Breeding success of Hutton's shearwater in the Kowhai and Shearwater Stream colonies during the 2006/07 breeding season

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Introduction

Hutton's shearwater is an endangered seabird that breeds in the seaward Kaikoura Mountains. The breeding range has contracted to two colonies; one at the head of the Kowhai River the other in Shearwater Stream. The total population is estimated at 106,000 breeding pairs, with 98,600 at the Kowhai and 7750 at Shearwater Stream (Cuthbert and Davis 2002). Much is known about the breeding ecology following a PhD study carried out during the 1997/98 and 1998/99 breeding seasons (Cuthbert 1999, Cuthbert 2001, Cuthbert and Davis 2002). Most of the research carried out on Hutton's shearwater has been done in the Kowhai colony, with infrequent visits to smaller Shearwater Stream colony.

The main purpose of this study is to investigate whether the Shearwater Stream colony has similar breeding success to those described in the Kowhai, as in the past this has generally been inferred from the Kowhai results.

Methods

Both the Kowhai and Shearwater Stream colonies were visited twice, firstly in mid November to locate burrows with incubating adults, and again in early march to check for near fledged chicks, hence determining breeding success. Sampling days were centred on the known breeding cycle of a mean laying date of 8-9th November, incubation averaging 50 days and chick rearing 84 days (Cuthbert 1999). Initial sampling was carried out in late November towards the end of the egg laying period. Mean fledging date is calculated at 19-20th March, re-sampling in early March occurring at the end of the chick-rearing period when most chicks should not have fledged yet.

A burrowscope was used to check the occupancy of burrows. Only burrows that the contents could be confidently identified were used, either adults incubating eggs, empty chambers or burrows being excavated. The contents of each burrow were recorded. Burrows containing incubating birds were GPS plotted, marked with a numbered metal tag and a coloured marker pole to enable burrows to be re-found.

Burrows were re-sampled in early March to check for the presence of well-developed chicks, the presence of a chick indicating breeding success, the absence failure.

Results and Discussion

Burrow occupancy

In the Kowhai colony it was possible to determine the contents of 187 burrows (21 November), at Shearwater Stream (22 November) 119 burrows (table 1). Burrows contained either an incubating bird, an empty chamber or evidence of burrow excavation. Burrowscopes could not be used in all burrows because of the twisted or tight nature of some burrows; Cuthbert and Davis (2002) found that 10% of burrows were impossible to use a burrowscope to confirm contents.

Burrow occupancy at the Kowhai was 53% and at Shearwater Stream was 57% (table 1). Between 1989 and 1999 burrow occupancy in the Kowhai colony averaged 70% (range 62-77%). Within the Kowhai colony four sub-colonies were sampled and occupancy rates varied in all these colonies, with occupancy lower in the two higher the sub-colony (Table 2). Mean egg laying is November 8/9th with laying extending over 27-38 days being completed by December 1st (Cuthbert 2001). Therefore during this study monitoring would have been taking place during the end of the egg-laying period, when most burrows should have been occupied. The lower occupancy of higher sub-colonies in the Kowhai suggests that laying was delayed in these sub-colonies, probably as a result of late snowfalls in early November.

Cuthbert's study used lower sub-colonies (c. 1280 m) to determine egg-laying dates and it is possible that higher sub-colonies have even more extended laying periods. Occupancy of below 47 and 43% in the two sampled higher sub-colonies is significantly below the average and suggests that egg laying was still underway. Occupancy of Harrow (64%) and Camp (61) sub-colonies is closer to the average and suggests egg laying was nearer to completion here.

Table 1. Occupancy of Hutton's shearwater burrows where contents could be confirmed by burrowscope, November 2006.

	Kowhai (%)	Shearwater Stream (%)
Burrows checked	187	119
Incubating birds	100 (53.5)	68 (57.1)
Empty nest	72 (38.5)	49 (41.2)
Being Dug	15 (8.0)	2 (1.7)

Table 2. Occupancy of Hutton's shearwater burrows in the Kowhai colony in relation to altitude of sub-colonies sampled.

	Harrow	Camp	Opposite Top	Top	Total
Altitude	1280	1280	1350	1350	-
Burrows checked	39	41	84	23	187
Incubating birds	25 (64.1)	25 (61)	40 (47.6)	10 (43.5)	100 (53.5)
Empty nest	10 (25.6)	14 (34.1)	36 (42.9)	12 (52.2)	72 (38.5)
Being Dug	4 (10.3)	2 (4.9)	8 (9.5)	1 (4.3)	15 (8.0)

Breeding success

The burrows in Shearwater Stream were re-sampled on March 5th, and on March 6th in the Kowhai. Of the 100 burrows located in the Kowhai containing eggs 80 (80%) were located to be re-sampled, and 57 (83%) of the 68 in Shearwater Stream were found. Vegetation growth, marker poles falling over and inaccuracies with GIS maps meant that not all burrows could be relocated to be re-sampled.

Breeding success at both sites is low. In the Kowhai 13 of the 80 re-sampled burrows contained chicks, breeding success of 16%. At Shearwater Stream only 2 of the 57 burrows contained chicks, exceptional low breeding success of 3.5% (Table 3). Between 1989 and 1999 breeding success in the Kowhai averaged 46.5% (range 27 to 66%) (Cuthbert and Davis 2002). The results of the present study fall not only well below the average, but also well below the previous lowest recorded breeding success of 27% (Cuthbert and Davis 2002).

It is impossible to determine if this is the result of an exceptionally poor season, or if breeding success has declined significantly since the 1990's. In particular there has never been a measure of breeding success at Shearwater Stream and it is possible with the lower population here that breeding success is considerable lower than the Kowhai. The smaller population may not buffer the effects of stoat predation that the larger Kowhai colony is reportable capable of.

Table 3. Re-sampling effort and productivity of Hutton's Shearwater in the Kowhai and Shearwater Stream colonies.

	Burrows re-sampled	Chick present (productivity)	Empty	Egg	Dead chick
Kowhai	80	13 (16.25%)	65 (81.255)	2 (2.5%)	
Shearwater Stream	57	2 (3.5%)	54 (94.7%)		1 (1.7%)

Causes of failure

The methods used in this study make it impossible to determine the cause of breeding failure. One burrow in Shearwater Stream contained a dead chick, and a deer trampled

another. Deer had also trampled two burrows in the Kowhai. Stoats and their sign were seen in both colonies and are known to be major predators of chicks (Cuthbert 2001). Only two un-hatched eggs were found in the Kowhai, none in Shearwater Stream. Predated adults and eggs were commonly encountered during the first visit, and predated chicks during the second, although no accurate count was kept of this.

Non-breeding population

A relatively large proportion of a healthy seabird population comprise of non-breeding birds, mostly pre-breeders, birds to young to breed or yet to find partners. It is almost impossible to determine the size of this proportion of the population. These birds are very active at the colony during the pre-egg and incubation stages (Warham 1990). Burrows recorded being excavated during November (incubation stage), are likely to be pre-breeders. The low number of such burrows in Shearwater Stream (1.7% of burrows) is of concern as it may indicate a small number of per-breeding birds in this population.

Can these results be trusted?

Is this low productivity a result of chicks fledging prior to re-sampling or re-sampling errors associated with the burrowscope? Do the results accurately reflect this year's productivity?

Cuthbert and Davis (2002) found that burrowscopes could not accurately identify contents in 10% of cases. However they did believe that burrowscoping was reliable to determine breeding success where burrow occupancy could be determined (Cuthbert and Davis 2002). In this study we identified burrows with birds incubating eggs, hence at re-sampling these were burrows with known occupancy. These same burrows were used to determine breeding success, and as such we knew we could get into the nest chamber with the burrowscope to re-sample the burrow to determine if a chick was present. Therefore the measure of breeding success will be accurate.

It is also unlikely that most burrows had fledged by the time we re-sampled. With a mean incubation period of 50 days, and chick rearing of 84 days (Cuthbert 2002), mean fledgling date would be around March 19/20th, two weeks after burrows were re-sampled. Lower than average burrow occupancy at the time of initial sampling, could also be interpreted as mean egg laying being later than average, which would further push back mean fledging. Therefore it is unlikely that fledging prior to re-sampling resulted in lower productivity being recorded.

During the same period as burrows were re-sampled, chicks were removed from burrows and wing length recorded to grade chicks for possible collection for transfer to Kaikoura Peninsular. The average wing length of all birds measured was 205 mm. By using known growth rates of chicks, and incubation periods a mean laying date can be determined. A mean wing length of 205 mm would give an average age of approximately 65-70 days, there most chicks would hatch around December 26-31st. Mean incubation of 50 days, would mean that most eggs would have been laid around November 9-14th. Further

evidence that the laying period this season was similar to that previously recorded and the early fledging is not likely to be impacting on results.

Therefore it seems likely that the results are a real reflection of productivity and highlight a high failure rate of breeding at the Kowhai and an almost complete failure at Shearwater Stream this year.

The only complicating factor could be that Harrow (pers comm.) believes that the Shearwater Stream colony may be up to three weeks ahead of the Kowhai, although he gave no evidence to confirm this. If this were the case, many successful nests at Shearwater Stream would have fledged young before the second visit and we may have wrongly recorded the nests as empty or 'failed'. However the higher altitude at Shearwater Stream (1800m) and the vulnerability of this colony to the November snowfalls would tend to encourage later rather than earlier laying.

Conclusion

The use of a burrowscope to determine breeding success is effective for Hutton's Shearwater. When breeding success is determined by using burrows previously known to contain incubating birds the method is reliable. Although based on just one seasons data the results are concerning and suggest that the Hutton's shearwater population is in trouble, especially the Shearwater Stream colony. It is vital that this monitoring is continued to confirm results, and that effective management is instigated to reverse these trends.

Evidence suggests that this year was a normal season with the breeding timetable similar to that previously recorded, principally a mean laying date of around November 8/9th. This is an important factor when analysing burrow occupancy and breeding success data. There is some question as to whether the Shearwater Stream colony is ahead of the Kowhai colony, but without precise data this cannot be accepted.

Estimates of total burrow occupancy at both the Kowhai and Shearwater Stream fall within the known range for Hutton's Shearwater, suggesting that there has been no change in burrow occupancy levels since the late 1990's. This suggests that there has not been any major change in adult survival, and the breeding population may be stable.

Breeding success was low, 16% for the Kowhai and 3% for Shearwater Stream. A significant drop in breeding success, below the lowest recorded between 1989-1999. Whether this is the result of an exceptionally poor year or a shift in breeding output from that previously recorded is unknown.

Almost complete failure in the Shearwater Stream is of grave concern. The low number of burrows being excavated suggests a small pre-breeding population, which points to breeding success being low for some time. So although occupancy suggests a stable population, long term poor breeding and lowering of the pre-breeding population

indicates a population under pressure and about to crash as the breeding population ages without being able to replace itself.

If there has been a shift in breeding success in the Kowhai since the 1990's, Shearwater Stream could be highlighting what is about to occur here also in the near future.

Recommendations

Monitoring should continue for a further 2-3 years to determine trends in breeding success, thus avoiding annual fluctuations.

Initial samples locating burrows should be taken between November 15-25th to be after peak laying when most burrows should be occupied.

Re-sampling in Shearwater Stream should take place in mid February. A sample of chicks should be remove from burrows to measure wing lengths to determine the average age to estimate the mean lay date to determine if this colony is three weeks ahead of the Kowhai. Re-sampling at the Kowhai should remain at early March.

If low breeding success (<30%) is recorded in the 2007/08 season, predator control must be initiated predator control be initiated at each colony.

Predator control methodology should be evaluated and trails conducted if required this season (2007/08) to be prepared for the worst case. Despite the difficulties of kea, methodology evaluation should include the toxins. I believe the aerial application of toxins at specific times may gain enough control to decrease stoat numbers to a level to significantly improve breeding success.

Deer should be controlled in both the Kowhai and Shearwater Stream colonies, were practical carcases should be removed.

References cited

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