NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION MONOGRAPH 11:
Atholl Anderson (ed.), ***Birds of a Feather: Osteological and Archaeological Papers from the South Pacific in Honour of R.J. Scarlett***

BIRDS OF A FEATHER

edited by

Atholl Anderson

New Zealand Archaeological Association
Monograph II

BAR International Series 62
1979

ISLAND AND COASTAL FOWLING STRATEGIES OF THE PREHISTORIC MORIORI

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Introduction

A series of workers have collected bird bone from the Chatham Islands (Figure 9.1) since at least the 1860s. However, with the exception of unpublished material from the 1962-1963 expedition (Simmons, 1964), no previous collection has had the advantages of stratigraphical control and radiocarbon dating. Ten prehistoric sites have been excavated in the Chatham Islands since 1973. The analysis of midden material from all of these is now complete. Radiocarbon dates are available from five sites. They range in age from 1450-1620 A.D. at one standard deviation from the mean (Sutton, 1976; 1977). Unfortunately dates are not yet available from the two inland sites and the CHC seal bone midden (N.Z.A.A. Site No. C240/689) which are discussed in detail below. However, nitrogen determination (Smith, 1977) for CHC and artefacts present in all three sites indicate that they will fall within the 15th-16th century range.

The analysis of bird bone recovered from a broadly contemporary pattern of sites on Chatham Island is useful in at least two areas. First, the results contribute to the reconstruction of Morior subsistence economics (Sutton, n.d.) within the Durham study area (Figure 9.1). Secondly, it will assist attempts to establish the causes of bird extenctions and range reductions which have led down, evidently very recently, to the current impoverished native avifauna of the islands (vide Marshal, Scarlett and Sutton, n.d.).

Materials

The sites discussed below are shown in Figure 9.1. Figure 9.2 shows a schematic section through the coastal terrace (Hamel, 1977) near Waihora.

The CHA site (C240/681) is located on the southwest aspect of Ridge III Figure (9.1). It is small, discontinuous and shallow site which extends over 30 metres down a low spur. Test-pitting showed that it consisted on a number of small patches of midden, each near one or more scoop hearths. Two adjacent 5 by 5 m excavation areas were laid out over the largest midden. The southernmost revealed a single dense layer of bird bone midden. The other contained 4 small scoops.

The CHB site (C240/680) was found beside a small swamply basin on the top of Ridge III, 200 metres inland from CHA and approximately 900 m etres from the sea. Again two adjacent 5 by 5 m areas were laid out. They contained a single continuous deposit of midden up to 30 cm deep. It contained very few portable artefacts and no evidence of structures. A large area around the site was test-pitted in a search for house structures but none were found.

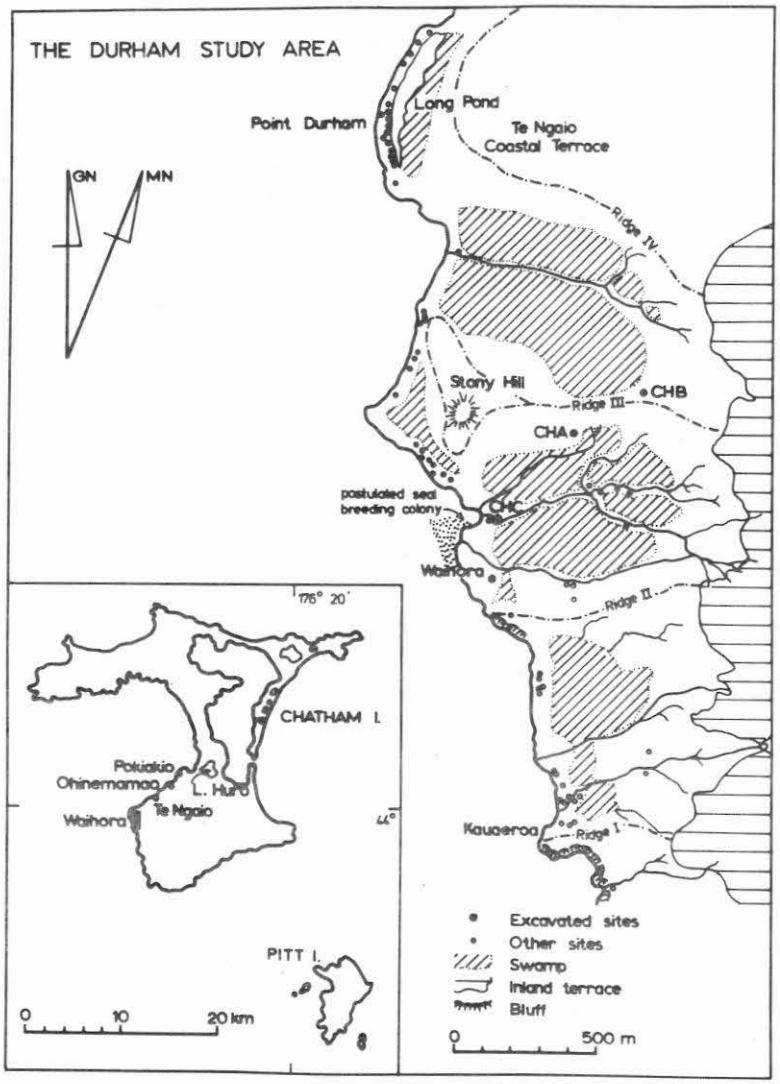

Fig. 9.1 The Durham Study Area.

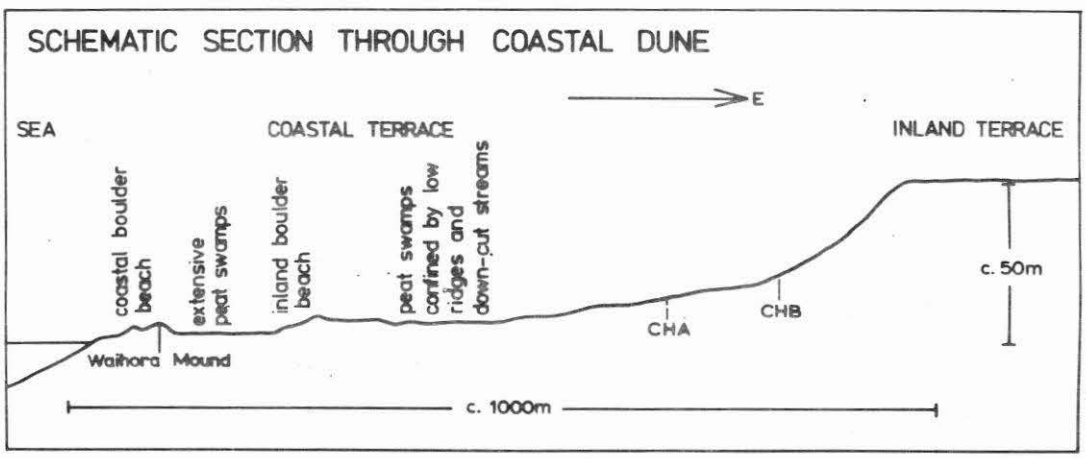

Fig. 9.2 Schematic Section through Coastal Terrace.

The coastal sites discussed below are on the CHC seal bone midden (Figure 9.1), excavated and reported by Smith (1977), and three small shellfish middens; Te Ngaio (C240/277), Ohinemamao (240/273) and Pokiokia (C240/266). They are located 4, 6 and 8 km respectively northeast of Waihora on the Southwest coast of Chatham Island (Figure 9.1). They were excavated and reported by McIlwraith (1976) and are radiocarbon dated to 1560, 1530 and 1530 respectively with a standard deviation of 40 years (Sutton, 1977).

Laboratory Analysis

The material recovered from these excavations was separated into primary components: shell, bone, charcoal and artefacts. A series of minor components was also separated out; crustacea, otoliths et cetera. The bone material was sorted into rat, bird, fish, marine mammal and human. The bird bone was steam cleaned and identified to anatomy.

The identification of this material to species level was undertaken by R. J. Scarlett and Y. M. Marshall. Minimum numbers per species were calculated using a method developed by B. F. Leach (this volume). The study of body parts representation per major species, discussed by Sutton and Marshall (1977) and mentioned below, also followed Leach's procedure.

The Assemblages

The assemblages from coastal and inland sites are summarised in Tables 9.1 and 9.2 respectively. The species identified are listed with the minimum number of birds represented per species.

Assemblages from the inland sites are very similar, although sample sizes are widely separated (n = 635 at CHB and n = 148 at CHA). The five most frequent represented species at both sites are:

Chatham Island Taiko
Chatham Island Pigeon
Chatham Island Petrel
Dieffenbach's Rail
Broad-billed Prion

They make up over 90% of both assemblages. The order in which they occur is almost identical. Moreover, the proportion of the total minimum number per assemblages which each species contributes is almost identical (Table 9.1). The only reversal is in the order of Pigeon and Diving Petrel. This may be explained by the location of CHB in a zone of broadleaf forest, as indicated by charcoal and landsnail data (Molloy, pers. comm., 1977; Wallace, 1977; 1979), contemporary vegetation ecology and historical records (Hamel, 1977; Begg, 1977). On the other hand, the CHA site was in a disturbed transitional vegetation containing fewer broadleaf tree species (Dodson and Kirk, n.d.) but nearer to the Stony Hill headland (Figure 9.2) where Diving Petrels would have bred.

The sets of minor species present in the two inland sites are also similar. All the nine major species represented in CHA are amongst the 26 species at CHB. The additional minor species at CHB are numerically incidental to the assemblage.

The coastal assemblages are quite distinctive (Table 9.2). Again a strong pattern is evident amongst the sites. They are all small and irregular in their species composition, and they are all unspecialised in that no one or a few species make up an overwhelming proportion of the assemblages. The species which dominate the inland middens are not strongly represented.

Habitat Types

The assemblages can be interpreted in terms of fowling strategies when the species lists are organised into habitat types. These categories include birds which are found most commonly in a specific habitat. Five habitat groups are discernible. They are:

i Coastal Birds: shags, gulls, oystercatchers and terns (Orders Pelecaniformes and Charadriiformes) and some non-breeding visitors.

ii Wetland Birds: all the duck species and the Extinct Swan (Anseriformes).

iii Forest-edge and Bogshrubland Birds: rails and snipes (Gruiformes and Charadriiformes).

iv Broadleaf Forest Birds: piegon (Columbiformes), Kaka and Parakeets (Psittaciformes) and Tui (Passeriformes).

v Marine Birds: there are species which come ashore for short intervals at various seasons of the year to breed and/or moult. They are the penguins and petrels (Sphenisciformes and Procellariiformes).

The percentage of the 2 inland and 4 coastal assemblages which are drawn from each of these habitat types are shown in Figure 9.3.

The operation of three separate fowling strategies is evident from the inland sites. The clearly dominant one is "muttonbirding" in which fledglings of small to medium sized petrels are taken from burrows or crevices during the latter stages of their pre-flight growth period. A commerical version of this ancient (Jones, 1971; Bowdler, 1974; Sutton and Marshall, n.d.) and very efficient strategy is used on Flesh-footed, Sooty and other shearwaters in New Zealand (Richdale, 1948; Oliver, 1955) and on the Short-tailed Shearwater in the Bass Strait Islands (Simpson, 1972). It is interesting to note here that Jones' (1971:550) procedure of counting minimum numbers of birds on the basis of "...pre-maxillae, dentaries, and posterior parts of the mandibles" may have resulted in an under estimation of the importance of birds throught the Rocky Cape sequence, possibly by a factor of at least 4-5 times (vide Sutton and Marshall, 1977: Figure 6 and 7; Sutton and Marshall, n.d.: Figure 6).

An examination of the degree of osteological maturity evident in the most frequently ocuurring bones of the Taiko, Diving Petrels and Broad-billed Prions at CHB proves that a large proportion of them were taken as fledglings. At least 65.5% of the Taiko scapulae, 35.6% of scapulae and coracoids of Diving Petrel and 16.6% of the tiny coracoid of the Prion survived as immature

TABLE 9.1:
COMPOSITION OF INLAND BIRD BONE ASSEMBLAGES
(CHA, L.1. and CHB, L.1.)

Species are arranged in numerical order as they occur in CHB and then taxonomic order. Nomenclature after Kinsky (et al., 1970), except where more recent revisions apply.

Species (Total 31 spp.)	Numbers per Species		% Assemblage		Total per Species
	CHB	CHA	CHB	CHA	
Chatham Island Taiko (Pterodroma magentae)	339	75	53.39	50.68	414
C.I. Pigeon (Hemiphaga novaeseelandiae chathamensis)	95	14	14.96	9.46	109
Southern Diving Petrel (Pelecanoides urinatrix chathamensis)	69	32	10.87	21.62	101
Dieffenbach's Rail (Rallus philippensis dieffenbachi)	40	9	6.30	6.08	49
Broad-billed Prion (Pachyptila v. vittata)	30	4	4.72	2.70	34
Extinct Giant Rail (Diaphorapteryx hawkinsi)	11	3	1.73	2.03	14
White-faced Storm Petrel (Pelagodroma marina maoriana)	6	3	0.94	2.03	9
Fluttering Shearwater (Puffinus g. gavia)	4	2	0.63	1.35	6
Pitt Island Shag (Stictocarbo punctatus featherstoni)	4	1	0.63	0.68	5
Fairy Prion (Pachyptila turtur)	3	-	0.47	-	3
Grey Teal (Anas gibberfrons gracilis)	3	-	0.47	-	3
New Zealand Shoveler (Anas rhynchotis variegata)	3	1	0.47	0.68	4
Weka (Gallirallus autralis)	3	-	0.47	-	3

Species (Total 31 spp.)	Numbers per Species		% Assemblage		Total per Species
	CHB	CHA	CHB	CHA	
C.I. Red-crowned Parakeet (Cyanoramphus novaezelandiae chathamensis)	3	1	0.47	0.68	4
Chatham Island Petrel (Pterodroma hypoleuca axillaris)	2	-	0.31	-	2
Grey Duck (Anas s. superciliosa)	2	1	0.31	0.68	3
Extinct Weka (Gallirallus minor)	2	-	0.31	-	2
White-fronted Tern (Sterna striata)	2	-	0.31	-	2
C.I. Tui (Prosthemadera novaeseelandiae chathamensis)	2		0.31	-	2
C.I. Blue Penguin (Eudyptula minor chathamensis)	1	-	0.16	-	1
Erect-crested Penguin (Eudyptes pachyrhynchus sclateri)	1	-	0.16	-	1
Northern Royal Albatross (Diomedea epomophora sanfordi)	1	-	0.16	-	1
C.I. Mollymawk (Diomedea cauta eremita)	1	1	0.16	0.68	2
Sooty Shearwater (Puffinus griseus)	1		0.16	-	1
Short-tailed Shearwater (Puffinus tenuirostris)	1	-	0.16	-	1
Paradise Duck (Tadorna variegata)	1	-	0.16	-	1
New Zealand Scaup (Aythya novaeseelandiae)	1	-	0.16	-	1
Extinct Coot (Fulica c. chathamensis)	1	-	0.16	-	1
C.I. Snipe (Coenocorphya aucklandica pusilla)	1	-	0.16	-	1
Red-Billed Gull (Larus novaehollandiae scopulinus)	1	-	0.16	-	1
Kaka (Nestor meridionalis)	1	1	0.16	0.68	2
	635	148	100.15	100.13	783

Table 9.2 Coastal Bird Bone Assemblage (CHC, Te Ngaio, Ohinemamao and Pokiakio)

Species are arranged in taxonomic order. Nomenclature after Kinsky (et al., 1970) except where more recent revisions apply.

Species (Total 40 spp.)	CHC		Te Ngaio		Ohinemamao		Pokiakio		Total per species
	No.	%	No.	%	No.	%	No.	%	
King Penguin (Aptenodytes patagonicus)	1	5.0	-	-		-		-	1
C.I. Blue Penguin (Eudyptula minor chathamensis)	1	5.0	1	6.25	3	12.50	1	2.44	6
Erect-crested Penguin (Eudyptes pachyrhynchus sclateri)	1	5.0	-	-	1	4.17	-	-	2
Northern Royal Albatross (Diomedea epomophora sanfordi)	-	-	-	-	-	-	1	2.44	1
C.I. Mollymawk (Diomedea cauta eremita)	1	5.0	-	-	-	-	1	2.44	2
C.I. Taiko (Pterodroma magentae)	-	-	1	6.25	1	4.17	1	2.44	3
C.I. Petrel (Pterodroma hypoleuca axillaris)	-	-	-	-	-	-	1	2.44	1
Broad-billed Prion (Pachyptila v. vittata)	1	5.0	1	6.25	-	-		-	2
Fairy Prion (Pachyptila turtur)	-	-	1	6.25	1	4.17	1	2.44	3
Sooty Shearwater (Puffinus griseus)	-	-	1	6.25	1	4.17	2	4.88	4
Fluttering Shearwater (Puffinus g. gavia)	1	5.0		-	-	-	-	-	1
Short-tailed Shearwater (Puffinus tenuirostris)	1	5.0	-	-	-	-	-	-	1
White-faced Storm Petrel (Pelagodrmoa marina maoriana)	-	-	-	-	-	-	1	2.44	1

Table 9.2 (contd.)

Species	CHC No.	CHC %	Te Ngaio No.	Te Ngaio %	Ohinemamao No.	Ohinemamao %	Pokiakio No.	Pokiakio %	Total per species
Southern Diving Petrel (Pelecanoides urinatrix chathamensis)	2	10.0	2	12.50	2	8.33	8	19.51	14
C.I. Shag (Leucocarbo carunculatus onslowi)	-	-	-	-	-	-	1	2.44	1
Pitt Island Shag (Stictocarbo punctatus featherstoni)	7	35.0	-	-	1	4.17	4	9.76	12
Extinct Swan (Cygnus sumnerensis)	-	-	-	-	-	-	1	2.44	1
Paradise Duck (Tadorna variegata)	-	-	-	-	-	-	1	2.44	1
Grey Duck (Anas s. superciliosa)	-	-	-	-	1	4.17	1	2.44	2
Grey Teal (Anas gibberfrons gracilis)	-	-	1	6.25	1	4.17	-	-	2
New Zealand Shoveler (Anas rhynchotis variegata)	-	-	1	6.25	-	-	-	-	1
N.Z. Scaup (Aythya novaeseelandiae)	-	-	-	-	-	-	1	2.44	1
Harrier (Circus approximans subspp.)	-	-	-	-	-	-	1	2.44	1
Extinct Giant Rail (Diaphorapteryx hawkinsi)	-	-	-	-	1	4.17	-	-	1
Dieffenbach's Rail (Rallus philippensis dieffenbachi)	2	10.0	1	6.25	2	8.33	1	2.44	6
Extinct Weka (Gallirallus minor)	-	-	1	6.25	-	-	1	2.44	2
Weka (Gallirallus australis)	1	5.0	-	-	-	-	-	-	1

Table 9.2 (contd.)

Species	CHC No.	CHC %	Te Ngaio No.	Te Ngaio %	Ohinemamao No.	Ohinemamao %	Pokiakio No.	Pokiakio %	Total per species
Extinct Coot (Fulica c. chathamensis)	-	-	1	6.25	-	-	-	-	1
C.I. Oystercatcher (Haematopus chathamensis)	-	-	1	6.25	-	-	1	2.44	2
Extinct Snipe (Coenocorphya chathamica)	-	-	-	-	1	4.17	-	-	1
C.I. Snipe (Coenocorphya aucklandica pusilla)	1	5.0	-	-	1	4.17	-	-	2
Southern Skua (stercorarius skua lonnbergi)	-	-	-	-	-	-	1	2.44	1
Southern Black backed Gull (Larus dominicanus)	-	-	-	-	-	-	3	7.32	3
Red-billed Gull (Larus novaehollandiae scopulinus)	-	-	1	6.25	3	12.50	3	7.32	7
White-fronted Tern (Sterna striata)	-	-	-	-	-	-	1	2.44	1
C.I. Pigeon (emiphaga novaeseelandiae chathamensis)	-	-	-	-	1	4.17	1	2.44	2
Kaka (Nestor meridionalis)	-	-	-	-	-	-	1	2.44	1
C.I. Red-crowned Parakeet (Cyanoramphus novaezelandiae chathamensis)	-	-	1	6.25	1	4.17	-	-	2
C.I. Yellow-crowned Parakeet (Cyanoramphys auriceps forbesi)	-	-	1	6.25	1	4.17	-	-	2

Table 9.2 (contd.)

Species	CHC No.	CHC %	Te Ngaio No.	Te Ngaio %	Ohinemamao No.	Ohinemamao %	Pokiakio No.	Pokiakio %	Total per species
C. I. Tui (Prosthemadera novaeseelandiae chathamensis)	-	-	-	-	1	4.17	1	2.44	2
Totals	20	100.0	16	100.00	24	100.04	41	100.03	101

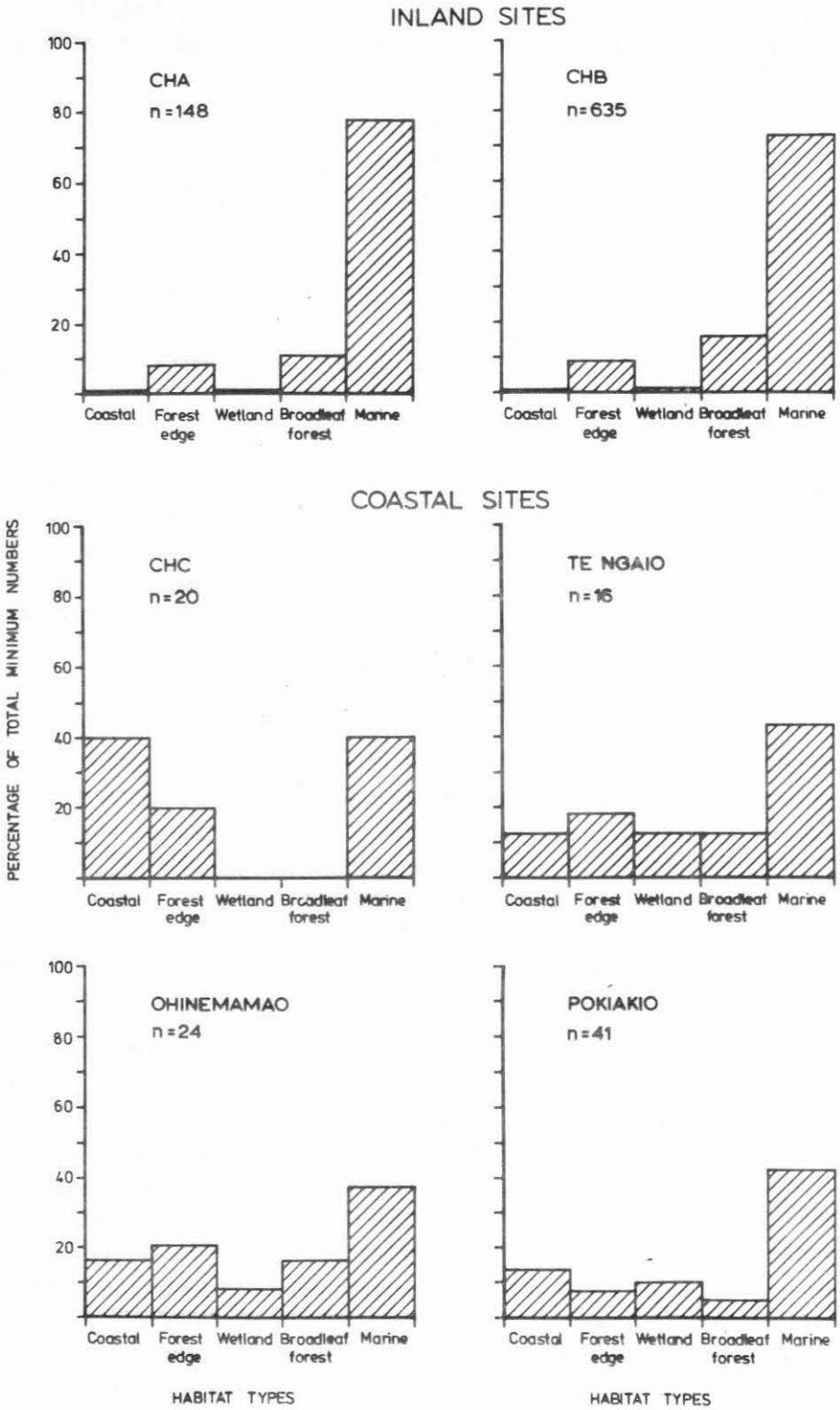

Fig. 9.3 Percentage of Birds Represented from different Habitat Types.

bones, representing deaths during the fledgling stage (Sutton and Marshall, 1977:8, Figure 6; Table 9.2). It is emphasised that these proportions are minimum figures due to the differential destruction of small, fragmentary and immature bones.

The second strategy represented is fowling in the broadleaf forest. The large, slow and conspicuous Chatham Island Pigeon would have been taken out of the low canopy of local broadleaf forest (Cockayne, 1901) with spears (vide Skinner's (1923:78 ff) section, "Implements Used in Fowling"). Broadleaf forest was mainly confined to a narrow and irregular corridor on sheltered aspects of the coastal terrace (Begg, 1977; Dodson and Kirk, 1978). The other species from the broadleaf forest (Kaka and Tui) may have been speared, netted or snared. The frequency with which the three species occur is clear evidence for selective hunting of pigeon.

The forest-edge and bogshrubland bird species represent a third discrete fowling strategy. It was, however, clearly less important than either of the two mentioned above. Snares and traps were probably used as the Polynesian dog has not been identified in a prehistoric context for the Chatham Islands (Sutton, n.d.). No detailed ethnographic description is available for rail hunting (vide Shand, 1911:6), nor have any Moriori artefacts been associated with it. The absence of dog may account, at least in part, for the relative unimportance of rails in the inland and other middens, despite the presence in the islands of 7 rail species (Olson, 1977), including an endemic genus (Diaphorapteryx).

Wetland and coastal fowling were both similarly unimportant at the inland sites. The absence of open wetlands nearby (Begg, 1977) may account for the former. The absence of the dog is not sufficient explanation as a small midden near Lake Huro (Figure 9.1) contained a total minimum number of 233 birds of which almost 63 percent are Anseriformes (Sutton, n.d.). The few coastal birds present at CHA and CHB reflect the highly specialised nature of most Moriori settlements. This point is developed below.

Evidence of distinctive fowling strategies is much less clear in the coastal middens. The apparent concentration on marine birds at all four sites includes little, if any, immature bone, suggesting the recovery of stranded adults, possibly during hunting or gathering along the shore. Diving Petrels were taken at Pokiakio (Table 9.2) but the minimum of 8 individuals represented there would be a very small proportion of those then available in the Waitangi Tuff cliffs (Hay et al., 1970: Fig. 6) above the site. Again, in the case of coastal birds, the seven Pitt Island Shags at CHC (Table 9.2) may have been taken when the chance arose or have been included in the gut contents of the many seals (n = 153) butchered at the site (Smith, 1977). Similarly, the few rails represented in the coastal sites may have been taken as they came on to the shoreline to feed on carrion.

There is, therefore, no clear evidence of specialisation in fowling at the coastal sites. Fowling was incidental to the main economic activity at these sites, whether shellfish gathering at Te Ngaio, Ohinemamao and Pokiakio (McIlwraith, 1976) or seal slaughter as at CHC (Smith, 1977). It appears to have consisted only of the opportunistic capture or recovery of live or stranded birds from a range of species.

Seasonality

Season of occupation can be assessed for both inland and coastal sites. The juxtaposition of high proportions of immature bone from Taiko, Diving Petrel and Broad-billed Prion can be used to establish seasonality at CHA and CHB. Broad-billed Prion fledglings are available in December (Fleming, 1939; Richdale, 1944). Diving Petrel fledglings are available in January (Richdale, 1943a). The breeding season of Taiko has not been established from live birds (Imber, 1976). However, its presence in CHA and CHB in the absence of immature bone of the Whitefaced Storm Petrel, Sooty Shearwater and Mottled Petrel whose fledglings are available in March, April-May and May respectively (Richdale, 1943b, 1963, 1964) suggests Taiko fledglings were available in the interval December to January and that the inland sites were occupied in that short summer season.

The seasonality for the coastal shellfish middens cannot be clearly ascertained. However, we know that they were occupied in the 16th century, and that this was the period of greatest severity of the Little Ice Age (Leach, H. M., 1976). Further, the efficiency with which intertidal shellfish can be gathered is dependent on sea and wind conditions (Anderson, 1973). Current wind data for Chatham Island indicates that any exacerbation of the critical southerly and westerly winds to the degree thought to have been associated with the Little Ice Age (Leach, H. M., 1976; Lamb, 1977), would have limited efficient and sustained shellfish gathering to intervals within the calmer months of October to February, and occasional days in other seasons.

Smith (1977:72-78) has established occupation of the CHC sites during summer, most probably in winter and possibly for other seasons of the year.

Interpretation

The seasonality data suggest strongly that shellfish gathering at areas of maximum intertidal exposure and muttonbirding at Taiko breeding colonies were both summer activities. Body parts representation for the Taiko at CHA and CHB (Sutton and Marshall, 1977:10-12; Figure 6) suggest the use at both stations of a single butchering pattern in which wing tips and lower leg were broken off and discarded, probably on the colony where the birds were taken. The meatier inner portions of wing and the thigh were kept. Heads and necks were discarded in a large proportion of the birds. This general pattern is also evident in the Broad-billed Prion and Diving Petrel remains (ibid.). It is consistent with one of the methods of preservation of the Sooty Shearwater described by Richdale (1948).

Meat from both shellfish gathering and fowling was evidently taken back to a centrally located village settlement for storage and then consumption in the colder winter months. This pattern of complementary exploitation of a range of resources at seasonal stations some distance from the village accounts for the very high ratio of small and shallow middens to complex "Village" sites in the Chathams (Simmons, 1964) and for the very specialised nature of the middens sites. For instance, the Pokiakio midden contained the remains of over 21,000 seellfish drawn from the largest and most economic of Chatham mollusca; paua (Haliotis iris), limpet (Cellana strigilis chathamensis) and

and Cookia sulcata (McIlwraith, 1976: Tables 7 and 8). However, there were no structures, and only a few portable artefacts present.

The central place village site type is represented in the Durham area by the Waihora mound site. This is known to be contemporary with McIlwraith's (1976) coastal middens (Sutton, 1977) and the CHC site. The contemporaneity of CHC and Waihora is based on Nitrogen determination (Smith, 1977) pending availability of C14 dates. There are positive indicators in the faunal assemblage for occupation during all seasons of the year and materials present from areas throughout the Chathams archipelago. These include bone of albatross chicks evidently from offshore breeding colonies (Dawson, 1973) and a total of over 15 different stone materials (Sutton, n.d.).

The site is central to the spatial distribution of resources discussed above. However, the nearby Fur Seal breeding colony, exploited from CHC, does appear to have been the only one on this stretch of coast at the time of occupation of these sites (Smith, 1977). It was a major source of meat, fat, bone and presumably skins for the Waihora site. The seals there were the only large meat source available all year round to the Moriori. The location of the seal colony is thus seen as the principal factor effecting location of the village. A similar pattern is likely to apply throughout sea coast settlements in the Chathams Chathams and has been reconstructed for the Foveaux Strait Coast of Southern New Zealand (Sutton and Marshall, n.d.).

Conclusion

The prehistoric Moriori were coastal hunter-gatherers occupying a medium-high latitude environment. Prehistoric horticulture was never possible. The limitations of the terrestrial resources (McCartney, 1975) brought about a dependence on the marine resources of the area. The most important of these were seals (the only accessible and perennial mammal present, apart from man) and marine birds.

The seals taken were: Southern Fur Seal (Arctocephalus forsteri), Southern Elephant Seal (Mirounga leonina), Leopard seal (Hydrurga leptonyx) and the New Zealand Sea Lion (Neophoca hookeri). The total population of Fur Seals present before European sealing must remain a matter of conjecture. However, a figure of 20,000 animals for the whole archipelago seems reasonable as the basis of Wilson's (1974) data for the few remaining colonies. The other, larger seals all bred on the Subantarctic Islands (Gaskin, 1972) and visited the Chathams where they would haul out for varying periods.

The marine birds exploited were: 3 species of penguin, at least 3 Diomedea species, 4 Pterodroma species, 2 Prions, a Procellaria species, 3 Shearwaters, a Storm Petrel and the Diving Petrel (Marshall, Scarlett and Sutton, n.d.). This unique concentration of marine birds (Bourne, 1967) is explicable on biogeographical grounds (Heather, 1966). The birds present formed a year-round succession of species coming ashore to breed for 6-8 weeks in the case of the smaller ones, then departing.

The bird bone assemblages discussed above result from the very successful adaptation (Richards, 1972) of Polynesian man to the "utter limits of (their)

colonisation" (Bellwood, 1978:416). A similar pattern of coastal adaptation is known to have occurred, with local modifications, on other southern high latitude coasts (vide Jones, 1971; Parkington, 1976; Stuart, 1977; Anderson, n.d.; Sutton and Marshall, n.d.)

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