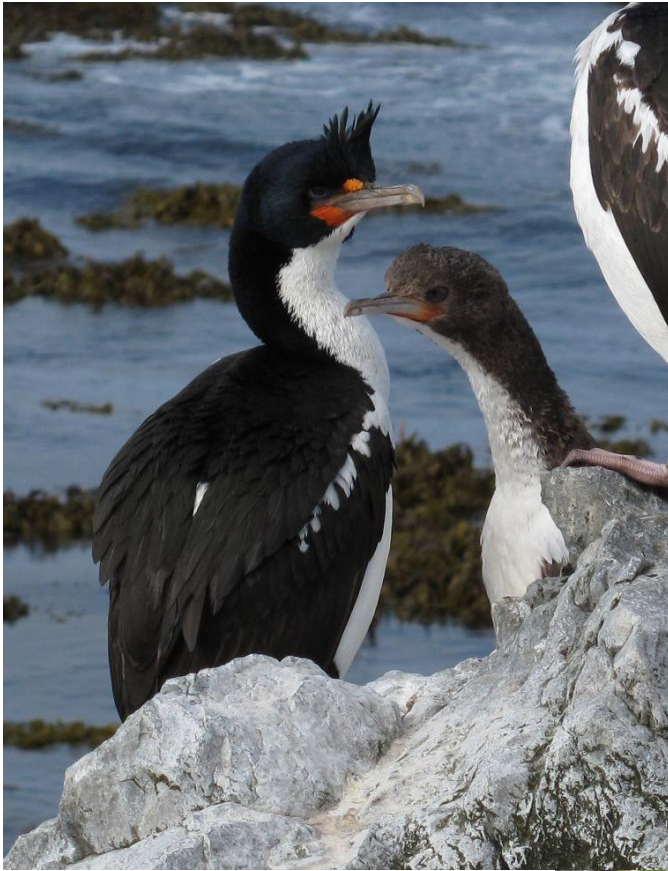


Chatham Island and Pitt Island shag census 2011

MCSPOP2010-02 Final Report



Chatham Island shag



Pitt Island shag

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Abstract

We conducted an extensive survey of coastal areas suitable for Chatham Island and Pitt Island shag nesting between August and November 2011. The census methods were designed to maximise comparability with an earlier census in 1997/98. Based on a complete census of all known Chatham Island shag breeding colonies we estimated the breeding population to be 355 pairs, representing a 58 % decline since 1997/98. We estimated the total Pitt Island shag breeding population to be 434 pairs, a 40% decline since 1997/98 (extrapolated numbers were used for some outlying islands known to hold this species that we did not visit).

A series of regular observations showed that breeding activity for both species peaks in October, though there is some notable variation in timing between colonies. Such variation must be taken into consideration in estimating the total breeding population for both species.

Both species are distributed across the Chatham Islands group. We found that population declines since 1997/98 have been particularly steep for both species at Pitt Island and outlying islands, with smaller declines on main Chatham Island. A range of anthropogenic threats have been identified, both land-based and at-sea. Because population declines have been particularly pronounced at pest-free, protected out-lying islands we conclude that at-sea factors are likely to be driving the population decline, though more research is required to identify causal factors.

1. Introduction

The Chatham Island shag (*Leucocarbo onslowi*) and Pitt Island shag (*Stictocarbo featherstoni*) are both endemic to the Chatham Islands, New Zealand. Both species classified as Nationally Endangered (Miskelly et al 2008), and high-moderate risk to both species from fishing was identified by Rowe (2010), primarily from poorly observed setnet and pot and trap fisheries. While there is limited knowledge on the breeding biology and life history parameters of these species (Taylor 2000), two censuses have been conducted to count the number of breeding pairs. The first systematic census was conducted from October 1997 to January 1998, and found 842 pairs of Chatham Island shag and 729 pairs of Pitt Island shag (Bell & Bell 200). The second census was conducted from October 2003 to January 2004, and found 271 pairs of Chatham Island shag and 547 pairs of Pitt Island shag (Bester & Charteris 2005). This represented declines of 68% and 25% for Chatham Island and Pitt Island, respectively, over a six year period. However, the extent to which differences in methodology or any inter-annual variability in breeding (as both censuses counted breeding pairs as an index of total population size) may have influenced these findings was unclear.

This study aimed to:

- (a) conduct a complete recensus of Chatham Island and Pitt Island shags in such a way as to maximise comparability with earlier counts in order to determine any trend in population size; and
- (b) investigate the effects of timing and methodology on colony counts, and make recommendations for future monitoring of the populations of Chatham Island and Pitt Island shags.

2. Methods

This census followed the methods of Bell & Bell (2000) as closely as feasible in order to maximise the comparability. Breeding pairs were used as the unit of population level, and represents the most measureable unit, as birds forage in the ocean and non-breeding birds may not be faithful to roost sites. A breeding pair was defined as either:

- (a) a nest with egg(s) or chick(s) present, or
- (b) a nest site with one or two adult breeding birds showing signs of nest building, incubation or courtship.

An extensive survey of all coast line suitable for shag nesting sites was conducted on 11 consecutive days, from 1 to 11 October 2011, on the following islands (including associated stacks etc): Chatham Island (including surround stacks and Te Whanga

Lagoon), Pitt Island (including surrounds stacks and the Murumuru Islands), Ragitira, Mangere Island, The Castle, Rabbit Island, North-eastern Reef and the Star Keys (Figure 1). This encompassed all known breeding sites for Chatham Island shag, and all but the following sites for Pitt Island shags: the Forty-fours, Western Reef and The Sisters. The survey was conducted either on foot following the tide line as closely as possible, by a small dive boat, or by a small commercial fishing boat (10 m in length, allowing for close approach to shore). Figure 1 details the coast line surveyed, by survey method. Landings on the Star Keys and Rabbit Island were planned, in order to aid the accuracy of counts, but were not possible due to tide and wind conditions.

The 11 day census was timed to correspond with peak breeding activity, when it was hoped a maximum of birds would be incubating, as birds at incubation are the easiest indicator of a breeding pair to count. In addition, a count was made at Motuhinahina on 28 August 2012 as earlier breeding of Chatham Island shags at this site has been recorded (see Results section), and further counts were made following the main census at Cape Fournier (for Chatham Island shags) and Kaingaroa, Te Wakaru Island and Waitangi West (for Pitt Island shags), as a later peak in breeding was suspected for these sites. Where multiple counts were made, the maximum count for each site is reported. In order to investigate the timing of nesting, and temporal variation in nest counts, a series of counts of both Chatham Island and Pitt Island shag nests were made at 12 sites at Chatham Island. These sites were visited up to once a month, dependent on other operational tasks, from July 2007 to April 2009. A summary of the schedule of visits provided in Appendix 1. On each visit the number of active nests was recorded, as well as a series of observations related to potential threats to shags, and any other general comments.

3. Results

3.1 2011 census

The October 2011 census systematically searched all sections of coastline suitable as breeding areas for Chatham Island and Pitt Island shags over the vast majority of the range for both species. All sites where Chatham Island shags have been documented to breed were surveyed, and the only islands not surveyed where Pitt Island shags have been documented to breed were the Forty-fours, Western Reef and The Sisters. We estimate the total breeding population of Chatham Island shags in 2011 to be 355 pairs, at 12 breeding colonies (all nests found in 2011 were in clearly definable colonies), as detailed in Table 1 and mapped in Figure 2. Within the area surveyed in 2011 we estimate

a total of 388 breeding pairs of Pitt Island shag at 33 breeding areas (being all nest sites generally within one kilometre or so of each other), as detailed in Table 2 and mapped in Figure 3. Using census results from 1997/98, adjusted by the average change in nest number between 1997/98 and 2011, for the Forty-fours, Western Reef and The Sisters, we estimate the total breeding population of Pitt Island shags in 2011 to be 434 pairs (Table 3). Extensive monitoring of albatross on The Pyramid during 2-4 week periods from late November to late January from 1999 to 2011 found no evidence of either species breeding there, although Pitt Island shags were observed foraging in the vicinity of the island (P. Scofield, pers. comm.), indicating relatively large foraging ranges for that species.

3.2 *Breeding timing and variability*

Summarised monthly nest counts for both Chatham Island and Pitt Island shags are presented in Figures 4 and 5. The observations for Chatham Island shags provide a more representative description of temporal breeding activity than for Pitt Island shags, as due to their more colonial breeding nature a larger proportion of the population was observed. The observations reveal a clear seasonality in breeding, with maximum active nest counts most sites monitored being recorded in September to November. The most obvious exception to this seasonality is at Motuhinahina Island. For both species maximum nest counts were in the period June to September. This is the only non-coastal nesting area, the island being within Te Whanga Lagoon on Chatham Island. The earlier timing of breeding may be related to calmer conditions (i.e. large storm-driven waves do not occur as in coastal sites), or temporal differences in prey availability if the birds breeding at Motuhinahina forage differentially, in preference of the lagoon, from coastal nest birds, though there is no information to support this latter hypothesis as studies of foraging behaviour are lacking for both species. Other variations in timing include Little Awatotara Creek (on the south-west coast of Chatham Island) for Pitt Island shags, and Cape Fournier for Chatham Island shags, both had later maximum nest counts in November to December.

Because of these known temporal variations in breeding the 2011 census was designed to include multiple visits to key sites where maximum nest counts may not have been obtained in early October. In line with the monthly counts, we found that for Chatham Island shags an August visit to Motuhinahina, and a November visit to Cape Fournier, produced peak nest counts for those sites, respectively. For Pitt Island shags, where our early October visit recorded significant nest building, or courtship by birds without nests, later visits were made, in November. For the Te Whakuru Island and Waitangi West

breeding areas these later visits recorded higher nest numbers. The results reported here for 2011 include the maximum counts for each site.

4. Discussion

4.1 *Population trends*

For Chatham Island shags, the total breeding population estimate of 355 pairs represents a 58% decline from the 842 pairs counted in 1997/98. Due to the similarity in methods and timing between the 1997/98 and 2011 censuses, and the flexibility that allowed counts to be made earlier at some sites (particularly Motuhinahina) and later at others (particularly Cape Fournier) we believe this represents a real decline in the population. We believe that differences in survey timing may have contributed to the particularly low estimate in 2003/04, as hypothesised by Bester & Charteris (2005). In particular, visits to Motuhinahina were made only in November and December 2003, and no active nests were observed. In 2011 we visited Motuhinahina on 3 October and observed that most Chatham Island chicks had fledged and would likely have dispersed by November.

Visiting the site earlier, in August, was critical to obtaining an accurate estimate for that site. The difference of 84 nests between 2003/04 and 2011 is of the order of the size of the Motuhinahina colony, as counted in 1997/98 and 2011.

For Pitt Island shags our total count of 388 nests in 2011 compares to 649 nests in 1997/98 and 530 nests in 2003/04, if known breeding areas not visited in 2011 are excluded from those early censuses. This represents a 40% decline since 1997/98, and a continuation of the decline between the first two censuses. We believe this represents a real decline in the population, with no information to suggest such substantial numbers of breeding pairs may have been missed in 2011.

4.2 *Spatial variation in population trend*

For Chatham Island shags colony by colony trends are complicated to describe due to movements between sites (e.g. Cape Fournier and The Pinnacles), however the colonies at Star Keys and Rabbit Island appear to have suffered the greatest declines, while Motuhinahina and Waitangi have remained stable or increased (Table 4). In particular, the decline at Star Keys represents the greatest loss in absolute number of breeding pairs between 1997/98 and 2011. Aggregated colony counts reveal declines in breeding Chatham Island shags of 42% for Chatham Island and 72% for Pitt Island and surrounding islands from 1997/98 to 2011 (Table 4).

Pitt Island shags are not as strictly colonial in their nesting as Chatham Island shags, with nests scattered along rocky shorelines and cliffs in some areas. This makes breeding

area by breeding area comparisons hard to interpret, and there are no studies of marked birds that would indicate their level of philopatry. However, as with Chatham Island shags, aggregated counts do reveal a pattern. Declines of breeding Pitt Island shags of 15% for Chatham Island and 68% for Pitt Island and surround islands (Table 3), reveal this species too has suffered stronger declines in the more southerly islands.

4.3 *Potential drivers of population decline*

A range of potential threats to both Chatham Island and Pitt Island shags, both natural and anthropogenic, that may contribute to, or drive the observed decline in population. Potential natural threats include: predation or disturbance by skuas, gulls, harriers or seals, and severe weather events (which could result in destruction of nests, increased levels of mortality or reduced foraging success). Potential human induced threats include habitat loss (particularly breeding sites), disturbance on land by human activities or stock, predation by introduced pests (including cats, rats, weka, pigs and possums), direct fishing mortality and changes in foraging success due to human impacts on the marine environment.

The changes in population level at an island level clearly indicate that the Chatham Island populations of both species have suffered smaller declines than those of Pitt Island and outlying Islands (Tables 3 and 4). For example, both species exhibited 74% declines at the Star Keys, and Pitt Island shags exhibited an even greater decline at Rangitira, a pest-free island under intensive conservation management. Chatham Island and Pitt Island are both inhabited, and possess stock and a range of introduced pests. In comparison, many of the outlying islands are free from introduced pests and none support stock. These results suggest that land-based anthropogenic threats are not driving the observed decline. There is no information to suggest that there have been major changes in the levels of natural predators, though increases in New Zealand fur seals could be causing increased disturbance at some sites. The more accessible nature of some of the Chatham Island shag colonies (compared to the cliff nesting sites of many Pitt Island shags) makes this species particularly prone to disturbance from stock. Coastal fencing projects have now provided good protection from stock at some sites, though other sites still remain at some risk.

Because of the greater declines at sites with fewer land-based threats we conclude that at-sea threats, that appear to be particularly manifest in the Pitt Island area, are most likely to be driving the observed population decline. Further investigation is required to identify the causal factors.

4.4 *Survey methodologies*

The strongly colonial nesting habits of Chatham Island shags, and their general preference for relatively flat nesting areas mean that monitoring the breeding population of this species is relatively easy. Incubation is the easiest time at which to estimate the number of breeding pairs at a colony. We have found that whilst incubation generally occurs in October timing between colonies is variable. There is also some movement between sites, for example between Cape Fournier and The Pinnacles (which may be related to levels of disturbance from stock at Cape Fournier). The movement between colonies and differences in timing must be incorporated into survey designs to ensure robust estimates are made. We conclude that Chatham Island shags are suitable for aerial photographic methods, as incubating birds stand out well from the rock substrate, and an aircraft platform would provide a better angle of view compared to ground counts. It is also likely that aerial methods could be more cost effective, particularly for accessing outlying sites such as Star Keys.

Most Pitt Island shags nests on cliffs, sometimes in caves or with over-hanging rock. Breeding areas are generally distinct, but nests may be scattered along several hundreds of metres of cliffs. These characteristics mean that robust estimates of the breeding population can only be achieved by intensive survey of coast lines. In most circumstances this would ideally be achieved from a boat, close to the shore. However, shallow reefs and heavy seas often make this unrealistic. Therefore, we conclude that the approach we used, of coastline survey on foot where possible, and by boat where not, is the best methodology. Comparisons over time will be maximised by continuing to use the same methods to survey the same stretches of coastline, and we aimed to achieve this as closely as possible for comparisons with the 1997/98 survey. As with Chatham Island shags, incubation is best time to accurately estimate the number of nesting pairs, and there appears to be some temporal variation between nesting areas, with a peak in October.

5. **Recommendations**

The population declines for both species since 1997/98 are very concerning, and causal factors are unclear. We have concluded that at-sea threats are likely to be driving the decline. Key areas of research required, for both shag species, to further our understanding of at-sea threats include:

- describing the nature and extent of direct fishing impacts (see Bell 2012);

- quantifying key demographic parameters including adult survival, fecundity and juvenile survival;
- identifying which demographic parameters are contributing to the observed population decline;
- describing the at-sea foraging habits;
- quantifying diet; and
- comparative studies of the elements listed above between sites where colony trends differ (e.g. Motuhinahina vs Pitt Island area).

We recommend that in order to maximise trend detection, further population monitoring should follow the methods described here. In particular:

- counts should be timed to coincide with incubation at all colonies/breeding areas;
- boat/at-sea methods should be standardised for any one area; and
- aerial photography is likely to be well suited for Chatham Island shags and should be trialled alongside ground counts.

Acknowledgements

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Table 1. Chatham Island shag colonies, 2011. Colony, map reference, survey method, date of 2011 census count and number of nests counted.

Colony	Method	Date	Nests
Matarakau	Land	3 Oct 2011	27
Okawa Point	Land	1 Oct 2011	42
Cape Fournier	Land	9 Nov 2011	51
Ke Orea Point	Boat	4 Oct 2011	3
Point Weeding	Boat	5 Oct 2011	19
Cape Pattison	Boat	7 Oct 2011	5
Ngatikitiki	Land	7 Oct 2011	13
Motuhinahina	Land	28 Aug 2011	72
Motutapu Point	Boat	11 Oct 2011	6
Rabbit Island	Boat	11 Oct 2011	18
North-eastern Reef	Boat	11 Oct 2011	11
Star Keys	Boat	11 Oct 2011	88
Total			355

Table 2. Pitt Island shag breeding areas, 2011. Breeding area, map reference, survey method, areas for comparison to historic counts, date of 2011 census count and number of nests counted.

Breeding area	Map Ref	Method	Comparative area	Date	Nests
Kaingaroa West	PIS-1	Land	Kaingaroa to Te Wakaru Island	3 Oct 2011	4
Kaingaroa East	PIS-2	Land	Kaingaroa to Te Wakaru Island	1 Oct 2011	2
Point Munning	PIS-3	Land	Kaingaroa to Te Wakaru Island	1 Oct 2011	27
Te Whakuru Island	PIS-4	Land	Kaingaroa to Te Wakaru Island	8 Nov 2011	29
Cape Fournier	PIS-5	Boat	Owenga-Ko Orea Point	4 Oct 2011	18
Pinnacles	PIS-6	Boat	Owenga-Ko Orea Point	4 Oct 2011	4
Cascade Gorge	PIS-7	Boat	SW Coast	4 Oct 2011	9
Green Point	PIS-8	Boat	SW Coast	4 Oct 2011	6
Awatotara	PIS-9	Land	SW Coast	5 Oct 2011	12
Basalt dyke	PIS-10	Land	Waitangi	5 Oct 2011	26
Point Weeding	PIS-11	Boat	Waitangi	5 Oct 2011	7
Red Bluff	PIS-12	Boat	Red Bluff	5 Oct 2011	10
Napper Point	PIS-13	Land	Port Hutt Bays	2 Oct 2011	1
Island Reef	PIS-14	Land	Port Hutt*	10 Oct 2011	14
Waipurua Bay	PIS-15	Land	Point Somes South**	10 Oct 2011	7
Te Raki Point	PIS-16	Land	Point Somes North***	10 Oct 2011	19
Waitangi West	PIS-17	Land	Point Somes North***	7 Nov 2011	17
Ngatikitiki Rocks	PIS-18	Land	Ngatikitiki Rocks	7 Oct 2011	3
Mairangi	PIS-19	Boat	Cape Young	9 Oct 2011	18
Cape Young	PIS-20	Boat	Cape Young	9 Oct 2011	44
Motuhinahina	PIS-21	Boat	Motuhinahina	3 Oct 2011	12
Flower Pot	PIS-22	Boat	Pitt Island North	11 Oct 2011	24
Motutapu Point	PIS-23	Boat	Pitt Island North	11 Oct 2011	4
Murumuru	PIS-24	Boat	Pitt Island South	11 Oct 2011	12
Murumuru islands	PIS-25	Boat	Pitt Island South	11 Oct 2011	3
Waihere	PIS-26	Boat	Pitt Island West	11 Oct 2011	1
Pebble Beach	PIS-27	Boat	Pitt Island West	11 Oct 2011	1
Rabbit Island	PIS-28	Boat	Rabbit Island	11 Oct 2011	6
Mangere Island	PIS-29	Boat	Mangere incl. Little Mangere	11 Oct 2011	6
Little Mangere Island	PIS-30	Boat	Mangere incl. Little Mangere	11 Oct 2011	9
The Castle	PIS-31	Boat	Castle	11 Oct 2011	11
Rangitira	PIS-32	Boat	Rangatira	11 Oct 2011	10
Star Keys	PIS-33	Boat	Star Keys	11 Oct 2011	12
Total					388

*Port Hutt - Ocean Bay

**Western headland of Ocean Bay to Point Somes

***Point Somes - Waitangi West

Table 3. Pitt Island shag census results. Overall change represents the change from 1997/98 to 2011. 1997/98 results are from Bell & Bell (2000), 2003/04 results are from Bester & Charteris (2005).

Comparative breeding area	Number of nests			Overall change
	1997/98	2003/04	2011	
Matarakau	3	11	0	
Kaingaroa to Te Wakaru Island	29	32	62	
Okawa Point	7	0	0	
Owenga-Ko Orea Point	31	24	22	
SW Coast	47	57	27	
Waitangi	33	33	33	
Red Bluff	6	9	10	
Port Hutt Bays	0	0	1	
Port Hutt	30	10	14	
Point Somes South	19	21	7	
Point Somes North	38	20	36	
Ngatikitiki Rocks	18	9	3	
Cape Young	68	14	62	
Motuhinahina	11	7	12	
Chatham Island total	340	247	289	15% decline
Pitt Island North	55	54	28	
Pitt Island East	32	36	0	
Pitt Island South	49	43	15	
Pitt Island West	6	11	2	
Pitt Island total	142	144	45	68% decline
Rabbit Island	29	18	6	
Mangere incl. Little Mangere	23	19	15	
Castle	6	14	11	
Rangatira	63	45	10	
Star Keys	46	43	12	
Pitt Island and surrounding islands total	309	283	99	68% decline
1997/98-2011 comparative subtotal	649	530	388	40% decline
Fourty Fours	9	4	5 [†]	
Sisters	71	9	41 [†]	
Western Reef	0	4	0 [†]	
Total	729	547	434[†]	

*Port Hutt - Ocean Bay

**Western headland of Ocean Bay to Point Somes

***Point Somes - Waitangi West

[†] 2011 counts for the Fourty Fours, Sisters and Western Reef have been extrapolated based on the average 40% decline since 1997/98, for the purpose of providing a total population estimate.

Table 4. Chatham Island shag census results (number of active nests). Overall change represents the change from 1997/98 to 2011. 1997/98 results are from Bell & Bell (2000), 2003/04 results are from Bester & Charteris (2005).

Colony	Number of nests			Overall change
	1997/98	2003/04	2011	
Matarakau	53	35	27	
Kaingaroa	0	1	0	
Okawa Point	114	47	42	
Cape Fournier	115	0	51	
The Pinnacles	0	30	0	
Ke Orea Point	7	4	3	
Waitangi	6	5	19	
Cape Pattison	0	11	5	
Ngatikitiki	38	4	13	
Cape Young	0	1	0	
Motuhinahina	68	0	72	
Chatham Island total	401	138	232	42% decline
Motutapu Point	0	0	6	
Kokepa Rock	0	15	0	
Rabbit Island	83	20	18	
North-eastern Reef	19	17	11	
Star Keys	339	81	88	
Pitt Island and surrounding islands total	441	133	123	72% decline
Total	842	271	355	58% decline

Figure 1. Map of the Chatham Islands showing the areas surveyed, by survey method.



Figure 2. Map of the Chatham Islands showing Chatham Island shag colony sites.



Figure 3. Map of the Chatham Islands showing Pitt Island shag breeding areas, and extent of comparative breeding areas. Numbered references refer to Table 2.



Figure 4. Monthly nest counts for Chatham Island shag.

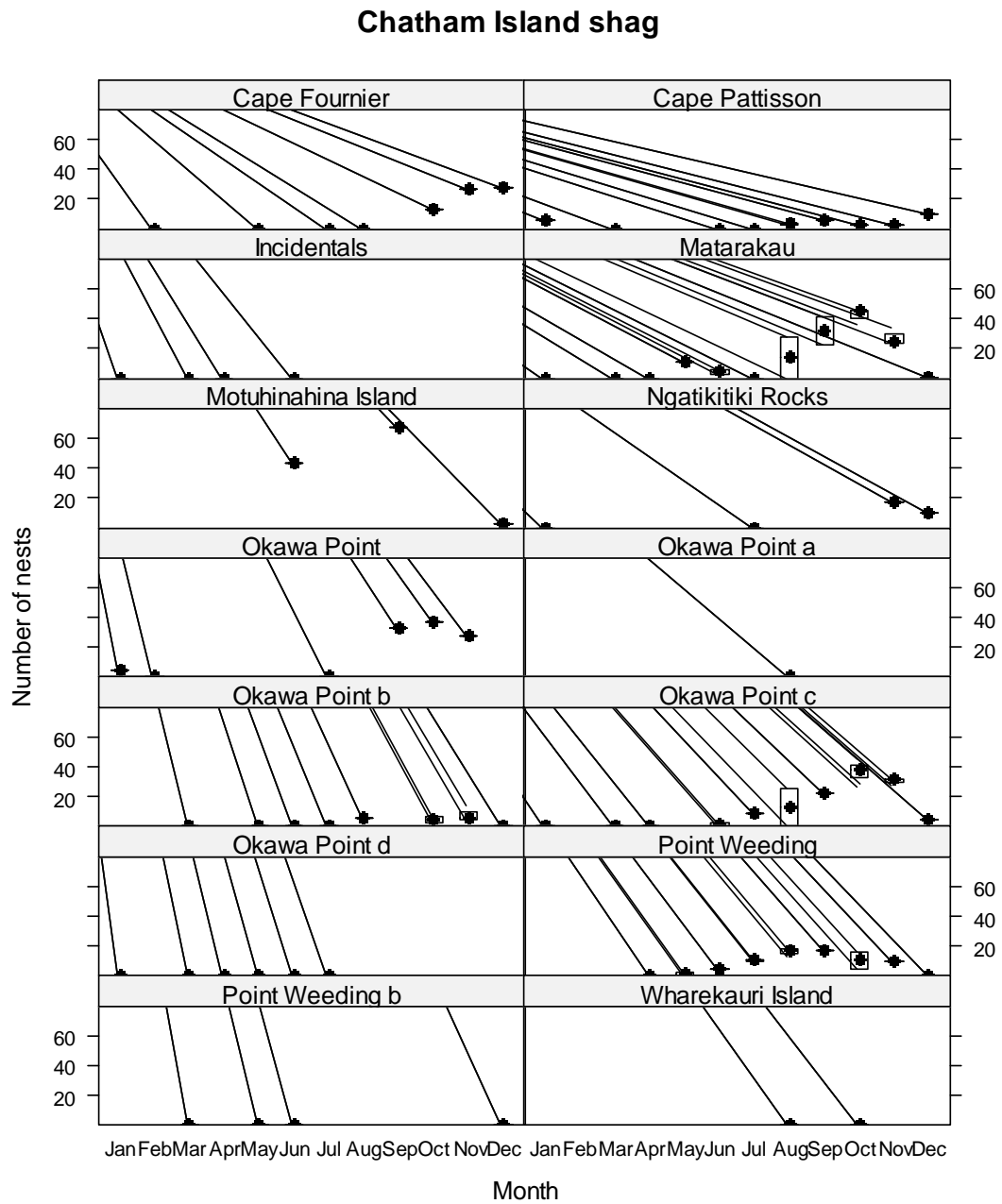
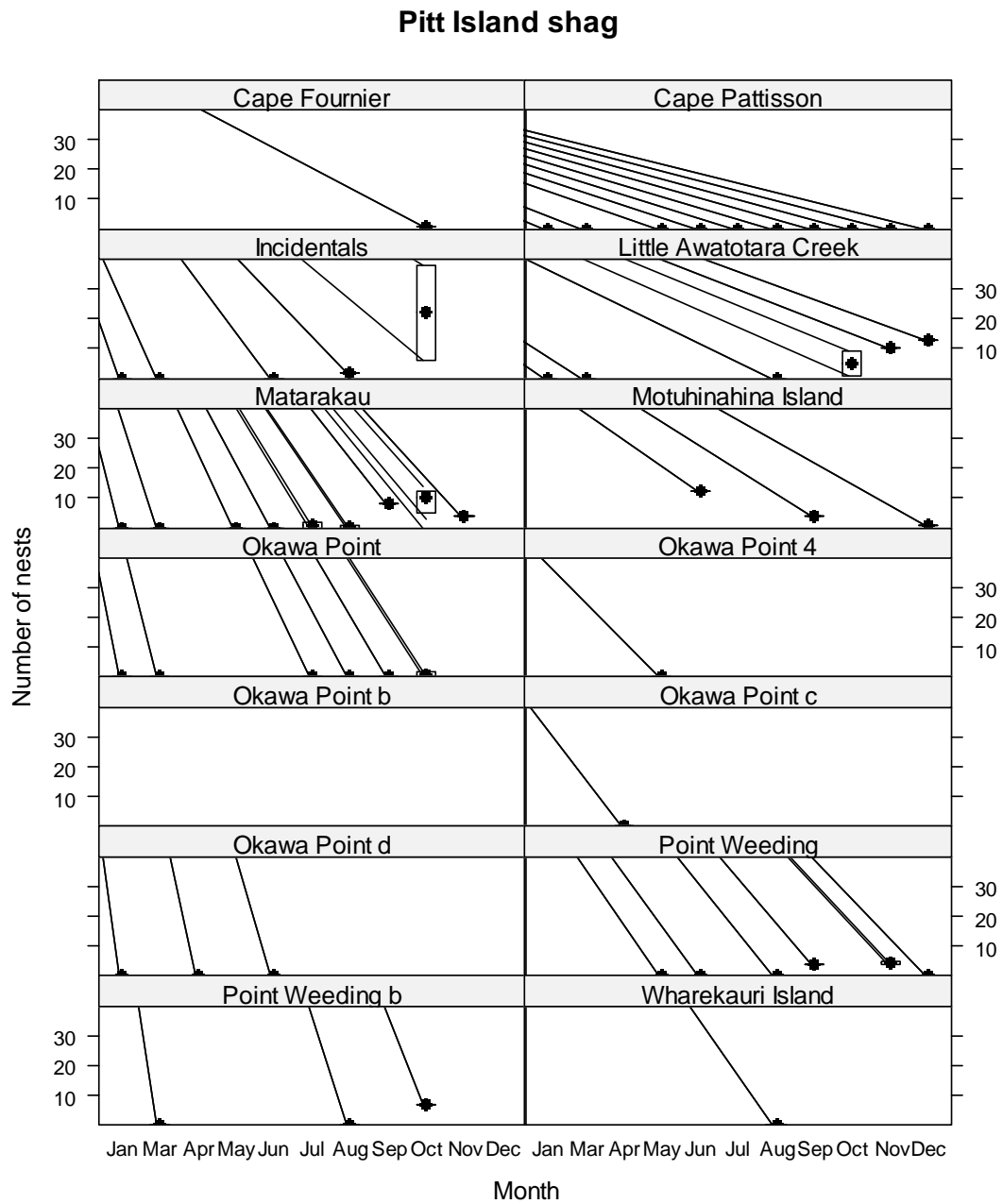


Figure 5. Monthly nest counts for Pitt Island shag.



Appendix 1. Schedule of monthly monitoring counts.

Table A-1. Chatham Island shag schedule of monthly monitoring counts.

Year	Month	Cape Fournier	Cape Patisson	Incidentals	Matarakau	Motuhinahina Island	Ngatikitiki Rocks	Okawa Point	Okawa Point a	Okawa Point b	Okawa Point c	Okawa Point d	Point Weeding	Point Weeding b	Wharekauri Island
2006	7		1		1		1	1					1		
	8														
	9		1		1	1		1					1		
	10	1	1					1							
	11	1	1					1							
	12	1											1		
2007	1						1	1							
	2	1						1							
	3							1							
	4				1										
	5	1			1					1		1	1	1	
	6		1	1	1					1	1	1	1	1	
	7	1	1		1					1	1	1			
	8	1	1		1				1	1	1		2		
	9														
	10				1					1	1		2		1
	11				2					2	2				
	12		1		1					1	1		2	1	
2008	1		1		1										
	2														
	3		1	1	1					1	1	1		1	
	4														
	5			2	1			1					1		
	6				1	1			1	1	1	1			
	7		1										1		
	8		1	1	1						1		2		1
	9		1	1	1						1				
	10				2					1	2	1			
	11				1		1			1	1		2		
	12					1	1								
2009	1			1	1						1	1			
	2														
	3					1									
	4			1	1						1	1	1		

Table A-2. Pitt Island shag schedule of monthly monitoring counts.

Year	Month	Cape Fournier	Cape Patisson	Incidentals	Little Awatotara Creek	Matarakau	Motuhinahina Island	Okawa Point	Okawa Point 4	Okawa Point b	Okawa Point c	Okawa Point d	Point Weeding	Point Weeding b	Wharekauri Island
2006	7		2			1		1							
	8														
	9		1			1	1	1					1		
	10	1	1			1		1							
	11		1												
	12												2		
2007	1							1							
	2														
	3							1							
	4					1									
	5		1			1			1				1		
	6		1	2		1						1	1		
	7		1			1		1							
	8		1			1		1					2		
	9														
	10			1	1	1		1						1	
	11				1	1									
	12		1		1										
2008	1		1		1										
	2														
	3		1	2	2	1		1						1	
	4														
	5			2		1		1							
	6					1	1			1	1	1			
	7		1											1	
	8		1	1	2	1								1	1
	9		1	2		1		1							
	10			1	1	2						1			
	11				1	1		1					2		
	12						1								
2009	1			1		1						1			
	2														
	3						1								
	4			1							1	1			