1992. Long-term population studies of seabirds. *Trends Ecol. Evol.* 7: 111–114.

WOOLLER, R.D., BRADLEY, J.S., SERVENTY, D.L. & SKIRA, I.J. 1988. Factors contributing to reproductive success in Short-tailed Shearwaters. *Proc. 19th Internat. Orn. Congr.*: 848–856.

WOOLLER, R.D., BRADLEY, J.S., SKIRA, I.J. & SERVENTY, D.L. 1989. Short-tailed Shearwater. In: Newton, I. (Ed.). Lifetime reproduction in birds. London: Academic Press. pp. 405–417.

WOOLLER, R.D., BRADLEY, J.S., SKIRA, I.J. & SERVENTY, D.L. 1990. Reproductive success of Short-tailed Shearwaters *Puffinus tenuirostris* in relation to their age and breeding experience. *J. Anim. Ecol.* 59: 161–170.

APPENDIX 1

DISTRIBUTION AND STATUS OF SHORT-TAILED SHEARWATER *PUFFINUS TENUIROSTRIS* COLONIES IN TASMANIA

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
1	Martha Lavinia	NW	39	40	144	07	NR	P	3.97	0.28	11 200	4900–17 450
2	Sea Elephant	NW	39	49	144	07	NR	P	8		500	400–600
3	Cowper Point	NW	39	49	144	08	CL	NC	4.04	0.19	7700	4040–14 948
4	Naracoopa Beach	NW	39	52	144	07	CL	NC	2.28	0.33	7600	3350–11 800
5	Fraser Bluff	NW	39	55	144	07	CL	NC	0.38	0.43	1750	1490–1950
6	Barrier Creek	NW	39	58	144	09	P	NC	0.25	0.63	1550	1200–1850
7	Bold Head	NW	40	03	144	06	P	NC	19.5	0.35	68 200	53 050–83 300
8	Grassy	NW	40	05	144	03	P	NC	5.42	0.47	26 010	22 050–29 950
9	Sandblow Point	NW	40	05	144	02	CL	NC	2.98	0.42	12 500	10 150–14 900
10	Red Hut	NW	40	06	144	00	P	NC	18.98	0.45	85 400	62 650–108 200
11	Seal Rocks	NW	40	07	143	52	SR	NC	26.66	0.31	82 650	72 000–93 300
12	Catarique Point	NW	40	04	143	51	P	NC	4.88	0.20	9760	7800–11 700
13	Badger Box	NW	39	56	143	51	P	NC	3.64	0.44	15 850	15 300–16 750
14	Whistler Point	NW	39	43	143	51	P	NC	13.72	0.44	61 700	44 050–79 350
15	Wash and Springs	NW	39	37	143	56	P	NC	12.82	0.46	59 150	37 850–80 400
16	Cape Farewell	NW	39	35	143	55	P	NC	5.31	0.46	24 650	21 900–27 500
17	Wickham Lighthouse	NW	39	35	143	57	P	NC	2.58	0.32	8362	7050–9650
18	Cape Wickham	NW	39	36	143	57	P	NC	3.71	0.40	14 800	8400–21 300
19	Rocky Point	NW	39	36	144	00	P	NC	7.06	0.40	27 975	18 200–37 750
20	Boulder Point	NW	39	38	144	03	CL	NC	3.05	0.70	21 200	18 200–24 200
21	Councillor Island	NW	39	50	144	10	CL	NC	2	1.07	20 000	21 400–22 800
22	Christmas Island	NW	39	41	143	50	NR	P	8	0.60	48 000	41 600–54 400
23	New Year Island	NW	39	40	143	50	GR	NC	20	0.60	120 000	104 000–136 000
24	Albatross Island	NW	40	23	144	39	NR	P	1	0.20	2000	1700–2300
25	Black Pyramid	NW	40	29	144	20	NR	P	0.1		2	1– 5
26	Steep Island	NW	40	34	144	41	GR	C	20	1.18	236 000	204 000– 268 000
27	Bird Island	NW	40	36	144	43	GR	NC	0.2	1.22	2440	2200–2680
28	Trefoil Island	NW	40	38	144	41	P	C	80.26	0.87	698 262	427 706–810 626
29	Doughboys West	NW	40	40	144	40	NR	P	1	1.19	11 900	9900–13 900
30	Doughboys East	NW	40	40	144	40	NR	P	1	0.98	9800	7600–12 000
31	Maxies Point	NW	40	49	144	42	P	P	0.1		100	80–120
32	Mt Cameron West	NW	40	52	144	42	P	P	0.1		100	80–120
33	Green Point	NW	40	55	144	38	P	P	1		4000	3700–4300
34	Pavement Point	NW	40	56	144	38	CL	P	0.25		200	150–250
35	Woolnorth	NW	40	40	144	43	P	P	0.25		500	400–600

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
36	Sea-crow Islet	NW	40	37	144	44	CL	NC	0.1	0.50	175	150–200
37	Harbour Island	NW	40	39	144	44	CL	NC	2	0.57	2850	2700–3000
38	Stack Island	NW	40	36	144	46	GR	NC	1		2500	2000–3000
39	Dugay Islet	NW	40	36	144	47	CL	NC	0.1		175	150–200
40	Edwards Islet	NW	40	36	144	47	CL	NC	0.1		15	10–20
41	Penguin Islet	NW	40	36	144	49	NR	P	1.5	0.24	3600	1200–6000
42	Hunter Island, South	NW	40	37	144	47	CA	C	6		15 000	13 000–17 000
43	Hunter Island, West	NW	40	33	144	45	CA	P	15		60 000	55 000–65 000
44	Hunter Island, North	NW	40	25	144	48	CA	C	22.13	0.57	127 570	107 400–149 160
45	Three Hummock, Home	NW	40	27	144	51	NR	NC	1	0.20	2000	1500–2500
46	Three Hummock, Ranger	NW	40	24	144	53	NR	NC	10		55 000	45 000–65 000
47	Three Hummock, Mermaid	NW	40	24	144	58	NR	C	6.39	0.46	32 709	25 497–39 921
48	Three Hummock, South Paddock	NW	40	29	144	53	NR	C	20.88	0.34	68 015	54 288–87 696
49	Southwest Petrel Island	NW	40	34	144	56	GR	NC	0.1		45	40–50
50	Sandy Petrel Island	NW	40	34	144	56	GR	NC	0.81	1.01	8200	8000–8350
51	Stony Petrel Island	NW	40	34	144	56	GR	NC	0.1	0.40	400	300– 500
52	Little Stony Petrel	NW	40	34	144	55	GR	NC	3	0.33	10 000	8000–12 000
53	Walkers Island	NW	40	37	144	57	P	NC	27	0.71	191 700	175 500–207 900
54	Robbins Island, north	NW	40	43	145	03	P	NC	2.5		10 000	9 000–11 000
55	Robbins Island, southeast	NW	40	41	145	02	P	NC	6.1	0.57	33 066	18 804–47 328
56	Howie Island	NW	40	44	144	59	CL	P	0.25		500	400–600
57	Stanley Nut	NW	40	47	145	19	SR	P	2.69	0.56	13 276	7532–22 596
58	Black River	NW	40	48	145	19	P	P	0.1		100	80–120
59	Rocky Cape, Forwards Beach	NW	40	53	145	28	CL	P	0.1		100	75–125
60	Sisters Island	NW	40	54	145	35	CL	P	0.1		15	15–20
61	Table Cape	NW	40	57	145	43	P	P	0.1		100	80–120
62	Lillico Beach	NW	41	10	146	18	CL	P	0.5		500	400–600
63	Don Heads	NW	41	10	146	20	P	P	0.5		1000	800–1200
64	Point Sorell	NW	41	08	146	32	P	P	1.5	0.47	7050	6500–7550
65	East Sisters Island	NE	39	39	147	59	MR	NC	12.89	0.12	15 468	10 312–20 624
66	West Sisters Island	NE	39	42	147	55	MR	NC	7.725	0.64	49 440	43 260–55 620
67	Babel Island	NE	39	57	148	20	MR	C	380	0.75	2 857 600	2 394 000–3 306 000
68	Cat Island	NE	39	57	148	21	WS	P	20	0.64	128 000	104 000–152 000
69	Storehouse Island	NE	39	57	148	21	CL	NC	10	1.04	128 000	104 000–124 000
70	Little Green Island	NE	40	14	148	15	MR	NC	30	0.46	138 000	120 000–156 000
71	Fisher Island	NE	40	13	148	14	CA	P	0.1		120	100–140
72	Great Dog Island	NE	40	15	148	15	MR	C	170	0.56	952 000	816 000–1 080 800
73	Little Dog Island	NE	40	15	148	12	GRP	NC	40	0.46	184 000	152 000–216 000

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
74	Puncheon Island	NE	40	18	148	18	P	NC	4.05	0.93	37 665	34 425–40 905
75	Pelican Island	NE	40	18	148	17	CL	NC	2	1.28	25 600	23 200–28 000
76	Gull Island	NE	40	26	148	30	WS	P	0.1		40	30–50
77	Passage Island	NE	40	30	148	20	CL	NC	0.72	0.31	2230	1945–2520
78	Forsyth Island	NE	40	30	148	19	WS	P	1	0.64	6400	5000–7800
79	Rum Island	NE	40	30	148	04	SR	P	4.425	0.60	26 550	22 125–30 975
80	Preservation Island	NE	40	29	148	03	SR	P	5	0.42	21 500	19 000–23 000
81	Goose Island	NE	40	18	147	47	CA	P	10	0.56	56 000	31 000–81 000
82	Little Goose Island	NE	40	18	147	47	CA	P	0.1		25	20–30
83	Beagle Island	NE	40	20	147	55	NR	P	0.1		180	150–210
84	Little Badger Island	NE	40	18	147	55	NR	P	0.63	0.36	2270	1640–2900
85	Chappell Island	NE	40	18	147	56	NR	P	160	0.40	640 000	512 000–768 000
86	Oyster Rocks	NE	40	18	148	04	NR	P	0.1		10	5–15
87	Big Green Island	NE	40	11	147	59	NR	P	5	0.41	20 500	13 500–27 500
88	East Kangaroo Island	NE	40	11	147	54	NR	P	10	0.24	24 000	15 000–33 000
89	Mile Island	NE	40	08	147	55	WS	P	1	0.36	3600	2800–4400
90	Chalky Island	NE	40	06	147	53	WS	P	2.3	0.10	2300	430–4140
91	Little Chalky Island	NE	40	08	147	54	CL	NC	1	0.11	1100	100–2100
92	Prime Seal Island	NE	40	06	147	45	CL	NC	1.45	0.21	3025	1885–4205
93	Wybalenna Island	NE	40	02	147	51	WS	P	0.2	0.05	100	20–180
94	Settlement Point	NE	40	01	147	52	CL	P	2	0.33	6060	5400–7800
95	Bird Island	NE	40	01	147	52	CL	P	0.72	0.49	3530	2375–4680
96	South Pasco Island	NE	39	57	147	46	CL	NC	5	0.25	12 500	6500–18 500
97	Outer Mid Pasco Island	NE	39	57	147	46	CL	NC	2.5	0.51	12 750	9750–15 750
98	Inner Mid Pasco Island	NE	39	57	147	46	CL	NC	1	0.51	5100	2700–7500
99	North Pasco Island	NE	39	56	147	47	CL	NC	0.1		200	150–250
100	Roydon Island	NE	39	55	147	46	CL	NC	0.1		10	5–15
101	Marriot Reef	NE	39	54	147	52	CL	NC	0.122	0.66	1805	415–1200
102	Sentinel Island	NE	39	50	147	46	CL	NC	0.81	0.18	1460	810–2105
103	Little Island (Killercrankie)	NE	39	50	147	49	CL	NC	1.62	0.13	2105	1460 –2755
104	Swan Island	NE	40	44	148	06	P	P	1.43	0.56	8010	6865–9150
105	Little Swan Island	NE	40	44	148	05	CL	P	0.5	0.78	3900	3400–4400
106	Foster Islands	NE	40	44	147	58	NR	P	0.36	0.51	1835	1620–2050
107	Waterhouse Island	NE	40	48	147	38	P	P	2		7850	7200–8500
108	Ninth Island	NE	40	50	147	16	CLP	P	10	0.97	97 000	73 000–121 000
109	George Rocks	NE	40	55	148	20	NR	P	0.1		100	70–120
110	St Helens Island	E	41	02	148	21	CL	P	0.5	0.47	2350	1750–2950
111	Long Point	E	41	45	148	18	P	P	0.5		2500	2000–3000

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
112	The Nuggets	E	42	07	148	22	CL	P	0.1		55	50–60
113	Picnic Island	E	42	08	148	16	P	P	0.2	0.31	620	460–780
114	Waterloo Point	E	42	08	148	04	P	P	0.2		650	500–800
115	Cressy Beach	E	42	10	148	04	CL	P	1		2500	2000–3000
116	Refuge Island	E	42	11	148	16	SR	P	0.1	0.48	480	320 –640
117	Buxton Point	E	42	16	148	02	P	P	0.2		1000	800–1200
118	Taillefer Rocks	E	42	22	148	19	SR	P	0.45	0.17	785	335–1235
119	Ile des Phoques	E	42	25	148	10	NR	P	0.1		75	50–100
120	Ile du Nord	E	42	34	148	03	CL	P	0.4	0.86	3440	3040–3840
121	Lachlan Island	E	42	39	147	59	CL	P	1.5	0.37	5550	3750–7350
122	Maria Island, Point Lesueur	E	42	40	148	01	SR	P	0.41	0.42	1720	1150–2300
123	Maria Island, No Good Bay	E	42	43	148	04	SR	P	1	0.50	5000	4000–6000
124	Maria Island, Whalers Cove	E	42	40	148	07	SR	P	0.1		50	40–60
125	Hippolyte Rocks	SE	43	07	148	03	NR	P	0.1	1.00	1500	1000–2000
126	Lanterns	SE	43	08	148	00	CL	P	0.5		2100	2000–2200
127	Tasman Island	SE	43	14	148	00	CL	P	1.5		6000	3000–9000
128	Wedge Island	SE	43	08	147	40	CL	P	2	0.57	11 400	7800–15 400
129	Black Jack Point	SE	42	59	147	39	CL	P	0.1		400	300–500
130	Sloping Island	SE	42	57	147	38	NR	P	15	0.51	7650	6300–9000
131	Smooth Island	SE	42	57	147	47	P	P	0.86	0.80	6880	4125–9625
132	Fulham Island	SE	42	55	147	47	P	P	2.5	0.97	24 250	20 250–28 250
133	Carlton Bluff	SE	42	53	147	38	P	P	1		5000	4000–6000
134	Spectacle Island	SE	42	52	147	36	CL	P	2	0.42	8400	7600–9200
135	Cremorne	SE	42	58	147	42	P	P	1		3000	2000–4000
136	Clifton Bluff	SE	42	59	147	33	CL	P	3.3	0.57	18 810	17 820–19 800
137	Watsons Bluff	SE	43	01	147	32	P	P	2		6000	5000–7000
138	Betsey Island	SE	43	03	147	29	NR	P	20		150 000	130 000–170 000
139	Fort Direction	SE	43	03	147	25	CAP	P	7	0.59	4130	3850– 4410
140	Cape Queen Elizabeth	S	43	16	147	26	GR	P	9.25	0.47	43 475	26 825–60 125
141	Miles Beach	S	43	16	147	24	GR	P	0.1		400	300–500
142	Neck, Bruny Island	S	43	17	147	21	GR	P	5	0.38	19 000	15 000–23 500
143	Big Friars, Tasman Head	S	43	32	147	18	CL	P	10	1.00	100 000	80 000–120 000
144	Little Friars	S	43	31	147	17	CL	P	5	0.70	35 000	30 000–40 000
145	The Friars	S	43	33	147	18	CL	P	0.25	0.35	1890	1460–2320
146	Cloudy Bay	S	43	28	147	14	CL	P	0.5		500	300–700
147	Whalebone Point	S	43	27	147	14	CL	P	1.35	0.68	9180	7830–10530
148	Courts Island	S	43	30	147	08	CL	P	4	0.85	34 000	29 200–38 800
149	Pineapples	S	43	28	147	07	SR	P	3	0.50	15 000	13 000–17 000

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
150	Huon Island	S	43	18	147	08	P	P	0.25		400	300–500
151	Southport Island	S	43	28	147	00	CL	P	4.6	0.46	21 000	19 000–23 000
152	Actaeon Island	S	43	31	147	00	CL	P	4.6	0.54	25 000	23 000–27 000
153	Chicken Island	SW	43	34	146	36	SR	P	0.36	0.69	2485	2125–2845
154	Hen Island	SW	43	34	146	35	SR	P	2.13	0.40	8520	5540–11 500
155	Ile du Golfe	SW	43	34	146	31	SR	P	15	0.53	79 500	58 500–100 500
156	Louisa Island	SW	43	32	146	21	SR	P	12	1.06	127 200	69 600–184 800
157	East of Louisa Island	SW	43	32	146	22	SR	P	0.61	1.30	8600	4270–11 590
158	De Witt Island	SW	43	36	146	21	SR	P	0.48	0.54	3190	2710–3770
159	Flat Top Island	SW	43	38	146	23	SR	P	0.6	0.07	320	200–400
160	Round Top Island	SW	43	39	146	22	SR	P	2.58	0.87	22 445	17 800–27 090
161	Maatsuyker Island	SW	43	39	146	17	SR	P	100		800 000	750 000–850 000
162	Walker Island	SW	43	38	146	17	SR	P	10	1.07	117 700	95 700–139700
163	Needle Rocks	SW	43	40	146	16	SR	P	0.2		800	700–900
164	Flat Witch Island	SW	43	37	146	18	SR	P	30	0.99	297 000	243 000–351 000
165	Smoke Signal Hill islet	SW	43	32	146	10	SR	P	0.1		400	300–500
166	Island Bay #1	SW	43	28	146	00	SR	P	0.1		10	5–15
167	Island Bay # 2	SW	43	28	146	00	SR	P	0.1		175	150–200
168	Island Bay # 3	SW	43	28	146	00	SR	P	0.1		50	40–60
169	Island Bay # 4	SW	43	28	146	00	SR	P	4	0.52	20 800	18 400–23 200
170	Island Bay # 5	SW	43	28	146	00	SR	P	0.1		100	75– 125
171	Muttonbird (Flat) Island	SW	43	25	145	58	SR	P	40	1.01	404 000	372 000–436 000
172	Sugarloaf Rock	SW	43	25	145	56	SR	P	0.1	1.26	1134	630–1638
173	Wendar Island	SW	43	25	145	56	SR	P	0.2	0.50	1000	40–1960
174	Big Caroline Rock	SW	43	22	145	56	SR	P	1	1.47	14 700	11 100–18 300
175	Swainson Island	SW	43	22	145	56	SR	P	0.2	1.53	3060	2540–3580
176	Hay Island	SW	43	22	145	57	SR	P	1	1.53	14 320	11 890–16 755
177	Shanks Island	SW	43	21	145	57	SR	P	0.9	0.84	8232	5760–9360
178	Kathleen Island	SW	43	19	145	58	SR	P	5.338	1.93	103 025	94 485–111 565
179	Breaksea Island	SW	43	20	145	58	SR	P	0.5		1250	1000–1500
180	Main Breaksea Island	SW	43	20	145	58	SR	P	26.425	0.69	182330	161 195–203 475
181	North Breaksea Island	SW	43	19	145	58	SR	P	10	0.69	69 000	61 000–77 000
182	West Pyramid	SW	43	18	145	49	SR	P	1		2500	2000–3000
183	Trumpeter Island	SW	43	17	145	48	SR	P	3	1.22	36 600	31 800–41 400
184	Hobbs Island	SW	43	14	145	47	SR	P	8	1.18	94 400	75 200–113 600
185	Montgomery Rocks	W	42	47	145	23	CA	P	0.36	0.16	576	216–936
186	Leelinger Island	W	42	38	145	17	CA	P	0.72	0.84	6048	4610–7490
187	Hibbs Pyramid	W	42	36	145	16	SR	P	1.14	0.55	6270	4675–7865

Colony number	Name of colony	*Region	Latitude (S)		Longitude (E)		Status	Use	Area (ha)	Burrow density	Number burrows	Range
188	Trumpeter Rock, Cape Sorell	W	42	12	145	11	CA	NC	2.1		10 500	8000–13 000
189	Hannants Bight	W	42	11	145	11	CA	NC	0.6	0.52	3120	2500–3740
190	Prater Rock (Pilot Bay)	W	42	12	145	12	CA	NC	0.2		1000	800–1200
191	Entrance Island	W	42	13	145	13	CA	P	0.4	0.29	1565	270–2860
192	Ocean Beach	W	42	10	145	16	CL	P	2.1	0.82	17 220	10 710–23 730
193	Little Henty	W	41	58	145	12	CL	P	0.1		50	40–60
194	Trial Harbour	W	41	56	145	09	CL	P	2	0.44	8800	8200–9400
195	Sandy Cape	W	41	24	144	46	CL	P	0.1		100	50–150
196	Craggy Island	BS	39	41	147	41	CL	P	0.1		500	400–600
197	Kent Group, North East Island	BS	39	27	147	23	CL	P	10	0.46	46 000	30 000–62 000
198	Kent Group, South West Island	BS	39	31	147	07	CL	P	8	0.62	49 600	38 400–60 800
199	Hogan Group, Hogan Island	BS	39	14	146	59	CL	P	2.85	0.52	14 820	11 970–17 670
200	Hogan Group, Long Islet	BS	39	12	147	00	CL	P	1	0.37	3700	1900–5500
201	Hogan Group, East Islet	BS	39	13	147	01	CL	P	1.29	0.35	4515	2965–6065
202	Hogan Group, Round Islet	BS	39	13	146	59	CL	P	0.1		175	150–200
203	Hogan Group, Twin Islets	BS	39	12	146	59	CL	P	0.1		55	50–60
204	Cone Islet	BS	39	30	146	40	CL	P	0.1		85	70–100
205	Devils Tower	BS	39	23	146	45	CL	P	0.1		400	300–500
206	Curtis Island	BS	39	28	146	39	NR	P	50	0.78	390 000	320 000–460 000
207	East Moncoeur	BS	39	14	146	32	CL	P	5.58	0.74	41 290	31 250–51 335
208	West Moncoeur	BS	39	14	146	32	NR	P	0.1		100	75–125
209	Rodondo Island	BS	39	14	146	23	NR	P	10	0.77	77 000	53 000–101 000

*Region: BS Bass Strait, E east, NE northeast, NW northwest, S south, SE southeast, SW southwest,. W west; Status: CA conservation area, CAP conservation area and private, CL crown land, CLP crown land and private, GR game reserve, GRP game reserve and private, MR muttonbird reserve, NR nature reserve, P private, SR state reserve, WS wildlife sancuary; Use: C commercial, NC non-commercial, P prohibited; Range: ±2SE at 95% confidence limits.