

be compared with 89. When further similar comparisons are made it is found that the population for the combined area is rather less (average value 1.37) than one and a half times the population for Arthurs Pass, so 8 Keas per square mile is an overestimate.

Certainly the results show that in a good year between 100 and 200 Keas can be seen at Arthurs Pass and Temple Basin, and further that the density of Keas is between one and eight per square mile. The weight of evidence suggests the true value is nearer the lesser value and indeed the greater value is for the Bealey Valley where my impression is of a great density.

THANKS

I wish to thank the Arthurs Pass National Park Board for permission to band Keas and continued interest in the project; Mr. R. Cleland for continually watching the Keas at Arthurs Pass; Mr. L. Angus for showing me how to snare Keas; Dr. B. I. Hayman for help with the statistics; Mr. E. G. Turbott for several discussions about the paper; and many friends for reports and observations.

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A MIXED SHAG ROOST AT CLEVEDON

By W. L. MOISLEY

On 28/3/60 I noticed that an evening shag roost near my home, known for some years, but not studied, contained four species of shags. The roost is in a small plantation of exotic pine trees on a short steep face above a tidal creek lined with tall mangrove. Flat grassland stretches back from the trees. The birds fly in from the sea about $1\frac{1}{2}$ to 3 miles distant and from the nearby river and maze of mangrove-bordered creeks. This roost shows no sign of ever having been used for nesting.

After it had been noted that the birds came in to roost from late afternoon to dusk, counts were made and notes taken for the six days March 30 to April 4 and on April 14, 18 and 19. In this I was assisted several times by H. R. McKenzie and on separate occasions also by Messrs. A. Blackburn, F. M. Brookfield and W. W. Renouf. Some of my observations were made from in the top of a totara tree, where I could command the bend in the creek and the face of the crescent of pine trees. The birds could see me but did not mind. Perhaps they thought I was another kind of shag with an odd choice of roosting tree. Most of the watching was done from a large hide I made in the mangroves, while I did some close study from a rough hide of branches right under the birds. Notes of the weather and tides were kept but the roosting was not affected by them.

The counting was exciting as dusk approached. Fifteen to twenty birds of perhaps three or four species would come in at once,

but some would miss their footing and swing out of sight again over the mangroves. The method was to count the whole lot in, write down the figure, count the outgoing birds, then check them back in until the first figure was reached. It was fast work. The writer could not see all the birds readily, so the busy caller sounded like an announcer at a football match.

For the dates given above the nine counts for each species are appended. For the sake of clarity the two phases of the White-throated are shown separately, the broken coloured ones being included in White-throated.

BLACK SHAG. (*Phalacrocorax carbo novaehollandiae*).

Counts: 51, 56, 54, 88, 88, 84, 83, 81, 83. This species always arrived first, sometimes forty or so being present when I got there at 3 p.m., but some would still come in right up to dark. About 15% were immature. At first only a few showed the white flank patch but by the end of the period over one-third of them had it.

PIED SHAG. (*Phalacrocorax varius varius*).

Counts: 8, 9, 12, 4, 7, 5, 9, 3, 3. The Pied were usually the second species to arrive and were seldom among the late ones. There were usually 2 or 3 immature.

WHITE-THROATED SHAG. (*Phalacrocorax melanoleucos brevirostris*).

Counts: 64, 62, 68, 61, 75, 91, 91, 89, 76. The true type prevailed but quite a large proportion had the extra long white area from throat to breast or were patchy. Some immatures were seen but when a bunch of birds, including Little Black, flew up the creek and could only be seen as they crossed the short space between the mangroves and the far end of the crescent of pines there was little time to make sure which was which. Those coming nearer to us we could be sure of. To be on the safe side, we changed over eight or so of our Little Black tally each time to allow for immature White-throated with no white throat. This I am sure was sound practice. White-throated and Little Pied together were nearly always the third arrivals in regard to the first in of species.

LITTLE PIED SHAG. (Pied phase of White-throated).

Counts: 27, 30, 33, 14, 20, 20, 26, 25, 27. These figures represent the usual proportion of Little Pied to White-throated Shags about the coast here.

LITTLE BLACK SHAG. (*Phalacrocorax sulcirostris*).

Counts: 13, 21, 28, 26, 33, 29, 38, 39, 31. Some immature were detected by their somewhat brownish appearance. This was nearly always the last species to start coming in.

ODDLY COLOURED BIRDS: One Black Shag had a white patch covering all of its side under the wing and another had a similar patch about $2\frac{1}{2}$ by 1 inches. These were not connected with flank patches.

A Little Pied Shag, seen from the pine-tree hide at ten feet, had a yellow bill, dark eyes, white head, neck, breast, belly and upper wing coverts, black primaries and secondaries, broken white on upper tail coverts and rump, black upper and lower surfaces of tail, black feet. In poor light the white upper wing coverts looked like white stumps of wings. Another bird was coloured much the same but with two

black shafts from the back up to each side of the base of the neck. A third had a whitish head with a thin dark strip from the fore-crown right back down to the centre of its back, its under surface being all dirty yellow.

ROOSTING HABITS.

The Black Shags used mostly the higher perches and kept to the outer surface of the clump of trees, spreading the full length of the crescent, about 150 yards. They did not use the lower branches down towards the creek. They were the easiest to count because they flew in higher than the others. No shags used the side of the plantation away from the creek.

The Pied Shags kept to one end and at lower than mid-height, on or very near the surface of the pine face. The smaller shags occupied perches from low kowhai trees on the creek bank up to one third of the height of the pine face, some on outer branches but many penetrating the trees to the second line of pine trunks in the plantation. These small shags, White-throated, Little Pied and Little Black, make a curious cooing noise "keh-keh-keh" when landing and when moving from branch to branch. This I heard from my hide only a few feet below them. Often two would hold an animated conversation, making the above noise and a clicking sound.

Preening is begun by arranging the primaries and secondaries of the folded wings. In between preening the birds relax, and with the bill slightly open there is a constant rippling movement in the throat. Another form of relaxing is to bend the neck well back and rest the bill on the upper breast. When sleeping the bird folds its head over on the upper part of its back in an awkward looking manner.

DAYTIME HABITAT.

Some of the Black Shags came from up the river but most would live in the lower river area and the estuary. It is thought that the roost would account for the whole population of the Wairoa (Clevedon) River, its estuary and the nearby coast.

The Pied represented only a small part of the local birds. Several other of their roosts are known. On April 14, H. R. McKenzie saw 20 feeding in the river only a mile from the roost, but there were never 20 seen at the evening roost.

The White-throated and Little Pied work mostly about the mouth of the river and the estuary. From a high vantage-point on the west side H.R.McK. and I saw so many of these that we were sure the roost was not drawing its numbers from beyond the estuary.

The Little Black seem to range more widely. They have not yet been seen in the estuary during the day, though they could frequently be there.

On one occasion I set out on the east side to see where the birds spent the day. On eight dead pine trees by the river, three-quarters of a mile west of the roost, I found 83 Black, 8 Pied, 64 White-throated, 15 Little Pied and 30 Little Black. This corresponded so closely with the roost numbers that I concluded that the fishing had been good and they were just waiting for bed-time. On April 14, in the early afternoon, H.R.McK. saw about 45 Black Shags on the same trees but no others. No doubt in both cases they would later fly up the creek to the roost.