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– ARTICLE –

Patterns of Faunal Resource Use at an Early Prehistoric Settlement at Whangamata on the Coromandel Peninsula, North Island, New Zealand

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ABSTRACT

Faunal analyses of midden excavated in 2007 from the 14th century Cabana Lodge site (T12/3) at Whangamata, New Zealand are presented here, along with interpretations from collections excavated and surface-collected previously. Analyses of the 2007 assemblage indicate fish (*Pagrus auratus*) and sea mammal (*Arctocephalus forsteri*) were of primary importance in the diet; other collections also indicate that dogs were significant. Comparatively few seals from the nearby rocks of the harbour mouth or fish from the harbour and nearby beach were taken relative to shellfish from the adjacent mudflats. But, whilst shellfish are abundant in the midden, they provided comparatively low overall energy and nutritional yields. The site was an extensive, multi-function permanent settlement.

Keywords: subsistence, prehistory, Whangamata, New Zealand

INTRODUCTION

The site known as Cabana Lodge or Whangamata Wharf has been referred to in the New Zealand archaeological literature since the 1960s (Shawcross 1964; Allo 1972; Jolly 1978; Gumbley and Hoffmann 2008). The site is extensive, covering an area of 1 to 1.5 hectares, and includes substantial early prehistoric midden deposits and a flaking floor, capped with a nineteenth century cultural deposit. Cabana Lodge is one of a number of sites along the east coast of the Coromandel Peninsula (Figure 1) whose occupation has been radiocarbon dated to prior to 1500 AD (James-Lee n.d.).

The site is located a short distance inside the mouth of Whangamata harbour, adjacent to the southern shore. It is recorded in the New Zealand Archaeological Association Site Recording Scheme as T12/3. A second archaeological deposit of similar age, recorded as T12/2, is located approximately 130 metres to the east, adjacent to the wharf at the mouth of Whangamata Harbour. From the evidence available it is likely that T12/3 and T12/2 are part of the same contiguous site.

This paper presents the results of midden analysis from 2007 excavations and integrates the results with previous faunal analyses and interpretations of material cul-

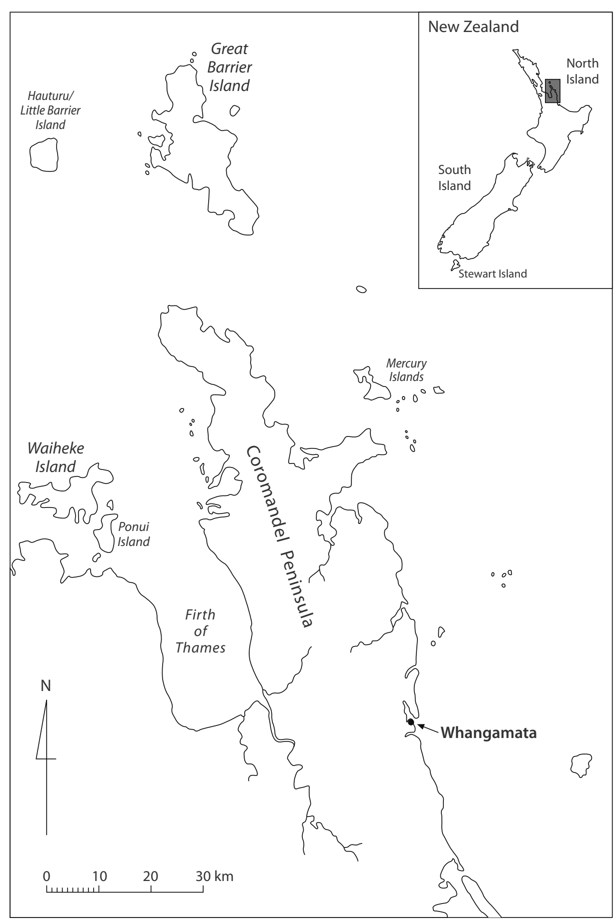

Figure 1. Map showing locality of site (Whangamata) on the Coromandel Peninsula

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ture. The importance of different faunal resources in the diet is examined. The quantification of midden contents in terms of energy contribution to the diet was pioneered in New Zealand by Shawcross (1967, 1970, 1972) at Galatea Bay, and also by Allo (1972) with regard to another part of the Whangamata site. Here we expand on these pioneering studies, considering degrees of interaction with and exploitation of local environmental components and their relative importance in the economy of the inhabitants.

PREVIOUS INVESTIGATIONS

T12/3 was first recorded by Bob Jolly in 1962, who documented the site as an exposure in the foreshore of the harbour, with flakes and bone material present (Jolly 1978). In 1963 Wilfred Shawcross excavated on the foreshore reserve immediately across Beach Road from Cabana Lodge Motel (Shawcross 1964; Pers. comm. with Gumbley 2006). He noted a layer of 'discoloured sand which shows no signs of ground surfaces and was probably disturbed before being finally buried under a thick mantle of modern sand dune' (Shawcross 1964: 17–18). Artefacts recovered by Shawcross included complete and incomplete moa-bone fish-hooks, numerous basalt and obsidian flakes, adze rough-outs, stone drill points and a polished nephrite (pounamu) chisel.

In 1968 Jolly carried out an excavation in the front lawn of the Cabana Lodge Motel where the landowners were constructing a rose garden (Jolly 1978). Jolly identified four layers: 'Layer 1 was sand darkened by ash and by gardening. Layers 2, 3 and 4 were grey rather than black and were well compacted' (1978: 135). He estimated that each layer was approximately 15 cm thick indicating the cultural deposits were approximately 60 cm thick. As a result of his work at Whangamata, and probably also Allo's investigations (see below), he believed that T12/3 and T12/2 were parts of the same occupation. Jolly reported finding lure-hook shanks and points; pieces of one-piece bone hooks and bone tabs for manufacturing hooks; a bone needle, an imitation whale-tooth necklace unit; adzes, adze roughouts and fragments of adzes; drill points; hammer stones; stone files; flakes of basalt, chert and obsidian; nineteenth century European artefacts; and bones including those of birds (including moa) (1978: 137).

Some, but not necessarily all, of the archaeological material recovered by Jolly has been stored at the Auckland Museum. This material is dominated by stone, including basalt waste flakes from adze manufacture, obsidian and chert flakes. Worked bone of moa and sea mammal is present and much of this is in the form of fish-hooks and items relating to their manufacture. The collection also includes a sizeable amount of fish-bone (particularly *Pagrus auratus*, snapper) and shellfish (*Austrovenus stutchburyi,* cockle; *Cookia sulcata,* cooks turban; *Struthiolaria papulosa,* ostrich foot; *Thais orbita,* whelk).

Allo (1972) carried out an investigation of T12/2 immediately east of the wharf in 1969. She recorded two cultural layers, the upper containing nineteenth century remains, and the lower containing material typical of early prehistoric sites, such as the remains of moa and fur seals. Allo concluded that seals and dogs provided most of the edible meat respectively, but shellfish made up relatively little of the diet. Fragments of butchered and burnt human bone were also present.

In 1981 the site was visited by Easdale and Jacomb, who reported that the midden deposit of T12/3 extended onto the reserve section on the corner of Port Rd and Beach Rd and along the frontage of Port Rd for the whole of the block (Easdale and Jacomb 1982).

THE 2007 EXCAVATIONS

Gumbley carried out investigations at Cabana Lodge in June 2007. Six areas were excavated, labelled A, B, C, D, E and F (Figure 2), the extent of these being restricted by the existing motel buildings and the boundaries of the property. Areas A, B, C, D and E were contiguous and together covered approximately 183 m². Area F was approximately 87 m² and divided into the roughly equal size Areas Fz and Fy, with each of these being subdivided with a baulk (Gumbley and Hoffmann 2008).

The western group of excavation areas (A–E) all had similar stratigraphy with each area having two cultural deposits, except B which had only one. Layer 1 was thin, never thicker than 20 cm, and generally grey or dark grey in appearance. This layer was roughly equivalent to the topsoil and included modern as well as prehistoric artefacts. The lower layer was present in each area, except B, and varied in thickness but was deepest in Areas A and E where it was up to 65 cm and 80 cm thick respectively. This layer had a generally grey sand matrix which in places included mottles of yellowish-brown subsoil sand as well as charcoal, ovenstones, shell and artefacts mixed though it. Where intact features were found these were present close to the base of the layer, often immediately overlying the natural sand. The variable depth and thickness of the lower layer along with the slope of its interface with the underlying natural indicates that it formed on a dune ridge system, with Areas B and C being located on the crest and eastern slope of a dune and Areas A and E being located over the slope and swale. The mixed nature of the lower layer is interpreted to be the result of pre-European gardening activities which moved soil, along with any cultural deposits present, from the crest of the dune, filling the swale.[3]

Area F had three cultural layers. Layer 1 was a loose unconsolidated grey sand which included some prehistoric and nineteenth century artefacts mixed with later twen-

3 A more detailed explanation of stratigraphy and accompanying section drawings will be presented in a forthcoming article addressing the archaeology and palaeo-environment.

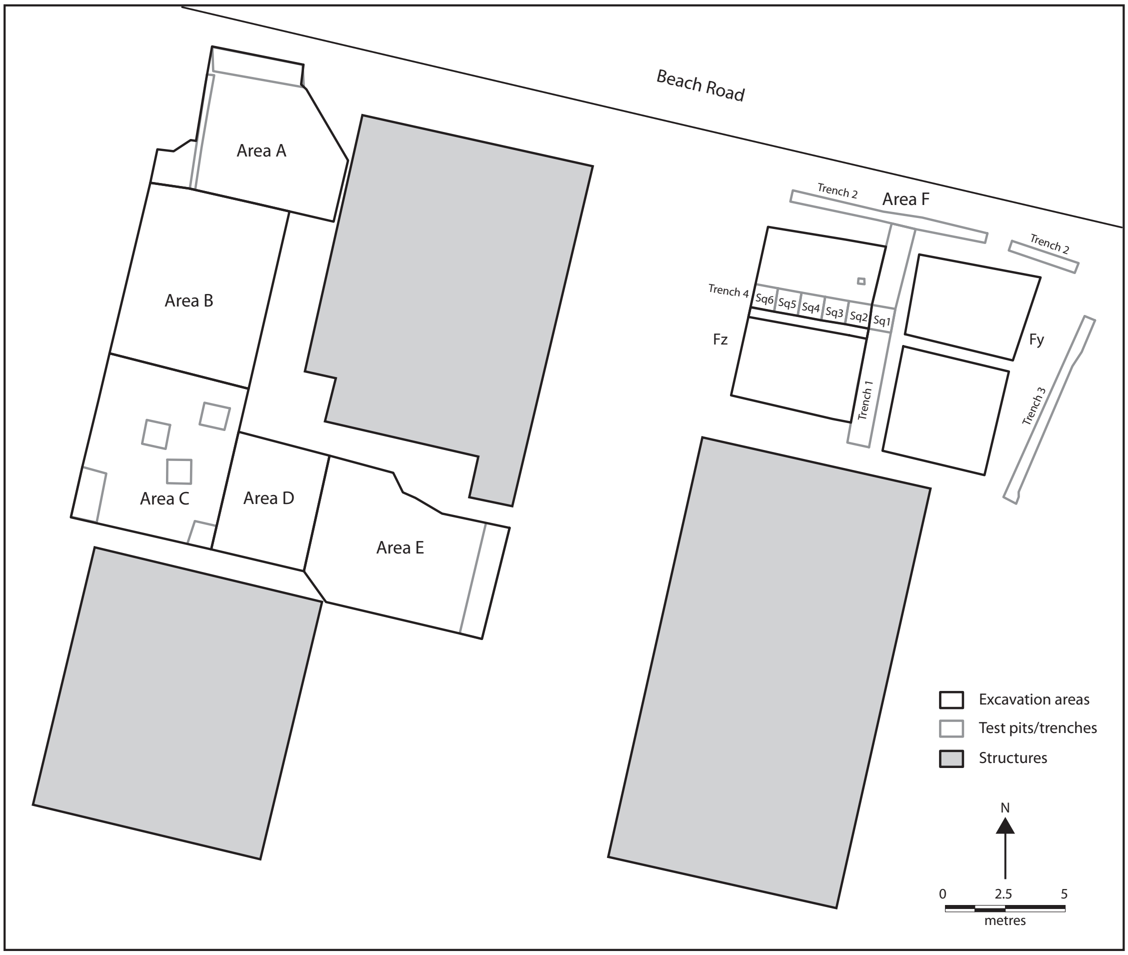

Figure 2. Excavation plan of Cabana Lodge (T12/3), Whangamata, Coromandel Peninsula.

tieth century material. Layer 2 was a midden layer which also included the majority of the fish-hook fragments and remains of fish-hook manufacturing in the form of drill points, bone tabs and partially made hooks. This layer was also rich in dog coprolites. Layer 3 was a dark grey sand mottled with yellowish-brown sand and included a number of cooking features, either umu or fireplaces.

Two shell samples were submitted for radiocarbon dating, both from Layer 2 in Area F. Cockle (*Austrovenus stutchburyi)* was used for Wk-21693 and tuatua (*Paphies subtriangulata)* for Wk-21694. Both dates were calibrated using OxCal 3.10. Sample Wk-21693 provided the calibrated age of AD 1300–1395 at 68.2 per cent probability and AD 1260–1440 at 95.4 per cent probability. Wk-21694 provided the calibrated dates of AD 1350–1460 at 68.2 per cent probability and AD 1310–1490 at 95.4 per cent probability. Together the two dates indicate the site was occupied in the fourteenth century.

FAUNAL ANALYSIS METHODS

Faunal material from the 2007 excavations was sorted into shell and bone classes. The bone was then sorted into fish, bird, mammal and 'unidentifiable' classes. The mammal class was further divided into 'small mammal', 'medium mammal' and 'large mammal' sub-classes. These classes were based on size and density of bone, and were only a rough guide – they were devised purely to facilitate the identification proce9ss. All elements of bone and shell were identified using the Reference Collection at the Otago Archaeological Laboratory (OAL), University of Otago; shell identification was aided using Crowe's (1999) shellfish identification guide; and Leach (1997) was utilised in the identification of fish bone. All bones were first identified to element and then species. Data appropriate to the class of faunal remains was entered into spreadsheets; differences in types of data recorded are noted below. Site, bag ID, element, taxon, side, age/sex, portion, Number of Identified Specimens (NISP) and 'notes' were entered where identified. Where possible, age at death was recorded in order to aid in Minimum Number of Elements (MNE) and Minimum Number of Individuals (MNI) calculation later on in the analyses. NISP and MNE were recorded to calculate MNI figures; weight was not recorded for the general assemblage. In this analysis, the fraction approach, whereby elements are arbitrarily divided into portions which are included in calculations based either on certain landmarks being present or more than half of the unit being present, was used in calculating MNE. While this approach has its weaknesses, it was deemed appropriate when dealing with a large assemblage, particularly when much of the bone is from the fish class, with a much smaller mammal class. Shellfish gastropod MNE were calculated by counting non-repeating element portions such as the apex of the shell or the operculum. For bivalves, complete hinges were counted, and this number was divided by two to calculate MNI. As the assemblage is in poor condition, a fair number of broken 'half-hinges' were present; these were counted and the total divided by two to calculate the MNE; this was then divided by two again to derive the MNI. All paired fish bones that could be identified using the University of Otago Comparative New Zealand Fish Collection were identified to element and family, if not species.

Wilfred Shawcross investigated nutritional components of prehistoric diet from two sites in the northern North Island (1967, 1970, 1972); his principal goal was to use the calorie yield to estimate the size of the human populations and the duration of their occupations at the sites, rather than to address the relative importance of different faunal classes in the prehistoric diet. In this research, however, the goal is to assess the relative contributions of each faunal species to human diet; the approach developed by Smith (2004) has been followed. The MNI for each species was converted into estimates of the weight of usable meat that they represent, using standardised meat yield values for each taxon (Smith 2011). To avoid over-estimating the importance of species with large body sizes (marine mammals, moa) minimum numbers of butchery units (MNBU) were used as the starting point. Meat yields for each taxon were then converted to energy yields (kcal) using taxa-specific kcal per kg values (Smith 2011). To facilitate inter-site comparisons species were grouped into seven faunal classes (fish, shellfish, marine birds, marine mammals, terrestrial mammals, moa and smaller terrestrial birds) and the proportion of total energy harvest from each of these was calculated, in order to determine the relative importance of each faunal class in the diet. These relative proportions were used to look for patterns in faunal resource use. The contribution of plant resources to the diet is not addressed in this paper as there is no technique or method to do this in a way that can be integrated with the faunal data. Both *Ipomoea batatas* (kumara) and *Colocasia esulenta* (taro) have been found in sediments and coprolites from the site; this tells us that they were present but not how important they were in the diet.[4]

4 The microfossil data from this site is included in a forthcoming article which deals with the archaeology and palaeo-environment.

UNIT RESULTS

NISP, MNE and MNI values for the Cabana Lodge assemblages are shown in Tables 1–6. Faunal remains from within the site are divided into assemblages based on excavation units: Area A, Area B, Area C, Area D, Area E, Area F Layer 1 and Area F Layers 2 and 3.

The assemblage from Area A (Table 1) has a total NISP of 163, and a total MNI of seven. The fish class makes up 71.43 per cent of MNI, followed by terrestrial bird and terrestrial mammal, both at 14.29 per cent of MNI. The dominant fish species is *Pagrus auratus* (snapper) contributing three individuals, supplemented by one each of *Latridopsis ciliaris* (blue moki) and *Nemadactylus macropterus* (tarakihi). The only bird present is a forest-dwelling species, *Hemiphaga novaeseelandiae* (kereru, New Zealand wood pigeon). One dog of unknown age is also present.

Table 2 presents the summary results of NISP, MNE, MNI and per cent MNI for Area B. The assemblage is extremely small with a total NISP of three and total MNI of one, contributed solely by fish remains.

The Area C summary data are presented in Table 3. The assemblage has a total NISP of 53 and a total MNI of three. Two waterfowl species are represented by one individual each - *Anas platyrnchos* (mallard) *and Anas superciliosa* (grey duck), although the former is a tentative identification as it was introduced in the 19th century (Dyer and Williams 2010) and is similar to the latter – their excavation context suggests they were both probably 20th century intrusions. One unidentified medium-sized mammal is also present.

In Table 4 the summary results for the Area E excavation unit are presented. The total NISP and MNI is only a total of one, representing a seabird, *Puffinus griseus* (sooty shearwater).

Table 5 presents the summary results for the faunal assemblage from Area F Layer 1 which includes a mixture of prehistoric, 19th and 20th century material. The assemblage has a total NISP of 18 and a total MNI of six. The terrestrial mammal class includes one each of *Ovis aries* (sheep), *Canis familiaris* (dog) and a large unidentified mammal species. Two individuals of *Pagrus auratus* make up the total fish MNI. One individual of *Gallus gallus* (chicken) makes up the remainder of the MNI total.

Gumbley observed that Area F Layers 2 and 3 appear to have been deposited with the same occupation event and can therefore be treated as one temporal unit. This assemblage makes up the largest of all the faunal units, with a total NISP of 68,533 and a total MNI of 9,595 (Table 6). Shellfish made up 98 per cent of all identified individuals, with half of these being *Austrovenus stutchburyi*, and about one third *Paphies australis*, both of which are soft-shore species. The large NISP value for 'shellfish sp.' represents fragments that are almost certainly from species already represented in the MNE and MNI counts. Fish were the best represented class of vertebrates, and 70 per

Table 1. *Area A faunal assemblage summary for NISP, MNE, MNI and per cent MNI.*

Taxon	Common Name	NISP	MNE	MNI	% MNI
Shellfish					
no shellfish		–	–	–	–
Fish					
Pagrus auratus	snapper	11	10	3	42.86
Latridopsis ciliaris	blue moki	6	6	1	14.29
Nemadactylus macropterus	tarakihi	1	1	1	14.29
fish ?sp.	fish ?sp.	134	23	–	–
Fish totals		**152**	**40**	**5**	**71.43**
Terrestrial bird					
Hemiphaga novaeseelandiae	kereru (NZ wood pigeon)	1	1	1	14.29
bird ?sp.	bird ?sp.	2	–	–	–
Terrestrial bird totals		**3**	**1**	**1**	**14.29**
Marine bird					
No marine bird		–	–	–	–
Terrestrial mammal					
Canis familiaris	dog	1	1	1	14.29
medium mammal ?sp.	medium mammal ?sp.	1	–	–	–
mammal ?sp.	mammal ?sp.	5	–	–	–
Terrestrial mammal totals		**7**	**1**	**1**	**14.29**
Marine mammal					
no marine mammal		–	–	–	–
Moa					
moa ?sp.	moa ?sp.	1	–	–	–
Moa totals		**1**	**–**	**–**	**–**
ASSEMBLAGE TOTALS		**163**	**42**	**7**	**100.00**

Table 2. *Area B faunal assemblage summary for NISP, MNE, MNI and per cent MNI.*

Taxon	Common Name	NISP	MNE	MNI	% MNI
Shellfish					
no shellfish		–	–	–	–
Fish					
fish ?sp.	fish ?sp.	3	2	1	100.00
Fish totals		**3**	**2**	**1**	**100.00**
Terrestrial bird					
No bird		–	–	–	–
Marine bird					
no marine bird		–	–	–	–
Terrestrial mammal					
no terrestrial mammal		–	–	–	–
Marine mammal					
no marine mammal		–	–	–	–
Moa					
no moa		–	–	–	–
ASSEMBLAGE TOTALS		**3**	**2**	**1**	**100.00**

cent of these were *Pagrus auratus*, with *Latridopsis ciliaris* and *Nemadactylus macropterus* the only other species to make more than minor contributions. *Arripis trutta* and *Notolabrus celidotus* each contribute 1.69 per cent of the fish assemblage MNI.

The high NISP and MNE counts for 'fish ?sp.' are mostly vertebrae and ribs almost certainly from the species positively identified. The marine bird class is small, with *Eudyptula minor* (little blue penguin) accounting for two of the four individuals. Fur seal is the only species pre-

Table 3. *Area C faunal assemblage summary for* NISP, MNE, MNI *and per cent* MNI.

Taxon	Common Name	NISP	MNE	MNI	% MNI
Shellfish					
no shellfish		–	–	–	–
Fish					
no fish		–	–	–	–
Terrestrial bird					
no terrestrial bird		–	–	–	–
Marine bird					
Anas platyrnchos	mallard	14	12	1	33.33
Anas superciliosa	grey duck	2	2	1	33.33
bird ?sp.	bird ?sp.	35	14	–	–
Marine bird Totals		**51**	**28**	**2**	**66.67**
Terrestrial Mammal					
medium mammal ?sp.	medium mammal ?sp.	2	–	1	33.33
Terrestrial mammal totals		**2**	**–**	**1**	**33.33**
Marine mammal					
no marine mammal		–	–	–	–
Moa					
no moa		–	–	–	–
ASSEMBLAGE TOTALS		**53**	**28**	**3**	**100.00**

Table 4. *Area E faunal assemblage summary for* NISP, MNE, MNI *and per cent* MNI.

Taxon	Common name	NISP	MNE	MNI	% MNI
Shellfish					
no shellfish		–	–	–	–
Fish					
no fish		–	–	–	–
Terrestrial bird					
no terrestrial bird		–	–	–	–
Marine bird					
Puffinus griseus	sooty shearwater	1	1	1	100.00
Marine bird totals		**1**	**1**	**1**	**100.00**
Terrestrial mammal					
no terrestrial mammal		–	–	–	–
Marine mammal					
no marine mammal		–	–	–	–
Moa					
no moa		–	–	–	–
ASSEMBLAGE TOTALS		**1**	**1**	**1**	**100.00**

sent in the marine mammal class, with Five individuals identifiedThe terrestrial mammal class is represented by two dogs and two rats,. Terrestrial birds included two indigenous species, *Halcyon sancta vagans* (New Zealand kingfisher*)* and the *Ardea n. novaehollandiae* (white-faced heron*),* along with bones from two individuals of *Gallus gallus* (chicken). The latter two species are interpreted as intrusions from the historic layer, and were excluded from meat weight and energy yield calculations. Although moa bone fragments were present in the assemblage, they were so small as to indicate they were probably debris from tool manufacture, so were also excluded from further analysis.

ENERGY CONTRIBUTIONS BY CLASS

The data set used for the energy calculations is Area F Layers 2 and 3. This data set has been chosen because it is the largest and therefore assumed to be the most representative of all the datasets.

The meat weights, energy yields and percentage energy yields calculated for each species are shown in Table 7. Despite their numerical dominance in the assemblage MNI

Table 5. *Area F Layer 1 faunal assemblage summary for NISP, MNE, MNI and per cent MNI.*

Taxon	Common Name	NISP	MNE	MNI	% MNI
Shellfish					
no shell		–	–	–	–
Fish					
Pagrus auratus	snapper	8	7	2	33.33
fish ?sp.	fish ?sp.	7	–	–	–
Fish totals		**15**	**7**	**2**	**33.33**
Terrestrial bird					
no terrestrial bird		–	–	–	–
Marine bird					
Gallus gallus	chicken	1	1	1	16.67
bird ?sp.	bird ?sp.	3	1	–	–
Marine bird totals		**4**	**2**	**1**	**16.67**
Terrestrial mammal					
Ovis aries	sheep	1	1	1	16.67
Canis familiaris	dog	1	1	1	16.67
large mammal ?sp.	large mammal ?sp.	1	–	1	16.67
mammal ?sp.	mammal ?sp.	2	–	–	–
medium mammal ?sp.	medium mammal ?sp.	4	1	–	–
Terrestrial mammal totals		**9**	**3**	**3**	**50.00**
Marine mammal					
no marine mammal		–	–	–	–
Moa					
no moa		–	–	–	–
ASSEMBLAGE TOTALS		**28**	**12**	**6**	**100.00**

Table 6. *Cabana Lodge prehistoric Area F Layer 2 and 3 faunal assemblage summary for NISP, MNE, MNI and per cent MNI.*

Taxon	Common Name	NISP	MNE	MNI	% MNI
Shellfish					
Austrovenus stutchburyi	cockle	9930	9554	4777	50.82
Paphies australis	pipi	6455	6455	3228	34.34
Turbo smaragdus	cat's eye	661	661	507	5.39
Paphies sp.	Paphies sp.	938	938	469	4.99
Paphies subtriangulata	tuatua	269	269	135	1.44
bivalve sp.	bivalve sp.	3203	136	84	0.89
gastropod sp.	gastropod sp.	242	66	66	0.70
Nerita melanotrogus	black nerita	29	29	29	0.31
whelk sp.	whelk sp.	25	25	25	0.27
Struthiolaria sp.	ostrich foot sp.	19	18	18	0.19
Amalda australis	southern olive shell	12	12	12	0.13
Penion sulcatus	siphon whelk	9	9	9	0.10
limpet sp.	limpet sp.	8	8	8	0.09
mussel sp.	mussel sp.	15	15	8	0.09
Crepidula costata	ribbed slipper shell	6	6	6	0.06
Cominella adspersa	speckled whelk	6	6	6	0.06
Amphibola crenata	mudsnail	4	4	4	0.04
Cookia sulcata	cook's turban	3	3	2	0.02
Austrofusus glans	knobbed whelk shell	2	2	2	0.02
Sigaptella novaezelandiae	circular slipper shell	1	1	1	0.01
Zeacumantus lutulentus?	horn shell?	1	1	1	0.01
Struthiolaria vermis	small ostrich foot	1	1	1	0.01
Pratulum pulchellum	strawberry cockle	2	2	1	0.01
shellfish sp.	shellfish sp.	20836	–	–	–
Chiton sp.	chiton sp.	25	25	–	–
Shellfish totals		**42702**	**18246**	**9399**	**100.00**

Table 6 *continued.*

Taxon	Common Name	NISP	MNE	MNI	% MNI
Fish					
Pagrus auratus	snapper	1124	864	125	70.22
Latridopsis ciliaris	blue moki	113	113	24	13.48
Nemadactylus macropterus	tarakihi	74	72	13	7.30
Meuschenia scaber	leatherjacket	5	4	4	2.25
Arripis trutta	kahawai	20	20	3	1.69
Notolabrus celidotus	spotty	3	3	3	1.69
Chelidonichthys kumu	red gurnard	19	6	1	0.56
Genyagnus monopterygius	spotted stargazer	2	2	1	0.56
Gempylidae sp.	snake mackerel sp.	1	1	1	0.56
Helicolenus percoides	sea perch	1	1	1	0.56
Carangidae ?sp.	mackerel ?sp.	1	1	1	0.56
Zeus faber	john dory	1	1	1	0.56
Notolabrus celidotus?	spotty?	1	1	–	0.00
Pagrus auratus?	snapper?	1	1	–	0.00
fish sp.	fish sp.	23385	2629	–	0.00
Fish totals		**24751**	**3719**	**178**	**100.00**
Terrestrial bird					
Gallus gallus	chicken	9	8	2	40.00
Anas superciliosa	grey duck	1	1	1	20.00
Halcyon sancta vagans	New Zealand kingfisher	1	1	1	20.00
Ardea n. novaehollandiae	white-faced heron	2	2	1	20.00
Terrestrial bird totals		**13**	**12**	**5**	**100.00**
Marine bird					
Eudyptula minor	little blue penguin	14	12	2	50.00
Larus novaehollandiae scopulinus	red-billed gull	2	2	1	25.00
Puffinus griseus	sooty shearwater	1	1	1	25.00
bird sp.	bird sp.	171	27	–	–
Eudyptula minor?	little blue penguin?	1	1	–	–
Marine bird totals		**189**	**43**	**4**	**100.00**
Terrestrial mammal					
Canis familiaris	dog	106	66	2	50.00
Rattus sp.	rat	10	10	2	50.00
mammal sp.	mammal sp.	536	–	–	–
medium mammal sp.	medium mammal sp.	150	4	–	–
Rattus sp.?	rat?	4	4	–	–
small mammal sp.	small mammal sp.	11	5	–	–
Terrestrial mammal totals		**817**	**89**	**4**	**100.00**
Marine mammal					
Arctocephalus forsteri	fur seal	22	21	5	100.00
Marine mammal totals		**22**	**21**	**5**	**100.00**
Moa					
moa ?sp.	moa ?sp.	39	–	–	–
Moa totals		**39**	**–**	**–**	**–**
ASSEMBLAGE TOTALS		**68533**	**22130**	**9595**	

total, shellfish contributed only 3.33 per cent of edible meat and about 0.96 per cent of the energy harvested. Fish provided the overwhelming majority of the assemblage meat weight yield at 54.38 per cent, but only 37.90 per cent of the total energy yield. Marine mammal, i.e. *Arctocephalus forsteri* (fur seal) was the other significant resource, providing 38.04 per cent of total meat-weight and 57.79 per cent of the energy yield. Terrestrial mammal provided only 3.40 per cent of the assemblage meat-weight yield, and only 2.46 per cent of energy yields. Marine and terrestrial birds were no more than marginal energy sources, and as noted above, moa did not contribute to the energy harvest.

Table 7. *Cabana Lodge prehistoric faunal assemblage MNI, meatweight, meat yield and energy yield calculations.*

Taxon	Common Name	MNI	MTWT kg	MTWT Yield kg	Energy kcal/kg	Energy Yield kcal	Energy Yield % kcal
Shellfish							
Austrovenus stutchburyi	cockle	4777	0.002	9.554	430	4108.220	0.494
Lunella smaragdus	cats eye	507	0.004	2.028	797	1616.316	0.195
Paphies australis	pipi	3228	0.001	3.228	410	1323.480	0.159
Paphies ?sp.	Paphies ?sp.	469	0.001	0.469	797	373.793	0.045
Paphies subtriangulata	tuatua	135	0.002	0.27	1100	297.000	0.036
Mollusca ?sp.	shellfish ?sp.	84	0.001	0.084	797	66.948	0.008
gastropod ?sp.	gastropod ?sp.	66	0.001	0.066	797	52.602	0.006
Struthiolaria ?sp.	ostrich foot ?sp.	19	0.002	0.038	797	30.286	0.004
Cookia sulcata	cooks turban	2	0.015	0.03	797	23.910	0.003
Nerita atramentosa	black nerita	29	0.001	0.029	797	23.113	0.003
Penion sulcatus	siphon whelk	9	0.003	0.027	797	21.519	0.003
Buccinulum ?sp.	whelk Buccinulum ?sp.	25	0.001	0.025	797	19.925	0.002
Amalda australis	southern olive shell	12	0.001	0.012	797	9.564	0.001
Cominella adspersa	speckled whelk	6	0.002	0.012	797	9.564	0.001
Maoricrypta costata	ribbed slipper shell	6	0.002	0.012	797	9.564	0.001
limpet ?sp.	limpet ?sp.	8	0.001	0.008	797	6.376	0.001
Mytilidae ?sp.	mussel ?sp.	8	0.001	0.008	797	6.376	0.001
Amphibola crenata	mudsnail	4	0.001	0.004	797	3.188	0.000
Aethocola glans	knobbed whelk	2	0.002	0.004	797	3.188	0.000
Sigapatella novaezelandiae	circular slipper shell	1	0.002	0.002	797	1.594	0.000
Pratulum pulchellum	heart cockle	1	0.001	0.001	797	0.797	0.000
Zeacumantis ?sp.	horn shell ?sp.	1	0.001	0.001	797	0.797	0.000
Shellfish totals		**9399**		**15.912**		**8008.120**	**0.964**
Fish							
Pagrus auratus	snapper	125	1.540	192.500	1174	225995.000	27.199
Latridopsis ciliaris	blue moki	24	1.890	45.360	1297	58831.920	7.081
Nemadactylus macropterus	tarakihi	13	0.560	7.280	1736	12638.080	1.521
Arripis trutta	kahawai	3	1.260	3.780	1828	6909.840	0.832
Notolabrus celidotus	spotty	3	1.050	3.150	1000	3150.000	0.379
Gempylidae ?sp.	snake mackerel ?sp.	1	1.860	1.860	1225	2278.500	0.274
Meuschenia scaber	leatherjacket	4	0.560	2.240	849	1901.760	0.229
Zeus faber	john dory	1	0.980	0.980	1020	999.600	0.120
Carangidae sp.	Carangidae ?sp.	1	0.770	0.770	1185	912.450	0.110
Chelidonichthys kumu	red gurnard	1	0.490	0.490	1013	496.370	0.060
Helicolenus percoides	sea perch	1	0.700	0.700	695	486.500	0.059
Genyagnus monopterygius	spotted stargazer	1	0.350	0.350	923	323.050	0.039
Fish totals		**178**		**259.46**		**314923.07**	**37.902**
Marine bird							
Eudyptula minor	Little penguin	2	0.770	1.540	3210	4943.400	0.595
Puffinus griseus	Sooty shearwater	1	0.560	0.560	3210	1797.600	0.216
Larus novaehollandiae	Red-billed gull	1	0.182	0.180	3210	584.220	0.070
Marine bird total		**4**		**2.280**		**7325.220**	**0.882**
Terrestrial bird							
Todiramphus sancta vagens	New Zealand kingfisher	1	0.046	0.0455	1760	80.080	0.010
Terrestrial bird total		**1**		**0.0455**		**80.080**	**0.010**
Terrestrial mammal							
Canis familiaris	dog - adult	1	10.000	10.000	1260	12600.000	1.516
	dog - sub adult	1	6.000	6.000	1260	7560.000	0.910
Rattus exulans	rat	2	0.100	0.200	1260	252.000	0.030
Terrestrial mammal totals		**4**		**16.200**		**20412.000**	**2.457**
Marine mammal							
Arctocephalus forsteri	fur seal - adult male	1	94.500	94.500	2620	247590.000	29.798
Arctocephalus forsteri	fur seal - adult female	2	30.000	60.000	2620	157200.000	18.919
Arctocephalus forsteri	fur seal - juvenile	2	14.380	28.760	2620	75351.200	9.069
Marine mammal totals		**5**		**183.260**		**480141.200**	**57.786**
Moa							
No subsistence moa remains		–		–		–	–
ASSEMBLAGE TOTALS		**9587**		**477.160**		**830889.690**	**100.000**

PROTEIN, CARBOHYDRATE AND FAT CONTRIBUTION

The values used to calculate protein, fat and carbohydrate yields are presented in Table 8. The fish class provides 60.42 per cent of the protein yield, but does not contribute as much fat (24.81 per cent of the total yield) or carbohydrate (11.96 per cent of the total yield). Fur seal contributes a lower proportion of protein (32.85 per cent), but higher proportions of fat (72.54 per cent of assemblage yield) and carbohydrate (84.45 per cent of assemblage yield). Shellfish contributes only 3.59 per cent of total carbohydrate yield; 1.90 per cent of protein yield, and 0.29 per cent of fat yield. Terrestrial mammal makes a small contribution to protein yield (4.36 per cent), fat yield (1.17 per cent) but zero to the carbohydrate yield. Terrestrial and marine birds make marginal contributions to the protein and fat yields.

It seems likely that the percentage yields of these faunal classes will be fairly dependent on the MNI values for those classes, rather than the species within them. For example fish are generally higher in protein and carbohydrate and lower in fat compared to shellfish, which have more carbohydrate than fat or protein by weight. Thus the faunal classes utilised in the diet are more informative as sources of nutritional value than specific species within classes.

Table 8. *Cabana Lodge prehistoric faunal assemblage MNI, protein yield, fat yield and carb yield calculations.*

Taxon	Common name	MNI	Protein g/kg	Protein Yield g	Fat g/kg	Fat Yield g	Carb g/kg	Carb Yield g
Shellfish								
Austrovenus stutchburyi	cockle	4777	82	783.428	9	85.986	6	57.324
Lunella smaragdus	cats eye	507	136	275.808	17	34.476	23	46.644
Paphies subtriangulata	tuatua	135	167	45.090	22	5.940	62	16.740
Paphies australis	pipi	3228	82	264.696	7	22.596	5	16.140
Paphies ?sp.	Paphies ?sp.	469	136	63.784	17	7.973	23	10.787
Mollusca ?sp.	shellfish ?sp.	84	136	11.424	17	1.428	23	1.932
gastropod ?sp.	gastropod ?sp.	66	136	8.976	17	1.122	23	1.518
Struthiolaria ?sp.	ostrich foot ?sp.	19	136	5.168	17	0.646	23	0.874
Cookia sulcata	cooks turban	2	136	4.080	17	0.510	23	0.690
Nerita atramentosa	black nerita	29	136	3.944	17	0.493	23	0.667
Penion sulcatus	siphon whelk	9	136	3.672	17	0.459	23	0.621
Buccinulum ?sp.	whelk Buccinulum ?sp.	25	136	3.400	17	0.425	23	0.575
Amalda australis	southern olive shell	12	136	1.632	17	0.204	23	0.276
Cominella adspersa	speckled whelk	6	136	1.632	17	0.204	23	0.276
Maoricrypta costata	ribbed slipper shell	6	136	1.632	17	0.204	23	0.276
limpet ?sp.	limpet ?sp.	8	136	1.088	17	0.136	23	0.184
Mytilidae ?sp.	mussel ?sp.	8	136	1.088	17	0.136	23	0.184
Aethocola glans	knobbed whelk	2	136	0.544	17	0.068	23	0.092
Amphibola crenata	mudsnail	4	136	0.544	17	0.068	23	0.092
Sigapatella novaezelandiae	circular slipper shell	1	136	0.272	17	0.034	23	0.046
Pratulum pulchellum	heart cockle	1	136	0.136	17	0.017	23	0.023
Zeacumantis ?sp.	horn shell ?sp.	1	136	0.136	17	0.017	23	0.023
Shellfish totals		**9399**		**1482.174**		**163.142**		**155.984**
Fish								
Pagrus auratus	snapper	125	179	34458.000	50	9625.000	2	385.000
Latridopsis ciliaris	blue moki	24	194	8800.000	57	2586.000	2	91.000
Nemadactylus macropterus	tarakihi	13	189	1376.000	108	786.000	2	15.000
Arripis trutta	kahawai	3	194	733.000	116	438.000	2	8.000
Notolabrus celidotus	spotty	3	167	526.000	36	113.000	2	6.000
Gempylidae ?sp.	snake mackerel sp.	1	182	339.000	55	102.000	2	4.000
Meuschenia scaber	leatherjacket	4	172	385.000	17	38.000	2	4.000
Carangidae ?sp.	Carangidae ?sp.	1	196	151.000	44	34.000	2	2.000
Zeus faber	john dory	1	181	177.000	32	31.000	2	2.000
Chelidonichthys kumu	red gurnard	1	186	91.000	29	14.000	2	1.000
Genyagnus monopterygius	spotted stargazer	1	159	56.000	31	11.000	2	1.000
Helicolenus percoides	sea perch	1	138	97.000	15	11.000	2	1.000
Fish totals		**178**		**47188.120**		**13789.820**		**518.920**
Marine bird								
Eudyptula minor	Little penguin	2	160	246.400	290	446.600	0	0.000
Larus novaehollandiae	Red-billed gull	1	160	29.120	290	52.780	0	0.000
Puffinus griseus	Sooty shearwater	1	160	89.600	290	162.400	0	0.000
Marine bird totals		**4**		**365.120**		**661.780**		**0.000**

Table 8 *continued.*

Taxon	Common name	MNI	Protein g/kg	Protein Yield g	Fat g/kg	Fat Yield g	Carb g/kg	Carb Yield g
Terrestrial bird								
Todiramphus sancta vagens	NZ kingfisher	1	280	12.740	60	2.730	0	0.000
Terrestrial bird totals		**1**		**12.740**		**2.730**		**0.000**
Terrestrial mammal								
Canis familiaris	dog - adult	1	210	2100.000	40	400.000	0	0.000
	dog - sub adult	1	210	1260.000	40	240.000	0	0.000
Rattus exulans	rat	2	210	42.000	40	8.000	0	0.000
Terrestrial mammal totals		**4**		**3402.000**		**648.000**		**0.000**
Marine mammal								
Arctocephalus forsteri	fur seal - adult male	1	140	13230.000	220	20790.000	20	1890.000
Arctocephalus forsteri	fur seal - adult female	2	140	8400.000	220	13200.000	20	1200.000
Arctocephalus forsteri	fur seal - juvenile	2	140	4026.400	220	6327.200	20	575.200
Marine mammal totals		**5**		**25656.400**		**40317.200**		**3665.200**
Moa								
No subsistence moa remains		–		–		–		–
ASSEMBLAGE TOTALS		**9587**		**78106.550**		**55582.670**		**4340.104**

DISCUSSION

The results of the faunal analysis tell us about the species that were important in the subsistence activities and diet of the inhabitants of this 15th century site. Analysis of environments that the species were harvested from gives greater insight into subsistence activities undertaken by the inhabitants of the Cabana Lodge site.

Exploited Ecological Zones:

The Cabana Lodge site is located beside the Whangamata Harbour mouth (Figure 3); the littoral environment in the immediate locale of the site includes estuarine, rocky coast and open sand zones. Access to the marine environment is to the south-east of the site, and terrestrial resources are available to the south, west and north of the site. While

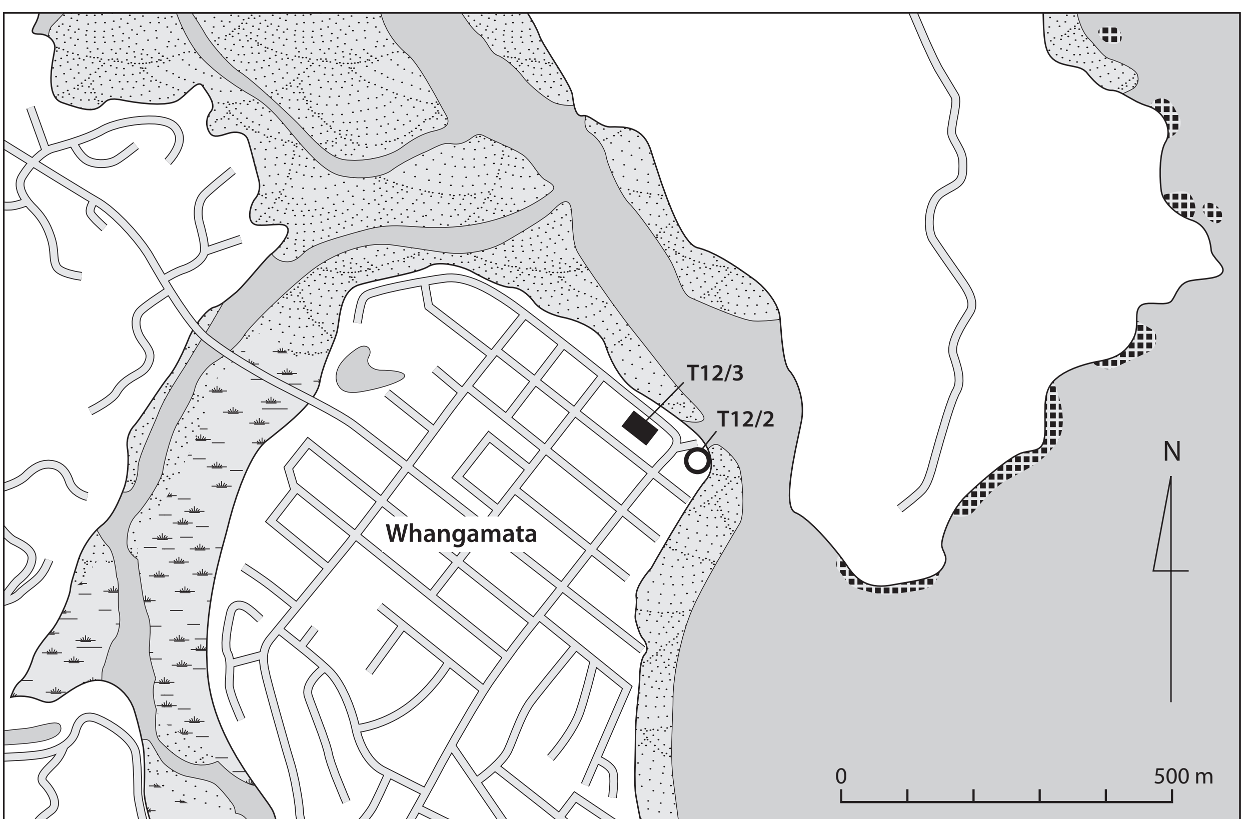

Figure 3. Map showing location of the Cabana Lodge site (T12/3) and the Whangamata Wharf site (T12/2), at Whangamata.

there are no major rivers that enter the harbour, there are minor sources of fresh water but no identifiable remains of freshwater species (such as eels) are present in the faunal remains.

The faunal resources utilised at the Cabana Lodge site are divided into three main ecological zones: marine, littoral and terrestrial. Using per cent energy yield as way of measuring importance in the diet gives us a picture of both daily activities and nutritional value of faunal resources utilised at the Cabana Lodge site (Table 9).

Marine Environment

In this analysis, faunal resources from the marine environment consist of one class, fish. The range of fish represented in the main assemblage from Cabana Lodge is broad with eleven species represented (see Table 10), but it focuses on mainly one, *Pagrus auratus* (snapper), with a few supplementary species (i.e. *Latridopsis ciliaris* and *Nemadactylus macropterus*); otherwise the remaining species seem to have been taken opportunistically and were not deliberately targeted. The total MNI for the fish assemblage was 178 individuals, or 1.86 per cent of total assemblage MNI. Fish produced 37.90 per cent of the energy yield for the main Cabana Lodge assemblage. These figures indicate that the fishing catch was a significant source of energy.

Leach notes that snapper are commonly taken in medium depth waters over sandy bottoms with baited hooks (1979). Crosby describes 19th century Maori taking snapper in the surf on sandy beaches with a hook and line; they were also taken with seine nets (1966). Shawcross notes that in the Houhora area snapper are observed in the harbour in winter months (1967). These are most likely larger solitary individuals which are known to overwinter inshore. As the main Cabana Lodge assemblage is dominated by snapper, it is unlikely that these were caught during winter in the Whangamata Harbour, which is when lower numbers would be expected (Leach 1979). Snapper readily take a baited hook (Crosby (Crosby 1966; Leach and Davidson 2000). It is possible that nets such as matarau circular hoop nets and kōrapa scoop nets would have been used to catch the snapper in rocky areas, where it would have been impractical to use drag nets or seine nets (Paulin 2007).

Table 9. *Marine, littoral and terrestrial faunal resource classes by per cent MNI and per cent energy yield for Cabana Lodge assemblage Fz Layers 2 and 3.*

Ecological Zone	Faunal class	% MNI	% Energy Yield
Marine	Fish	1.69	37.90
	Marine Total	**1.69**	**37.90**
Littoral	Shellfish	98.13	0.96
	Mammal	0.05	57.79
	Bird	0.04	0.88
	Littoral total	**98.23**	**59.63**
Terrestrial	Mammal	0.04	2.46
	Bird	0.04	0.01
	Moa	0.00	0.00
	Terrestrial Total	**0.08**	**2.47**
Total		**100.00**	**100.00**

Latridopsis ciliaris (blue moki) are found around New Zealand but are more abundant around the South Island, particularly along the east coast from Banks Peninsula in the South Island to East Cape on the North Island, and dwell on rocky reefs and sandy bottoms from 20 to 100 m in depth (Ayling and Cox 1982; Paul 2000). Only occasionally are large specimens (3–10 kg) seen in the far north (Ayling and Cox 1982). Paul notes that:

> moki were important to early Maori, particularly in the eastern Bay of Plenty and near East Cape, where large quantities were caught seasonally by line, and where it remains a culturally important fish. Considerable knowledge and skill, and special catching techniques were required as moki seldom take a normal baited hook (2000: 208).

Modern blue moki fishing methods usually involve netting or spearing over reefs or among weed, and also using a light line with a small shellfish bait (Paul 2000). Blue moki can be caught in quantity with set nets from September to November when the school at the surface during spawning (Leach 1979). Crosby notes that moki school around Cape Runaway (northern East Cape) in winter, and are taken on large baited hooks (1966). It is unlikely that blue moki would have been netted at Whangamata, as they are less abundant north of East Cape, and it is probable that they would have been caught, perhaps opportunistically, on baited hook.

Nemadactylus macropterus (tarakihi) are found around New Zealand, but are most abundant over soft mud bottoms on the East Cape and the east and west coasts of the South Island. Sometimes they are observed swimming near rock reefs over 25 m deep. They move in shoals and can be taken with deep trolling lures and baited hooks; information on their seasonal abundance is unclear (Crosby 1966; Leach 1979). It is possible that tarakihi were taken with set nets laid close inshore (Coutts 1975). However, given the low numbers of tarakihi in the Cabana Lodge main assemblage, and its lower abundance generally north of the East Cape, it is more likely that fish were caught with baited line and hook.

Littoral Environment

The littoral environment encompasses the estuarine shore, rock and sandy beaches zones. Faunal resources from these zones include shellfish (Table 11), sea mammals (specifically seals) and marine birds.

Table 10. *Fish species per cent MNI, niche environment and probable catch method for Cabana Lodge Area Fz Layer 2 and 3.*

Species	Common name	% MNI	% Energy Harvest	Habitat	Catch Method
Pagrus auratus	snapper	70.22	71.76	rocky reef, sand & mud bottom	baited hook, dragged nets, set nets (Coutts 1975, Leach and Davidson 2000)
Latridopsis ciliaris	blue moki	13.48	18.68	rocky reef & sand bottom	line (Paul 2000); hook and line (Coutts 1975)
Nemadactylus macropterus	tarakihi	7.30	4.01	mud bottom & rocky reef	multiple hook and line, seine and set nets? (Coutts 1975); specialised hook and line (Paul 2000)
Parika scaber	leatherjacket	2.25	0.60	rocky reef, sand & mud bottom	set nets? (Coutts 1975, Mann 2009)
Arripis trutta	kahawai	1.69	2.19	pelagic (to 50m), sand & mud bottom	lure hook and line, nets, seine nets (Coutts 1975); specialised trolling lures (Paul 2000)
Notolabrus celidotus	spotty	1.69	1.00	rocky reef & mud bottom	hook and line, hoop and set nets? (Coutts 1975)
Chelidonichthys kumu	red gurnard	0.56	0.16	sand & mud bottom	line and seine net (Paul 2000)
Genyagnus monopterygius	spotted stargazer	0.56	0.10	sand & mud bottom	seine nets? (Coutts 1975)
Helicolenus percoides	sea perch	0.56	0.10	sand bottom	hook and line? (Coutts 1975)
Zeus faber	john dory	0.56	0.32	rocky reef, sand & mud bottom	(no references found)
Carangidae ?sp.	mackerel ?sp.	0.56	0.29	unknown	(no references found)
Gempylidae ?sp.	snake mackerel ?sp.	0.56	0.72	unknown	barracouta - jigged on feather or shell decorated wooden lures (Paul 2000); lure hook and rod (Coutts 1975)
Fish totals		**100.00**	**100.00**		

The Whangamata Harbour estuarine environment includes a combination of mudflats and sandflats, which are typical environments for the main shellfish species in the Cabana Lodge assemblage, *Austrovenus stutchburyi* (cockle, *tuangi*, *tuaki*) and *Paphies australis* (pipi). *Austrovenus stutchburyi* are often the dominant bivalve in mudflats at mid-tide level, and can reach sizes of up to 6 cm, though they are usually much smaller. They form dense beds and are shallow burrowers (Crowe 1999; Paul 2000). *Paphies australis* are found in muddy and sandy shores and live buried just below mid-tide, on silty sandbars or sandy beaches just inside harbour entrances, and small beds are sometimes located near river mouths. Their average size is 4–6 cm, though some measure up to 8 cm. Pipi do not bury deeply and are sometimes partially exposed; they have short siphons (Crowe 1999; Paul 2000). The shellfish class contributed only 0.96 per cent of the total energy harvest for the assemblage, while making up 98.04 per cent of assemblage MNI, indicating that while shellfish was a low-return faunal resource in terms of energy, it was used as a staple supplement in the diet. Shellfish from the mudflat and mud/sand zones give a combined total of 85 per cent of MNI (Table 12).

The north side of the Whangamata Harbour mouth provided the inhabitants of the Cabana Lodge site with access to rocky coast resources. Rocky shore shellfish species make up only 6.06 per cent of shellfish MNI indicating that generally-speaking, little time was spent there gathering shellfish. Out of the rocky shore shellfish species, *Lunella smaragdus* (cats eye, *ataata*, *pupu*) which is found on intertidal rocks, was the most common (Crowe 1999).

The rocks at the Whangamata Harbour mouth also provided the nearest location to the Cabana Lodge site where cropping of *Arctocephalus forsteri* (New Zealand fur seal, *kekeno*) would have occurred. The remains of one adult male fur seal, two juveniles (unknown sex), and two adult females are present. The species is found on rocky coastlines of New Zealand from Three Kings Islands in the north to Macquarie Island in the south, a range of ca. 2700 km (King 2005). Usually fur seals are encountered at rookeries (breeding colonies) or hauling grounds (non-breeding colonies), and occasionally individuals haul out by themselves (Smith 2005). The fur seal breeding season runs from November to January, when most are restricted to the breeding colony. With regards to prehistoric Maori hunting of fur seals, Smith notes:

Table 11. *Cabana Lodge shellfish per cent* MNI, *per cent energy harvest and habitat.*

Taxon	Common Name	% MNI	% Energy Harvest	Habitat
Austrovenus stutchburyi	cockle	50.82	51.30	mudflat
Paphies australis	pipi	34.34	16.53	mud/sand
Lunella smaragdus	cats eye	5.39	20.18	rocky
Paphies ?sp.	Paphies ?sp.	4.99	4.67	sandy
Paphies subtriangulata	tuatua	1.44	3.71	sandy
bivalve sp.	bivalve sp.	0.89	0.84	unknown
gastropod sp.	gastropod sp.	0.70	0.66	unknown
Nerita melanotrogus	black nerita	0.31	0.29	rocky
whelk sp.	whelk sp.	0.27	0.25	unknown
Struthiolaria sp.	ostrich foot sp.	0.19	0.38	mud/sand
Amalda australis	southern olive shell	0.13	0.12	sandy
Penion sulcatus	siphon whelk	0.10	0.27	rocky
limpet ?sp.	limpet sp.	0.09	0.08	rocky
Mytilidae ?sp.	mussel sp.	0.09	0.08	rocky
Cominella adspersa	speckled whelk	0.06	0.12	mudflat
Maoricrypta costata	ribbed slipper shell	0.06	0.12	rocky
Amphibola crenata	mudsnail	0.04	0.04	mudflat
Cookia sulcata	cooks turban	0.02	0.04	rocky
Austrofusus glans	knobbed whelk shell	0.02	0.30	sandy
Pratulum pulchellum	strawberry cockle	0.01	0.01	deep water
Zeacumantus lutulentus?	horn shell?	0.01	0.01	mudflat
Sigaptella novaezelandiae	circular slipper shell	0.01	0.02	rocky
Struthiolaria vermis	small ostrich foot	0.01	0.01	sandy
Totals		**100.00**	**100.00**	

Table 12. *Cabana Lodge shellfish per cent* MNI *and habitat classes.*

Shellfish Habitat	% MNI	% Energy Harvest
mudflat	50.94	51.47
mud/sand	34.54	16.91
sandy	6.59	8.81
rocky	6.06	21.08
unknown	1.86	1.75
deep water	0.01	0.01
Total	**100.00**	**100.00**

> In the northern North Island, securely dated evidence of regular cropping is confined to the late 13th or 14th centuries, coinciding with the presence of breeding colonies. Opportunistic encounter hunting was also evident at smaller or more specialised sites of the same age and appears to have persisted for about a century after the demise of northern breeding populations, but after c. 1,500 AD fur seals completely disappear from the northern archaeological record (2005: 10).

During the prehistoric period, two major exploitation strategies were employed in the hunting of fur seals. Opportunistic *encounter hunting* is evident at archaeological sites where fur seal MNI is low (typically MNI ≤ 2) and the sites are located at least 10 km from the nearest rocky shore. The sites often have generalised faunal assemblages or are focused on shellfishing or fishing. The skeletal elements of fur seals present in these sites include those from low and high meat utility units indicating that the fur seals had been captured nearby during a chance encounter with an individual. Sites where *regular cropping* is in evidence have higher MNI values for fur seals, but also usually have generalised faunal assemblages, and are located within a few kilometres of regularly occupied fur seal colonies. In sites where regular cropping took place, skeletal elements usually represent high meat utility units as low meat utility units were abandoned at the butchery sites, with the exception of small animals which were transported back to the main site whole (Smith 2005).

The fur seal elements identified by age and sex are listed in Table 13. The elements identified as belonging to adult females are from fore (ulna, radius) and rear (femur) limbs and the pelvis, while the elements from the adult male are digits (metacarpals, phalanx). The elements identified as belonging to juveniles are from the fore limbs (radius) and pelvis. Other elements which could not be assigned to age or gender are from the torso (scapulae, ribs, vertebrae, pelvis) and the skull (teeth). The MNI total

Table 13. *Arctocephalus forsteri (New Zealand fur seal) skeletal portions, Cabana Lodge Area Fz Layers 2 and 3.*

Age/Sex	Element	Side	Portion	NISP	MNE
adult female	pelvis	L	part acetabulum + ilium frag	1	1
adult female	pelvis	R	acetabulum	1	1
adult female	ulna	L	PS-MS	1	1
adult female	ulna	R	MS	1	1
adult female	radius	R	C**	1	1
adult female	radius	R	P*-DS	1	1
adult female	femur	L	C**	1	1
adult male	metacarpal 1	L	MS-D	1	1
adult male	metatarsal 2	R	P+M	1	1
adult male	metatarsal 5	L	C	1	1
adult male	phalanx 1st	R	C	1	1
adult unknown sex	metacarpal 1	L	DS-DS	1	1
juvenile female	pelvis	L	ilium	1	1
juvenile female	radius	L	C**	1	1
juvenile unknown sex	radius	L	P*-DS	1	1
?	pelvis	L	Ilium frag + acetabulum frag	1	1
?	ribs	?	C**	1	1
?	scapula	L	>½	3	1
?	scapula	R	>½	2	1
?	tooth-canine	?	C	1	1
?	tooth-lower canine	?	C	1	1
?	tooth-post canine	?	C	1	1
?	tooth-post canine	?	C	1	1
?	tooth-post canine	?	C	1	1
?	tooth-post canine	?	frag	1	0
?	tooth-upper 3rd incisor	?	C	1	1
?	tooth-upper incisor	?	C	1	1
?	vertebra	A	>½	1	1
?	vertebra-axis	A	>½	1	1
?	vertebra-cervical	A	>½	1	1
?	vertebra-cervical 1	A	C	1	1
?	vertebra-lumbar	A	>½	1	1
?	vertebra-thoracic	A	C	1	1
?	vertebra-thoracic	A	C**	1	1
?	vertebra-thoracic	A	C**	1	1
?	vertebra-thoracic	A	C**	1	1
?	vertebra-thoracic	A	centrum**	1	1
Total				**40**	**36**

of 5 and the range of skeletal elements present at Cabana Lodge indicate the occupants there utilised the *regular cropping* foraging strategy for hunting fur seals. The five fur seals represent almost 60 per cent of the energy yield, but only 0.05 per cent of the main assemblage MNI. This indicates that fur seals provided an energy-dense resource in the diet compared with shellfish.

The open beach to the south of the Cabana Lodge site provided only a minor contribution to the MNI, with 6.59 per cent of the shellfish MNI. *Paphies subtriangulata* (tuatua) was the most common shellfish from the sandy beach environment. These are found on open sandy beaches at intertidal or lower tide levels (Crowe 1999; Paul 2000).

The sandy beach is also the most likely place that the occupants of Cabana Lodge site would have encountered *Eudyptula minor* (little blue penguin, korora). Other birds found on the sandy shore present in the Cabana Lodge assemblage include *Larus novaehollandiae scopulinus* (red-billed gull, *akiaki*, *tarapunga*) and *Puffinus griseus* (sooty shearwater, *titi*).

Terrestrial Environment

The terrestrial environment was in the immediate vicinity of the Cabana Lodge site, and extended to the west. Resources in this zone include forest, wetland and open country birds, dogs, rats and moa.

Only one species was identified in the terrestrial bird class in the main assemblage, *Halcyon sancta vagans* (New Zealand kingfisher, *kotare*). This species is New Zealand's only native kingfisher, and is found in a wide range of habitats including open forest, along the shores of estuaries, farmland, near rivers and lakes, near the high tide line on sandy beaches and also along rocky shores (Moon 1996). No diagnostic moa bones were identified in the 2007 assemblage.

Two species in the terrestrial mammal class were identified in the main assemblage, *Canis familiaris* (Polynesian dog, *kuri*) and *Rattus exulans* (Polynesian rat, *kiore*). One subadult and one adult dog, and two rats were identified. During prehistory *Rattus exulans* (Pacific rat, *kiore*) were found in a variety of habitats including grasslands, shrublands and forests throughout the three main islands and many offshore islands, as well as several outlying islands (Atkinson and Towns 2005). The kuri would likely have been bred and managed for hunting and as a source of meat (Clark 1997); while Best (1942: 447) reported that the kiore were considered a valuable food source by Maori, who set traps for them along trails or near where trees dropped their fruit. It is reported, based on ethnographic accounts of the 19th century (Wilson 1878; Downes 1926; Best 1942) that Maori trapped kiore extensively for food, using either snares made out of supplejack in spring, or pit traps (1.2–1.5 m deep) baited with berries. Near the end of the trapping season in August, kiore generally moved from forests to scrub and fernland; sometimes shorter vegetation was burnt and kiore were removed from holes in the ground. Kiore were plucked of their fur and cooked (in an *umu* or steam oven) and either eaten immediately or packed in gourd-vessels or kelp bags, with their own fat (Atkinson and Towns 2005).

SUMMARY

In terms of faunal subsistence activities, hunting and gathering resources in the littoral zone accounts for 98.23 per cent of total assemblage MNI; the littoral zone also produced the largest proportion of energy at almost 60 per cent of total energy yield. When broken down into faunal classes however it is clear that there is no positive correlation between MNI and energy provided. While shellfish gathering made up 98 per cent of the MNI in the littoral zone, this activity actually provided very little energy (less than 1 per cent of total assemblage energy yield). On the other hand hunting for littoral zone mammals (0.05 per cent of assemblage MNI) contributed almost 58 per cent of total assemblage energy yield, and therefore was hugely significant in the diet. Assuming the MNI for littoral zone birds is representative of how many were being caught at the site, it appears the birds were scarce (or difficult to catch) and therefore it is likely that little time was spent catching them; they were not important in the diet.

The next most important ecological zone for the inhabitants of the Cabana Lodge site was the marine zone. This consists of only one faunal class, fish. Relative to the littoral zone, fish contribute only 1.69 per cent of total assemblage MNI. However, fish were a significant source of energy in the diet, providing almost 38 per cent of total energy yield.

The terrestrial zone was the least significant source of fauna in the diet for the people living at the Cabana Lodge site. Few terrestrial zone mammals (0.04 per cent of MNI) appear to have been caught, implying that they were also not significant in the diet (at 2.46 per cent of total assemblage energy yield). While an equally small number of terrestrial birds were successfully caught, they were even less important in the total energy input of the diet (at 0.01 per cent of total assemblage energy yield). No economic moa remains were recovered; moa hunting was rarely if ever undertaken at this site and moa are not apparent in the diet in this assemblage.

The overall picture of ecological zone use shows that littoral and marine zone hunting activities (seal hunting and fishing) had high energy return results despite comparatively low contribution to MNI. The littoral zone also provided a stable resource (shellfish) collected in quantity, but for significantly lower energy returns. While the former activities would have been dependent on weather and sea conditions in the marine zone, and opportunity in the littoral zone, and undertaken by individuals or smaller groups of people, shellfishing could be undertaken in most conditions and by large groups of people of varying strengths and skills. These three resource activities and the fauna they harvested provided the mainstay of the energy (and no doubt protein and fat) in the diet of the late fourteenth century inhabitants at Cabana Lodge.

Previous analyses of fauna

As discussed earlier, there is a small assemblage from the Cabana Lodge site excavated by Jolly in 1968 (Jolly 1978) and a more substantial assemblage excavated east of the wharf by Allo in 1969 (Allo 1972). In the Jolly assemblage stored at the Auckland Museum, *Austrovenus stutchburyi*, *Cookia sulcata*, *Struthiolaria papulosa* and *Dicathais orbita* were the predominant species. The assemblage has been examined but not recently quantified by weight or MNI; however it is apparent that while the estuarine species *Austrovenus stutchburyi* was common, rocky shore species (*Cookia sulcata* and *Dicathais orbita)* and sandy beach species (*Struthiolaria papulosa*) were not. Allo's analysis of shellfish use at Cabana Lodge involved a 300 kg sample of midden, where only whole shells or those with a hinge were sorted into species. The three most important species were *Austrovenus stutchburyi*, *Paphies australis* and *P. subtriangulata*. She used the weight of sorted shell to calculate meat-weight, based on Shawcross' proportion of meat-weight to shell weight at approximately 32.5 per cent

(1967), and including unspecified gastropods, calculated a total meat-weight for shellfish of 96.76 kg (Allo 1972). This approach to meat-weight calculation is no longer followed in modern methods of faunal analysis; a re-analysis of this and the Jolly assemblage should be undertaken in the future for more reliable interpretation and comparisons.

The assemblage excavated by Allo had low numbers of fish, with a total MNI of six. These included three *Pagrus auratus*, one individual of unidentified species, one *Pseudocaranx dentex* (trevally, *araara*) and one *Nemadactylus douglasii* (porae); the latter two of which are additional to those identified in the 2007 assemblages. Trevally and porae are not as well documented in archaeological fish catches as snapper, blue moki or tarakihi, but it seems likely that trevally could have been caught in the Whangamata Harbour and porae near the rocks at the harbour mouth or in open water; the suitable habitats located near the site and the use of the Reference Collection at the OAL make it unlikely that these individuals have been mis-identified. Allo calculated an approximate value for total fish meat-weight of 8.6 kg (1972). Gumbley and Hoffmann note that the Jolly assemblage includes a substantial amount of fish bone, a large proportion of which is snapper, but no MNI values are available for the complete assemblage or the part assemblage held at the museum (2008).

Allo's assemblage included seven species of bird, including three 'Phalacrocoracidae ?sp.' (shags), one 'Anatidae ?sp.' (duck), one '*Apteryx* ?sp.' (kiwi), one *Prosthemadera novaeseelandiae* (tui), one *Egretta alba modesta* and one *Eudyptula minor.* These gave a total meat-weight of 8.68 kg. If the white heron is excluded from the Allo assemblage (as was done in the 2007 assemblage on the basis that white herons are arrivals from Australia during late prehistory), the total meat-weight becomes 7.11 kg. One juvenile moa, (possibly *Euryapteryx gravis*) was also identified, with a meat-weight of 15.00 kg. Allo identified two fur seals in her assemblage, which were the largest source of edible meat; her calculations do not specify age or sex but give a total 252 kg of edible weight (1972). The Allo assemblage is notable for having an MNI of 17 kuri, giving a meat-weight of 102.5 kg. Kuri bone is present in the stored Jolly assemblage in the Auckland Museum (Gumbley and Hoffmann 2008). The Allo assemblage yielded 0.24 kg of rat meat.

Evidence of marine bird resource use is limited to *Eudyptula minor*, *Larus novaehollandiae scopulinus* (red-billed gull) and *Puffinus griseus* (sooty shearwater). The former would have been easy targets, coming ashore in the evenings; the latter species was commonly targeted as a mutton bird. Only the remains of one terrestrial bird from the prehistoric period were recovered, that of *Halcyon sancta vagans* (New Zealand kingfisher). This bird is found in coastal areas during winter. The feathers of the little blue penguin and the kingfisher may have been used on *pā kahawai* lures at Cabana Lodge.

Only one species of marine mammal is identified in the faunal remains from Cabana Lodge, that of *Arctocephalus forsteri* (New Zealand fur seal). The rocky coastline near the site would have been a convenient location for regular cropping of fur seals. This matches the 2007 main assemblage with one adult male fur seal, two juveniles, two adult females, giving a meat-weight total of 183.26 kg, or 38.41 per cent of the assemblage total.

Subsistence artefacts

Pieces of at least thirteen one-piece fish-hooks worked from moa and sea mammal bone are present in the Auckland Museum collection from the Cabana Lodge investigation by Jolly. As well as the hooks there are ten broken tabs and nine broken cores remaining from the manufacture of fish-hooks. Also in the Auckland Museum collection are five complete lure-hook shanks (one circular, three lenticular and one triangular in cross-section) and two broken lure-hook shanks. Prehistoric artefacts associated with fishing recovered from Allo's excavation amounted to a single one-piece fish-hook (Allo 1972; Gumbley and Hoffmann 2008). Two tabs of whale bone, which appear to have been blanks for the manufacture of one-piece hooks were found in the upper midden that contained nineteenth century artefacts. Whether these reflected a late reliance on old technology or are a consequence of a taphonomic process that resulted in their re-deposition in the later midden is uncertain.

The 2007 investigation of the Cabana Lodge site resulted in the recovery of approximately 4000 artefacts. Most of these artefacts were lithic, the majority being basalt flakes relating to adze manufacture or obsidian and chert flakes. However, drill points formed a distinct component of the lithic assemblage and these are interpreted to have been associated with the manufacture of fish-hooks. Artefacts associated with fishing were also common. Items belonging to this class included three lure shanks (one stone and two broken bone shanks) and two lure points. Approximately 70 broken or whole one-piece fish-hooks were found along with 11 bone tabs and cores relating to the manufacture of hooks. Almost all of the fish-hook remains were found in association with the Layer 2 midden in Area F.

Artefacts associated with a range of fishing techniques have been found among the various Cabana Lodge assemblages. These indicate the use of hooks for bottom-dwelling fish and trolling lures for pelagic fish, such as barracouta and kahawai. Stone sinkers that could have been used with nets or hooks were found in the 2007 excavations. Early European observations of Maori fishing noted that nets were much more important than hook and line fishing; many were impressive in their size and most of the community were involved in their production. As well as large *kaharoa* (seine nets up to 1.6 km in length), *matarau* (simple hoop nets which were baited, sunk with stones and then drawn up vertically, in rocky areas), *kōrapa* (scoop nets with that were worked sideways a rigid wooden handle, also in rocky areas), *hīnaki* (set nets or traps left in streams or channels), *ahuriri* or *riritai* (large funnel-shaped nets measuring up to 25 m long, used in tidal rivers and frequently caught up to 1000 lb of fish) were other types of nets used in specific environments (Paulin 2007). The only physical remains of these nets that would survive archaeologically in typical conditions would be stone sinkers; the *harakeke* and *kiekie* net, lashings and wooden components would last seven years at the most, or as short as a month before deteriorating (Paulin 2007: 24). The two artefact assemblages from Cabana Lodge (Jolly 1978, Gumbley & Hoffmann 2008) and the Whangamata Wharf (Allo 1972) have yielded notably different assemblages. Allo's contained a lack of fishing gear proportionate to the low numbers of fish, an absence of basalt flakes but had a substantial amount of obsidian flakes. In comparison, the 2007 assemblage yielded a substantial amount of fishing gear (Gumbley and Hoffmann 2008) as well as a large number of basalt, obsidian and chert flakes. This indicates that within the extensive area of the Whangamata early phase site, T12/2 and T12/3, there are areas of variable function and feature types. Aside from the artefacts relating to fishing, no other artefacts indicative of specific hunting, gathering, butchering or food processing techniques have been noted in the reporting for any of the Whangamata early phase assemblages.

CONCLUSIONS

Comparison of the faunal analysis results of the 2007 assemblage with those of the Allo investigation must be cautious given the different techniques employed. However, doing this, together with considering artefacts associated with fishing, broadly establishes a case for what appears to be intensive fishing and dog culling, and opportunistic harvesting of fur seals at the site. A variety of fish (but primarily snapper) were available in the immediately adjacent harbour or nearby marine environment, which could be netted or caught on hook; the dominant shellfish species (cockle and pipi) were from the muddy harbour flats; other shellfish could also be collected on the rocks on the north side of the Whangamata Harbour and immediately outside its mouth. Finally, the open beach to the south provided further access to other shellfish (primarily tuatua) with pelagic fish and even marine birds available off-shore. Terrestrial birds, including moa, were seemingly unimportant as a dietary resource; indeed, of the terrestrial resources, the focus was clearly on dog as a source of food.

The two main investigations of the Whangamata early phase deposits from the wharf (T12/2; Allo 1972), and from Cabana Lodge (T12/3) in 2007, show both areas have similar stratigraphy with a nineteenth century occupation layer superimposed over a much older occupation layer. Both investigations were of food preparation, cooking and waste dumping areas where the dominant exploitation activities were marine oriented and which were calorifically dominated by seal meat, supported by dog. Among both assemblages the pattern of shellfish exploitation was broadly similar but the 2007 investigation found significantly more evidence for the role of fishing in the early phase economy in that part of the site than Allo's 1969 investigation.

The two parts of the site investigated in 1969 and 2007 appear to have been broadly contemporary, if not very close in age, and this appears to describe an early phase occupation that was extensive and featured specialised activity areas. The site was also located to facilitate access to three marine environments and it is tempting to interpret the faunal remains as evidence for permanent or semi-permanent settlement.

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