adults of this species feeding at a nest near Pine Creek, NT, and I noted two trios (two males: one female) near Mount Isa. Orenstein also observed a trio of *C. picumnus melanota* attending one nest at Mareeba, Qld.

I conclude that Brown, Rufous, Red-browed and Black-tailed Treecreepers are facultative cooperative breeders because I have observed three of these species also breeding in simple pairs. It is interesting that groups of these species typically contain more males than females. Skewed sex ratios may be characteristic of many Australian cooperative breeding passerines (Dow 1973) but few such species are sexually dimorphic. The White-throated Treecreeper probably never breeds cooperatively and this species differs from the above four in many other aspects of behaviour and morphology (unpubl. data). As the White-browed Treecreeper is closely related to the Red-browed (Keast 1957), it may also breed co-operatively.

A more detailed account of the social behaviour and breeding success of these birds will appear at a later date.

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SALINE COASTAL SWAMP IN NORTHERN TERRITORY AS A HABITAT FOR WATERBIRDS

Coastal building in recent geological time has been extensive and rapid in parts of the Northern Territory (Williams 1969). This has isolated sections of mangrove forest from the sea. This forest has then been ravaged by the monsoonal climate and succeeded by saline swamps and alluvial plains. The salinity in these areas seems to originate largely from the substratum, because any input from spring tides only affects their margins. Little study seems to have been made of this type of habitat but it probably has much in common with salt marshes of temperate climates.

The aim of this project was to study seasonal changes in numbers of waterbirds in one such area, Leanyer Swamp, five kilometres south-east of Darwin, also to compare the birds in this area with those in fresh-water and littoral habitats.

The Darwin region has a long cool dry season (May to September) and a hot humid wet season (December to March) when most of the annual rainfall (average 1,500 mm) is received. There are also transitional periods of high temperatures and humidity but comparatively little rain (October–November and April); McAlpine (1969) describes the climate in detail.

The census was carried out in the north-western corner of Leanyer Swamp between October 1970 and July 1971. The area consisted of bare clay pans dissected by beds of sedges, salt-tolerant grasses and other herbage (Story 1969). During September 1970, the swamp was completely dry; shallow flooding resulting from fresh-water drainage occurred in early October. This water became hypersaline as salt was deposited in the swamp. Salinity seemed to have been high enough to prevent germination of the sedges until after substantial inflows of fresh water in December 1970 and January 1971 (Fig. 1c). The sedges started to germinate in mid-January and by early March two thirds of the open water had been overgrown. Water-levels reached a maximum of about one metre in March but dropped steadily through April and May. The swamp was completely dry again by mid-July. After March, evaporation seemed to be the sole factor for reducing the level of the water. This caused the levels of salinity to rise and the sedges to die and mat down so that the habitat again became fairly open.

Observations were made along two transects about 100 metres wide and 400 metres apart. The census area covered about five hectares.

Richness of species (Fig. 1b) was calculated by totalling the number of species seen on each visit during a month and dividing by the number of visits. Weekly visits were made except from December to February when they were increased to twice a week at times. Sorensen's (1948) similarity quotient (QS) index was used to determine the relation between birds listed from Leanyer Swamp and Fogg Dam (freshwater) and the coast (Fig. 1a). The formula is $QS = [2W (a + b)] 1000$ where a = list of species from area A, b the list from area B and W those recorded from both areas. Each week censuses were carried out in the other two areas. The QS values were obtained by using the monthly list of species from each area. The areas were of unequal size; so there was a danger of bias with the use of the index (Southwood 1966). Leanyer Swamp was the smallest area. Because the index makes use only of lists of

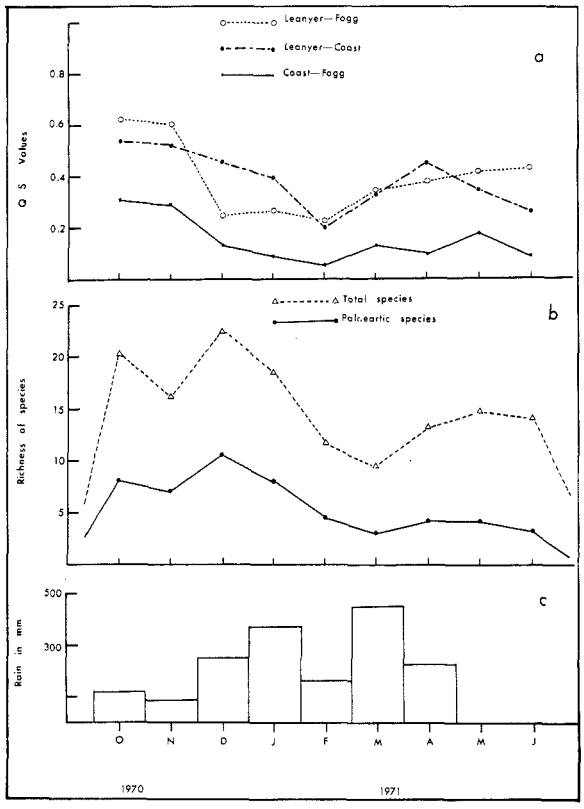

Figure 1. **a** Values of similarity quotient of Leanyer, Fogg Dam and on the coast.
b Richness of species in total and of Palaearctic species separately.
c Rainfall during the period.

species, the bias can be reduced by pooling results from several visits. Calculations indicated that monthly (4 visits) lists of species gave satisfactory estimates (Caughley 1965).

A list of species recorded in the Leanyer Swamp appears in a general account of the birds in the Darwin area (Crawford 1972). Not included in results of the present investigation were records of passerines and species of secretive habits.

RESULTS AND DISCUSSION

Figure 1b shows the fluctuations in richness of waterbirds and Palaearctic waders. Positive correlations were found between richness of species and $\log_e$ (Numbers) for both groups ($p < 0.01$). Fluctuations in richness of species at Fogg Dam and on the coast did not follow the bimodal pattern seen at Leanyer Swamp. Peaks of richness did occur in October–November 1970 but not in April–May.

In October–November the high QS values (Fig. 1a) seem to reflect the extent to which the areas were used for refuge before the start of the wet season. With improvement in conditions inland after rain in December, QS values of Leanyer–Fogg and coast–Fogg decreased, as birds left Fogg Dam and the coast. There was an influx of some species into Leanyer Swamp because, unlike Fogg Dam and similar areas, it was not being suddenly overgrown by vegetation. Marsh Sandpipers *Tringa stagnatilis*, Royal Spoonbills *Platalea regia* and Grey Teal *Anas gibberifrons* showed the most significant increases.

The decline of index values of Leanyer—coast through the early part of the wet season seemed to reflect the gradual development of sedge in the swamp, which excluded species that preferred open water; most of the Palaearctic waders left by the end of January (Fig. 1b). The increase at Leanyer—Fogg Dam and Leanyer–coast in March–April indicates return of some species to the swamp after water-levels started to drop (Fig. 1b). From January to June 1971, no Palaearctic waders were recorded at Fogg Dam because conditions were unsuitable. They predominated in the coastal census at all times. Consequently, the values for Leanyer–Fogg and Leanyer–coast in March–April result from almost completely different lists of shared (W) species (Fig. 1a).

All species recorded in Leanyer Swamp were found elsewhere but the occurrences were often different. Black-winged Stilts *Himantopus himantopus* were present at Leanyer Swamp throughout the wet season. They were not recorded from the coast and left Fogg Dam in late November. Black-tailed Godwits *Limosa limosa* and Sharp-tailed Sandpipers *Calidris acuminata* were the most abundant Palaearctic waders in Leanyer Swamp. In a list of abundance compiled from all wet habitats from July 1970 to June 1971, they ranked seventh and ninth respectively.

The maximum theoretical QS value is 1000 when the same species are recorded from both areas being compared. This is unlikely ever to occur naturally. QS values of about 850 are not unusual in a comparison of lists from areas in a homogeneous habitat. The index values (Fig. 1a) show that the bird community in Leanyer Swamp was always significantly different from those of Fogg Dam and the coast. The persistently low value of coast–Fogg Dam compared with the other two variables (Fig. 1a) indicate the intermediate position of the swamp as a habitat for waterbirds. This difference between Leanyer Swamp and the other two habitats seems to result from its salinity, which discouraged the growth of standing vegetation at the beginning and end of the wet season.

In a study of waterbirds on salt fields in South Australia (Crawford 1975) it was found that there was considerable daily movement between the saltmarshes and the coast because many birds, particularly waders, had other feeding sites on the tidal mud-flats. No such mass movements were observed between Leanyer Swamp and the coast even though less than 500 metres of mangrove forest separated them.

Since August 1971 a sewage works has come into operation on the outskirts of Leanyer Swamp; so the area is probably no longer fairly typical of the saline coastal swamps.

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REMARKS ON THE NOMENCLATURE AND TAXONOMY OF THE CRESTED PENGUINS

While revising accounts of penguins in *The Handbook of Australian Sea-birds* I noticed Carin's interesting short communication (1974, Emu 74: 55-57) on 'Facial characteristics of Rockhopper Penguins'. He makes the point that, in photographs, birds from the Falklands, Staten Island, Gough and New Amsterdam Islands appear to be dark faced compared with those from Campbell, Heard and Macquarie Islands. The dark face is evidently caused mainly by the absence of fleshy fillets round the base of the beak, a feature seen also in the Fiordland Penguin *Eudyptes pachyrhynchus* and to some extent in the young and yearlings of all species of *Eudyptes*. Carins suggests that the Rockhopper can be divided into two forms on this facial character. However, caution is advisable before any alteration to the existing nomenclature, because I suspect that, partly because philopatry occurs and gene flow between populations is restricted, the adults of all populations are separable sex for sex on morphological characters. For example, I produced evidence (1972, Auk 89: 86-105) suggesting that breeding Rockhoppers at Antipodes Island have bigger bills than those at Campbell Island and also drew attention to slight differences in colour of bills between birds from Macquarie, Campbell and Antipodes Islands.

Thus it seems important that a revision of a circumpolar species such as this ought not to be attempted without a detailed comparison of all the populations in which a variety of characters is used and measuring techniques are strictly comparable. Meantime, the present arrangement in which we recognize the very distinct long-plumed birds with heavily patterned underflippers (*moseleyi*) and those with shorter head-tassels and more lightly patterned underflippers (*chrysocome*) ought to be retained for the Australian list.

I notice too that in the recent amendments to the Checklist (1978, Emu 78: 80-87) the Royal Penguin has been elevated to full specific status. This may well prove to be appropriate but no reasons are given for the change and it would be interesting to learn what new evidence or re-interpretation of old evidence led to this decision. I myself have been unable to obtain good samples, valid statistically, of measurements for sexed Royal Penguins of known status (e.g. breeders); so I cannot yet establish how much overlap in size there is between, say, a female adult Royal and a male adult Macaroni, let alone the degree of overlap among the younger age classes. I wonder if anyone knows the answer to such questions? There are many specimens in museum collections but few truly adult are sexed: the situation with Macaroni Penguins is better and the British Antarctic Survey has kindly measured some breeding pairs at my request. Furthermore there is the thorny problem of how many Macaroni genes are carried into the population of Royals on Macquarie Island by stragglers from farther west. For example, some of Shaughnessy's findings (1975, Emu 75: 147-152) on the distribution of facial colours of the Royal Penguin could be explained by gene flow from outside.

Finally, attention ought perhaps to be drawn to ICZN Opinion 1056 of 24 October 1975 suppressing the name *Eudyptes atratus*: hence the correct name for the Erect-crested Penguin is *Eudyptes sclateri*.

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