The Australian

BIRD BANDER

Dispersal Patterns of Cormorants Banded in South Australia

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The recoveries of bands from 116 Black Cormorants *Phalacrocorax carbo*, 1326 Pied Cormorants *P. varius*, 55 Little Black Cormorants *P. sulcirostris*, 49 Little Pied Cormorants *P. melanoleucos*, and 444 Black-faced Cormorants *P. fuscescens* are mapped. The five species were found to differ in their gross habitat preferences and thus presumably they avoid competition for food.

The Black and Little Black Cormorants were recovered mainly inland in south-eastern Australia, east of 139°E. The Black-faced, Pied and Little Pied Cormorants were recovered mainly in the sheltered marine area of Spencer and St Vincent Gulfs, west of 139°E. Only the Black Cormorant dispersed across Bass Strait to Tasmania. No bands from any of the five species were recovered north of the Tropic of Capricorn, or west of the Great Australian Bight.

Introduction

In several parts of the world sympatric species of cormorants and shags, Phalacrocoracidae, have been shown to differ in their habitat requirements, e.g. *Phalacrocorax carbo* and *P. aristotelis* in England (Steven 1933); *P. olivaceus, P. gaimardi* and *P. bougainvillii* in Peru (Koepcke 1970; Murphy 1925); and *P. auritus, P. pelagicus* and *P. pennicillatus* in British Columbia (van Tets 1959).

In southern Australia there are five sympatric species of Phalacrocoracidae: the Black Cormorant *P. carbo*, the Pied Cormorant *P. varius*, the Little Black Cormorant *P. sulcirostris*, the Little Pied Cormorant *P. melanoleucos*, and the Black-faced Cormorant *P. fuscescens*. Large numbers of individuals from each of these species have been banded in south-eastern South Australia with bands provided by the Australian Bird-Banding Scheme. This work was undertaken with the co-operation of the National Parks and Wildlife Service of South Australia and the Division of Wildlife Research, CSIRO.

The geographic distribution patterns of the band recoveries arising from this work has provided an opportunity to quantify the gross habitat preferences of the five species.

Methods

In this paper only bands recovered at least 16 km from where they were placed around the legs of nestling cormorants are considered. The earliest recoveries from each species were: Black Cormorant October 1963, Pied Cormorant June 1962, Little Black Cormorant May 1966, Little Pied Cormorant April 1964, and Black-faced Cormorant June 1964. The last recoveries considered were obtained in June 1975.

The numbers of recoveries have been totalled for each one degree of latitude and longitude quadrangle. All banding was within the five degree of latitude and longitude quadrangle 33°-38°S 136°-141°E. This is referred to later in the text as the banding quadrangle.

Results

Of 59 000 Pied, 22 000 Black-faced, 4200 Black, 4000 Little Black and 3800 Little Pied Cormorants that were banded, bands of 1326 (2%) Pied, 444 (2%) Black-faced, 116 (3%) Black, 55 (1%) Little Black and 49 (1%) Little Pied Cormorants were recovered.

The Black Cormorant (Figure 1) shows the greatest dispersal with 56% of the recoveries outside the banding quadrangle. It is the only species that dispersed across Bass Strait to Tasmania. It is also the only species of cormorant known to stray from Australia or New Zealand to Macquarie Island (Keith and Hines 1958, Kinsky 1970).

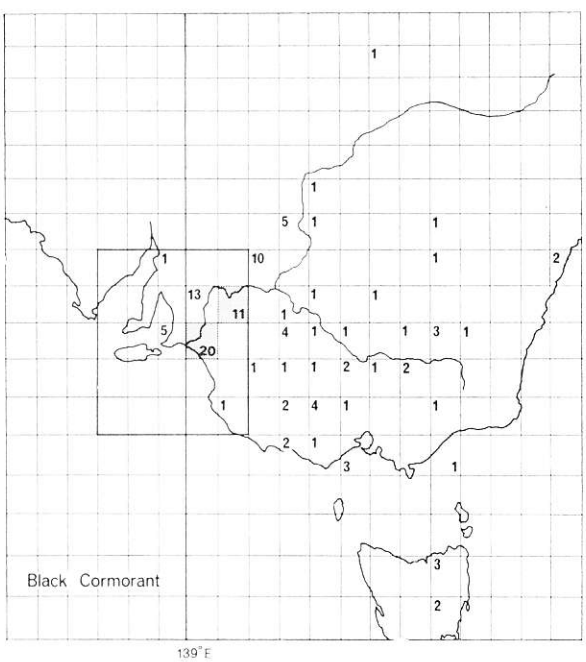


Figure 1. *Map of number of band recoveries of Black Cormorant within the small quadrangles. All five species of cormorant were banded within the large quadrangle. Black Cormorant were banded within the shaded quadrangles.*

The Pied Cormorant (Figure 2) shows the least dispersal with only 7% of the recoveries outside the banding quadrangle. The longitudinal dispersal of the Pied Cormorant with 98% of the recoveries west of 139°E, complements that of the Black Cormorant with 95% of the recoveries east of 139°E. Thirty recoveries of Pied Cormorant in Western Australia also showed slight dispersal, restricted to the coast (Ford 1963).

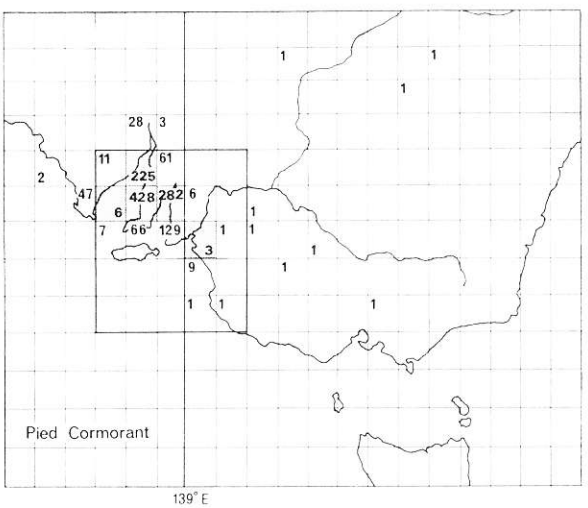
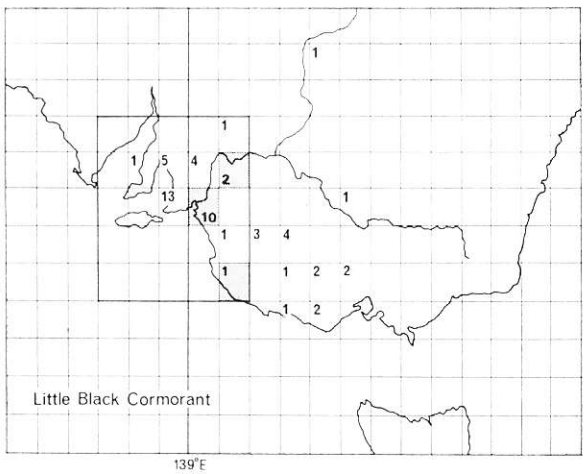


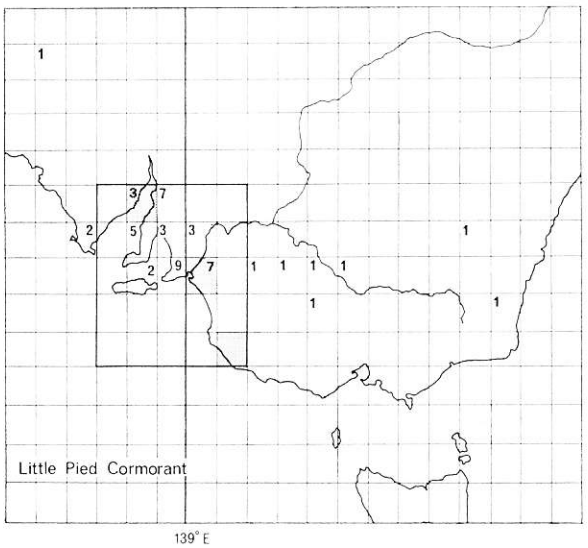
Figure 2. *Map of number of band recoveries of Pied Cormorant within the small quadrangles. Pied Cormorant were banded within the shaded quadrangles.*

The Little Black (Figure 3) with 31% and the Little Pied Cormorant (Figure 4) with 20% of the recoveries outside the banding quadrangle show an intermediate amount of dispersal. Outside the banding quadrangle 15 out of 17 recoveries of Little Black Cormorant are south of 36°S, and eight out of ten recoveries of Little Pied Cormorant are north of 36°S. The longitudinal dispersal of the Little Pied Cormorant with 65% of the recoveries west of 139°E, complements that of the Little Black Cormorant with 65% of the recoveries east of 139°E.

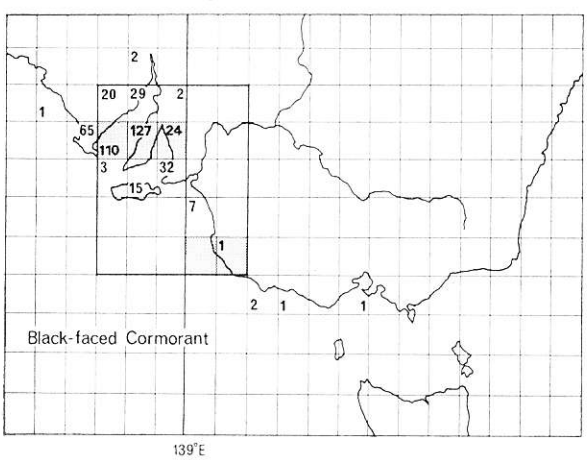
The Black-faced Cormorant (Figure 5) is a sea shag belonging to the genus or sub-genus *Leucocarbo* which is restricted to marine waters for foraging (van Tets in press). It is therefore not surprising that its dispersal is coastal with 16% of the recoveries outside the banding quadrangle. Longitudinally with 97% of the recoveries west of 139°E the dispersal of the Black-faced Cormorant matches that of the Pied Cormorant.



● Figure 3. *Map of number of band recoveries of Little Black Cormorant within the small quadrangles. Little Black Cormorant were banded within the shaded quadrangles.*



● Figure 4. *Map of number of band recoveries of Little Pied Cormorant within the small quadrangles. Little Pied Cormorant were banded within the shaded quadrangles.*



● Figure 5. *Map of number of band recoveries of Black-faced Cormorant within the small quadrangles. Black-faced Cormorant were banded within the shaded quadrangles.*

There is no evidence of any major northward migration for any of the five species. There are no recoveries north of the Tropic of Capricorn, and only a few north of the head of Spencer Gulf at Port Augusta, 32°S (3 Pied, 2 Black, 1 Little Black and 1 Little Pied Cormorants). The Black-faced Cormorant is restricted to the southern coasts of Australia, but the ranges of the other four species extend into northern Australia (Serventy *et al.* 1971; Storr 1973).

There is also no evidence of any major westward dispersal for any of the five species. There are no recoveries along the exposed coast of the Great Australian Bight west of 134°E and only a few west of 135°E (2 Pied and 1 Black-faced Cormorants). There are few recoveries on the Victorian coast, south of 38°S and east of 141°E (7 Black, 3 Little Black and 4 Black-faced Cormorants).

Within the banding quadrangle there are few recoveries south of 36°S, where there are exposed coasts (12 Pied, 8 Black-faced, 2 Little Black and 1 Black Cormorants). North of 36°S the recoveries of the Pied and Black-faced Cormorants are concentrated around the sheltered maritime waters of Spencer and St Vincent Gulfs, west of 139°E; the Black Cormorant around the mouth and lower reaches of the Murray River, east of 139°E; and the Little Black and the Little Pied Cormorants around both areas.

Discussion

The Black and the Pied Cormorant are both large and their size ranges overlap. The Little Black and the Little Pied are both small and

their size ranges overlap. The Black-faced Cormorant is intermediate in size. These three size categories presumably help to reduce competition for food.

The wings of the Black Cormorant are relatively longer and stronger than those of the other four species, and may be related to its greater degree of dispersal. In South Australia the Black Cormorant appears to avoid competition with the Pied Cormorant by dispersing inland and to Tasmania, where the Pied Cormorant has been extinct since pre-historic times (van Tets in prep.). On the Atlantic coasts of North America the Black Cormorant is a marine species, presumably prevented from dispersal inland by competition with the Double-crested Cormorant, *Phalacrocorax auritus* (*cf.* Lewis 1929).

The Little Pied Cormorant feeds mainly on arthropods (McNally 1958; Serventy 1938; Thomson and Morley 1966; Vestjens in prep.), and thus avoids competition with the other four species which feed mainly on fish.

Three species that thrive in the sheltered marine waters of Spencer and St Vincent Gulfs differ not only in size, but even more so in the length and shape of their bills, long and thin in the Pied, intermediate in the Black-faced, and short and stubby in the Little Pied Cormorant. All three of these species are dark dorsally and white ventrally, whereas the other two species with mainly eastern inland dispersal are dark all over, hence their names Black and Little Black Cormorants.

None of the five Australian species like exposed sea shores which are the niche of the subgenus *Stictocarbo*, which includes the Spotted Shag *Phalacrocorax punctatus* and the Shag *P. aristotelis* of Europe. There is no evidence yet to show that *Stictocarbo* was represented in Australia in pre-historic times.

Acknowledgements

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The maps were drawn by Frank Knight.

References

Ford, J. (1963), 'Dispersal and Mortality in the Pied Cormorant in Western Australia', *W.A. Nat.* 8: 177-181.

Keith, K. and M. P. Hines (1958), 'New and Rare Species of Birds at Macquarie Island During 1956 and 1957', *CSIRO Wildl. Res.* 3: 50-53.

Kinsky, F. C., Convener (1970), Annotated Checklist of the Birds of New Zealand, pp. 96, A. H. and A. W. Reed, Wellington.

Koepcke, M. (1970), The Birds of the Department of Lima, Peru, pp. 144, Livingston Publ. Co., Wynnewood.

Lewis, H. F. (1929), The Natural History of the Double-crested Cormorant (*Phalacrocorax auritus* (Lesson)), pp. 94, Ru-Mi-Lou Books, Ottawa.

Murphy, R. C. (1925), Bird Islands of Peru, pp. 362, G. P. Putnam's Sons, New York.

McNally, J. (1958), 'Cormorants, Their Feeding Habits in Victoria', *Wildlife Circular No. 8*, pp. 12, Fisheries and Game Department, Victoria.

Serventy, D. L. (1938), 'The Feeding Habits of Cormorants in South-western Australia', *Emu* 38: 293-316.

Serventy, D. L., V. Serventy and J. Warham (1971), 'The Handbook of Australian Sea-birds', pp. 254, A. H. and A. W. Reed, Sydney.

Steven, G. A. (1933), 'The Food Consumed by Shags and Cormorants Around the Shores of Cornwall (England)', *Journ. Marine Biol. Assoc. U.K.* 19: 277-292.

Storr, G. M. (1973), 'List of Queensland Birds', *W.A. Mus. Special Publ. No. 5*, pp. 177.

Thomson, J. A. and N. W. Morley (1966), 'Physiological Correlates of Habitat Selection in Australian Cormorants', *Emu* 66: 17-26.

van Tets, G. F. (1959), 'A Comparative Study of the Reproductive Behaviour and Natural History of Three Sympatric Species of Cormorant' (*Phalacrocorax auritus, Ph. penicillatus, Ph. pelagicus*) at Mandarte Island, B.C. Unpub. M.A. Thesis, Univ. Brit. Columbia.

van Tets, G. F. (in press), 'Australasia and the Origin of Shags and Cormorants, Phalacrocoracidae', *Proceedings of the XVI I.O.C., Canberra.*

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