NEW ZEALAND JOURNAL OF ARCHAEOLOGY

Coastal hunting in the Subantarctic Zone

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ABSTRACT

An adaptation type is defined which was characteristic of prehistoric, coastal, hunter-gatherer groups within the Subantarctic Zone. Hunting strategies focused on seals, flying oceanic birds and penguins which were killed when they were fattest and could be taken most economically. This and a preliminary list of similarities in material culture suggest that convergent adaptation has occurred amongst the culturally and racially independent groups which occupied coastal regions of the zone.

Keywords: COASTAL HUNTING, SUBANTARCTIC ZONE, ADAPTATION TYPE, CONVERGENT ADAPTATION.

INTRODUCTION

New Zealand is the most environmentally diverse island group in Polynesia. While most of the land mass is within the subtropical latitudes, the southern half of the South Island, known as Murihiku, the Chatham Islands and the scatter of offshore islands to the south and east of the South Island (Fig. 1) lie in the Subantarctic Zone (Fig. 2). This is defined as the broad band between the Subantarctic and Subtropical Convergences, approximately 50-55 and 42-47°S respectively (Heather 1966, Knox 1975). In New Zealand it was beyond the range of prehistoric horticulture due to major climatic factors (Leach, H. M. 1976), the population was markedly less concentrated than in the north (although we have no reliable quantitative data), and fortifications appear to be either absent or dating to the late arrival of northern influences and/or population (Leach 1978).

On the positive side the Subantarctic Zone has a distinctive and important range of endemic resources. The flying oceanic birds (*Procellariiformes*) and penguins (*Sphenisciformes*) both may have their evolutionary origins in the high latitude areas of the southern hemisphere. They are now concentrated within the Antarctic and Subantarctic Zones and because southern New Zealand, Tasmania, the Bass Strait Islands and the Scotia Arc Islands of the southwest Atlantic make up a major portion of the limited land of this zone, they support high concentrations of breeding subantarctic seabirds (Murphy 1936, Oliver 1955, Simpson 1972). In the New Zealand region these include seven species of penguins, eight albatrosses, 22 species of fulmars, petrels and shearwaters and three storm petrels (Kinsky *et al.* 1970).

Both major groups of seals are strongly represented in the Subantarctic Zone. There are three earless seals (*Phocidae*), the leopard seal, crabeater and southern elephant seal. The latter is the largest of the southern *Pinnipedia*. There are a total of eight eared seals (*Otaridae*) present, three sea lions and five species of fur seal (*Arctocephalus* spp.).

Cetacea are, or were until recently, plentiful in many areas of the zone (Brown *et al.* 1974). In the area around the Chathams, for instance, there are 17 species known and a further 13 are thought likely to occur there (Sutton n.d.).

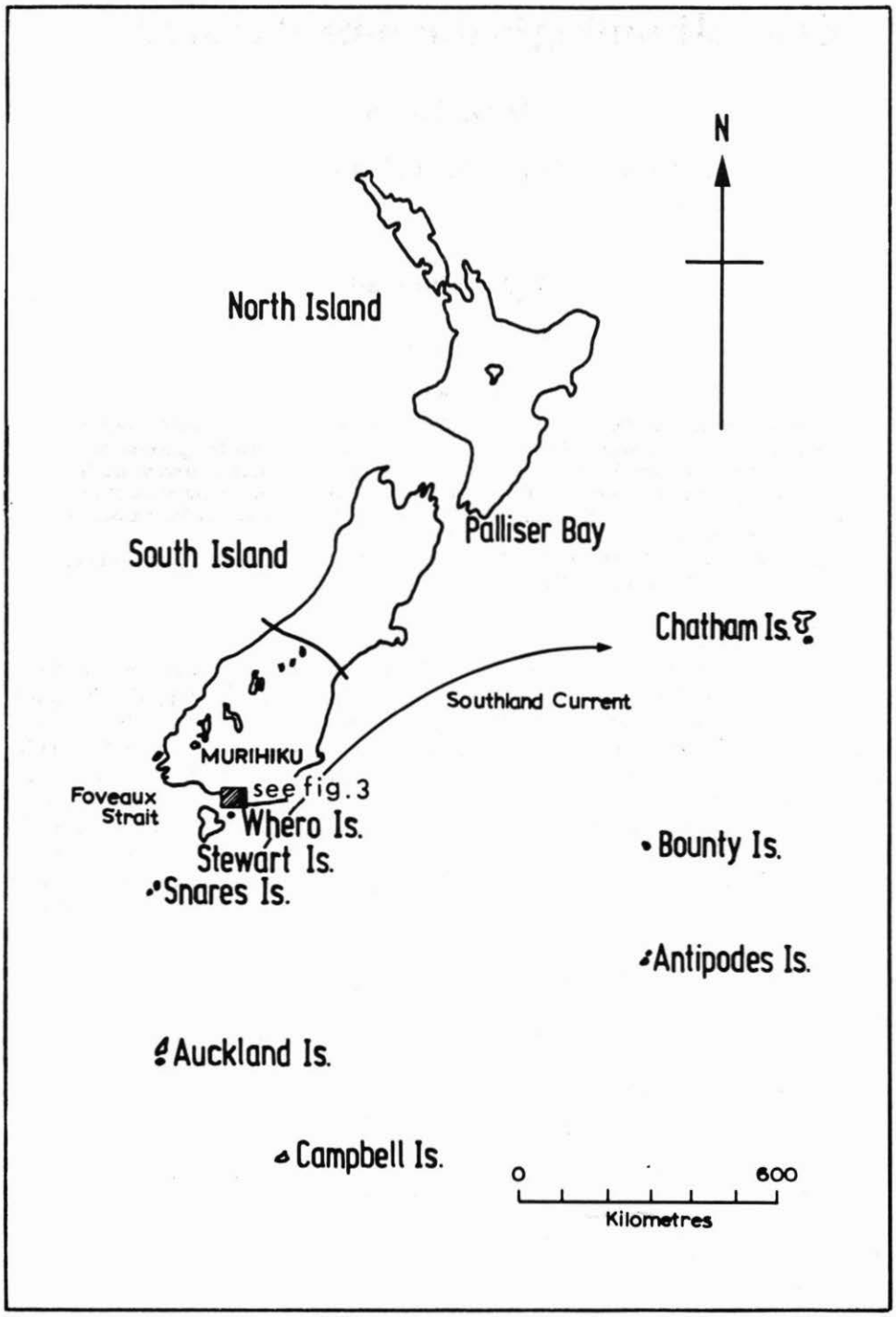

Figure 1: New Zealand and the offshore islands

At the same time as there was an abundance of marine resources in the Subantarctic, terrestrial resources were limited, especially in island and archipelago situations. Terrestrial bird numbers were limited by island size and ecological diversity (Lack 1976). Species diversity amongst the land birds was limited by distance from the colonising source (MacArthur and Wilson 1967). These factors have been discussed for Tasmania (Hope 1973, Diamond 1977, Jones 1977), New Zealand and the Chathams (Fleming 1962, 1979) and the Chilean archipelago (McCartney 1975).

Large land animals were present on continental areas within the zone. Some species (Fittkau 1969) are known to have been hunted in the prehistoric period on Tierra del Fuego (Stuart 1977) and the Chilean archipelago (McCartney 1975). However, in both these areas marine resources, particularly sea lions, fur seals, otters, penguins and several flying oceanic birds were also available and "clearly more important than the terrestrial fauna from man's viewpoint" (McCartney 1975:317).

Many of the marsupial and placental mammals of Australia crossed the Bassian landbridge (Jones 1977) and were available to the Tasmanians (Hope 1973). However, as in the South American situation, marine resources, specifically an elephant seal, fur seal and a migratory shearwater, are prominent in the archaeological record (Jones 1971, 1977; Bowdler 1974; Vanderwal 1978), and may have been central food resources in the prehistoric period, particularly after the severence of the landbridge (see Jones 1966).

This paper outlines adaptations to the physical conditions of the Subantarctic Zone which were made by Polynesian settlers on the Foveaux Strait coast of Murihiku and

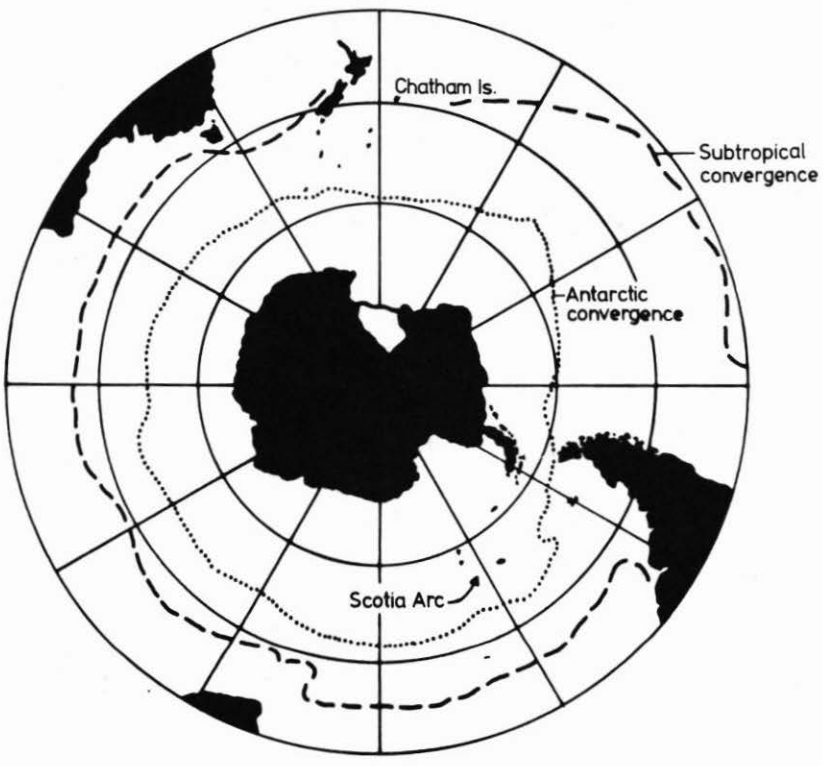

Figure 2: The Subantarctic Zone (after Heather 1966).

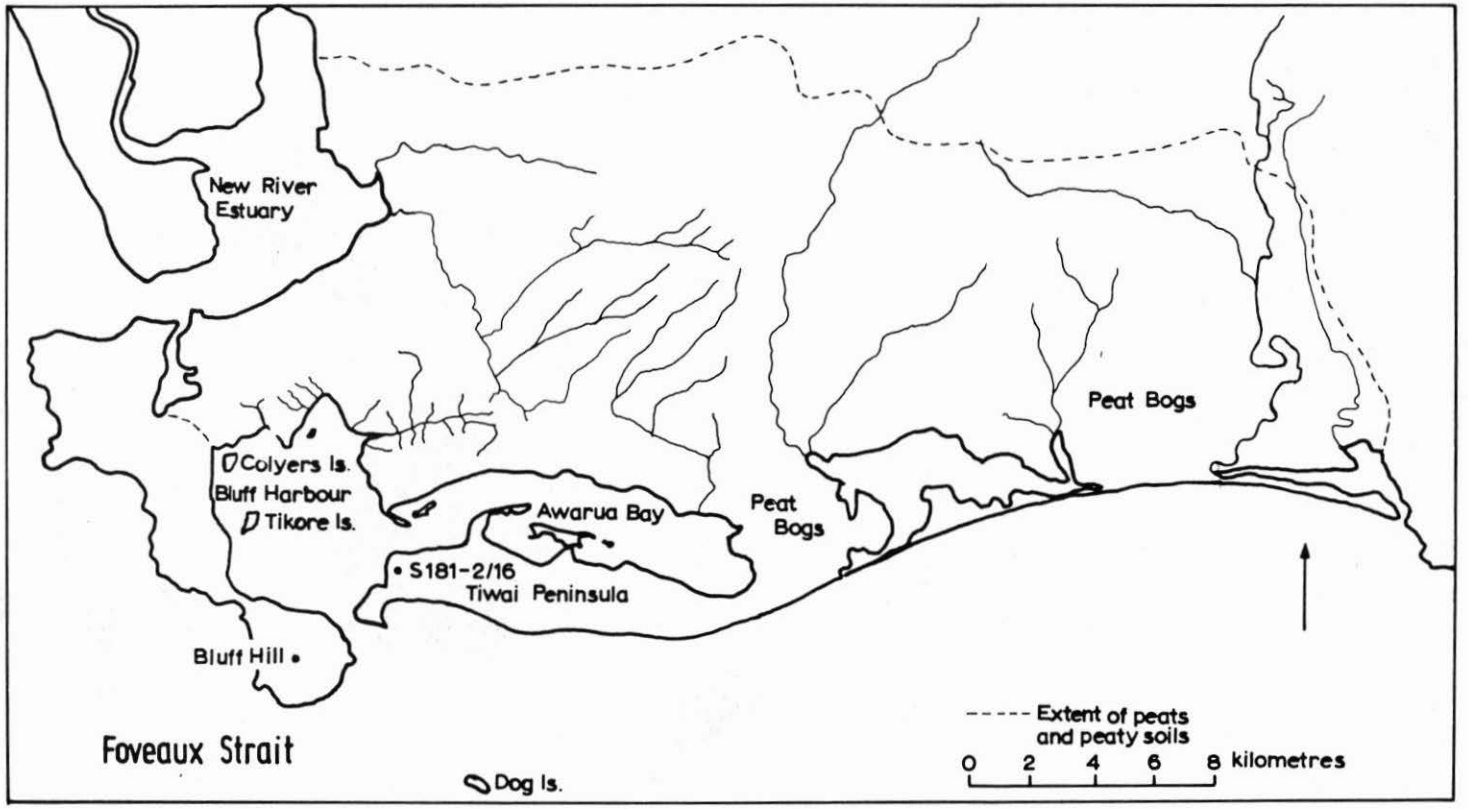

Figure 3: Tiwai Point and environs.

the south-west coast of Chatham Island. These convergent adaptations are shown to involve the development of very similar hunting strategies (Diamond 1977) which centred on the exploitation of fatty meat bearing resources at the time of the year when they were most aggregated, easily taken and fattest. The suggestion that these similarities reflect convergent adaptation and not simply the effects of common geographical and cultural origin is supported by archaeological evidence of comparable hunting strategies from independent regions of the Subantarctic Zone. Similarities in material culture are also noted.

THE FOVEAUX STRAIT CASE

The site to be discussed in this section (New Zealand Archaeological Association Site Record Number S181-2/16) is located on low undulating ground in a small bay one kilometre north-west of the western end of Tiwai Point, Bluff Harbour (Fig. 3). The climate reflects the location of the site on a subantarctic shore where strong, salt-laden, southwesterly winds are the "dominating feature of the local weather" (Hamel 1969:149). Temperatures are moderate-cold, and annual rainfall is about 1020 mm, most of it falling in wind storms.

The site was excavated in 1967-1968 under the direction of G. Stuart Park, Anthropologist, Otago Museum, in response to the threat presented by the construction of the Comalco Aluminium Smelter. The major emphasis of the excavation was on the exploration of the stone working floor which was evident in eroding sections and test-pits. One area of shallow but dense midden was located adjacent to one of the two stone working areas excavated. It was this small area of five by ten metres which yielded the material discussed below. The layer was 10-15 cm thick. There was no discernible stratigraphy within the midden, nor indeed within the remainder of the site.

A series of five radiocarbon dates from charcoal samples from within the cultural layer date occupation to a short period about the thirteenth century A.D. (Park 1978). The Archaic (Golson 1959) date is confirmed by the presence of trolling lures and fishhook tabs in moa bone. Three *Dentalium* spp. "grooved sections" (Leach, B. F. 1976) were also found (Park 1969:146). Moreover, stone working at the site included the use of high angle percussion in the manufacture of adzes, saws, files and drills (Huffadine 1978). Park (pers. comm., 1978) has noted the presence of blades in the assemblage. High angle percussion and blade manufacture are associated with the Archaic phase in Murihiku (Leach, B. F. 1969).

Preliminary analysis of the faunal material recovered from the site began in 1969. Bone from a portion of the excavation was identified by Higham and Scarlett (Higham 1976). In 1976 the authors initiated further analysis of the assemblage. The bone component was separated out and divided into classes: fish, moa, smaller bird, marine mammal and dog. No human bone was found. Leach, Smith and Teal studied fish, marine mammal and dog bone respectively. The authors worked on the bird material. As there was no reliable way of separating previously identified bone from the bulk of the assemblage all the material was processed. This resulted in a number of changes to species identifications, particularly in the bird and marine mammal material.

All species identifications of bird bone were undertaken in the Canterbury Museum by one of the authors (Marshall) and R. J. Scarlett. An attempt was made to classify the degree of osteological maturity of the bone. Three age-related categories were used:

(i) adult; fully matured bone.
(ii) sub-adult; bone at or near full adult length but still with a granular surface.
(iii) immature; articular ends unformed, highly granular surface texture, often with only the basic shape of the bone formed.

The minimum number of birds present per species was calculated using a method developed by B. F. Leach (1976: Appendix 21). The number of immature and sub-adult birds present per species was noted. The bird species present were divided into five

TABLE 1
PARTS OF THE SKELETON USED TO CALCULATE MINIMUM NUMBERS

MOA	SMALL BIRDS
head	head
vertebrae	quadrate
sternum + ribs	scapula
pelvis	coracoid
femur	furcula
tibiotarsus + fibula	sternum
tarsometatarsus	humerus
phalanges	ulna
unidentifiable fragments	radius
	carpometacarpus
	pelvis
	femur
	tibiotarsus
	tarsometatarsus
	vertebrae + fibula + ribs + phalanges
	unidentifiable fragments

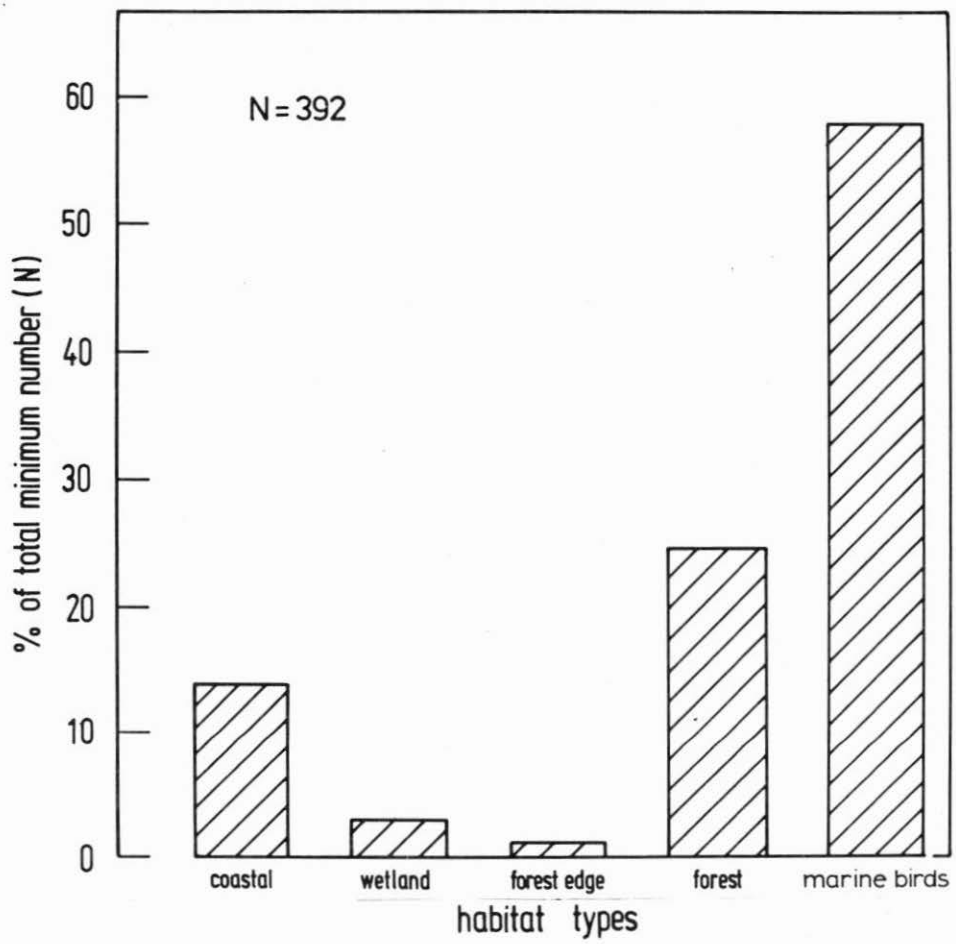

Figure 4: Proportion of birds per habitat type at Tiwai Point, Area X, Layer 2.

habitat groups, each of which includes species which are known to have been found most commonly in one of the major environmental zones of the area. The categories are: coastal, wetland, forest-edge, podocarp-broadleaf forest and marine bird species. The latter includes oceanic birds of the two endemic orders *Sphenisciformes* and *Procellariiformes.* Petrel species included are known to breed in dense colonies near the coast in the Foveaux Strait region (Richdale 1942, 1943, 1944, 1945, 1963). The moa species found in the Tiwai midden were considered separately. Although their ecological preferences are still unclear (Hamel 1977), an attempt was made to establish the areas from which they are most likely to have been taken.

The proportional representation of different areas of the skeleton of various animals in archaeological sites may be used to reconstruct butchering patterns (Payne 1972, Coutts and Jurisich 1972: Appendices 1 and 2). In the present study the minimum number of birds present per species was calculated on the basis of up to thirteen bones from different parts of the skeleton (Table 1). These minimum numbers were expressed as a percentage of the maximum minimum number (Leach, B. F. 1976: Appendix 21) which had earlier been calculated on the basis of the most frequently occurring bone. The proportional representation of different parts of the skeleton was graphed for the eight most frequently represented species. Butchering patterns were established for the moa species and the muttonbird *(Puffinus griseus).* None of the other species showed regular patterns of body parts' representation.

During the calculation of minimum numbers it became clear that all the bird species present were not distributed evenly throughout the midden area. The distributions of the two most frequently occurring bones of the eight major species were plotted on site plans. In the event only the muttonbird proved to be clustered. It was found to have been deposited in two discernible concentrations. This feature is discussed below.

The total live weight represented by each of the principal meat sources was calculated in order to clarify the relative importance of moa, smaller birds and marine mammals in the Archaic economy of this region. Weights for the marine mammals of specific age/sex classes which could be identified osteologically were calculated by Smith (pers. comm.) from his own data, Gaskin (1972) and Crawley and Wilson (1976). Data on bird weights were taken from Richdale (1944, 1963) and Sutton (n.d.). Moa weights were estimated by Marshall using Shawcross's (1972) figures for comparable species.

RESULTS

The Bird Remains

The minimum numbers for the bird material are given in Table 2 with the numbers of subadult and immature individuals per species. The total minimum number is 392. They were drawn from 36 species. An illustration of the percentages of birds taken from each of the five habitat types is shown (Fig. 4).

The spatial distribution study showed that two discrete concentrations of muttonbird humeri were present. Concentration One was centred in rows X and Y and Concentration Two in P, Q, R and S (Fig. 5). There was a systematic difference in the levels of osteological maturity evident in the two groups. Almost all of the Concentration One bone (minimum number (n) = 33) was immature, and many individuals had been very young at death (Class iii). Concentration Two, on the other hand, was larger (n = 92), and most of the bone was subadult (Class ii) with a few adult birds and an equally small proportion of immature individuals. The body part's representation for these two groups were tabulated and tested for significant differences using the standard test for significant difference between two proportions. Wings, tarsi and sterna were significantly less frequently represented in Concentration Two (Fig. 6; Table 3).

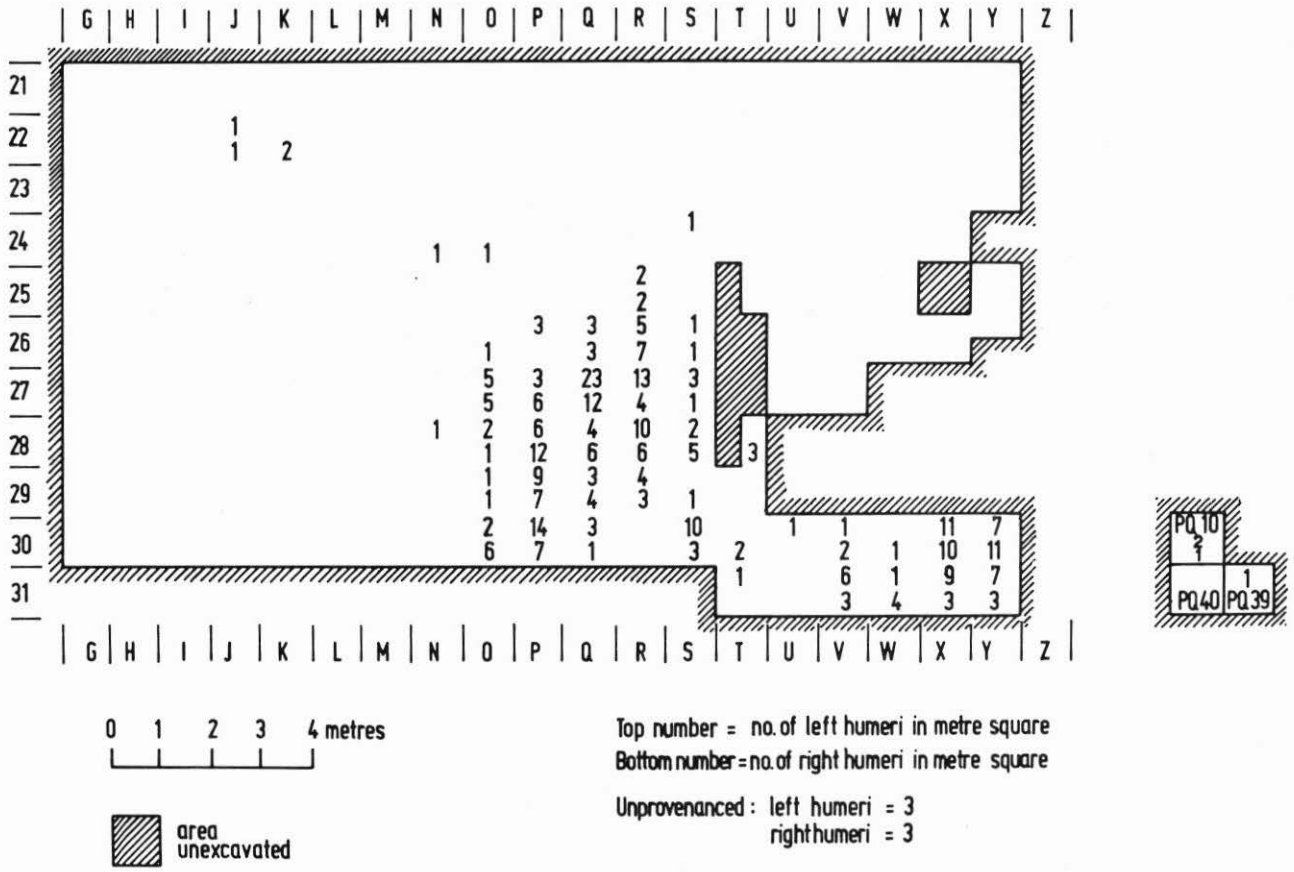

Figure 5: Distribution of muttonbird (*Puffinus griseus*) humeri at Tiwai Point, Area X.

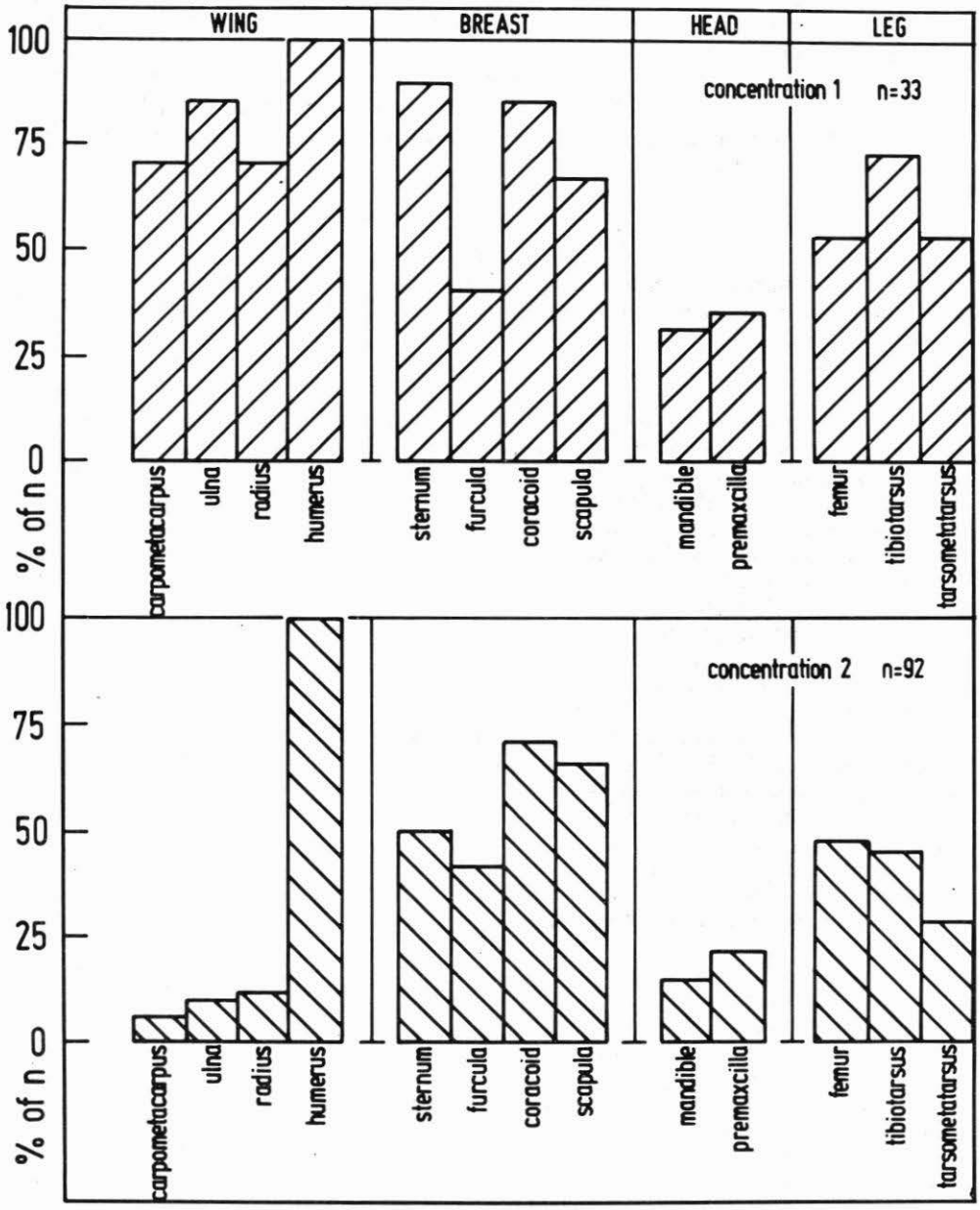

Figure 6: Body parts representation of *Puffinus griseus* at Tiwai Point.

Explanation of these differences was sought in descriptions of traditional southern Maori muttonbirding. When the birds are taken, usually in April, they are prepared for storage at the birding sites by removal of the heads, removal of the wings by a cut through the humeri, removal of the legs at the end or middle of the tibiotarsi and, finally, splitting of the body open down the breast by cutting through the sternum and furcula (Richdale 1948:100-102).

The body parts'representation in Concentration Two (Fig. 6) is consistent with that found when birds are preserved in this manner (Sutton pers. obs., 1976). The wings, legs and heads were removed at the colony and the sterna were broken when the carcasses were opened up. The latter, therefore, are under-represented

TABLE 2
BIRD SPECIES PRESENT IN THE TIWAI POINT MIDDEN

Species are arranged in numerical and then taxonomic order. Nomenclature is after Kinsky *et al.* (1970). The moa material is given last.

Species	Total	Immature/ Sub-adult
Puffinus griseus (Sooty shearwater or New Zealand muttonbird)	177	138
Cyanoramphus novaezelandiae (Red-crowned parakeet)	45	–
Pachyptila vittata (Broad-billed prion)	35	3
Leucocarbo carunculatus (Stewart Island shag)	28	12
Prosthemadera novaeseelandiae (Tui)	25	–
Hemiphaga novaeseelandiae (New Zealand pigeon)	17	–
Stictocarbo punctatus (Shag)	9	3
Anas superciliosa (Grey Duck)	7	1
Pachyptila turtur (Fairy prion)	4	1
Pterodroma inexpectata (Mottled petrel)	3	2
Anas rhynchotis (New Zealand shoveler)	3	–
Diomedea spp.	2	1
Puffinus tenuirostris (Short-tailed shearwater or Tasmanian muttonbird)	2	–
Larus dominicanus (Southern black-backed gull)	2	1
Larus novaehollandiae (Red-billed gull)	2	1
Sterna striata (White-fronted tern)	2	–
Apteryx australis (Kiwi)	1	–
Apteryx oweni (Little spotted kiwi)	1	–
Eudyptula minor (Blue penguin)	1	–
Eudyptes pachyrhynchus (Crested penguin)	1	–
Diomedea cauta (Mollymawk)	1	–
Macronectes giganteus (Giant petrel)	1	–
Puffinus gavia (Fluttering shearwater)	1	–
Anas gibberifrons (Grey teal)	1	–
Falco novaeseelandiae (New Zealand falcon)	1	–
Coturnix novaezealandiae (New Zealand quail)	1	–
Gallirallus australis (Weka)	1	–
Gallirallus minor (Extinct weka)	1	–
Chlidonias hybrida (Black-fronted tern)	1	–
Strigops habroptilus (Kakapo)	1	–
Nestor meridionalis (Kaka)	1	–
Cyanoramphus auriceps (Yellow-crowned parakeet)	1	–
Philesturnus carunculatus (Saddleback)	1	–
Callaeas cinerea (Kokako)	1	–
Euryapteryx gravis	7	2
Emeus crassus	4	1

TOTAL MINIMUM NUMBER = 392

TABLE 3
PROPORTIONAL REPRESENTATION OF MUTTONBIRD BONES

Bone	Concentration 1 (n=33)	Concentration 2 (n=92)	SE (P_1-P_2)	Significant difference (5% level)
Carpometa.	0.7	0.054	7.53	+
Ulna	0.85	0.098	10.80	+
Radius	0.7	0.11	6.85	+
Humerus	1.00	1.00	0	–
Sternum	0.87	0.51	4.80	+
Furcula	0.39	0.41	0.20	–
Coracoid	0.85	0.71	1.79	–
Scapula	0.67	0.66	0.10	–
Mandible	0.30	0.14	1.83	–
Premaxilla	0.36	0.21	1.70	–
Femur	0.58	0.47	1.10	–
Tibiotarsus	0.73	0.45	3.01	+
Tarsometa.	0.58	0.26	3.29	+

TABLE 4
MARINE MAMMALS IN TIWAI POINT (S181-2/16)

Species	Age/Sex Class	Minimum No.
N.Z. fur seal	Adult male	4
(Arctocephalus forsteri)	Adult female	3
	Subadult male	7
	Juvenile	6
	Pup	1
	Total:	21
Hooker's sea lion *(Phocarctus hookeri)*	Adult male	4
Southern elephant seal *(Mirounga leonina)*	Subadult male	6

archaeologically because they were lost or remain as unidentified fragments. Concentration One, with its younger and more complete birds, is best explained as an accumulation of bone from birds taken earlier in the season, probably during March (Richdale 1948, 1963), and returned to the settlement for immediate consumption.

Other fauna

The marine mammals identified by Smith (pers. comm.) are listed in Table 4. They indicate exploitation of at least one New Zealand fur seal breeding colony and of the locations at which the big southern seals (leopard seal, Hooker's sea lion and elephant seal) hauled out.

Dog bone recovered from the midden was identified and aged in relation to dental eruption by Teal (pers. comm., 1978). Three dogs were present, all of which were less than twenty months old at death. The total live weight they contributed to the midden was very small, and is therefore not shown in Figure 7. The fish bone recovered was found to represent only a very few fish.

The shellfish have not yet been fully analysed. However, preliminary observations show there to be an abundance of the harbour breeding cockle *(Chione stutchburyi)*, a small amount of rocky shore shellfish (*Haliotis* spp., *Cookia* sp. and *Cellana* sp.),

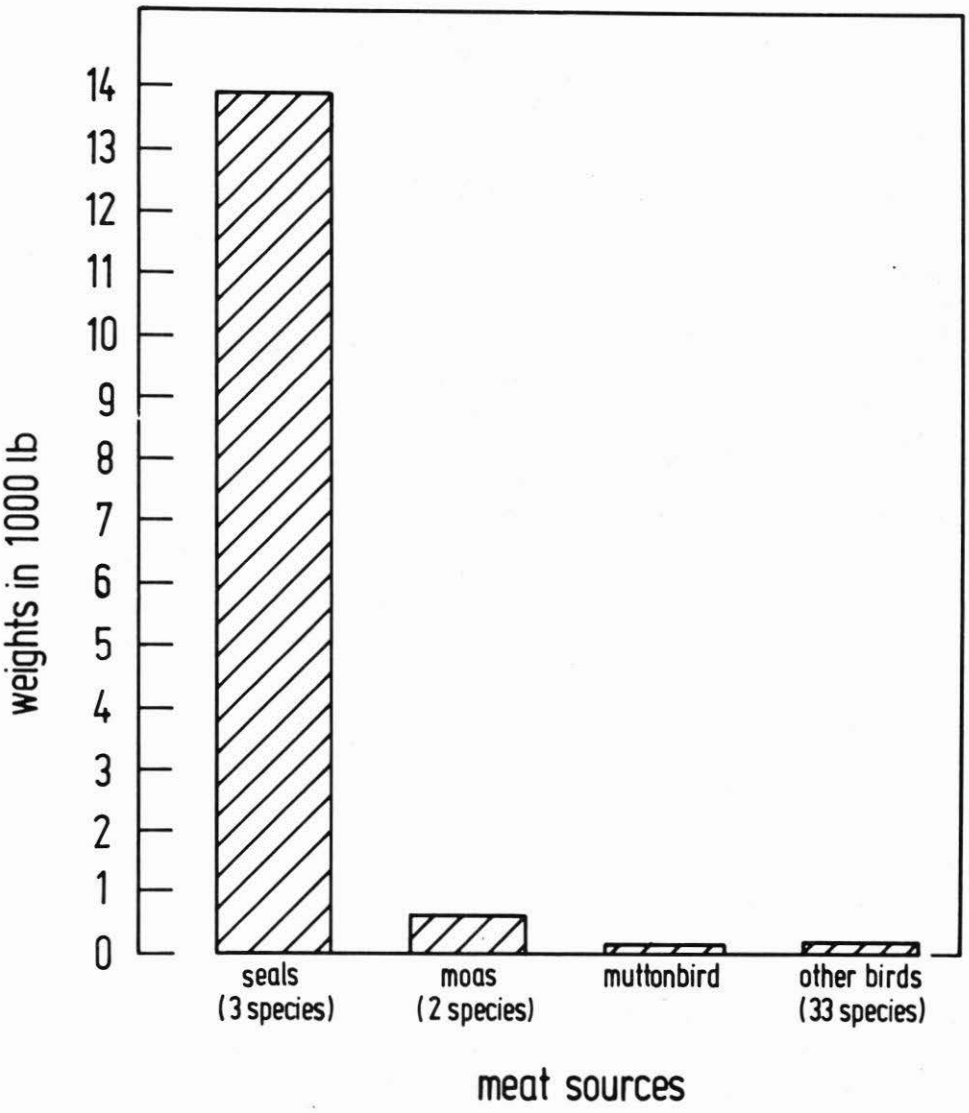

Figure 7: Live weights of major meat sources at Tiwai Point, Area X.

and a large number of the spiral gastropod *Alcithoe* sp. which were either taken from below neap tide level or when they were storm stranded on the turbulent oceanic beaches (Hamel 1969, Higham 1976). No minimum numbers are available for the shellfish species; however, they are not amongst the principal resources represented in the midden either by weight or in terms of calorific value, especially in view of the relatively poor food value of shellfish per unit weight (Meehan 1977). The total live weight represented by each of the principal resources is shown in Figure 7.

INTERPRETATION

Seasonality

The presence of seasonally available species can be used to establish the time of year at which the site was occupied. The periods of availability of 12 seasonal bird species are illustrated in Figure 8. The intervals shown are based on three assumptions:

(i) that, apart from beach wrecks involving few individuals, several petrel species were available then, as they are now, only during specific limited seasons,

(ii) that any species represented by immature bone was exploited in its breeding season, as well as possibly at other times,

(iii) that certain forest species were taken during or soon after periods at which their foods were most plentiful and the birds were in optimum condition.

The last assumption requires some explanation. All the forest species identified, with the possible exception of the kakapo, are associated with the broadleaf forest where seasonally available berries, flowers, nectar and leaves support large bird populations from the Orders *Columbiformes, Psittaciformes* and *Passeriformes.* Traditional Maori methods of capture are directly related to the seasonal abundance of these forest foods (Ranapiri 1895; Best 1902; Downes 1928; Leach, H. M. 1969).

The intervals shown in Figure 8 cover the period in which each species is most likely to have been taken. It is possible that they were killed outside the limits set. However, this possibility is small in each case and probably smallest for the migratory and oceanic feeding petrels. It would not account for more than a few individuals of any species.

Previous attempts to seasonally date the Tiwai site (Higham 1968, Coutts and Higham 1970, Higham 1976:227-228) have rejected the use of seasonal fowling as a dating criterion because the birds represented archaeologically may have been taken and preserved in another season or year, possibly some distance from the site from which they were recovered. However, the analysis of osteological maturity and body parts' representation in the two clusters of muttonbird bone indicates that the Concentration One material represents young fledglings taken early in the season, probably in March, and returned to the site for immediate consumption. Other species which could have been preserved tend to occur in the midden as single adult individuals. Preservation of bird meat, however, is known to have occurred only when relatively large numbers of birds were taken together (Richdale 1948, Oliver 1955).

Growth in cockle shells and sea mammal presences were used (Coutts and Higham 1970, Higham 1976) to establish an occupation period of November to February. However, while occupation during that interval may have been established, the apparent lack of winter indicators does not prove that the site was abandoned during the balance of the year. In fact, when all the seasonal criteria are considered together a picture of all year round activity emerges. Positive indicators are present for all seasons of the year.

Spring

The presence of bone of broad-billed prion fledglings suggests occupation between September and December (Fleming 1939).

Summer

Occupation in the interval November-February has already been suggested (Higham 1976:228). In addition the immature bones of two bird species, fairy prion and red-billed gull (Richdale 1944a, Mills 1973), indicate occupation in the months January to March and December to March respectively.

The small numbers of *Puffinus tenuirostris* were probably collected as beach wrecks. Some specimens, presumably young birds, are found on New Zealand shores in May

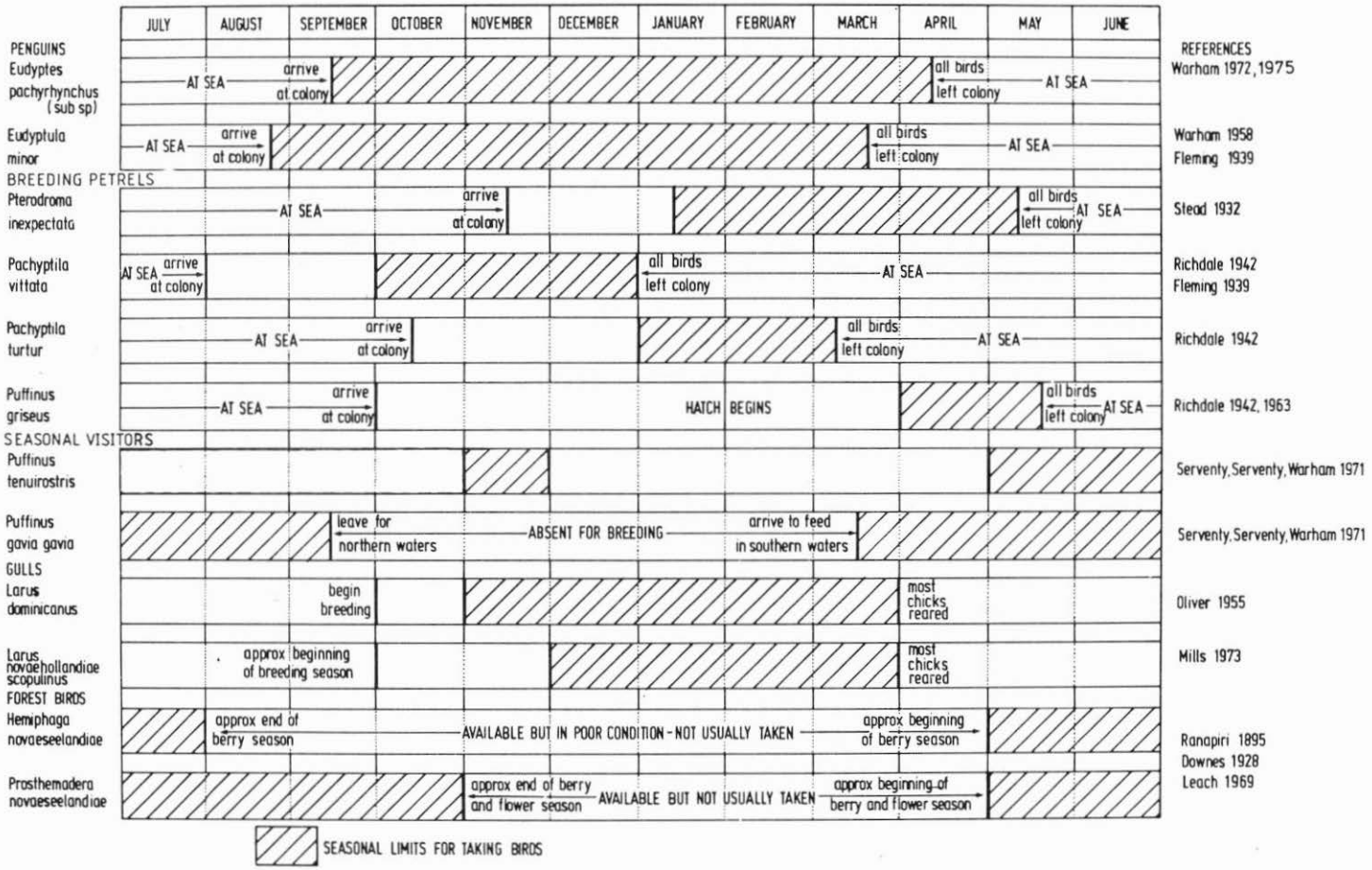

Figure 8: Seasonality of bird species at Tiwai Point.

and June, but this species is more likely to have been collected over the summer months, particularly November (Hamel: pers. comm.).

Autumn

The presence of mottled petrel fledgling bone suggests occupation in the period January-July (Warham *et al.*, 1977). Moreover, the two clusters of muttonbird bone appear to have been taken in March and April.

Winter

The presence of the fluttering shearwater suggests winter occupation. It is absent from southern New Zealand from mid-September until about mid-March (Fig. 8). Several of the forest birds are most likely to have been taken in the winter months (Fig. 8). In addition, Smith (pers. comm.) has identified a minimum of six subadult elephant seals and four adult male sea lions (Table 4). These strongly suggest winter exploitation.

Smith added further evidence of year round activity at Tiwai with the conclusion that:

> (i) The sizes of the pup and juvenile bones do not exhibit any marked grouping which would be expected if the animals were hunted at a single restricted period of the year.
>
> and
>
> (ii) The age/sex composition of the fur seal population is too diverse to be the product of hunting at a single season of the year.

The Hunting Strategy

The hunting strategy used at Tiwai Point focused on the exploitation of a relatively small number of seasonal food resources generally from breeding colonies within a short distance of the site. The most important of these were the most abundant, aggregated and easily taken fatty meat sources present in the region. If we exclude the moa, the major hunting foci were the marine mammals and muttonbirds.

The seals would have been taken from colonies, probably near the rocky promontories on the Foveaux Strait coast within one kilometre of the site. The larger southern seals would haul out in this area. The New Zealand muttonbirds were clearly taken as fledglings from breeding colonies, and 78% of all muttonbirds represented were immature or subadult at death. This proportion must be regarded as a minimum because of the differential destruction suffered by immature and broken bones in sites (Binford and Bertram 1977). The muttonbird colonies were most probably located on the slopes of Bluff Hill, one kilometre to the south-west where burrows have been recorded in historic times (Hamel 1969:151). The fine quartz gravel of the Tiwai Peninsula is unsuitable for burrowing birds.

The moa bone recovered represents two species: *Euryapteryx gravis* and *Emeus crassus*. A total of eleven individuals are represented, of which three were osteologically immature at death. The dogs present may have been used to hunt these as well as being the sole domesticated food source. The presence of eggshell, though not necessarily only of moa, indicates that the Tiwai hunters were exploiting moa nesting sites. No interpretation of the presence of subadult bone is possible at present. Leahy (1976:51) has suggested that, "it is possible that an egg could be gathered during the nesting period and a young, immature bird from the season before caught at a similar time". This assumes that young moa were to be found near the nests until at least a year old and cannot be supported either by empirical data on moas (Hamel 1977:75-91) or by analogy with other cursorial birds (Lack 1968).

The Tiwai material fits the tendency of *Emeus crassus* to be found in middens on the coast of Murihiku (Hamel 1977: Table 2.6). *Euryapteryx gravis* is common in both early and late Archaic middens in Murihiku, "especially on the east coast of Otago north of the Clutha River, *where conditions for forest are marginal*" (Hamel 1977:80). (Emphasis mine).

The association of *Euryapteryx gravis* with non-forested areas suggests that those found in the Tiwai midden were hunted on the western end of the Tiwai Peninsula. The moderate rainfall and exposure to salt spray which are characteristic of the area would have made any forest on this end of the peninsula vulnerable to fire and, therefore, likely to be converted to a mosaic of tussock and forest (Hamel 1969, pers. comm.: 1978). This kind of vegetation is likely to have existed on the western end of the peninsula by the thirteenth century. The view that the *Euryapteryx gravis* moas were killed in that area is supported by the fact that they were found in the site with heads and necks, suggesting they were killed locally and carried a short distance to the site.

Emeus crassus is most likely to have been taken from forested areas, either around the harbour margins or further east on the peninsula. Moas of this species were represented only by bones of the leg: femora, tibiotarsi, tarsometatarsi and phalanges. This suggests the return of only the meat-bearing "hind leg" part of the carcass over some distance from the kill site to the Tiwai Point settlement.

Whereas seals, muttonbirds and moa were hunting foci, all groups of terrestrial birds were minor components of the assemblage. Coastal birds comprised only 13% of the total minimum number of birds in the assemblage, despite the location of the site between soft and rocky oceanic shores and a large and convoluted harbour. Only the shags were present in significant numbers (n = 37). Both species present were represented by adult and immature bone. They were, therefore, taken at rookeries on the rocky cliffs and promontories near the site during the breeding season (Hamel 1969:151).

Similarly, despite there being vast areas of wetland in the peat bogs to the north-east of Bluff Harbour, within one kilometre of the site (Fig. 3), there was little evident interest in hunting wetland birds. Only eleven ducks were represented, just 3% of the assemblage. The forest-edge birds were also under represented in relation to the extent of the nearby forest-edge habitat. They, like the ducks, were simply not favoured, while the fatty, aggregated, and easily caught, muttonbird fledglings were taken in considerable numbers during the short period in which they were available.

The forest birds were the most important of the terrestrial groups. They make up 25% of the assemblage but selective hunting is strongly evident within the group. Three species, known to include the largest and most conspicuous birds of the southern forests, total 93% of the forest birds represented. The parakeet and the tui may have been sought for their plumage (B. F. Leach 1976) as well as for their flesh. The native pigeon, at approximately 650 g live adult weight (Sutton n.d.), is easily the largest of the forest birds.

In summary, analysis of an Archaic midden at Tiwai Point indicates that the site was occupied either all year or at seasons throughout the year. Also most, if not all, of the food resources represented archaeologically could have been obtained from zones within a two kilometre range of the site. All these zones occur within the ecotonal Bluff harbour region. This conclusion, of permanent settlement by a hunter-gatherer group in the Foveaux Strait coast, contradicts Higham's (1976:231) earlier conclusion that:

> The social adjustments to such an economic base [as the resources of the Foveaux Strait region] appear to have involved the dispersal of small, mobile groups over a large annual territory and their coalescing during the difficult winter months.

Very similar settlement patterns featuring wide dispersal of small mobile groups have been offered for Tasmania (Jones 1971), Tierra del Fuego (Bird 1938) and the Chathams (Simmons 1964). The present paper argues that this now is incorrect for the Foveaux Strait case and at least two of those mentioned above. Further examination of evidence from the northwest of Tasmania is also likely to result in the discovery of perennial settlements associated with the seal breeding colonies of that area. The shell mounds of south-east Tasmania (Vanderwal 1978) may represent one part of a coastal settlement pattern in that area, similarly focused on seals and pelagic birds.

THE CHATHAMS CASE

The Chatham Islands are located 970 km east of Banks Peninsula, New Zealand. They lie within the northern quarter of the Roaring Forties and on the zone of Subtropical Convergence where cold and less saline subantarctic waters borne north by the Southland Current (Fig. 1) meet warmer, saline waters from the subtropical north. Atmospheric and oceanic convergences occur in the area of the Chatham Islands. This gives rise to an overcast, temperate climate with constant winds, frequent changes of wind direction, low rainfall, high humidity and low sunshine hours.

Prehistoric horticulture was impossible due to these climatic conditions. Food resources available to the prehistoric Moriori hunters were similar to those of the Foveaux Strait region. Fur seals were present in very large colonies (Wilson 1974) and the larger southern seal species straggled to the islands. Moreover, due to their position as one of the few island groups in the Subantarctic Zone the islands were, "probably . . . the most important breeding station of petrels in the world at the time of the first human occupation" (Bourne 1967:2). A total of 16 species bred there (Kinsky *et al.* 1970; Marshall, Scarlett and Sutton n.d.). Penguins of three species were present and of these two bred in the islands (Marshall, Scarlett and Sutton n.d.). Other birds present were of Subtropical, mixed and Subantarctic Zone origins (Fleming 1939). Many were seasonal visitors.

However, as in the Foveaux Strait region, there was an abundance of marine resources dependent on high levels of primary and other marine production in the area (Bradford and Roberts 1978) but a limited, if not depauperate, range of available terrestrial foods. There were no land mammals, apart from the introduced Polynesian rat, nor were the Ratites present. The terrestrial avifauna consisted of a reduced range of New Zealand genera, often separated at the subspecific level from New Zealand counterparts (Kinsky *et al.* 1970), and a number of endemic rails (Olson 1977).

Recent archaeological excavations by one of the authors (Sutton) have revealed a pattern of functionally-interrelated 16th century sites in the Durham area on the south-west coast of Chatham Island. This includes a coastal village, two inland middens and a series of four specialised coastal middens. The village covered a low sand mound approximately 120 m in diameter, and contained a burial area, a number of substantial houses, at least three discrete middens and a cooking area. It was laid out in a systematic manner; burials in the margins of the boulder beach a few metres from the sea, houses between that area and the cooking and food preparation areas, and finally middens on the inland leeward margin of the mound. The economic and artefactual evidence reflects selective hunting and gathering of marine and littoral resources. Seals and penguins were most important. A range of shellfish species were collected from the nearby intertidal platforms. Inshore fish species were taken in quantity, apparently largely by netting off the rocks. The seasonal bird species present in this large assemblage of bird bone ($n = 1461$) indicate occupation all year, with the return of food resources taken at separate resource zones to the village.

This pattern of return to the village is perhaps most clearly illustrated by the immature albatross bone found in the site. All three species of *Diomedea* which breed in the Chathams are represented *(D. epomophora, D. bulleri* and *D. cauta).* If, as is most likely, the sixteenth century distribution of *Diomedea* species breeding colonies was the same as at present (Dawson 1973) this reflects exploitation of the breeding colonies on the Pyramid 56 km to the south-east, the Forty Fours 69 km to the east, and the Sisters which are 53 km to the north-west.

The artefactual material found in the Waihora village is also clear evidence for the return of materials gathered at some distance from the site back to the village. A large assemblage of waste flakes was found (Campbell n.d.) to represent stone material from a total of 14 sources spread throughout the islands.

This evidence of transport of materials to the Waihora village reflects its functions

as a central place settlement (Ambrose 1969) in the 16th century occupation of the Durham area. However, the excavation of small and specialised middens near Waihora established that, as in the Foveaux Strait region, almost all of the food resources represented at that site were collected at seasonal resource zones within two kilometres of the village.

The inland middens (C240/680,681) represent one such resource zone. The taiko *(Pterodroma magentae)* was 'muttonbirded' from a nearby breeding colony, which is likely to have been positioned on or near the crest of the ridge on which these sites were located. Bones of the taiko make up approximately 50% of the bird assemblage in each case (Sutton n.d.a.). A minimum number of 339 taiko were recovered from C240/680 and a further 75 from C240/681, at least 65% of birds in the larger group being immature (Class iii) at death.

Seasonal indicators present at these sites point to occupation during the summer months, particularly January, when the taiko fledglings were in optimum condition (Sutton 1979). Shellfish and fish from the coast, one kilometre to the south-west, were transported to these middens and consumed there. Some forest birds, including a number of the large Chatham Islands pigeon, were also taken during the occupation of this inland forested location. The absence of evidence of structures and any quantity of portable artefacts suggests recurrent short term occupation within successive summer seasons. This was related to the availability of the taiko fledglings.

The specialised utilisation of coastal resource zones is reflected in four small middens near Waihora. Three of these were shellfish middens (C240/266,273 and 277). They represent many similar sites located on this coast. Each of them contained considerable quantities of larger rocky shore shellfish species (*Haliotis* spp., *Cookia sulcata* and *Cellana* sp.) and only very small amounts of fish and bird bone. No seal material was found, despite the fact that the fur seal occupied this coast all year round (Smith 1977, Sutton n.d.). For instance, Pokiakio (C240/266) contained over 23,000 shellfish (McIlwraith 1976), a minimum number of only 40 birds (Sutton 1979), and a similarly small number of fish. Some crayfish (Leach and Anderson 1979) and echinoderms were identified but there was no trace of sea mammal bone.

This pattern is repeated in each of the three shellfish middens and together with the stratigraphical evidence, the absence of any structural evidence and almost complete absence of portable artefacts suggests that occupation consisted of short recurrent visits. The season of occupation cannot be established directly due to the lack of faunal indicators. However, wind speed and direction are critical to exploitation of the littoral zone on this coast. Almost constant winds, frequently from the south and south-west (Anon 1961-1971), limit access to the intertidal in all seasons (Anderson 1973), particularly winter. This restriction would have been particularly severe during the 16th century when these sites were occupied due to the effects of the Little Ice Age (H. M. Leach 1976, Lamb 1977). On this basis shellfish collecting is likely to have been limited to intervals within the calmer months – October to February, and occasional days in other seasons. Summer dispersal from the central village settlement, therefore, included shellfishing and muttonbirding.

Year round exploitation of a fur seal breeding colony is indicated by results of excavation of a seal bone midden (C240/689) found on a low river terrace 300 m north of Waihora. A quarter of the midden was excavated. It was found to contain the remains of 112 fur seals, 12 elephant seals, eight leopard seals and two New Zealand sea lions (Smith 1977). There was very little other midden material present, no structural evidence and no portable artefacts other than a scatter of large chert flakes. The fur seals included animals of all the age/sex categories, reflecting hunting all year round. A large proportion (70%) of the seals are of adult age, suggesting selective hunting of these larger, and therefore more valuable, animals. Pups and juveniles are under represented. Whole seal carcasses were removed from the nearby colony to the midden

and butchered there, leaving equal representation of all major bones of the skeleton (Smith 1977) in the site. The other seal species were probably winter visitors.

This remarkable site contained the most concentrated and largest archaeological deposit of sea mammal bone recovered in southern New Zealand to date. The exploitation of the fur seal breeding colony was clearly the most important single activity in the subsistence economics of the 16th century Moriori hunters of this area. However, while the deposit represents an enormous amount of seal meat and fat, it is to be seen as part of the overall structure of Moriori economics. This involved the complementary exploitation of a range of different resources at discrete resource zones within a short distance of the centrally positioned village site. Shellfish were collected in large quantities with echinoderms and crayfish from several large intertidal platforms. Taiko were taken in the summer season from sheltered inland breeding colonies and, finally, seals were taken from their breeding colony near Waihora throughout the year.

The major hunting foci were the fatty, meat-bearing resources: seals and mutton-birds. These were taken when they were most aggregated. Shellfish collecting and other gathering activities may have involved at least as much time as birding and the seal slaughter but the return would be much smaller, both in terms of calories per unit weight (Meehan 1977) and total weight of food collected per unit time.

DISCUSSION

Fitzhugh (1975:343) has argued that for subarctic coastal hunters, "Northern maritime adaptations result in functionally-related cultural forms due to similar requirements of northern exploitation patterns which arise independently in different parts of the circumpolar zone".

This contention has been surrounded by controversy as some (Gjessing 1944, 1975; Simonsen 1975) have attempted to explain similarities within the northern Circumpolar as the result of the migration of Palaeolithic hunters into all areas of the zone from a common broad cultural stock while others, including Fitzhugh (1975) and Moberg (1975) have emphasised the adaptation argument. It may well be that the case can never be resolved in the north where the possibility of circumpolar cultural diffusion exists.

The southern case is much simpler. Man settled the Subantarctic Zone on three independent landmasses; southern New Zealand and the Chathams (no prehistoric occupation has yet been found on New Zealand's southern subantarctic islands); Tasmania and the Bass Strait Islands, and southern South America. There is now archaeological evidence to support the view that cultural adaptation through time in each area led to the type of settlement pattern and selective coastal hunting strategy outlined above for the Chatham Islands and Foveaux Strait coast (Bird 1938; Jones 1966, 1971; Bowdler 1974; Sutton n.d.a.).

An inland adaptation, or mixed coastal-inland strategy, also existed in most areas of the zone which possessed continental fauna including large land animals. For instance, guanaco hunting is well documented for Tierra del Fuego (Bridges 1948; Stuart 1977). Coastal hunters of the West Cape region of South Africa are known to have moved inland seasonally to avoid red water outbreaks and collect plant and animal foods (Parkington 1976). Inland moa-hunting sites are known in Murihiku (Lockerbie 1959; Anderson 1979). However, the Tasmanians, like the Moriori, were firmly marine oriented (Jones 1971, 1977; Bowdler 1977).

There are notable parallels in material culture between these areas. The wash-through raft is common to all three regions (Skinner 1919, Lothrop 1928, Jones 1976) and is seen in at least two cases as being an aspect of birding rather than voyaging technology, allowing access to petrel colonies on offshore islands (Jones 1976; Sutton n.d.a.). Large stone knives or scrapers are particularly conspicuous in assemblages

from the Chilean archipelago (McCartney 1975), Murihiku (Leach, B. F. 1969) and the Chathams (Skinner 1923). Those found in coastal settlements in each of the medium-high latitude areas have been associated with butchering of marine mammals or other large animals. The same function may have been performed by smaller retouched flakes from Jones' (1971, 1974 Fig. 2.4) Tasmanian sites and by shell *Donax* scrapers from the West Cape region of South Africa where the distribution of archaeological sites and former seal colonies are closely correlated (Parkington 1976). Bird bone awls are found on the Chilean coast (McCartney 1975), Murihiku including the Tiwai Point site (Sutton pers. obs.), the Chathams (Skinner 1923, Cave 1977) and Tasmania (Jones 1971). They have been associated with the working of heavy skins, particularly seal skins (Cave 1977). Finally, handclubs are firmly associated with the slaughter of seals in the Chilean archipelago (McCartney 1975). This is most likely to have been the function of the many symmetrical and undecorated *patu* from the Chathams (Sutton pers. obs.). Highly decorated patu, including the sharp-edged forms from New Zealand, have been presumed to be either weapons (Keyes 1967, Skinner and Simmons 1974) or status markers.

CONCLUSION

This paper identifies a coastal adaptation type (Fitzhugh 1975) which is characteristic of most hunter-gatherers living within the Subantarctic Zone. The economic strategies which developed in the zone depended primarily on seals, flying oceanic birds and penguins. They were slaughtered when they were fattest and could be taken most economically. The high dietary fat requirements of hunters in high latitude situations are well documented (Stefansson 1924, Eidlitz 1969, Sinclair 1953). A preliminary list of similarities in material culture suggests that convergent adaptation has occurred, particularly in artefacts related to the "core elements" (Steward 1955) of cultural life, amongst the culturally and racially independent groups which occupied coastal regions of the zone.

ACKNOWLEDGEMENTS

The authors wish to thank Ron Scarlett for bird bone identifications, David Horton and particularly Rhys Jones for sending on some stimulating offprints and papers in press; Jill Hamel, Jenny Hope and Harry Allen for comments on a draft; and Atholl Anderson for discussions during the development of the paper.

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Received 8 December 1978