KING SHAGS IN THE MARLBOROUGH SOUNDS

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ABSTRACT

Colonies of the King Shag **Leucocarbo carunculatus carunculatus** (Gmelin, 1789) were visited three times in 1964-65. Numbers are now about the same as when they were discovered in 1773 — two or three hundred birds — although more colonies are known. Since 1773, large fluctuations have probably occurred; heavy collecting by nineteenth century ornithologists, shooting for ladies' muffs around 1900 and, more lately, misguided shooting " to protect fisheries " have all taken a toll.

Details of nests and eggs are given. The species usually breeds once each year, in winter; but sometimes two cycles of breeding have been observed. The times of breeding vary from colony to colony and from year to year.

King Shags are easily disturbed at the breeding colony, possibly because of long persecution. Any further study of the birds themselves should be limited to regular, remote censusing only. Ecological work and banding on less vulnerable subspecies such as **L. c. chalconotus** should be done in the hope that the results will prove valid or helpful for conserving their rarer relatives.

INTRODUCTION

King Shags *Leucocarbo carunculatus carunculatus* (Gmelin 1789) are interesting for three reasons:— Firstly, at latitude 41°S they are the northernmost representatives of the pink-footed, blue-eyed subantarctic shags, which occur in a belt mostly south of latitude 50°S. (However, the closet relatives are both found north of this line: Stewart Island Shags, *L. carunculatus chalconotus,* range as far north as Dunedin at 46°S, and another subspecies, the Chatham Island Shag *L. c. onslowi,* is isolated 500 miles east of Christchurch, at latitude 44°S.)

Secondly, they are confined to a relatively small area, the Marlborough Sounds, close to the convergence of sub-antarctic with subtropical waters which is sometimes associated with Cook Strait.

In sharp contrast with many New Zealand native birds, now rare but formerly plentiful, the King Shags' third distinction is that they have apparently never been known to be numerous or widespread.

As a reconnaissance for a population study, three visits were made to colonies during the winters of 1964 and 1965 (20-27 July 1964, 25 August 1964, and 18-22 May 1965). The information gathered has been combined with information from Internal Affairs Department files in an attempt to provide an up-to-date picture of the status and breeding habits of this rare bird.

PUBLISHED RECORDS

In 1773, J. R. Forster, naturalist on Cook's second voyage, collected the first King Shags from White Rocks outside Queen Charlotte Sound; he estimated the total population at about 160 birds (see Hutton 1878). Later expeditions collected more specimens but added nothing to this information.

Over a hundred years later, White Rocks was still the only known breeding colony, but Buller (1891) stated that there were then only 80 birds; eggs and young were found in both July and

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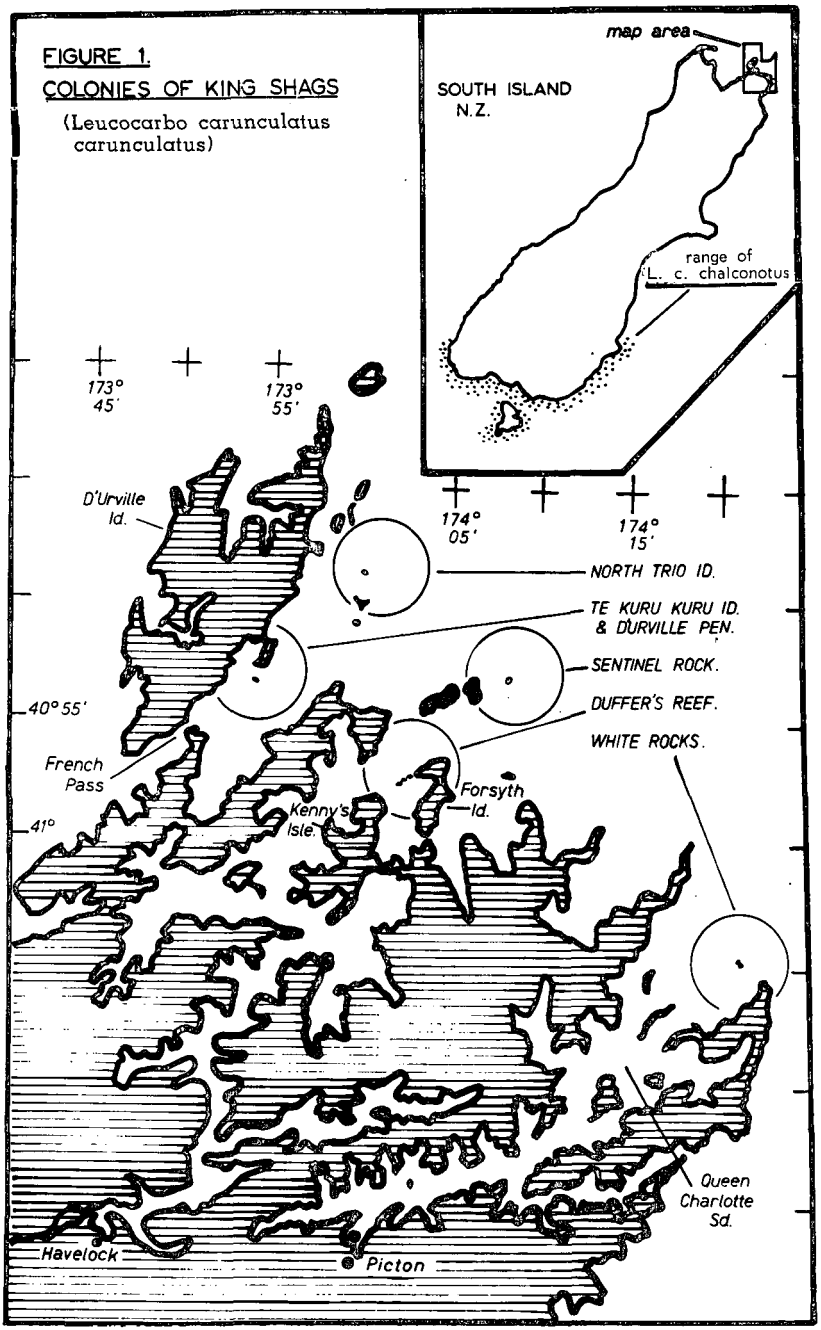
FIGURE 1.
COLONIES OF KING SHAGS
(Leucocarbo carunculatus carunculatus)
map area
SOUTH ISLAND N.Z.
range of L. c. chalconotus
173° 45'
173° 55'
174° 05'
174° 15'
D'Urville Id.
NORTH TRIO ID.
TE KURU KURU ID. & D'URVILLE PEN.
SENTINEL ROCK.
DUFFER'S REEF.
WHITE ROCKS.
40° 55'
41°
French Pass
Kenny's Isle.
Forsyth Id.
Queen Charlotte Sd.
Havelock
Picton

October of that year. Forty years on, Falla (1933) found smaller irregular colonies on other islets nearby, and counted 80 adults on White Rocks in July 1932. He concluded that nesting occurred in midwinter.

By 1948, Falla (unpublished, Internal Affairs Department file) had recorded a new major colony on the North Trio Island as well as a regular roost on Sentinel Rock. However, both White Rocks and North Trio then had only 25 nests each, a small increase compared with that of about 40 nests at White Rocks alone in 1932.

Since that time, the Wildlife Service has kept a watch on the birds; new colonies have been found at Duffer's Reef (a major colony discovered by Dr. Fleming in 1951), Sentinel Rock (1951) and Te Kuru Kuru Island (1960). A temporary colony on D'Urville Peninsula found in 1951 and occupied up to 1959 probably gave rise to the rookery on Te Kuru Kuru Island from 1960-67. Similarly, a favoured roost on Kenny's Isle (a peninsula near Duffer's Reef) may soon follow the history of Sentinel Rock to become another colony. Probably there have always been several colonies, with changes of sites from time to time.

COLONIES VISITED

In 1964-65, visits were made to all five known colonies (see Fig. 1):—

(i) *White Rocks,* where the colony is on the only sloping area, the southern face, of an otherwise vertical, narrow stack 50-60 feet high;

(ii) *Sentinel Rock,* a high razorback in Cook Strait east of Outer Chetwode Island. The colony is on its eastern slope (37-45°), out of reach of high seas and partially protected from wind by taupata scrub *(Coprosma repens);*

(iii) *Duffer's Reef,* a chain of rocks extending west from Forsyth Island at the entrance to Pelorus Sound. King Shags have nested on the three outermost rocks, referred to from the landward side as I, II and III. *I* was the main colony site up to about 1964. The birds nest on a plateau which has a clear area of 55 by 17 feet facing west and beyond the reach of the waves. On *II,* the Shags in 1964 cleared an area of 12 by 13 feet facing north, but did not nest there again. Here there was sheltering scrub to the south and east, and no danger from the sea. Although *III* is a bare, storm-swept rock only a few feet above the sea, it was the only site occupied at Duffer's Reef by 1966, after starting as a colony the year before.

(iv) *North Trio Island,* to the west of the Chetwode Islands. Here the area occupied changes from year to year; in 1964 nests were being built on a pinnacle on the northern end, but in 1965 a new area 25 by 17 feet had been cleared on the steep southern face (Group IV).

(v) *Te Kuru Kuru Island* ("Bushy" or "Stewart" Island) in sight of French Pass township. The position of the colony changed from a steep face looking south-eastwards in 1964 to a low rock about four feet above sea level, on the western side, in 1965.

RESULTS

Nests and Eggs

Nests were about 20 inches wide (range 14-26 inches), up to 17 inches high on the downhill side, with a nest chamber about 11 inches wide and 3 to 4 inches deep (21 measured). Nests were usually about 40 inches apart (range 24 to 91 inches). Although ultimately ruled by pecking distance, distance apart probably varies according to the density of the population and the slope of the site. Two-egg clutches are usual, but because some of the one-egg clutches in Table I may have been incomplete, the numbers of larger clutches should probably have been higher.

TABLE 1: Clutch Size (all records 1949-65)

	One Egg	Two Eggs	Three Eggs	Totals
No. of clutches	59	88	20	167
% of Total Clutches	35.4	52.7	11.9	Mean 1.8 eggs/clutch

Eight eggs were measured; mean length was 65 mm (range 63-67 mm) and mean width 41 mm (range 40-43 mm). Two eggs weighed about 62 gms each.

Breeding Seasons

Although the colonies have been visited many times, there is still not enough information to follow the timing of breeding in any one colony. This is partly because the observations are concentrated in the months May to November, partly because there are few years with more than one observation and partly because many records are incomplete.

From all information available in Internal Affairs Department files, it seems that King Shags usually nest once each year at each colony, but on fairly rare occasions they may nest twice in the same year (6 times in 49 colony/years); whether or not the same birds are involved is unknown. What does seem clear is that a normal breeding cycle takes about five months, and that the bulk of breeding activity occurs between March and December. Breeding normally starts about May, but tends to start two or three months earlier if two cycles are attempted (Table 2).

The onset of breeding varies from colony to colony and from year to year. In some years breeding activity would be seen throughout the year if all the colonies were visited month by month. Among other New Zealand Shags, it is normal for each colony to follow its own timing and for breeding to occur in a diffuse way with generalised peaks of activity, rather than substantially in unison.

Numbers

Again, because records are fragmentary, it is not possible to say accurately how many King Shags there are. In Table 2, the figures for 1951, 1961, 1964 and 1965 are nearest complete: 333 birds seen in 1951, 260 birds estimated in 1961, 245 birds seen in

TABLE 2 — Records of maximum numbers of birds

Colony	1948	1949	1950	1951	1952	1953	1954	1955	1956
White Rocks	- 25 n	-	60 b 40 n	70 b 22 n	-	20 b -	-	-	32 b 25 n
North Trio Id	- 25 n	80 b 33 n	100 b 28 n	95 b 15 n	-	80 b -	75 b 47 n	-	-
Duffer's Reef	(Colony unknown before 1951)			150 b 29 n	-	-	-	-	100 b 80 n
Sentinel Rock		-	-	18 b 4 n	-	-	-	-	-
D'Urville Peninsula	(Colony unknown before 1951)			-	-	-	-	-	-
Te Kuru Kuru Id	(Colony transferred from D'Urville Peninsula in 1960)								
TOTALS:									
Birds	-	80	160	333		100	75		132
Birds estimated	(100)	(66)	(136)	(140)	NO RECORDS	-	(94)	NO RECORDS	(210)
Nests	50	33	68	70		-	47		105

1964 and 192 birds estimated in 1965. For estimates, a nest is assumed to represent a pair of birds. Probably there are about three hundred all told, allowing for non-breeders and others not seen.

Miscellaneous Results

Feeding: Diving times are consistently longer in King Shags than in other species. Although Stonehouse (1967) recorded a maximum of 64 seconds for a Pied Shag *(P. varius)* in deep water, this was an unusual observation and he was able to show that the bird was near the limit of its capabilities; the average length of time under water was 12 seconds. On the other hand, King Shags average 46.5 seconds (6 individuals, 22 dives) and can easily stay under as long at 95 seconds.

They apparently hunt bottom-living fish: birds disturbed at their nests in 1964 regurgitated soles *(Peltorhamphus novaezelandiae)* and sand-eels *(Gonorhynchus gonorhynchus)*. Locally they are blamed for depleting the blue cod *(Parapercis colias)* fishery, but birds illegally shot to stop this are said to have contained only soles. Falla (1933) found small blue cod at the White Rocks colony, and expressed the opinion that they were the main food; he made the point, however, that marine birds scarcely ever deplete their food supply.

Parasites: Two species of ticks, found in nests on North Trio Island and Te Kuru Kuru Island respectively, were identified as *Ixodes eudyptidis* Maskall (previously known from Spotted Shags *Stictocarbo punctatus,* Black Shags *P. carbo,* Black-backed Gulls *Larus dominicanus,* and Little Blue Penguins *Eudyptula minor)* and *Ornithodoros capensis* Newmann (previously known from Spotted Shags — Dumbleton 1961).

and nests (from Table 2) n = nests, b = birds.

1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
80 b -	90 b -	-	-	36 b 29 n	-	31 b 14 n	80 b 23 n	-	-	-
-	10 b -	- 13 n	- 29 n	- 24 n	21 b 11 n	80 b -	30 b 6 n	37 b 17 n	61 b -	-
60 b -	62 b -	120 b -	-	- 68 n	- 47 n	-	85 b 40 n	97 b 54 n	94 b -	45 b 20 n
-	-	4 b 2 n	-	5 b 4 n	11 b 8 n	-	20 b 12 n	20 b 12 n	21 b 18 n	-
16 b 7 n	22 b 7 n	-	(Colony abandoned after 1959)							
			12 b 6 n	- 5 n	9 b 6 n	-	30 b 10 n	33 b 13 n	-	-
156	184	124	12	41	41	111	245	187	176	45
(14)	(14)	(30)	(70)	(260)	(144)	(28)	(182)	(192)	(36)	(40)
7	7	15	35	130	72	14	91	96	18	20

Some think that infestation of chicks may cause much of the movement of colonies from site to site, as at North Trio Island (B. D. Bell, pers. comm.) but no more evidence of this has been gathered yet.

DISCUSSION

King Shags have been protected since 1924, but, like other Shags throughout New Zealand, they have suffered illegal attacks in the cause of assumed fisheries protection. For a time late last century, commercial shooters shot King Shags for skins to be made into ladies' muffs; previously they had been collected avidly by scientists. Before the chicks hatch, merely a close approach from a sight-seeing launch is enough to cause birds to fly from their nests in alarm. Because the eggs are brooded between the feet and the belly, many are tumbled out of the nest in the hurry to get away, and others are taken by Reb-billed Gulls *Larus novaehollandiae scopulinus* before the Shags come back.

Neglecting previous heavy predation by man, why has the population of King Shags remained small since 1948 ? It appears that there is plenty of food and nesting space, no competition from other species, and no records of diseased or heavily parasitised birds. Possibly, the reason lies within the birds themselves.

King Shags may be struggling against an ecological gradient which we cannot discern at present, perhaps because they are better suited to life further south; here, one would expect them to have evolved adaptations to life at a lower latitude to offset this. Another possibility is that, as a small breeding stock, with little genetic variability, they may have less success in breeding than a larger stock with a larger gene pool. Again, perhaps some colonies are too small

to attain the minimum amount of social stimulation needed for successful breeding; Fraser-Darling's theory is probably tenable this far at least (Fraser-Darling 1938); and small groups of Pied Shags at Lake Pukepuke had less success than larger groups, and their breeding was less well co-ordinated (E. K. Saul, unpublished). Whatever the reason for its rarity, the species seems to be surviving and just replacing the breeding stock; further disturbance by man could upset this balance. But unless man was responsible for keeping numbers low in Forster's time (Maoris may have used the squabs as food, as they did with other species of Shags), this is debatable. For their conservation, it is safest to assume that disturbance will have a bad effect.

Considering their very small numbers, there is no doubt that King Shags are vulnerable as a subspecies; considering their history, there is no doubt that they are also very resilient. We know very little about them, and to conserve them properly we need to know much more. Their extreme timidity is a big difficulty, making observation difficult and conservation perilous while they are being studied. The safest methods would probably be those *not* involving landing and handling, but careful, regular observation from as far away as possible. This is uncomfortable and expensive from small boats, but perhaps easier and cheaper with light aircraft. Although estuarine Shags are not panicked by aerial surveys, we do not know yet how King Shags react to planes overhead; however, if they are not unduly disturbed, all their colonies could be aerially checked and photographed in a single morning. This would yield only gross data; total numbers of birds, nests and fledglings; but perhaps these would be enough to allow calculation of productivity and survival rates for each colony. For reasons of conservation alone, such a programme of regular surveillance would be valuable.

A banding and colour-marking programme planned to get more specific details (such as age at which breeding first occurs, individual faithfulness to nest site and mate, and all the data needed for making proper life tables) would be fraught with the danger of disrupting some colonies even if banding were to be done when the birds are least timid — that is, when adult, and when at least 50% of chicks are hatched, or for birds of the year just before they can fly. Night banding might reduce disturbance, but few operators would be willing to risk injury to find out.

Neither long-range observation nor banding is likely to provide us with many leads about the King Shags' relations with the physical world or other animals. What they eat can only be gauged from regurgitated fish and pellets found around the colonies; taking birds as specimens for stomach analyses, or even forcing birds to disgorge, is indefensible today, although Fairchild's decimation of the colony at White Rocks was recorded with equanimity by Buller in 1891.

To obtain this additional information, the only safe course seems to be to get it at second-hand from studies of the more numerous Stewart Island Shag *L. c. chalconotus*. These studies are much more likely to produce information applicable to King Shags than are any attempts to obtain it from the King Shags themselves. To find out how Stewart Island Shags get their livelihood, how their populations are made up and how they interact with their environment may well

be the best foundation for doing something useful for their scarcer relatives. In their ecology especially, once the important factors are known for Stewart Island Shags, it should be possible to measure the same factors in the King Shags' environment without disturbing the birds.

CONCLUSIONS

(i) For as long as they have been known, King Shags have maintained a small population of about three hundred birds or less. Constant harassing seems to have made them very afraid of man, and no doubt has caused big changes in their numbers in the past. The figures quoted in this paper are tentative and do not permit us to say whether the birds are increasing or decreasing.

(ii) King Shags generally breed once each year, starting in May or June. More information on breeding is needed to explain why numbers remain small in spite of protection. Some of this information could be gathered by regular aerial censuses. Because any further work at colonies, however meticulously planned, would inevitably cause disturbance, studies of ecology, behaviour and population should be undertaken on other subspecies which are less vulnerable. The results of these studies would be either valid for King Shags or at least indicative of lines to be explored for the species.

ACKNOWLEDGEMENTS

I thank Mr. B. D. Bell of the Wildlife Service for his advice during this work and for landing me safely on various islands; Dr. W. H. Dawbin, Sydney University, Dr. R. A. Falla and Mr. R. Stidolph for lending their field notes; Mrs. H. Oliver, until recently the Internal Affairs Department's librarian; Mr. J. C. Smuts-Kennedy, Wildlife Service, for drawing the map; Mr. L. J. Dumbleton, Entomology Division, D.S.I.R., for identifying ticks, and Dr. G. R. Williams, Wildlife Service, for helpful criticism of the manuscript. I am greatly indebted to Mr. E. K. Saul, D.S.I.R., for spending much of his time preparing the manuscript for publication and particularly for his help with the discussion.

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