

## The recovering population of the Chatham Island oystercatcher (*Haematopus chathamensis*)

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**Abstract** Historical records of the Chatham Island oystercatcher (*Haematopus chathamensis*) suggested a sparse and small population. In 1970, there may have been as few as 52 birds, but this apparently increased to 112 in 1987 and 144 in 1998. Intensive predator control and nest and habitat management has since boosted productivity and recruitment of oystercatchers along the northern Chatham Island (Rekohu) coastline and resulted in a rapid increase in total numbers; by 2004 there were 316–340 birds, including 89 pairs. In 2005–2006 management effort was shifted to Pitt Island (Rangiauria) in the southern range of the species. Although low productivity contributed to the total population levelling off at about 313–351 birds in 2006, ongoing recruitment of young birds resulted in an increase to 109 pairs. Currently, there are fewer than 250 mature individuals and therefore the species remains a high priority for conservation management.

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### INTRODUCTION

The Chatham Island oystercatcher (*Haematopus chathamensis*) is endemic to the Chatham Islands (Baker 1973; Turbott 1990; Marchant & Higgins 1993), which lie about 800 km east of mainland New Zealand (44°S 176°30'W). Birds breed on the coasts of four islands: Chatham (Rekohu), Pitt (Rangiauria), Rangatira (South East) and Mangere. Birds have also been reported on Star Keys (Davis 1988). Breeding adults are generally sedentary and defend territories throughout the year on rocky, boulder and sandy coasts or in a mixture of these habitat types. They also sometimes use adjacent farmland to feed, especially in damp areas and during winter (*pers. obs.*; Schmechel & Paterson 2005).

The Chatham Island oystercatcher is an endangered species with a high risk of extinction because of its small population (Birdlife International 2007; IUCN 2006). The species is ranked by New Zealand's Department of Conservation (DOC) as 'nationally critical', making it a high priority for conservation management (Molloy *et al.* 2002; Hitchmough *et al.* 2007). Population estimates ranged as low as 50 birds in 1970 (Baker 1973) but the most definitive coastal surveys found 110 birds and 44 breeding pairs in 1987 (Davis 1988) and then 142 adults and 34–41 breeding pairs in 1998

(Schmechel & O'Connor 1999). Although annual adult (88%) and juvenile (48–68%) survival in the 1970s–80s was comparable to other oystercatcher species, productivity was low (0.22 fledged young/pair annually) and a population decline to extinction was predicted in 50–70 years (Davis 1988).

In an effort to boost oystercatcher productivity and numbers, a 16 km stretch of northern Chatham Island coast was intensively managed from 1998 to 2004. This included predator trapping, relocation of nests above storm tides, and the exclusion of farm stock from nests. Further censuses were conducted in 1999–2006 to measure the response of the oystercatcher population. Population changes as a result of these management measures are reported in this paper.

### METHODS

Years in this paper refer to the breeding season (Oct–Feb); thus, 2004 refers to the 2004/05 breeding season.

Previous population estimates were compiled from published and unpublished reports. Partial censuses, or surveys of unknown accuracy, occurred in 1970 (Baker 1973), 1986 (Best 1987), 1988 (Davis 1989), 1991 (Page 1992) and 1995 (Schmechel & O'Connor 1999). Additional records of birds on Rangatira were compiled from Fleming (1939) and Merton & Bell (1975). More comprehensive censuses

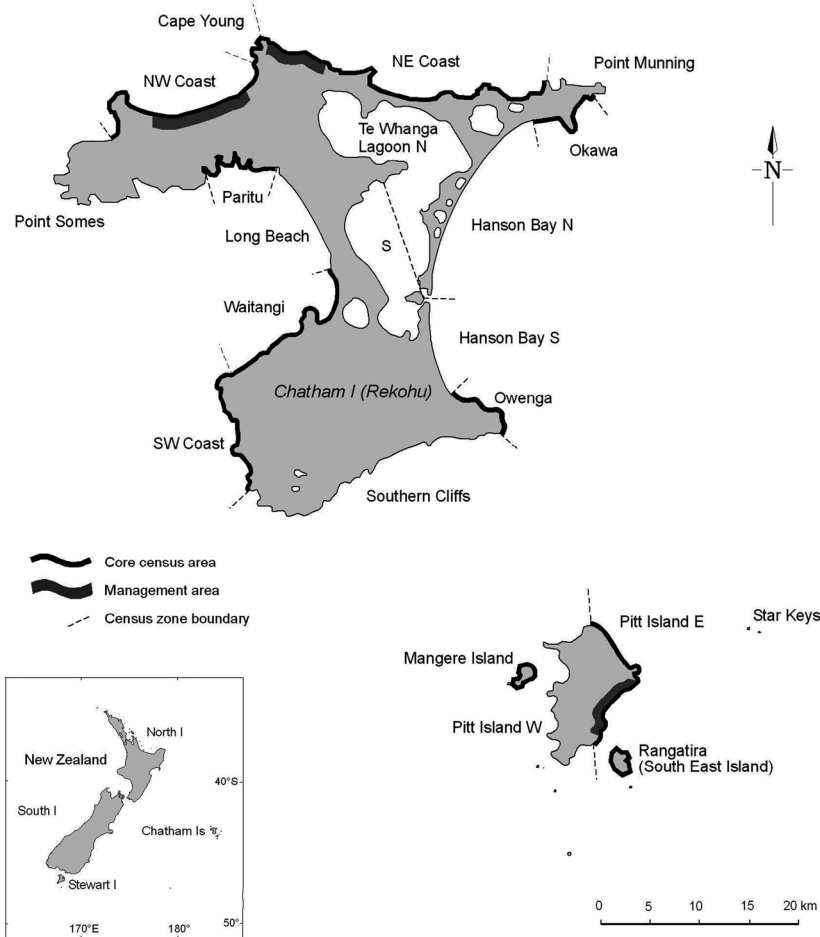


Fig. 1 Chatham Island oystercatcher census areas, 1999-2006.

of all islands were conducted in 1987 (Davis 1988) and 1998 (Schmechel 1999; Schmechel & O'Connor 1999). Some re-interpretation of raw data presented in these reports was made here. For example, multiple sightings of individuals in 1987 were used to adjust the total count and colour-banded 1-year-olds were reassigned from breeder to non-breeder status, as birds do not breed until at least 2 years of age. The locations of breeding pairs in 1999 were used to re-interpret several associations of 2 birds of unknown status in 1998.

During 1999–2004, an annual census of Chatham Island oystercatcher was conducted, usually in the second week of December, following similar methodology and area boundaries used by Schmechel (1999) and Schmechel & O'Connor (1999). Schmechel (1999) identified 8 priority 'a' breeding areas for monitoring (northwest coast, northeast coast, Owenga, southwest coast, Paritu, east Pitt Island, Mangere and Rangatira), 7 priority 'b' areas (Cape Young, Okawa, north lagoon, southern cliffs, Waitangi, Point Somes, west Pitt

Island) with previous sightings or difficult access, and priority 'c' areas (Point Munning, south lagoon, north and south Hansen Bay and Long Beach) with no previous sightings of oystercatchers. These priority areas were adjusted for use during 1999–2006 after it became apparent that the lower priority areas should receive more survey effort so that the spread and increase of the population could be documented. As a result, 11 core census areas (Fig. 1), including all 8 priority 'a' areas (Schmechel 1999), and Cape Young, Okawa and Waitangi, were fully surveyed in most years. The 11 core areas comprised approximately 167 km of coast and lagoon (36% of the total Chatham Islands coastline) and 96% of the oystercatcher territories that were found in 1998 (Schmechel & O'Connor 1999). Nine other lower priority areas (Fig. 1) of outer coastline and Te Whanga Lagoon were surveyed in some years. During 1999–2001, approximately 55–69% of coastline and lagoon was surveyed each year, but as the population expanded into new areas a greater proportion (76–96%) of coastline was surveyed in

**Table 1** Population estimates of Chatham Island oystercatchers during years when surveys were incomplete or were of unknown quality (Baker 1973; Best 1987; Davis 1989; Page 1992; Schmechel & O'Connor 1999)

	1970	1986	1988	1991	1995
Census		60	77	71	97
Minimum estimated number of birds	52	73	90	79	100–120
Breeders + territory holders	48	64	76	68	

2002–2004. During 2005–2006, more limited surveys (52–55% of coastline) included 10–11 of the core census areas (D. Williams, DOC, *pers. comm.* 2005; A. Leseberg, DOC, *pers. comm.* 2006).

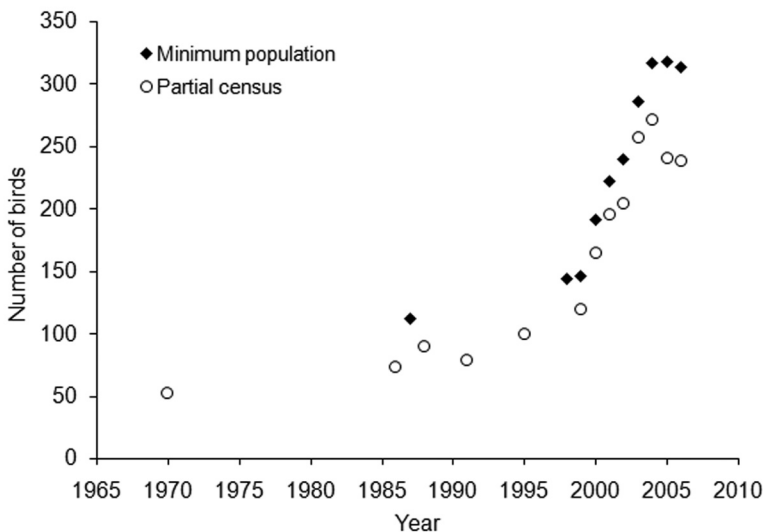
Oystercatchers were counted from 4-wheel motorbikes or on foot (or horseback for some years at Pitt Island). Areas with difficult access, or with potential oystercatcher habitat below cliffs, were searched from vantage points using binoculars or telescope or by boat (mainly the southern cliffs and western Pitt Island) and partial visits on foot. Whereas 35 people surveyed over a 6-day period in 1998 (Schmechel & O'Connor 1999), a smaller number of usually experienced oystercatcher observers conducted censuses in 1999–2004. Where possible, the same observers surveyed the same shoreline each year, and used the same method of travel. New teams conducted the censuses of 2005–2006.

Pairs of birds were categorised as: breeders, if nests or chicks were found; suspected breeders, if they showed the characteristic furtive behaviour

of birds that have eggs or loud and aggressive behaviour normally used by birds defending chicks; or territorial, if they were apparently defending the area. Breeding was confirmed in some cases from subsequent monitoring of pairs during the season. For example, a territorial pair present in the same area during the season was re-categorised as a breeding pair if a nest was found after the census. Note that the 'floating pair' category used by Schmechel & O'Connor (1999) was not used – these birds were included in the general floater category. Floaters included all apparently non-territorial birds (non-breeding adults and immature birds).

Four hundred and seventy-two individual Chatham Island oystercatchers, including 117 adults and 355 chicks, were marked with uniquely numbered metal bands between 1970 and 2004. During 1998–2004, many breeding birds throughout the Chatham Islands were banded (or rebanded) with unique combinations of plastic colour bands. Similarly, as many chicks as possible were colour-banded each year in 1998–2004. Sightings, including breeding activity and location, of colour-banded birds were compiled each season.

The number of sightings of breeders and floaters additional to the Dec census varied greatly between years and areas. During an intensive research period (1999–2001) in northern Chatham Island, daily records were kept for managed areas (Wharekauri and Maunganui; Fig. 1) and daily-weekly records for unmanaged areas from Oct to Feb. During 2002–2004, daily recording continued at managed areas, but the frequency of visits to unmanaged areas decreased to approximately once every 1–4 weeks. Elsewhere on Chatham Island and the three other islands in 1999–2004, and all islands



**Fig 2** The number of Chatham Island oystercatchers counted during partial censuses (open circles) and minimum population estimates (solid diamonds), 1970–2006.

**Table 2** Population estimates of Chatham Island oystercatcher during years of comprehensive surveys (Davis 1988; Schmechel & O'Connor 1999; this study).

	1987	1998	1999	2000	2001	2002	2003	2004	2005	2006
Proportion of coast and lagoon covered (%)	83	98	55	69	62	76	91	96	55	52
Census <sup>A</sup>	103	142	117	159	193	199	246	257	223	238
Multiple count <sup>B</sup>	12	0	2	6	2	5	11	14	18	13
Seen later <sup>C</sup>	9	2	15	20	21	31	33	49	62	41
Not surveyed <sup>D</sup>	0	0	14	12	8	9	7	10	32	34
Prop. colours counted <sup>E</sup>	0.97	0.76	0.67	0.84	0.86	0.80	0.85	0.78	0.66	0.75
Prop. colours counted <sup>F</sup>	0.97	0.88	0.93	0.98	0.99	0.98	0.99	0.98	0.91	0.91
Census sightings <sup>A+B</sup>	115	142	119	165	195	204	257	271	241	251
Minimum population <sup>A+C+D</sup>	112	144	146	191	222	239	286	316	317	313
Maximum population estimate <sup>(A/F)+D</sup>	107	186	190	200	233	257	298	341	371	351
Breeders + territory holders <sup>G</sup>	84	98	106	117	137	152	175	179	185	219
Floater <sup>H</sup>	28	46	40	74	85	87	111	137	132	94

<sup>A</sup> number of birds counted during the census, not including multiple sightings of individuals

<sup>B</sup> multiple sightings of birds (identified by colour bands or birds flying ahead of the surveyor)

<sup>C</sup> other territory holders or colour-banded individuals seen during the remainder of the season

<sup>D</sup> an estimate of the number of birds in areas not surveyed (based on the most recent survey)

<sup>E</sup> the proportion of colour-banded birds known to be alive and seen during the census (22 individuals were assumed to be alive in 2006 as they were seen in 2005)

<sup>F</sup> the proportion of colour-banded birds that were seen at all times during the season

<sup>G</sup> breeders and territory holders (minimum population)

<sup>H</sup> floaters (or non-breeders) without territories (minimum population)

in 2005–2006, opportunistic visits were made to core breeding areas to record breeding activity and record colour band combinations of floaters. This occurred generally 1–3 times per season.

Population estimates were made for the years of more comprehensive censuses (1987, 1998–2006). The census count (census<sup>A</sup> in Table 2) was the number of birds counted during the main survey, but not including any multiple sightings of marked individuals, or birds that were seen later in the season. The total number of birds seen during the census (census sightings<sup>A+B</sup> in Table 2) included the known multiple sightings of marked individuals, or birds that were seen flying between neighbouring areas. The rationale for this was that in years when there were few marked individuals (e.g. 1998), it was less likely that multiple sightings would be noted, and thus the total count would be more comparable across years. Minimum population estimates were based on the census count plus any birds that were missed during the census, but seen later in the season, and an adjustment for birds in un-surveyed areas (as found in a previous survey). Maximum population estimates used the proportion of colour-banded birds seen during the

census compared with the number known to be alive to adjust the census counts plus an adjustment for the un-surveyed areas.

## RESULTS

### Population estimates

Population estimates are provided in Tables 1 & 2 and Figs 2 & 3. The first published estimate of the total population size of the Chatham Island oystercatcher was about 50 birds in 1970 (Baker 1973). This was based mainly on a trip to Rangatira, where there were 23 birds, supplemented with previous sightings at other localities between 1957–1970 (6 birds on Mangere, 5 on Pitt and 18 on Chatham Island; Lindsay *et al.* (1959) and data supplied by Brian Bell, R.A. Stanley and Don Merton (as listed in Davis 1988)).

In 1986, Best (1987) conducted a partial census of Chatham Island, which included the most likely oystercatcher areas, supplemented by reported sightings elsewhere, and estimated a total of 65–75 birds (33–43 on Chatham, 8 on Pitt, 20 on Rangatira and 4 on Mangere) (Best 1987). Subsequent surveys estimated 92–98 birds in 1988 (Davis 1989), 71–79 birds in 1991 (Page 1992) and

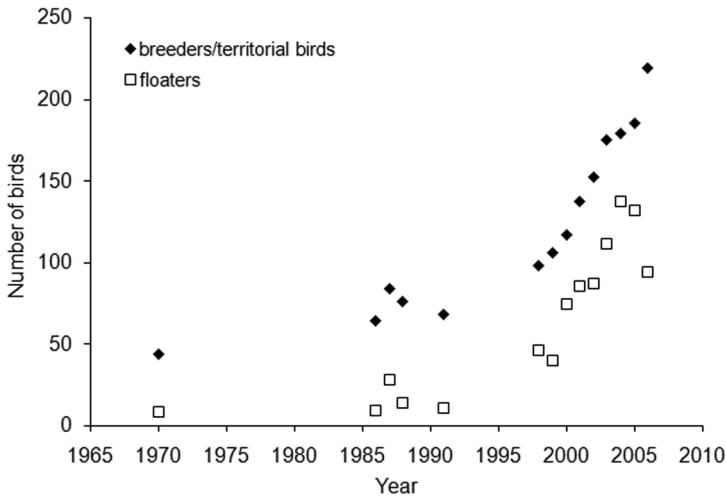


Fig 3 Minimum population estimates of breeders/territory holders (solid diamonds) and floaters (non-breeders) (open squares) of Chatham Island oyster-catcher, 1970–2006.

97 birds in 1995 (Schmechel & O'Connor 1999). The above estimates have not been considered in the main analysis as they may have underestimated numbers owing to incomplete coverage of areas, inexperienced observers, the methods used or the timing (Schmechel & O'Connor 1999). However, they suggested a population of at least 50–120 birds (Table 1).

The surveys in 1987 and 1998–2006 provide the most reliable population estimate (Table 2, Figs 2 & 3) as these covered the coastline more comprehensively and/or combined additional observations at other times of the year, including those of marked individuals. The total count from surveys with maximum coverage of the coast (>80% of coastline and lagoon shore) showed an increase from 115 birds (including multiple sightings) in 1987 to 142 birds in 1998 and 271 birds in 2004 (census sightings<sup>A+B</sup> in Table 2).

The number and proportion of colour-banded individuals in the population varied from 30 (27%) in 1987, 17 (12%) in 1998, 30 (20.5%) in 1999 to a peak of 245 (77%) in 2005. At least 82% of the census sightings in 2004 were of marked (metal- and/or colour-banded) birds, which made identification of territory holders and individuals accurate. In contrast, floaters were mobile and often occupied areas that were not part of the core census zones. Additionally, failed breeders were occasionally absent from their territories. Therefore, only 67–86% of colour-banded birds were seen during censuses in 1999–2006 (Table 2). The lower proportions generally occurred when censuses covered only half the total coastline and lagoon shore (Table 2). However, monitoring of breeding areas during the remainder of the breeding seasons increased the proportion (90–99%) of marked birds that were seen

(compared to the number retrospectively known to be alive). Only 1–5 colour-marked birds per year were not seen during the year in 1999–2004, but this increased to at least 22 individuals per year in 2005–2006. The proportion of colour-banded individuals counted during censuses was used to estimate the maximum population (Table 2) on the assumption that unmarked birds would escape detection equally as much as marked birds. This maximum population estimate increased from 107 birds in 1987 to 186 birds in 1998, 341 birds in 2004 and 351 birds in 2006 (Table 2). The lower coverage of the shoreline in the census, an expanding breeding range, less monitoring during the season and increasing uncertainty about the total number of marked individuals still alive all contributed to the minimum and maximum estimates for 2005–2006 being less reliable than in earlier years.

The minimum population estimates used the census count (minus multiple sightings of individuals), supplemented with sightings of birds later that season, plus an adjustment for areas not surveyed (Table 2). These suggest the population increased 29% from 112 to 144 birds over the 11 years between 1987 and 1998. Over the next 6 years, the increase was 121% from 144 to 316 birds (Table 2). This more than doubling of the population occurred during the period of intensive management in northern Chatham Island. Numbers apparently levelled off at 313 birds in 2005–2006 as management had ceased and fewer juveniles were being produced. However, the smaller coverage of coastline during the census and infrequent monitoring of breeding areas in the latter 2 years make the estimates less reliable. The population growth rate, calculated from regressions of the logarithms of the minimum population (Table 3),

**Table 4** Minimum population estimates of Chatham Island oystercatcher in northern Chatham Island (northwest coast, Cape Young, northeast coast, Okawa and Paritu; Fig. 1), other parts of Chatham Island, and other islands (Pitt, Rangatira and Mangere).

	1970	1987	1998	1999	2000	2001	2002	2003	2004	2005	2006
Northern Chatham Island	10	32	68	79	108	136	141	186	189	203	194
Other Chatham Island	8	32	27	20	22	29	38	45	64	58	60
Other Islands	34	48	49	47	61	57	60	55	63	56	59
Total	52	112	144	146	191	222	239	286	316	317	313

was 2.3% before 1998, 15.1% in 1998–2004 and –0.5% in the next 2 years.

### Breeding population

There may have been as few as 24 breeding pairs in 1970 (as interpreted in Best 1987, Davis 1988), although since this was a composite of sightings from 1957–1970 (Baker 1973) the estimate is not strictly comparable with later censuses. The number of breeding pairs increased from 42 in 1987 (two of the 44 pairs estimated by Davis 1988 included 1-year-old birds which were too young to breed), to 49 in 1998 (in addition to the 34–41 pairs estimated by Schmechel & O'Connor (1999) there were several associations of two birds at localities that had breeding pairs in 1999), to 89 in 2004 and then 109 in 2006. Whereas the population growth rate of breeding birds was 2.0% before 1998, it increased to 11.6% in 1998–2004 and remained high over the next 2 years (Table 3).

The minimum number and proportion of non-breeders (floaters) in the population increased from 28 (25%) in 1987 to a peak of 137 (43%) in 2004. A subsequent decrease to 94 (30%) in 2006 occurred as young birds entered the breeding population but fewer juveniles were being produced. Consequently the growth rate of the non-breeder component of

the population was 21.7% in 1998–2004, but became negative (–17.2%) over the next 2 years (Table 3).

### Distribution

The distribution of oystercatchers in the Chatham Islands has changed from a southern to a northern dominance since 1970. At that time, 65% of the population was found on the southern three islands (Pitt, Mangere and Rangatira) and 35% on Chatham Island (Table 4). By 2006 this had reversed with 81% of the population on Chatham Island (62% in northern core census areas) and only 19% on the southern islands (Table 4). The distribution of pairs (confirmed breeders, suspected breeders and territorial) in 2006 is shown in Fig. 4. Supplementary information is included for areas not surveyed in 2006 (part of the Matarakau and Waitangi coasts and parts of Chatham Island's southwest coast in 2005 and southern cliffs in earlier years).

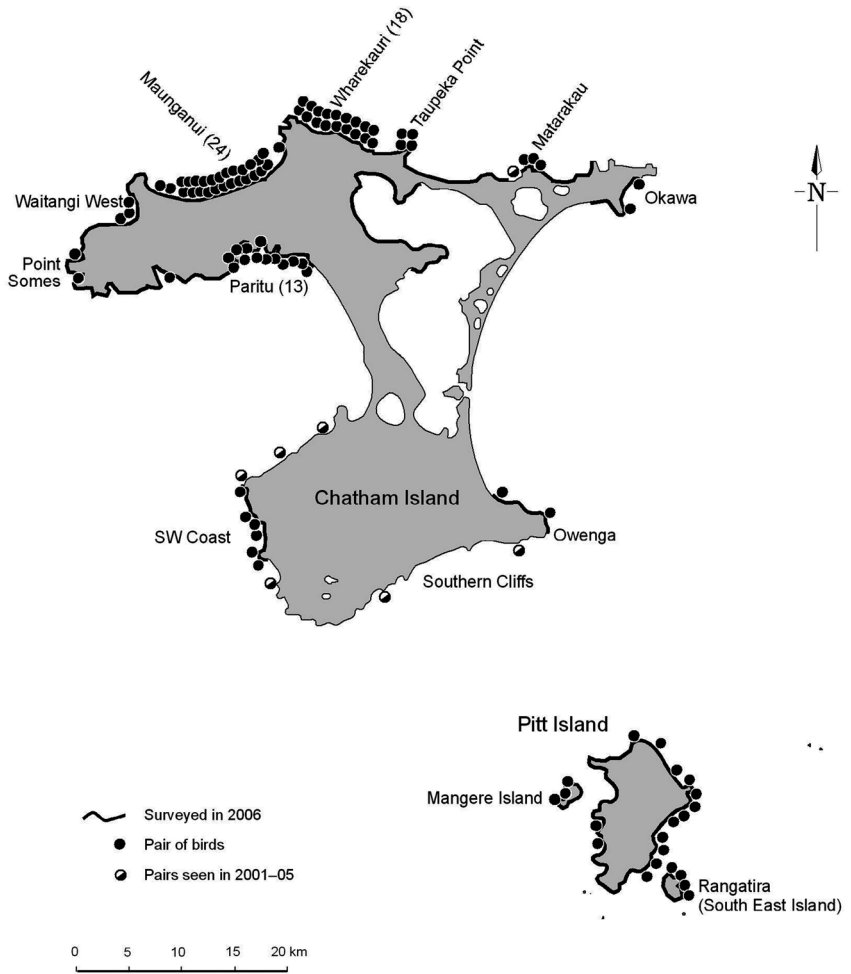
Although some expansion in the distribution and number of pairs occurred in northern Chatham Island in 1970–1998, this greatly accelerated after 1998 as new breeding pairs and non-breeders were produced from the managed areas at Maunganui and Wharekauri. On this combined 16 km of coastline, only 2 pairs were reported in 1970, 11 pairs in 1987, 16 in 1998, 38 in 2004 and 42 in 2006 (Fig. 5). At five other breeding areas of northern Chatham Island (Waitangi West, Paritu, Taupeka, Matarakau and Okawa), there were 2 or 3 pairs in 1970, 2 in 1987, 11 in 1998, 18 in 2004 and 26 in 2006.

On the remainder of Chatham Island, numbers apparently decreased between 1987 and 1999 but increased to 58–73 birds by 2004–2006 (Table 4), largely as a result of larger numbers of non-breeding floaters visiting the areas. At southern Chatham Island areas (southwest coast, southern cliffs and Owenga,) there were 3 pairs in 1970, 11 in 1987, 7 in 1998 and 10–12 pairs in 2004–2006. The recent increase was mainly on the southwest coast. Uncertainty remains about some new pairings on Waitangi coast and Point Somes as these have yet to be observed in consecutive years. The number of pairs may be slightly underestimated on the southern cliffs coastline, as this area was difficult

**Table 3** Population growth rate estimates from regressions of logarithms of minimum population estimates (Tables 1 and 2) between 1987–1998, 1998–2004 and 2004–2006 (numbers over 1.0 indicate a growing population and less than 1.0 indicate a decreasing population)

	1987– 1998	1998– 2004	2004– 2006
Total	1.023	1.151	0.995
Breeder/territory holders	1.020	1.116	1.106
Floaters	1.031	1.217	0.828
Northern Chatham Island	1.071	1.197	1.013
Other Chatham Island	0.985	1.185	0.968
Other islands	1.002	1.038	0.968

**Fig 4** Distribution of Chatham Island oystercatcher pairs in 2006, supplemented with data from areas surveyed in earlier years (dark line along coastline). Solid circles are pairs of birds, half-filled circles are pairs seen in 2001–2005.

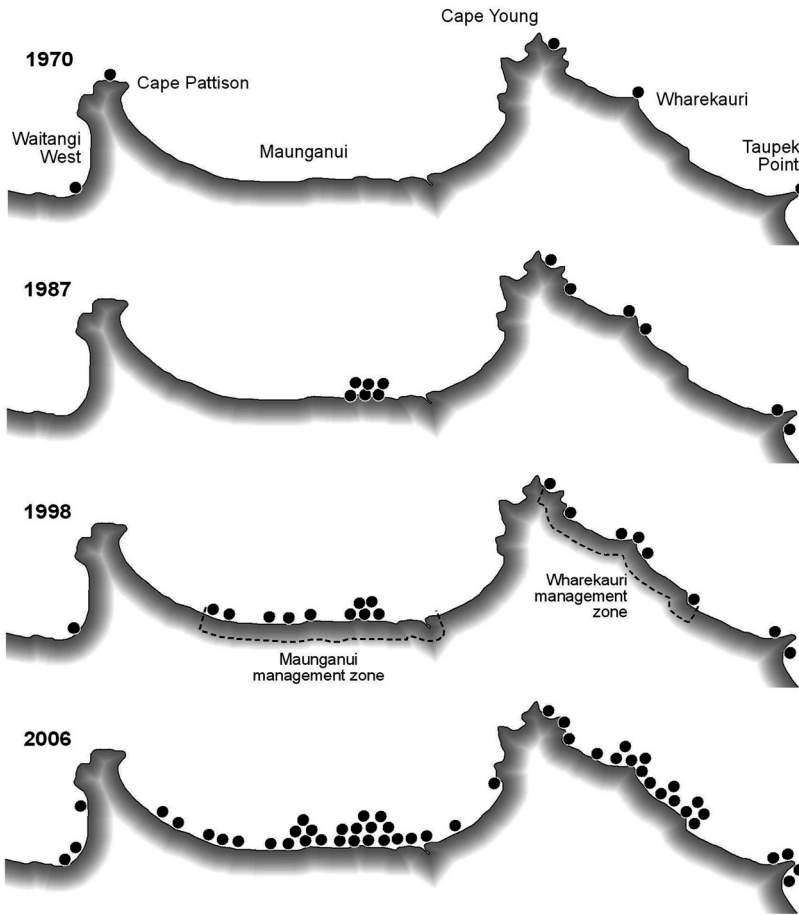


to access and was not surveyed as often or as effectively as other areas.

Collectively, the offshore islands population increased from 34 birds in 1970, to 47–48 in 1987–1999 and 55–63 in 2000–2006 (Table 4); however, the trajectories have been different at the individual islands. There were probably only 2 pairs on Pitt Island in 1970, 8 in 1987, 10 in 1998 and 13–15 pairs in 2004–2006. The number of pairs on the western side of the island may be underestimated because the cliff terrain makes surveying difficult. At Rangatira, there were only 3 pairs in 1937, but numbers increased to a peak of 11–13 pairs (up to 28 birds) in 1970–1977, before gradually declining to 3–4 pairs in 2004–2006 (Fig. 6). In most cases, the decline was a result of established birds disappearing and not being replaced, rather than moving to nearby Pitt Island. Mangere Island had 1 pair in 1961, but from 1968–2006 there were 2–3 pairs.

**DISCUSSION**

My review of the population status of the Chatham Island oystercatcher suggests this endangered species has undergone a period of recovery since 1987, when the first reliable census was conducted. At that time, the population was a little over 100 birds, but by 2006 this had increased 3 times to over 300 oystercatchers, resulting in increased breeding density and expansion to other suitable habitat available throughout the island group. Most of this increase occurred during a period of intensive management during 1998–2004, especially the control of introduced predators. As a result, the status of the Chatham Island oystercatcher is less precarious than it was a few decades ago, although the small population size and restricted range of the species still means it is vulnerable to extinction.



**Fig 5** Distribution of Chatham Island oystercatcher pairs (solid circles) in part of northern Chatham Island 1970–2006. 1970 data were a compilation of sightings from 1959–1970, whereas the other years were full censuses of the coastline.

### Historical records

Historical records of the Chatham Island oystercatcher suggest a sparse and small population. In the 1860s, it was 'not common and usually found on sandy beaches' (Travers & Travers 1872). In the 1930s, it was 'not particularly abundant' but had a range that was broadly similar to that found today, being '...widely distributed on the rocky shores near Kaingaroa, and other northern areas, and from Ouenga (sic) to the Tuku in the south. It is present also on Pitt, Mangare (sic) and South East Islands. It is seldom, if ever, seen on sandy shores...' (Fleming 1939). In the 1950s, usually pairs or a few oystercatchers were noted at a small number of localities on the four islands of the Chatham Islands (Bell 1955; Dawson 1955; Lindsay *et al.* 1959).

By 1970, the small population of about 50 birds was centred on Rangatira and Mangere Islands (Baker 1973), and including Pitt Island, 65% of the total was found on the smaller southern islands. Baker (1973) noted that the oystercatcher '... tends to occur in rocky habitats, but does feed on some

sandy beaches on Chatham and Pitt Islands'. However, because the census included old records from 1957–1970 on Chatham and Pitt Islands, and more observation effort probably occurred on Rangatira and Mangere, the total of 24 pairs and a few singles was a conservative estimate (Baker 1973; Best 1987; Davis 1988).

The small population of the Chatham Island oystercatcher was undoubtedly influenced by a combination of hunting, habitat destruction and introduced predators, as these factors have been major causes of extinction and decline of many New Zealand species.

### Hunting of oystercatchers

Oystercatcher bones have been found in dune deposits and middens (Millener 1990), indicating that the birds were hunted once Moriori arrived on the Chatham Islands 500 years ago. About 14 species of birds are believed to have gone extinct after Moriori colonised the islands and a further seven species after Europeans and Maori arrived in 1791





Fig 6 Number of breeders/territorial holders (solid diamonds) and total number of birds (open diamonds) estimated on Rangatira Island 1937–2006.

and 1835, respectively (Aikman & Miskelly 2004). The increasing rarity of birds attracted professional bird collectors hoping to obtain specimens to send to museums and private collectors (Aikman & Miskelly 2004). For example, an oystercatcher specimen held at Te Papa Tongarewa, Museum of New Zealand, was collected from Pitt Island in 1871 (Falla 1939) and 10 specimens were sent to Tring Museum in 1890 (Hartert 1927). This type of collecting in the late 1800s may have had a significant impact on the small oystercatcher population.

Shooting of oystercatchers on mainland New Zealand apparently severely depleted the populations there, especially of South Island pied oystercatchers (*Haematopus ostralegus finschi*), as they were considered a choice table bird (Baker 1973). Formal protection of shorebirds in 1940 resulted in a spectacular population recovery of South Island pied oystercatchers (Baker 1973; Heather & Robertson 2005; Dowding & Murphy 2001). Whether hunting of oystercatchers continued into the 20<sup>th</sup> century on the Chatham Islands is unrecorded, however it is likely to have followed the trend shown by human exploitation of seabirds, which waned on the Chatham Islands after the early 1900s (Bell & Robertson 1994).

### Habitat destruction

Farming of cattle and sheep on Chatham Island began in the 1840s–1850s and by 1901 there were 60,000 sheep and much of the forest had been burnt and cleared (Butler & Merton 1992), particularly in coastal areas (Bell & Robertson 1994). By 1901, the foredunes in northern Chatham Island still retained their natural form of low mounds and ridges which were sparsely vegetated with herbs and grasses but were being heavily modified by

grazing and trampling by farm animals (Cockayne 1902). The dunes became unstable and marram grass (*Ammophila arenaria*) was introduced in the early 1900s to bind the sand. Unfortunately, the marram was even more effective at stabilising dunes than native plants and this had the unintended side effect of limiting nesting opportunities for oystercatchers. The narrow beaches created by the heavily vegetated dunes on the sandy beaches of northern Chatham Island and eastern Pitt Island forced birds to nest close to the high tide mark. This increased the incidence of nests being washed away by high tides and storm waves (Best 1987; Aikman *et al.* 2001; Schmechel 2001); for example 48% of eggs were washed away in 1994–1997 (Schmechel & Paterson 2005). Although predators caused most egg failures of nests filmed over 3 years (1999–2001), during years of high storm frequency (e.g. 1998, 1999 and 2004), 40–50% of egg losses were caused by the sea (Moore *et al.* 2001; unpubl. data). The use of marram to stabilise dunes has caused similar problems for hooded plovers (*Thinornis rubricollis*) in Australia (Park 1994) and Western snowy plover (*Charadrius alexandrinus*) in the United States (U.S. Fish & Wildlife Service 2001).

### Introduced predators and farm animals

Introduced predators have been the main agents of decline of New Zealand shorebirds, driving at least five taxa (including the Chatham Island oystercatcher) to fewer than 150 individuals (Dowding & Murphy 2001; Dowding 2005). Humans introduced three species of rats (*Rattus exulans*, *R. norvegicus* and *R. rattus*), mice (*Mus musculus*), cats (*Felis catus*), possums (*Trichosaurus vulpecula*), pigs (*Sus scrofa*), sheep (*Ovis aries*), cattle (*Bos taurus*) and a flightless rail, the weka (*Gallirallus australis hectori*)

to the Chatham Islands. Most have had negative effects on native wildlife from the early 1800s, soon after the arrival of Europeans. Native bird populations were eliminated or severely reduced on the main island, although some species such as the Chatham Island taiko (*Pterodroma magentae*) held on in critically low numbers (Bell & Robertson 1994). The lack of introduced predators on Mangere and Rangatira Islands created havens for several highly endangered species (Butler & Merton 1992), including the oystercatcher. Although cats reached Mangere by 1900 and eliminated at least 12 bird species, they were later exterminated by shepherds (Aikman & Miskelly 2004).

Although the Chatham Island oystercatcher survived on the inhabited Chatham and Pitt Islands, predation by introduced animals was thought to be a major cause of low productivity and the small population (Best 1987; Davis 1988; Aikman *et al.* 2001; Schmechel 2001). Video monitoring of oystercatcher nests in 1999–2001 confirmed that introduced predators caused most egg failures. Over 3 seasons, at areas where predators were not controlled, 17 nest failures were captured on film and 13 (76%) were caused by cats, 3 by weka, and 1 by a sheep trampling eggs. At sites where predators were controlled, 2 failures were observed on film: one caused by a red-billed gull (*Larus novaehollandiae scopulinus*) and the other by the sea washing away the eggs (Moore *et al.* 2001; unpubl. data). Cats were not only a problem for the survival of eggs but also chicks and adults. Corpses of adult oystercatchers have been occasionally found that were probably killed by cats (M. Thorsen, DOC, *pers. comm.* 2000; M. Ogle, DOC, *pers. comm.* 2002; Dowding & Williams 2007). Other known introduced predators include domestic dogs (*Canis lupus familiaris*), and on Chatham and Pitt islands it is likely that pigs, possums and cattle also destroy nests. Natural predators include brown skuas (*Catharacta skua lonnbergi*) and southern black-backed gulls (*L. dominicanus*), particularly on Mangere and Rangatira (Aikman *et al.* 2001).

### Island nature reserves

Mangere and Rangatira were gazetted as Nature Reserves in the 1950s; the last sheep were removed in the 1960s and concerted efforts began to save the remaining bird fauna (Anon. 1996; Aikman & Miskelly 2004). In 1970, Merton & Bell (1975) noted that Chatham Island oystercatchers had increased in numbers on Mangere and Rangatira since the 1930s, and they associated this with the reduction in sheep numbers and protection of the islands. Presumably the farming activities, dogs and trampling of nests by sheep had kept oystercatcher numbers at low levels, but once sheep were removed there was plenty of open ground available for nesting and feeding. By

the 1970s, Rangatira (13 pairs) and Mangere (3 pairs) were thought to be the strongholds for the species and excess chick production supplemented the low numbers on the main islands (B.D. Bell in Davis 1988). However, despite the absence of introduced predators or sheep, oystercatcher numbers on Rangatira progressively declined to 4 pairs by the mid-2000s. Perhaps the favourable conditions shortly after the reserve was created allowed the population to overshoot its long-term carrying capacity. The subsequent recovery of coastal scrub and forest may have reduced the availability of pasture or sward feeding areas as well as open nesting habitat for oystercatchers. Schmechel (2001) suggested that longer fledging times of a small sample of chicks on Rangatira compared with the northern Chatham Island average might be an indication of low food availability on the offshore island. Regular disturbance by people visiting Rangatira to work on other bird species might also have contributed to a decline (Aikman *et al.* 2001). Other possible influences are predation by skuas, increased exposure to storms because of climate change, or increased exposure to waves because the oystercatchers were forced to nest closer to the sea by the recovering vegetation.

### Population trends in 1980s–1990s

The first detailed survey in 1987 found 112 birds, including 42 breeding pairs, with a higher proportion (57%) of birds found on Chatham Island (Davis 1988) than had been found previously. If the 1970 population estimate was correct, then the population had increased by 1987, which would suggest that conditions on the main island had improved. Some local anecdotal knowledge confirms that oystercatcher numbers had increased in northern areas (Davis 1988). Nevertheless, numbers were still critically low, and it was predicted that low productivity (0.22 fledged young/pair annually) would drive the population to extinction in 50–70 years (Davis 1988). This was mainly based on population parameters measured on Rangatira, but there was equally low productivity on the other islands. Davis (1988) and others recommended that urgent management action be taken to arrest the decline in numbers.

Although the population on Rangatira did decline, the total population increased, and the next comprehensive census in 1998 found 144 adults, including 49 breeding pairs (Schmechel & O'Connor 1999). In the 1990s, sporadic management, mainly predator control, had been attempted in some years on northern Chatham Island and may have improved productivity (0.54 fledged young/pair, 1990–1993, 1997; DOC Chatham Island Area Office unpubl. field reports). Alternatively, 1987 may have been a comparatively poor year, with subsequent

nesting success higher in some years. For example, Schmechel (2001) found an average breeding success of 0.44 chicks/pair in northern Chatham Island in the mid-1990s during years of no management.

### Conservation management

In the 1990s, there was continued concern that the Chatham Island oystercatcher needed conservation action to decrease the threat of extinction. The *Chatham Island oystercatcher recovery plan 2001–2011* (Aikman *et al.* 2001) aimed to improve productivity and adult survivorship and increase the total population to > 250 (mature) individuals by 2011. This would decrease the international threat ranking from endangered to vulnerable (IUCN 2001) and from nationally critical to nationally endangered (Molloy *et al.* 2002). Predation of eggs and chicks by introduced predators had been identified as a key issue (Davis 1988). Other threats included the trampling of eggs and chicks by domestic stock (sheep and cattle), disturbance by stock, dogs or people, resulting in predation or exposure of eggs or chicks and the over-stabilisation of dunes by marram reducing nesting opportunities (Best 1987; Davis 1988; Aikman *et al.* 2001; Schmechel 2001).

Consequently, a programme of intensive management was started in 1998 in northern Chatham Island involving predator control, protection from stock and moving nests located near the high tide mark. Two areas of coast with a high concentration of oystercatcher pairs (16 pairs in total) were chosen for management. Daily trapping from October–February removed a variety of potential predators, including 26–51 cats (*Felis catus*) and up to 719 weka per year (Moore *et al.* 2001; unpubl. data). Existing fences or portable electric fences were used to protect nests from farm stock and nests were protected from flooding by gradually moving them to cleared areas of the foredune or raising them on mounds.

The combined management methods proved effective at protecting nests – in 1999–2001 chicks fledged from 39% of managed eggs, yet only 6% of unmanaged eggs fledged. Consequently, the annual success of birds in northern Chatham Island increased from 0.1–0.9 fledged chicks/pair before 1998 to 0.5–1.6/pair in 1998–2004, with an output of 18–35 fledglings per year. With additional chicks produced from other parts of the Chatham Islands, up to 50 juveniles were entering the population, placing the population in an ideal position for a recovery.

The result was an increase in the population growth rate from about 2.3% per year before 1998 to 15.1% per year afterwards. The 144 birds (49 pairs) present in 1998 (Schmechel & O'Connor

1999) increased to at least 316 birds (89 pairs) by 2004. The further addition of new pairs in the formerly managed areas and other northern areas in 2005–2006 showed the flow-on effect of management with the delayed effect of new recruits entering the population at 2–5 years of age. The number of breeding pairs increased from approximately 49 in 1998 to 109 in 2006. Clearly, the recovery goal of > 250 mature individuals was within reach. However, because boosted recruitment mainly benefited other parts of northern Chatham Island, management effort was shifted to Pitt Island in 2005 to boost the prospects for the species in the southern part of its range. Unfortunately, few chicks were produced there, or in the formerly managed areas, and this probably contributed to a stalling of further population growth. Dowding & Williams (2007) also expressed concern at the apparently high mortality of adults at the formerly managed areas and suggested that cat predation probably had increased after management ceased. With probably less than 250 mature individuals alive, the species remains endangered (IUCN 2006) and nationally critical (Molloy *et al.* 2002; Hitchmough *et al.* 2007), and should continue to be a very high priority for conservation management.

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