SUMMARY

The first census of the avifauna of Clipperton Island was made in July 1968; it revealed the presence of about 26,000 individuals. The boobies are the most numerous (77.3 per cent of the total population), followed by the terns (19.3 per cent), and the frigates (2.5 per cent).

While the White-bellied Boobies and the terns spread out over the whole island, the Blue-faced Boobies inhabit mainly the northern and western sides of Clipperton, and the frigates, the eastern and southern sides.

The boobies and frigates were found in greatly increased numbers, as compared with the numbers reported by visitors to the island in 1958, while the number of terns was found to be relatively reduced, partly as a result of the Sooty Terns' absence at the time of our stay.

Since the last check made in 1958, some new species have been recorded on the island, raising to 40 the number of species reported from the atoll.

LITERATURE CITED

EHRHARDT, J. P. 1968a. Recensement en 1968 de la population de *Gecarcinus planatus* Stimpson sur l'atoll de Clipperton. Rapport particulier du Centre de Recherches du Service de Santé des Armées (C.R.S.S.A.), Division de Biologie Générale et Ecologie (Biol. Ecol.), Paris 40:1–9.

EHRHARDT, J. P. 1968b. Recensement et repartition des oiseaux de Clipperton. Rapport particulier, C.R.S.S.A., Biol. Ecol. 42:1–13.

HAEZE, G., J. C. WISSOCQ, J. BARLOY, AND P. NIAUSSAT. 1967. Etude zoologique des espèces rapportées de la Mission Bougainville, Groupe Rouge. Rapport particulier, C.R.S.S.A., Biol. Ecol. 25: 16–18.

LAFAIX, J. M. 1969. Ecologie des oiseaux de Clipperton. Rapport particulier, C.R.S.S.A., Biol. Ecol. 49:1–12.

NIAUSSAT, P., J. BARLOY, AND G. HAEZE. 1968. Contribution à l'étude des oiseaux de l'atoll de Clipperton. Rapport particulier, C.R.S.S.A., Biol. Ecol. 32:1–17.

OBERMULLER, A. G. 1959. Contribution à l'étude géologique et minérale de Clipperton. *In* Recherches géologiques et minérales en Polynésie Française. Inspection Générale des mines et de la géologie, Paris, p. 45–60.

SACHET, M. H. Histoire de l'île de Clipperton. Cahiers du Pacifique 2:1–22.

SACHET, M. H. 1962. Monographie physique et biologique de l'île de Clipperton. Ann. Inst. Oceanogr. 40:89–97.

STAGER, K. E. 1964. The birds of Clipperton Island, eastern Pacific. Condor 66:357–371.

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# A NOTE ON FORAGING OVERLAP IN WINTER BIRDS OF DECIDUOUS WOODS

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Field data on the foraging behavior of woodpeckers, nuthatches, and Brown Creepers (Willson 1970) have been analyzed with respect to differences in bill size. Overlap, indexed by $R_o$ (Horn 1966), between pairs of species and sexes (when distinguishable in the field) was calculated for utilization of tree species, foraging sites, and foraging heights, and compared with the amount of difference in bill length, depth, and width (measurements given in Willson 1970). During the winter, differences in bill size show no statistically significant ($P \geqslant 0.05$) relationship to differences in foraging behavior, with a single exception: an inverse correlation of difference in bill length and overlap of foraging height (fig. 1). In spring, again no correlation was found between bill size differences and overlap of tree types or foraging sites, but a negative correlation can be shown between differences of bill length and depth, and foraging height (fig. 1). Thus size differences of bills and foraging overlap are independent of each other except with respect to height, where similarity of bill size is sometimes associated with similarity of foraging behavior.

Pairs with less difference in bill size have more overlap in foraging height. The pairs especially involved are: Red-bellied Woodpecker, male vs. female; red-belly vs. Red-headed Woodpecker; Downy Woodpecker, male vs. female; and for length: Brown Creeper vs. downy, in spring; and in winter, red-belly vs. red-head; downy, male vs. female; creeper vs. nuthatch and vs. downy male and female; nuthatch vs. downy male and female. Clearly, an increase in bill size difference does not permit greater overlap in foraging behavior.

One might conclude that, despite a similarity in foraging height and in bill size, resources are partitioned in other ways. However, overlap values for tree species and foraging sites tend to fall in the medium-to-high range for all pairs concerned. Therefore one cannot conclude that those pairs similar in bill size and foraging height transfer their major mode of resource partitioning to either tree species or foraging sites. However, in most cases there are noticeable differences (between creeper and downy, nuthatch and downy, and red-head and red-belly) in the use of special foraging techniques such as hammering (Willson 1970) and perhaps to some extent also in food items. According to Martin et al. (1951), both red-heads and red-bellies are largely vegetarian during the winter months, and nuthatches then also eat a surprising amount of plant food, while downies and creepers are mainly insectivorous. The fruits of oaks and corn are major winter plant foods for the three winter vegetarians. All species are more insectivorous in spring and summer.

Seasonal changes in the amount of behavioral overlap are quite marked in many cases. Overlap between many pairs (22 of 43) is noticeably (difference $\geqslant 0.0500$) less in spring than in winter. In only six cases does overlap increase greatly in spring: downy vs. red-bellies of both sexes (height); downy female and male vs. red-head (height); and downy female vs. red-belly female (height). Character difference is large in all six pairs, and there frequently are significant differences in their use of special

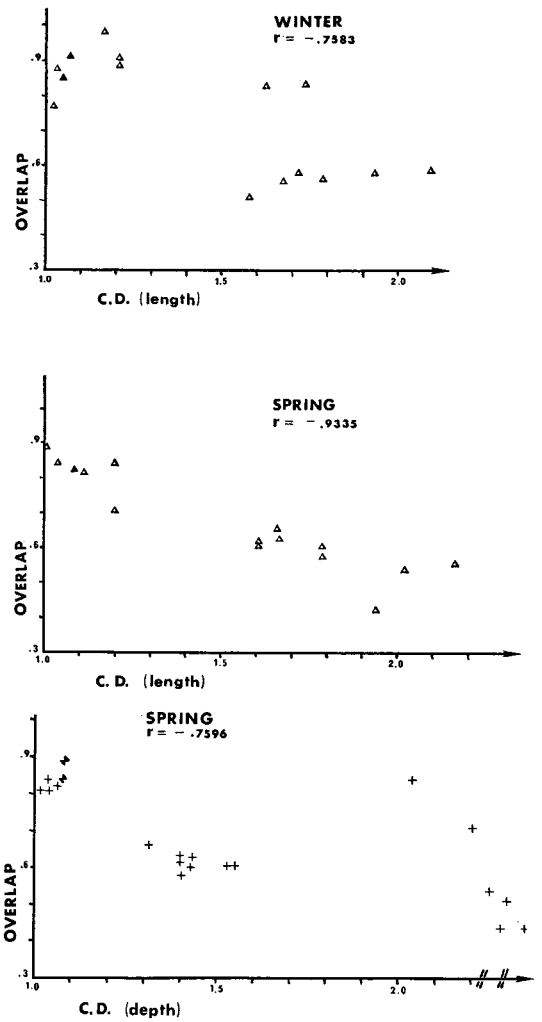


FIGURE 1. Horn's (1966) index of overlap ($R_o$) for foraging height vs. character difference (C. D.) in bill length and bill depth of several species of scansorial birds wintering in deciduous woods. All correlation coefficients (r) significant, $P < 0.01$. Solid symbols represent intersexual comparisons; open symbols, the interspecific comparisons.

foraging techniques (Willson 1970), which, however, do not seem to be consistently associated with differences in bill size or shape.

The convergence in bill size and foraging height of these scansorial birds may represent any one of the following situations. It may be a statistical fluke, which seems unlikely because it occurs in two seasons despite some changes in foraging behavior. Secondly, it may be a result of spatial proximity during pair formation of red-bellies and downies, but it occurs during winter also, when red-belly male and female may occupy separate territoritories, and the correlations hold good even if these points are omitted (see fig. 1). It may be a convergence due to similarity of relevant habitat components (Schoener 1970), but this should produce a strong convergence of bill size and foraging *site*, rather than of *height*. This was not the case, but it is possible that habitat utilization *other than* foraging results in feeding convergence. Finally, it may represent a condition permitted by a great abundance of certain foods and therefore relaxed competition.

There were an unusual number of red-heads in the woods during that winter (more individuals than remained to breed) and almost none the next. The great variability of red-head density suggests that this species may, at least in winter, be foraging rather opportunistically, i.e., settling in large numbers in response to abundant food and departing for other areas if food is scarce. Other species may do so to some extent also. Interspecific aggression was fairly frequent in winter but may have resulted primarily from physical proximity and violation of individual distances more than from competition for food. Possibly during this one-winter study there was an unusually good supply of some kinds of food (such as acorns, corn left standing in nearby fields, etc.) obtained by means other than bark-gleaning which were not quantified.

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LITERATURE CITED

HORN, H. S. 1966. Measurement of "overlap" in comparative ecological studies. Amer. Nat. 100: 419–424.

MARTIN, A. C., H. S. ZIM, AND A. L. NELSON. 1951. American wildlife and plants. Dover, New York. (1961 reprint of orig. McGraw- Hill ed.)

SCHOENER, T. W. 1970. Size patterns in West Indian *Anolis* lizards. II. Correlations with the sizes of particular sympatric species—displacement and convergence. Amer. Nat. 104:155–174.

WILLSON, M. F. 1970. Foraging behavior of some winter birds of deciduous woods. Condor 72: 169–174.

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## BIRD RECORDS FROM WEST NEW BRITAIN

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The island of New Britain lies in the Bismarck Archipelago 50 mi. E of New Guinea and has the richest avifauna of the Pacific islands except for New Guinea. The lowlands of east and central New Britain have been fairly well explored ornithologically, and there have been two surveys of New Britain mountains, by W. F. Coultas (Whitney South Sea Expedition) and by E. T. Gilliard. In May–July 1969 I collected on Cape Gloucester at the west tip of New Britain, from sea-level to the 5600-ft summit of Mt. Talawe. Pending a full report on the collection, I here report eight records of interest.

Little Pied Cormorant. *Phalacrocorax melanoleucos*. A pair was observed, and one collected, near the coast. This cormorant has a wide but somewhat ir-