

## Numbers and distribution of New Zealand king shag (*Leucocarbo carunculatus*) colonies in the Marlborough Sounds, September-December 2006

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**Abstract** A survey of the entire 1500 km coastline of the Marlborough Sounds between Sep - Dec 2006 located 9 king shag (*Leucocarbo carunculatus*) breeding colonies, including 2 new colonies. The total population was estimated at 687 birds, a figure similar to the 10-year average estimated for the period 1992-2002. The 4 largest colonies supported 85% of all birds recorded. The total population appears stable compared to earlier surveys, but there was a tendency for some of the smaller breeding colonies to be occupied only temporarily.

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### INTRODUCTION

The New Zealand king shag (*Leucocarbo carunculatus*) is endemic to the Marlborough Sounds. The ecology of king shags is poorly known, primarily due to the remote breeding locations and the high sensitivity of birds to disturbance (Marchant & Higgins 1990). Schuckard (1994) defined the breeding season as Mar-Aug, with all juveniles flying by Jan. The species is strictly marine, with all foraging occurring in the Sounds area, and nesting sites restricted to rocky islands and cliffs adjacent to the sea (Marchant & Higgins 1990).

The king shag is presently classified as vulnerable due to its small population and restricted breeding range (Birdlife International 2000), and listed as Nationally Endangered in

the New Zealand Threat Classification System (Miskelly *et al.* 2008). The global population was estimated at about 645 birds for the period of 1992-2002 and it has been assumed that numbers of this species have been stable for the past 50 to 100 years (Schuckard 2006). During the period 1992-2002, breeding colonies were recorded from North Trio I, Duffers Reef, White Rocks, Sentinel Rock, Rahuinui I, Stewart I, and a small rock south of Victory I. Breeding was also recorded at Blumine I during 1999-2001, but the site was abandoned in 2002 (Schuckard 2006). Before 1992, breeding was also recorded from Chetwode Is and the D'Urville Peninsula.

Here, I report the results of a count of king shags along the entire coastline of the Marlborough Sounds during Sep-Dec 2006. My objective was to estimate the current global population of this species, and to compare it with previous estimates to determine if its current threat status warrants a reassessment.

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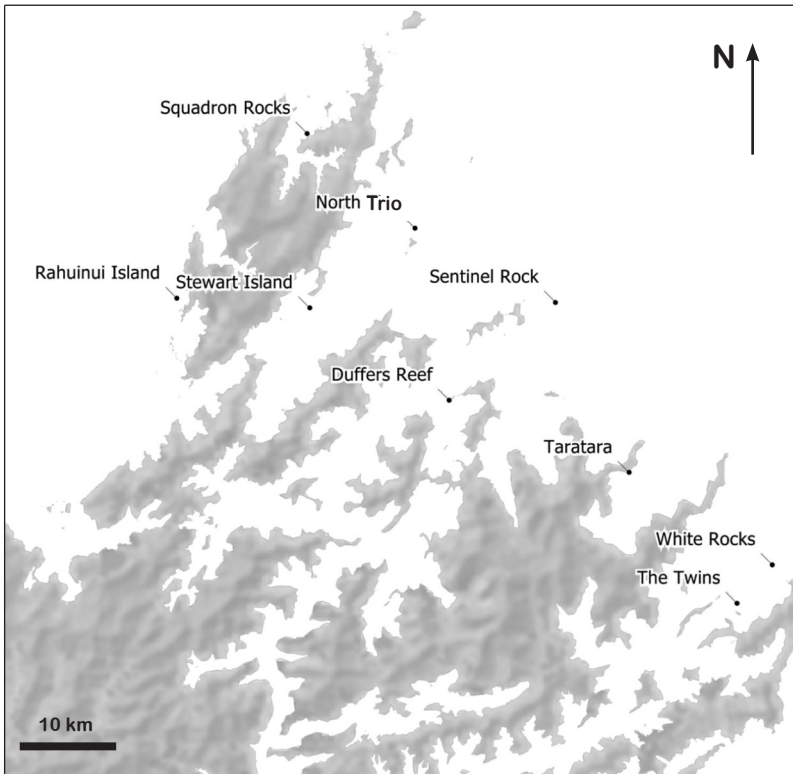


Fig. 1. Location of king shag breeding colonies within the Marlborough Sounds in 2006.

## METHODS

A census of breeding birds along the entire coastline of the Marlborough Sounds was conducted between 9 Sep and 16 Dec 2006 (Fig. 1). The survey incorporated the 1500 km of coastline between Rarangi Beach in the southeast to Cape Soucis in the west, passing and counting colonies on each section of coastline only once. To minimise disturbance, all counts were conducted 90–130 m from a colony; closer proximity of boats to the colony can cause mass departure of birds. Colony locations were recorded on a hand-held GPS; the number of adults, and fledged and downy young were recorded, and a count undertaken of large nests which appeared to have been recently used. Schuckard (2006) found that only 'big' well-built nests contained chicks later in the season, suggesting that counting large nests during the post-breeding period can give an indication of the number of breeding pairs. The survey was not conducted before early morning feeding departures, and so to account for birds that had already left to feed, the number of birds counted at each colony was multiplied by the correction figures derived by Schuckard (2006). During the present study all counts were carried out between 1000 h and 1400 h, when 40–75% of the birds were absent. Schuckard (2006) provides correction factors for the 4 main colonies when conducting census

counts at this time of time: 2.5 x for Duffers Reef, 2.9 x for North Trio I, 2.2 x for Sentinel Rock, and 2.4 x for White Rocks. I used these correction factors for these colonies when estimating population size. For those colonies with no correction factor, I used the average (i.e., 2.5 x) from the 4 main colonies.

## RESULTS

### Breeding distribution and population size

King shag breeding was confirmed at 9 sites within the Marlborough Sounds, with all colonies located in the Outer Sounds (Table 1 and Fig. 1). Two of these colonies, at The Twins and Taratara, were previously unknown, and the exact location of a third colony at Squadron Rocks was confirmed. In total, 266 adult king shags, 112 nests and 96 chicks or recently fledged young were counted. Correcting for birds absent from colonies, the total population was estimated to be 687 adult birds (Table 2), with 85% of birds at the 4 largest colonies: North Trio (220 birds, 32% of total population), Duffers Reef (183 birds, 27%), White Rocks (125 birds, 18%) and Rahuinui I (55 birds, 8%).

### New colonies

*The Twins*, Queen Charlotte Sound (262134E; 601029N NSMG)

On 23 Sep 2006, a small colony with 4 large nests

**Table 1.** Date of observation, number of adult birds, large nests, and chicks (includes nearly fledged and fledged young of the year) recorded at king shag colonies during September-December 2006.

| Location       | Date   | Number of adults | Number of chicks | Number of nests |
|----------------|--------|------------------|------------------|-----------------|
| Duffers Reef   | 10 Dec | 73               | 34               | 28              |
| North Trio     | 2 Dec  | 76               | 19               | 30              |
| White Rocks    | 28 Sep | 52               | 23               | 23              |
| Sentinel       | 3 Oct  | 16               | 6                | 8               |
| Rahuinui I     | 7 Oct  | 22               | 7                | 8               |
| Stewart I      | 2 Dec  | 8                | 1                | 1               |
| Squadron Rocks | 7 Oct  | 3                | 1                | 2               |
| The Twins      | 23 Sep | 5                | 2                | 4               |
| Taratara       | 10 Dec | 11               | 3                | 8               |
| Total          |        | 266              | 97               | 112             |

was found. Five adult birds were present. Birds were nesting on a low southwest facing rocky slope on the larger outer rock stack. After allowing for a correction factor, the colony size was estimated to be 13 birds.

*Taratara, Port Gore (261242E; 602132N NZMG)*

On 10 Dec 2006, a colony was found at Taratara, approximately halfway to Cape Lambert, Port Gore. This area had previously been recorded as a king shag roost site (Schuckard 2006). This colony was atypical in that it was the only colony found on the mainland. Although late in the breeding season, 8 large nests were counted, with 3 large downy young present. When the count was carried out at 1300 h, only 11 adult birds were present. After applying a correction factor, the colony size was estimated to hold a total of 28 birds.

*Squadron Rocks, D'Urville I (258541E; 6044958N NZMG)*

Schuckard (2006) reported that Ian Flux found a small colony of king shags on a rock stack south of Victory I in Apr 2003. In 2006, I found a colony on Squadron Rocks, which Ian Flux (*pers. comm.*) confirmed was the same location reported by Schuckard (2006). Squadron Rocks are a small group of rock stacks at the entrance to Port Hardy. King shags were breeding on the largest of these rocks on a southwest-facing slope. On 7 Oct 2006, I located 2 large nests, 3 adult birds and 1 recently fledged chick at this site. Correcting for birds absent from the colony, the size was estimated to be 8 birds.

## DISCUSSION

The total population of 687 king shags in 2006 is very similar to the 645 birds estimated in surveys from 1992 to 2002, in which Schuckard (2006) suggested the population had been stable for perhaps as long as 50-100 years. Schuckard (2006) used dawn counts at the 4 main colonies which he surveyed annually, combined with maximum counts at the 2 minor colonies known during his study; however the entire coastline of the Marlborough Sounds was not systematically surveyed. The proportion of birds at the 3 largest colonies, North Trio, Duffers Reef and White Rocks, has remained high, with 83% of all birds breeding in these colonies during 1992-2002, and 77% in 2006.

Despite the apparent stability in the main colonies, there has been temporal variation in the occupation of some of the smaller colonies. The number of birds breeding at Sentinel Rock has declined from 51 birds in 1992-2002 to 35 birds in 2006. During the same period, the colonies at Stewart I and Squadron Rocks appeared stable, while the Rahuinui I colony increased from 28 birds to 55 birds. In addition, new colonies have formed at The Twins and Taratara. These recent changes in colony occupation are not a new phenomenon; Schuckard (2006) reported small colonies at D'Urville Peninsula and Chetwode Is had disappeared in the mid 1900's, with others forming at Stewart I and Rahuinui I. A small colony at Blumine I was also formed in 1999 and then abandoned in summer of 2001-2002.

The establishment of new colonies can be evidence of seabird populations increasing and expanding their range (Warham 1996). However,

**Table 2.** Number of king shag adults (after allowing correction factor) and nests found between 1992-2002 (from Schuckard 2006), and in 2006 (this study). Colonies at The Twins and Taratara did not exist in the 1992-2002 survey.

| Location       | 1992-2002 Survey |             | 2006 Survey |       |
|----------------|------------------|-------------|-------------|-------|
|                | Adults           | Nests       | Adults      | Nests |
| Duffers Reef   | 201              | 30-37       | 183         | 28    |
| North Trio     | 205              | 29          | 220         | 30    |
| White Rocks    | 134              | 26-37       | 125         | 23    |
| Sentinel       | 51               | 11-17       | 35          | 8     |
| Rahuinui I     | 28               | 3           | 55          | 8     |
| Stewart I      | 25               | 3           | 20          | 1     |
| Squadron Rocks | Not counted      | 3           | 8           | 2     |
| The Twins      | Not present      | Not present | 13          | 4     |
| Taratara       | Not present      | Not present | 28          | 8     |
| Total          | 645              | 102-126     | 687         | 112   |

with limited knowledge on the productivity of king shags over time, the success and failure of these satellite colonies are difficult to interpret. It is highly likely that factors other than population increase are involved in the temporary occupation of small colonies. At this stage the constraints on the king shag population are not known, and further research is warranted.

The new colony of king shags found at Taratara is particularly interesting. Schuckard (2006) showed that most king shags belong to a single population centred in the western Marlborough Sounds, and suggested that the eastern White Rocks birds may be an isolated population. At this time Taratara was used as a roost by king shags, but their origin was unknown (Schuckard 2006). The formation of the new Taratara breeding colony midway between the western and eastern birds suggests that the whole population is probably linked. However, the greater proportion of birds in the west may indicate that some environmental conditions (e.g., suitable breeding habitat or quality of feeding grounds) may exist of which we are not aware.

Due to the wide geographic spread and remote location of existing king shag colonies, no previous survey has counted all colonies simultaneously. As a result, movements of birds between colonies may affect the results. Further research into census techniques, including aerial photography, should be investigated to develop a robust population monitoring methods for this threatened species.

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