

A breeding survey of three species of shags in the Marlborough Sounds

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Abstract The Marlborough Sounds has a coastline of 1500 km and hosts the greatest diversity of marine shag species in New Zealand. A survey of all breeding shag species was conducted in spring 2006. Apart from New Zealand king shag, 3 species were counted: spotted shag (*Strictorcarbo punctatus*), pied shag (*Phalacrocorax varius*) and little shag (*Phalacrocorax melanoleucos*). Two other species (black shag *Phalacrocorax carbo* and little black shag *Phalacrocorax sulcirostris*) also occur in the area but were not recorded breeding. A total of 1,254 pairs of spotted shag were recorded at 193 sites, with most colonies occurring in the outer Sounds and inner Queen Charlotte Sound. Average colony size was 6.5 pairs (range 1-76 pairs), with 85% of colonies containing ≤ 10 pairs. The distribution of spotted shag colonies appears to be influenced by the availability of suitable cliff habitat. Breeding pied shags were found at 48 colonies, with a total of 438 pairs. Colonies were widely distributed, and average colony size was 9.1 pairs (range 1-28), with 83% containing ≤ 15 pairs. A total of 226 little shag pairs were found at 24 colonies, with most colonies also including nesting pied shags. Colony size was on average 9.4 pairs (range 4-24), with 75% of colonies containing ≤ 10 pairs. Colonies of pied shags and little shags were found mostly in native vegetation. Colonial seabirds that occur at relatively few locations can be used as indicators to establish critical thresholds for marine management and marine conservation. It is proposed that this survey provide a good baseline for such an approach in the Marlborough Sounds.

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Keywords Spotted shag; pied shag; little shag; census; breeding distribution; Marlborough Sounds

INTRODUCTION

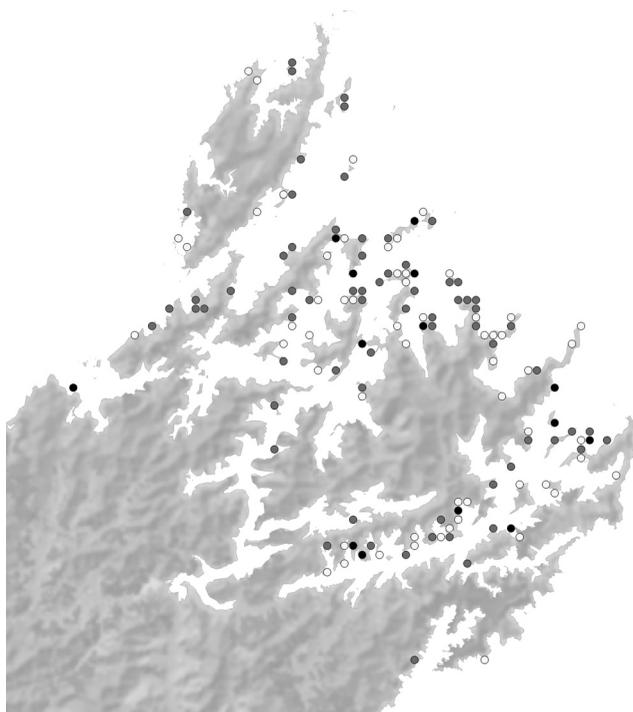
Six species of shags have been recorded in the Marlborough Sounds of which 4 are breeding (Robertson *et al.* 2007). Information about the colony distribution, number of shags at each colony, foraging movements and prey of the king shag (*Leucorcarbo carunculatus*) have recently been well documented (Schuckard 2006; Bell 2010). However, comparative information for the other 3 breeding species - spotted shag (*Stictorcarbo punctatus*), pied shag (*Phalacrocorax varius*), and little shag (*Phalacrocorax melanoleucos*) - is not available.

The spotted shag is endemic to New Zealand and exists as 2 subspecies; *S. p. punctatus* in the North I and in the South I from Otago north, and *S. p. oliveri* in the southern South I and Stewart I (Checklist Committee (OSNZ) 2010; Heather & Robertson 1996). The spotted shag is widespread in the South I, but has a patchy distribution in the North I (Heather & Robertson 1996; Robertson *et al.* 2007). The breeding season can vary between years and in different parts of the country (Heather & Robertson 1996). Within the Marlborough Sounds breeding is thought to be similar to that recorded at Banks Peninsula (Fenwick & Browne 1975). Birds begin nest building in Aug, and laying starts in the second week of Sep, peaking in early Oct.

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Fig. 1. Number of spotted shag nests per 1 km grid square in the Marlborough Sounds in 2006. ○ <5 nests, ● 5-20 nests, ● >20 nests.



Incubation is started after the 2nd egg is laid and lasts 28-31 days, with chicks fledging after 9 weeks and colonies deserted by Mar (Fenwick & Brown 1975; Marchant & Higgins 1990). In the 1980s, the population of spotted shag was estimated as 10,000-50,000 breeding pairs (Robertson & Bell 1984). Numbers in the Hauraki Gulf declined in the late 1970s (Cunningham & Moors 1985) but appear to be increasing elsewhere. Around Banks Peninsula numbers more than doubled between 1960 and 1996 (Doherty & Brager 1997), and in Wellington the breeding range extended to Kapiti I (Miskelly 2000). Spotted shag is listed as not threatened in the New Zealand Threat Classification System (Miskelly *et al.* 2008).

The pied shag has a patchy breeding distribution, with most birds occurring in the northern North I, top of the South I from Tasman Bay to Banks Peninsula, and around Fiordland (Heather & Robertson 1996; Robertson *et al.* 2007). Colonies are active year round, but there are 2 peaks of egg laying; in Jul-Oct and Jan-Mar (Heather & Robertson 1996). Incubation lasts 25-33 days, with chicks fledging after 8 weeks (Heather & Robertson 1996). Despite laying occurring in all months, it is likely that each pair raise only a single brood per year (Powlesland *et al.* 2008). The national population of pied shag was estimated at 5,000-10,000 breeding pairs (Robertson & Bell 1984) and although there is evidence to suggest numbers are increasing (Heather & Robertson

1996; Powlesland *et al.* 2008) it is listed as nationally vulnerable (Miskelly *et al.* 2008).

The little shag breeds throughout New Zealand in both coastal and inland waterways (Heather & Robertson 1996; Robertson *et al.* 2007). The breeding season starts in Jul, and egg laying occurs from Aug-Feb with a peak in Oct-Nov (Heather & Robertson 1996; Powlesland & Luke 2000) There is no information on incubation or chick-rearing periods (Marchant & Higgins 1990; Heather & Robertson 1996). The breeding population is estimated to be 10,000-50,000 pairs (Robertson & Bell 1984), with the population increasing (Heather & Robertson 1996; Robertson *et al.* 2007), leading to a threat ranking of naturally uncommon (Miskelly *et al.* 2008).

To provide baseline information on the numbers of coastal birds breeding within the Marlborough Sounds a survey of the entire coastline of the Sounds was carried out during Sep-Dec 2006. This paper presents the distribution of colonies and numbers of occupied nests per colony of spotted, pied and little shag in the Marlborough Sounds.

METHODS

Between 9 Sep and 16 Dec 2006, the entire coastline of the Marlborough Sounds was surveyed to determine the location and size of all shag colonies. All the coastline from Rarangi Beach in the southeast to Cape Soucis in the west was included in the survey, a total distance of 1,500 km.

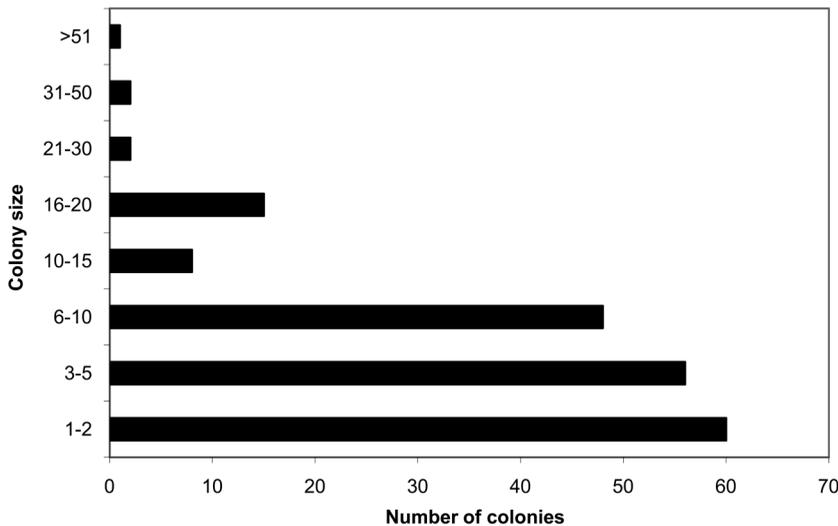


Fig. 2. Size frequency of spotted shag colonies in the Marlborough Sounds in 2006.

Surveys were primarily carried out from a boat travelling at 5-8 knots and a distance of 5-30 m (usually 5-10 m) from the shoreline depending on topography. The boat was stopped offshore from colonies to undertake counts and record their location on a hand-held GPS. As it was not possible to confirm the contents of nests, I used a count of apparently occupied nests to estimate the number of breeding pairs at each colony. Birds in breeding plumage at nest sites, pairs in the process of nest building, incubating birds and nests with chicks were all recorded as occupied nests. A separate colony was recorded for any nest greater than 50 m distant from another nest. Single nests were recorded as well but treated for the purpose of analysis as colonies of 1 pair. For each pied shag and little shag colony, the vegetation type was recorded.

RESULTS

Spotted shag

A total of 1254 breeding pairs of spotted shag was found at 193 colonies in the Marlborough Sounds (Fig. 1). Colonies were patchily distributed, with high numbers in the outer Sounds and the inner Queen Charlotte Sound. Colonies were almost entirely absent from inner Pelorus Sound and Tory Channel. Low numbers of colonies were recorded along the south-east coast (Rarangi to Cape Koamaru) and the west side of D'Urville I. Average colony size was 6.5 nests per colony (range 1-76, $n = 193$). About 85% of colonies involved 10 or fewer pairs, and 23 sites were of single nests (Fig. 2). Spotted shags nested almost exclusively in single species colonies. Only 2 sites were encountered with multi species colonies. This involved 1 colony with pied shags and another colony with both pied shags

and little shags. At these sites, pied shags and little shags were nesting in trees, and spotted shags on cliffs or steep ground under these colonies.

Pied shag

A total of 438 breeding pairs of pied shag was recorded at 48 widely distributed colonies (Fig. 3). Average colony size was 9.1 pairs (range 1 – 28 pairs), with 83% of colonies containing ≤ 15 pairs (Fig. 4). Almost all colonies (92%) were on native scrub or trees, with regenerating broadleaf forest being the vegetation type most frequently used (54%; Fig. 5).

Little shag

A total of 226 pairs of little shag were recorded breeding in 24 colonies, all but 3 of which were in colonies with pied shags (Fig. 6). Average colony size was 9.4 pairs (range 4-24), with 75% of colonies containing ≤ 10 pairs (Fig. 4). As with pied shags, most colonies (87.5%) were found in native trees (Fig. 5).

DISCUSSION

The distribution of spotted shag breeding colonies in the Marlborough Sounds appears to be driven by breeding habitat availability. Places where spotted shag colonies were absent or were small had limited areas of coastal cliffs with suitable nest sites, such as Tory Channel and the inner Pelorus Sound. In contrast, the inner Queen Charlotte Sound has a large number of low cliff areas and this coincides with greater numbers of breeding spotted shags. Interestingly, this area also has numerous holiday homes and is subject to higher levels of human activity. At present, it seems that spotted shags readily nest in close proximity to human settlements although it is not known if the

Fig. 3. Number of pied shag nests per 1 km grid square in the Marlborough Sounds in 2006. ○ <5 nests, ● 5-15 nests, ● > 15 nests.

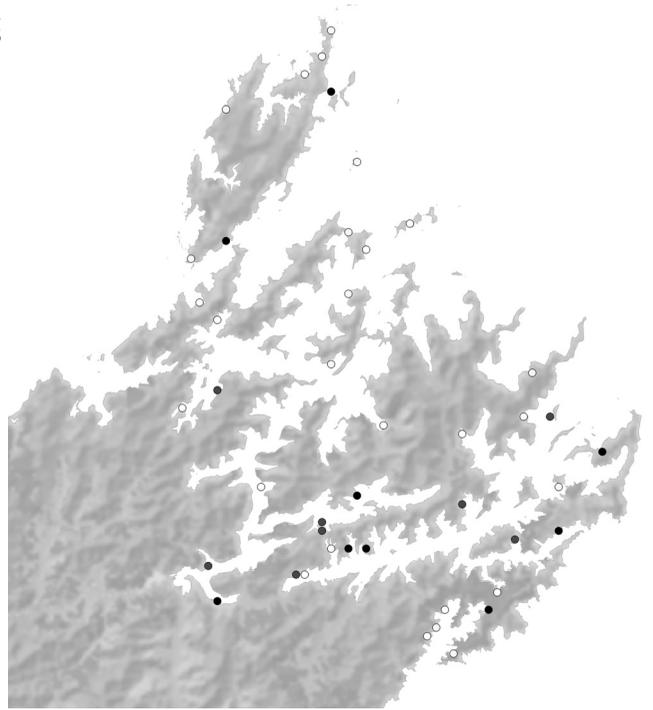
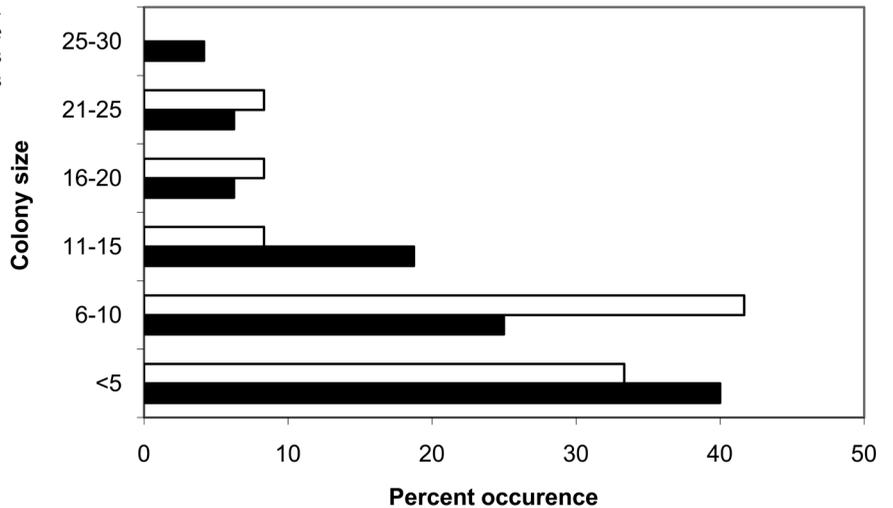


Fig. 4. Size frequency of pied shag (solid bars) and little shag (open bars) colonies in the Marlborough Sounds in 2006.



populations in these areas would have been even higher if disturbance was reduced.

Although there is no previous systematic count data to directly compare with the current study, an unpublished report from the 1980s recorded only 33 colonies, a lower number of breeding colonies than observed in this study (D. Butler, *unpubl. data*). Even though the 1980s survey did not cover the entire Marlborough Sounds or estimate the number of nests, in the same area during this study a total of 126 colonies were found. However, in the present

study the number of colonies was likely over-estimated, as single nests and small colonies >50 metres apart were recorded individually. Despite this, the spotted shag is probably increasing within the Marlborough Sounds. Dorherty & Brager (1997) recorded a >100% increase in the spotted shag breeding population between 1960 and 1996 at Banks Peninsula which they attributed to legal protection and changed fishing practises. It is likely that there has been a similar increase in spotted shag numbers in the Marlborough Sounds.

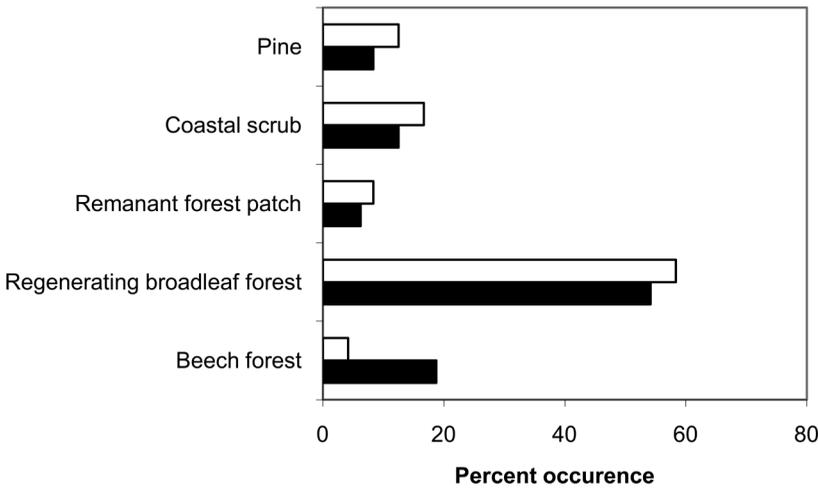


Fig. 5. Vegetation type used by pied shag (solid bars) and little shag (open bars) colonies in the Marlborough Sounds in 2006.

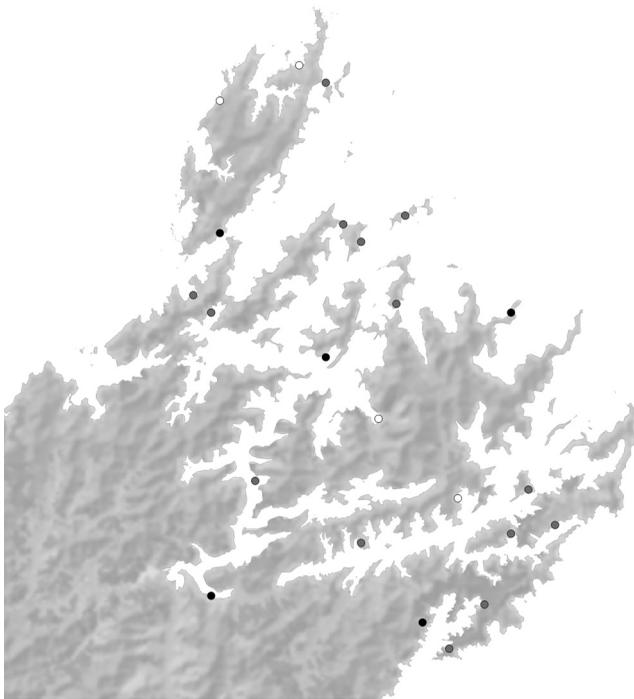


Fig. 6. Number of little shag nests per 1 km grid square in the Marlborough Sounds in 2006. ○ <5 nests, ● 5-15 nests, ● >15 nests.

There appears to be sufficient unutilised nesting habitat (*i.e.*, low cliffs) to cater for further population expansion of the spotted shag in the Marlborough Sounds, although the absence of shags in these underutilised areas may be linked to food availability and commuting distances to available food resources. It would be worthwhile to repeat the surveys done in this study in the future to determine whether the population continues to grow and expands into these currently unoccupied areas. With increasing numbers of spotted shags in the South I, it is interesting that numbers of this

species in northern New Zealand (especially in the Hauraki Gulf) are decreasing, (Robertson *et al* 2007; Heather & Robertson 1996). Further investigation into the differences between these populations is warranted.

Pied shag have 2 peaks of breeding, 1 peak during spring and another in autumn (Heather & Robertson 1996). Counts presented here indicate the size of the spring breeding population. Given that it is likely that different individuals are breeding in autumn than in spring (Powlesland *et al.* 2008) a census of the entire breeding population would

need additional counts to be carried out in autumn. There is no comparative data to determine the trend in numbers of pied shags and little shags within the Marlborough Sounds over the past 20 years or more. Nationally both species are considered to be increasing (Heather & Robertson 1996; Robertson *et al.* 2007; Powlesland *et al.* 2008), although until more historical count data becomes available it is impossible to determine the present trend of populations in the Marlborough Sounds.

Breeding colonies of both pied and little shag are widely and evenly distributed through the Marlborough Sounds, and show a strong preference for nesting in native vegetation. Habitat availability is likely to be a key factor in determining the present and future distribution of breeding colonies. Exotic pine plantations and farmland to the water's edge provide little habitat for nesting shags. Although both species readily nest in pine trees (Heather and Robertson 1996), and there are numerous pine plantations in the Marlborough Sounds, more colonies were found in native vegetation. Retaining native vegetation along the coast line is likely to be important for providing breeding habitat for these 2 species.

Generally all 3 shag species had small colonies spread throughout the Marlborough Sounds. Along with habitat availability suitable for colonies, the size and distribution of colonies may be influenced by food resources in the waters adjacent to each colony, the time and energy requirements for commuting between foraging areas and colonies, and a trade off between commuting distances. A study on foraging behaviour of shags in the Marlborough Sounds would provide an interesting case study to test this relationship.

This study provides comprehensive survey data on the breeding population size of the spotted shag and little shag, and the size of the spring breeding portion of pied shag, in the Marlborough Sounds. This will enable future surveys to accurately determine population trends. With increasing human demands for further development in the Marlborough Sounds, especially for recreational homes and marine farming, this and future studies will be important to help guide regional planners when making decisions on future development in this biological important area.

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