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Prehistoric and Historic Māori Fishermen of Mana Island, Cook Strait, New Zealand

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ABSTRACT

Fish remains from excavations in two parts of an extensive archaeological site on Mana Island, Cook Strait, were analysed. A total of 6380 identified bones produced a Minimum Number of Individuals of 1802 fish from at least 25 families. Recent surveys show that the archaeologically documented catches closely reflect the species still present in the immediate inshore environment. Comparison of one late (nineteenth century) and two early (fifteenth century) assemblages show an apparent decline in the importance of New Zealand snapper (*Pagrus auratus*) and an increase in the use of netting, although angling with a demersal baited hook was the dominant method used by all the Mana fishermen. Comparison with other assemblages from Cook Strait show that a wide range of species were taken, with widely varying proportions of different fish from one site to another. Although certain species are found in most of the Cook Strait sites, no single species stands out, like snapper in the northern North Island or barracouta (*Thyrsites atun*) in much of the South Island.

Keywords: NEW ZEALAND, COOK STRAIT, MANA ISLAND, PREHISTORY, ARCHAEOZOOLOGY, FAUNA, FISHING.

INTRODUCTION

Understanding of pre-European fishing practices in New Zealand grows by a process of accretion. Each newly analysed faunal assemblage from a single site or location provides information on fishing behaviour in that location at one point in time or, if it is a site with a long history of occupation, through time. As the number of assemblages analysed from a single region grows, the complexities and variety of fishing practices in that region, and throughout New Zealand, can be better appreciated. As a contribution towards this growing body of knowledge, this paper describes the results of a study of fish remains from excavations on Mana Island in Cook Strait, and compares them with results of other studies in the Cook Strait region.

Mana Island (Te Mana o Kupe ki Aotearoa) lies about 4 km off Titahi Bay near the southwest tip of the North Island (Fig. 1). It is about 2.5 km long and 1.25 km wide. Much

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of the island is bounded by cliffs but there is a sheltered landing in the southeast where the main stream system reaches the coast. The flat behind the beach here has always been the principal occupation area on the island. Cultural deposits extend for about 300 m along the beach ridge and have been recorded as a single archaeological site (R26/141). Much of the deposit is pre-European in age, but there are also remains of nineteenth century Māori and European occupation and standing buildings.

Excavations were carried out under Horwood's direction in 1990 in two parts of the beach ridge. The excavations and the material culture recovered have been described in detail elsewhere (Horwood 1991). The larger northern excavation contained a relatively deep stratified deposit. Six stratigraphic layers were identified, the uppermost of which was interpreted as redeposited material from a 1973 drainage trench. The layers can be grouped as upper (predominantly or entirely the historically documented occupation by a group of Ngāti Toa in the first half of the nineteenth century) and lower, a considerably earlier prehistoric occupation. An area of 25.5m^2 was opened in the northern area and all except about 3 m^2 was excavated to the underlying natural. Excavation was by hand trowel and the deposit was sieved through 2 and 5 mm mesh. The southern excavation, 260 m to the south, was in a single shallow layer of concentrated midden. The cultural layer was designated Layer 3, as two overlying sterile layers were distinguished. An area 1 x 2 m was excavated and the entire deposit removed for laboratory analysis. This cultural deposit is fully prehistoric.

Radiocarbon dates for seven samples from the excavations were received after the excavation report was published. The results are described in Appendix 1.

Initial sorting and analysis of material took place in Wanganui. In 1991 faunal material from the excavation was gifted to the Museum of New Zealand Te Papa Tongarewa.

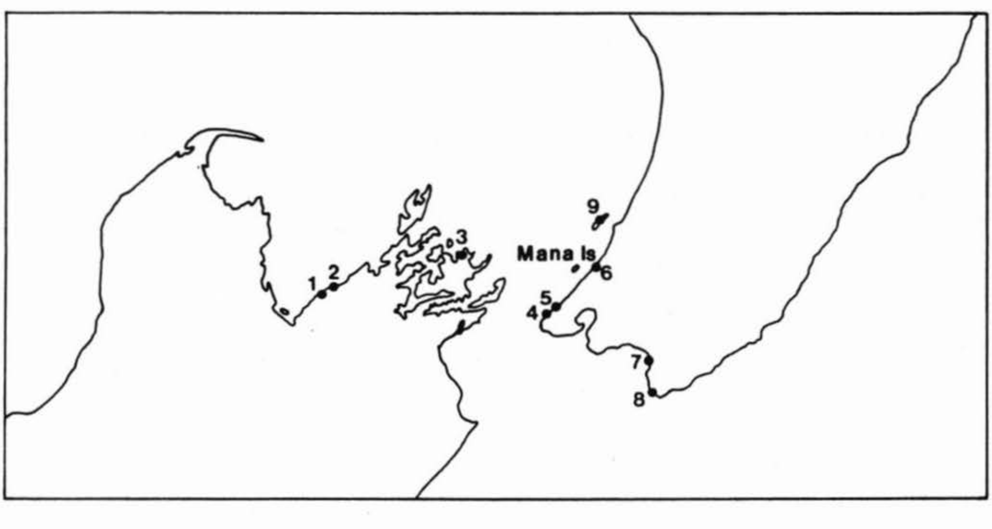

Figure 1: The Cook Strait region, showing sites and locations mentioned in the text. 1, The Glen. 2, Rotokura. 3, Titirangi. 4, Te Ika a Maru. 5, Makara. 6, Paremata. 7, Washpool. 8, Black Rocks. 9, Kapiti Island.

ANALYSIS OF FISH REMAINS

The methods used for analysis followed the techniques developed in New Zealand for the treatment of archaeological fish bone assemblages from Pacific islands generally. This has been described in detail elsewhere (Leach 1986; Leach *et al.* 1997). All identifications are made to the lowest taxonomic level possible. Taxonomy and nomenclature follow Paulin and Stewart (1985) and Paulin *et al.* (1989). Wherever possible, common names are used in this paper. The correspondences between common name, binomial and fish family are given in Appendix 2.

Species not represented in the comparative collection in the Archaeozoology Laboratory at the Museum of New Zealand Te Papa Tongarewa have been grouped into one class, Osteichthyes and may represent more than one family. An unusual feature of the assemblage is the presence of some very large labrids. These are not well represented in the comparative collection and are the focus of current ongoing research.

The calculation of minimum numbers followed the general technique of Chaplin (1971) as discussed by Leach (1986; see also Leach *et al.* 1977). No attempt was made to increase MNI by taking into account observed size mis-matches. A total of 6380 fish bones were able to be identified from the Mana Island assemblage. These yielded a minimum number of 1802 fish. The distribution of bones by anatomy from the two sites is given in Table 1.

TABLE 1
Distribution of identified bones by anatomy and side
from Mana Island

Anatomy		**South Site**			**North Site**	
	Left	*Not-Sided*	*Right*	*Left*	*Not-Sided*	*Right*
Dentary	161	-	201	266	-	322
Articular	97	-	127	171	-	172
Quadrate	188	-	198	245	-	266
Premaxilla	277	-	274	337	-	340
Maxilla	186	-	177	241	-	217
Superior Pharyngeal	75	-	71	117	-	109
Inferior Pharyngeal	-	228	-	-	386	-
Tooth/Dental Plates	-	-	-	-	48	-
Vomer	-	-	-	-	10	-
Operculum	-	-	-	-	4	-
Dorsal/Erectile Spine	-	71	-	-	63	-
Dorsal Spine Cage	-	-	-	-	3	-
Ventral Spine/Sternum	-	-	-	-	1	-
Scute	-	24	-	-	61	-
Vertebra	-	76	-	-	566	-
Cranial Fragment	-	-	-	-	4	-
Totals	**984**	**399**	**1048**	**1377**	**1146**	**1426**
Grand Totals		**2431**			**3949**	

THE MARINE ENVIRONMENTAL SETTING

Mana Island itself is an example of one of the oldest marine terraces in the Wellington region. Its basement rocks are dark grey argillites and greywacke sandstones capped by gravels of Pleistocene age (Timmins *et al.* 1987: 41). The coast is predominantly rocky. The island is separated from Titahi Bay on the mainland by a channel which does not exceed 25 m in depth. There is a tidal stream between the mainland and Mana Island which flows south-westward with a rising tide and north-eastward with a falling tide. When the stream exceeds 1 knot a large eddy forms near the centre of the channel. This eddy flows clockwise on a rising tide (Ridgway 1962: 243). The stream can reach 3.5 knots, and would be an important factor for people fishing on the eastern side of the island.

The immediate coastal waters around the island are shallow with an extensive intertidal zone. Nairn *et al.* (n.d.) undertook six transects, each extending 150 m from high water mark, in the course of a study of shellfish and coastal ecology. They described substrates of rock platforms, rocks and boulders in transects in the north, west and south of the island. Two transects on the east had very little solid rock and were the only places where sand was observed. In all transects *Carpophyllum* species were the dominant large algae. Species of large brown algae were found only on the exposed northern and western transects.

Despite its proximity to Wellington and its popularity with recreational fishermen, many with boats at nearby Mana and Paremata, there has been little study of the marine resources around Mana. The survey by Nairn *et al.* (n.d.) was primarily concerned with shellfish and algae, but fish were also noted. Spotties were seen in all transects and butterfish, blue cod, banded parrotfish and blennys in four or five. Fish observed less frequently were triplefins, roughies, leatherjackets, clingfish, scarlet parrotfish, marble fish, red moki, moki, conger eels and a single blind eel.

A recent survey of coastal fishes of Mana and its larger neighbour to the north, Kapiti, by Museum of New Zealand staff included a station in 10–15 m of water off the north end of Mana and another in 5–10 m off Southwest Point (Roberts 1996). A total of 44 species were documented from these two stations, whereas 78 species were recorded from five stations around Kapiti. Spotties and scarlet parrotfish were the most numerous fish throughout the survey of both islands. Pelagic species such as kahawai and barracouta were observed passing through the area.

There have been several previous surveys of fish around the coast of Kapiti Island, which is probably not dissimilar to Mana. Rippon (1979) described the inshore environment in some detail and listed 46 species found there. He also provided data on the sizes of the seven most common species caught in spear fishing competitions in the summers of 1967 and 1970; these were red moki, butterfish, marblefish, moki, banded parrotfish, kahawai, and snapper. He noted that a warm current from the northwest brought schooling kahawai, trevally and kingfish to the island every February.

Baxter (1987a) conducted a subtidal ecological survey of Kapiti, including fish censuses of three habitats. Twenty fish species were recorded and their relative abundance in the different zones analysed. Baxter (1987b) also investigated recreational fishing between January and March 1986 by means of a diary survey of local dive and boating club members and an access point (launching site) survey. These provided data on the relative abundance of different species in the recreational catch. In the diary survey two species, tarakihi (38.1%) and blue cod (29.2%), contributed the bulk of the 3350 fish recorded. Seven other species (kahawai, gurnard, sea perch, butterfish, blue moki, hagfish and snapper) accounted for a further 26% between them, while 15 other species plus sharks and rays comprised the remainder. In the access point survey, three species dominated the catch of 369 fish recorded: blue cod (43.1%), kahawai (18.2%) and tarakihi (17.1%). Ten species made up the rest of the catch. Baxter noted that the snapper fishery had declined in this general area since the 1960s, when tarakihi and snapper had been the main species targeted.

Battershill *et al.* (1993) recorded 34 fish species belonging to 20 families in a survey of 11 sites around Kapiti. Most abundant were goatfish, paketi, banded parrot fish, scarlet parrot fish, butterfish, blue cod and leatherjacket. Blue cod, scarlet parrotfish and goatfish were more abundant at greater depths and banded parrotfish and butterfish at shallower depths.

During the late nineteenth century and the first half of the twentieth century, Paremata on the mainland opposite Mana was a small commercial fishing port. Boats fished the waters of the immediate vicinity from Kapiti Island in the north to Makara on the coast to the south. Anecdotal evidence describes the main species targeted as groper, blue cod, butterfish, snapper and warehou (Makarios 1995). Old fishermen remembered February and March as the season for large catches of snapper. An area near Mana was mentioned as a particularly prolific spot for netting warehou.

Patchy though these data are, they provide a picture of a shallow rocky inshore environment around Mana Island in which spotties and parrotfish, blue cod, butterfish, gurnard and leatherjacket are abundant. Pelagic fish, especially kahawai and barracouta, pass through the area as do sharks and rays. Snapper were formerly abundant, particularly in late summer, but appear to have been declining in numbers for some decades. Several writers have commented on the fact that Kapiti and Mana are in an interesting biogeographical location close to the southern distribution limit of New Zealand's northern fish fauna, and it has been suggested that the appearance of a warm current from the north around February brings with it schooling species.

THE CHARACTER OF THE ARCHAEOLOGICAL FISH CATCH

The Minimum Numbers of Individuals of 1802 fish from all assemblages combined on Mana Island are listed in Table 2 and illustrated in Figure 2.

It will be immediately apparent that the catch was dominated by labrids and snapper, with significant numbers of blue cod, greenbone, leatherjacket and moki. Also caught in some numbers were kahawai, barracouta, tarakihi, sharks and conger eels.

In general these results are not surprising when they are considered in the light of the various surveys described above. Labrids or wrasses include both spotties and parrot fish; Nairn *et al.* (n.d.) noted spotties in all transects, banded parrotfish in most, and scarlet parrotfish in some. Roberts (1996) observed that spotties and parrotfish were most numerous throughout his survey of Mana and Kapiti. As noted above, the Mana assemblage includes some unusually large labrids which have not yet been identified to species. They are almost certainly parrotfish rather than spotties and are the subject of continuing research.

Nairn *et al.* (n.d.) found blue cod and greenbone to be abundant around Mana while leatherjackets, moki and conger eels were also present. Various surveys have noted that kahawai, barracouta and sharks and rays move through the inshore area.

Nevertheless, there are some unusual features in comparison with other archaeological assemblages. In particular, leatherjackets are not common in archaeological sites, although they are a common inshore species in New Zealand.

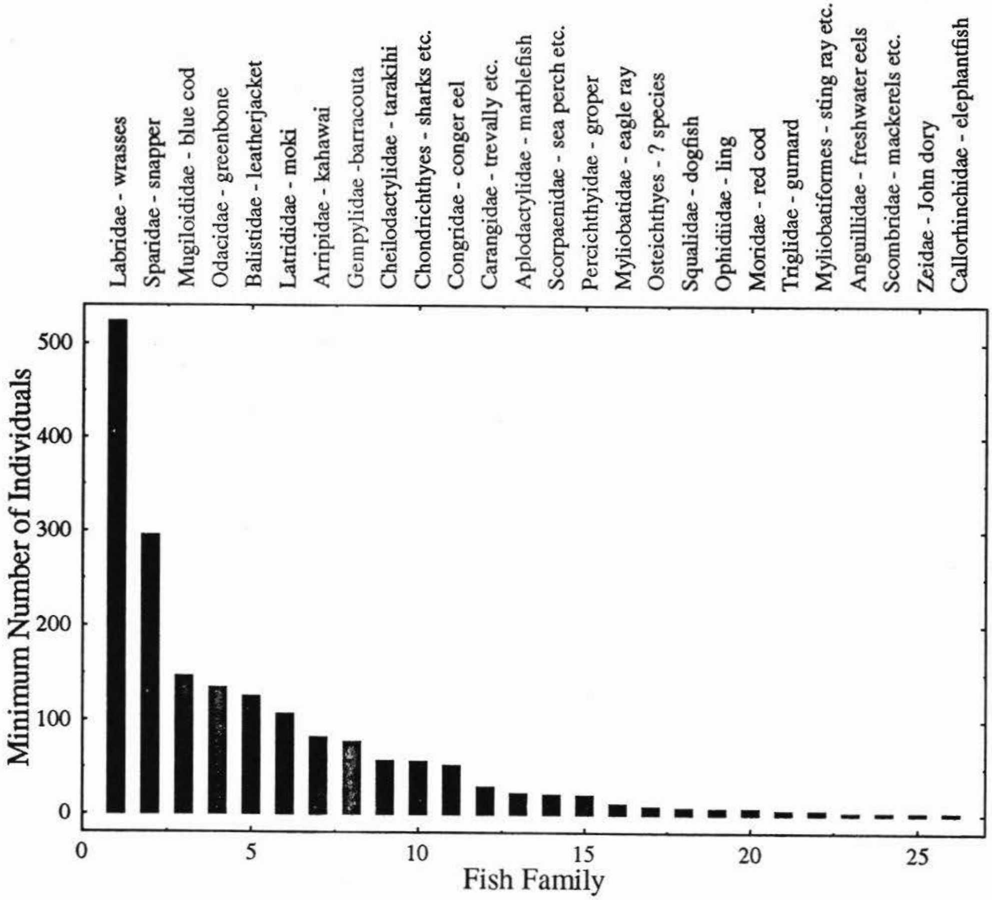

Figure 2: Minimum Number of Individuals from Mana Island by family in declining order of abundance.

The case of snapper is interesting and is discussed further below. Here it can be noted that historical evidence suggests a decline in snapper in the region in the last 30 years; it appears, however, that there may have been much longer term trends in snapper fishing in the area.

Some fish which have been reported as abundant around Kapiti, at least, feature rarely if at all in the archaeological record. Red moki have not been identified; tarakihi are not as numerous in the archaeological catch as their present importance to recreational fishermen might predict; marblefish, gurnard and sea perch are of little significance.

TABLE 2

Fish MNI in the Mana Island sites combined

Family Name	**Common Name**	**MNI**	**%**
Labridae	spotty etc.	523	29.02
Sparidae	snapper	295	16.37
Mugiloididae	blue cod	146	8.10
Odacidae	greenbone	134	7.44
Balistidae	leatherjacket	125	6.94
Latrididae	blue moki	106	5.88
Arripidae	kahawai	82	4.55
Gempylidae	barracouta	77	4.27
Cheilodactylidae	tarakihi	57	3.16
Chondrichthyes	sharks, skates, rays	56	3.11
Congridae	conger eel	52	2.89
Carangidae	trevally	29	1.61
Scorpaenidae	scarpee, sea perch etc.	24	1.33
Aplodactylidae	marble fish	22	1.22
Percichthyidae	groper	20	1.11
Myliobatidae	eagle ray	11	0.61
Osteichthyes	unknown species	8	0.44
Squalidae	dogfish	7	0.39
Ophidiidae	ling	6	0.33
Moridae	red cod	6	0.33
Triglidae	gurnard	4	0.22
Myliobatiformes	skates and rays	4	0.22
Anguillidae	freshwater eels	2	0.11
Scombridae	blue mackerel	2	0.11
Zeidae	John dory	2	0.11
Callorhinchidae	elephant fish	2	0.11
Total		**1802**	**100.00**

It is interesting to compare graphically the relative abundance of different fish families found in the archaeological deposits on Mana Island and that established for recreational fishermen in the vicinity of Kapiti Island (Baxter 1987b: 9). This is illustrated in Figure 3, and reveals major differences. It is not likely that the natural abundance of different fishes is greatly different from one of these islands to another, although the combined effects of Māori and European fishing in this region are bound to have changed the abundances over the centuries from the original unfished community. Each of the two fish catches illustrated in Figure 3 is a blend or product of three factors:

1: the relative abundance in the environment of each fish type,
2: the desire on the part of the fishermen to catch each, and
3: the efficacy of the technology employed to catch each.

The dramatic differences between the two abundance curves shown in Figure 3 are due to a combination of these three factors. For example, fish belonging to the Labridae family are

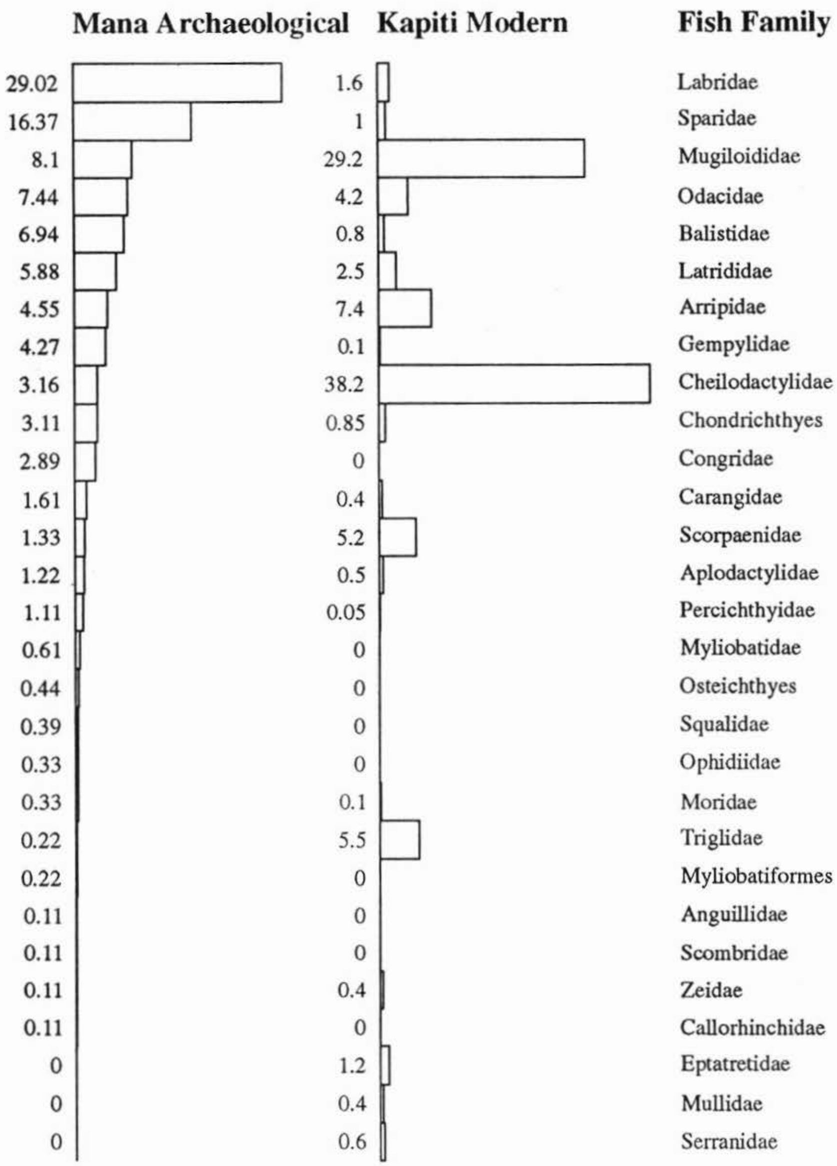

Figure 3: Comparison of ancient and modern fish catches in the vicinity of Mana and Kapiti Islands.

not highly sought after by European fishermen but, as modern ecological surveys have shown, they are very abundant. The great difference between the two percentages for Labridae in Figure 3 is, therefore, largely attributable to the second factor. Conversely, the substantial difference observed in the case of Sparidae (snapper) may be due to a decline in natural abundance over the centuries (factor 1). Finally, the large difference observed in the case of Cheilodactylidae (mainly tarakihi), may be due to different technologies employed. It is well known that tarakihi are most easily taken with very small iron hooks, and it is possible that the bone and shell hooks used by the Mana Island fishermen were too large for these fish to have been taken in abundance.

SPATIAL AND TEMPORAL VARIATION IN THE MANA ISLAND FISH CATCH

The Mana Island fish data can be divided into three assemblages in order to explore variations in time and space. The material from the southern excavation is one unit; the lower layers of the northern excavation are another, and the upper layers of the northern excavation are the third.

The first two are broadly contemporary and together constitute an 'early' assemblage, probably dating to the early fifteenth century. The third is 'late'— largely or entirely dating from the 1820s to the early 1840s.

While there are some differences between 'early' and 'late', there also appear to be some differences between 'northern' and 'southern'. Both the early and late northern deposits probably represent established settlements. Certainly the nature of the nineteenth century Ngāti Toa settlement from which the late deposits derive is well documented. The nature of the early deposits in the same location is less easy to interpret but the presence of a deliberately laid pavement suggests a settlement rather than a temporary fishing camp. The nature of the southern deposit is even less certain, but test pitting suggested that it, too, was part of an extensive settlement area rather than a small isolated midden dump (Horwood 1991: 29).

The proportions of fish in these three assemblages, according to family, are given in Table 3 and depicted in Figure 4. A ± figure is given in each case, which is the error range of a percentage using the method described by Snedecor and Cochran (1967: 210–211, Leach and de Souza 1979: 32). The calculation of the confidence limit of a proportion is as follows:

$$C = K * (P * (1.0 - P) / N)^{0.5} + 1 / 2N$$

where C is the confidence limit, P is the same proportion, N is the sample size, and K is a constant related to the chosen probability level (= 1.96 for 95% confidence, following the distribution of student's t). The factor 1/2N is added as a correction for continuity, which is important for small samples.

The early assemblage from the southern excavation is substantial, with almost 600 fish, but contains fewer species from fewer families than either of the northern assemblages. It is dominated by labrids, followed by snapper and leatherjackets, with lesser numbers of kahawai, blue cod, tarakihi, carangids (trevally and mackerel), and moki. Nine other families each contribute less than one percent of this catch.

The early assemblage from the northern excavation, with only 144 fish, is unfortunately much smaller than the other two and consequently less reliable statistically. Yet it contains 24 species of fish from 20 families. Moreover, although it is dominated by almost equal numbers of labrids and snapper, these two families make up less than fifty percent, with a number of other families apparently making a more significant contribution than in the southern excavation.

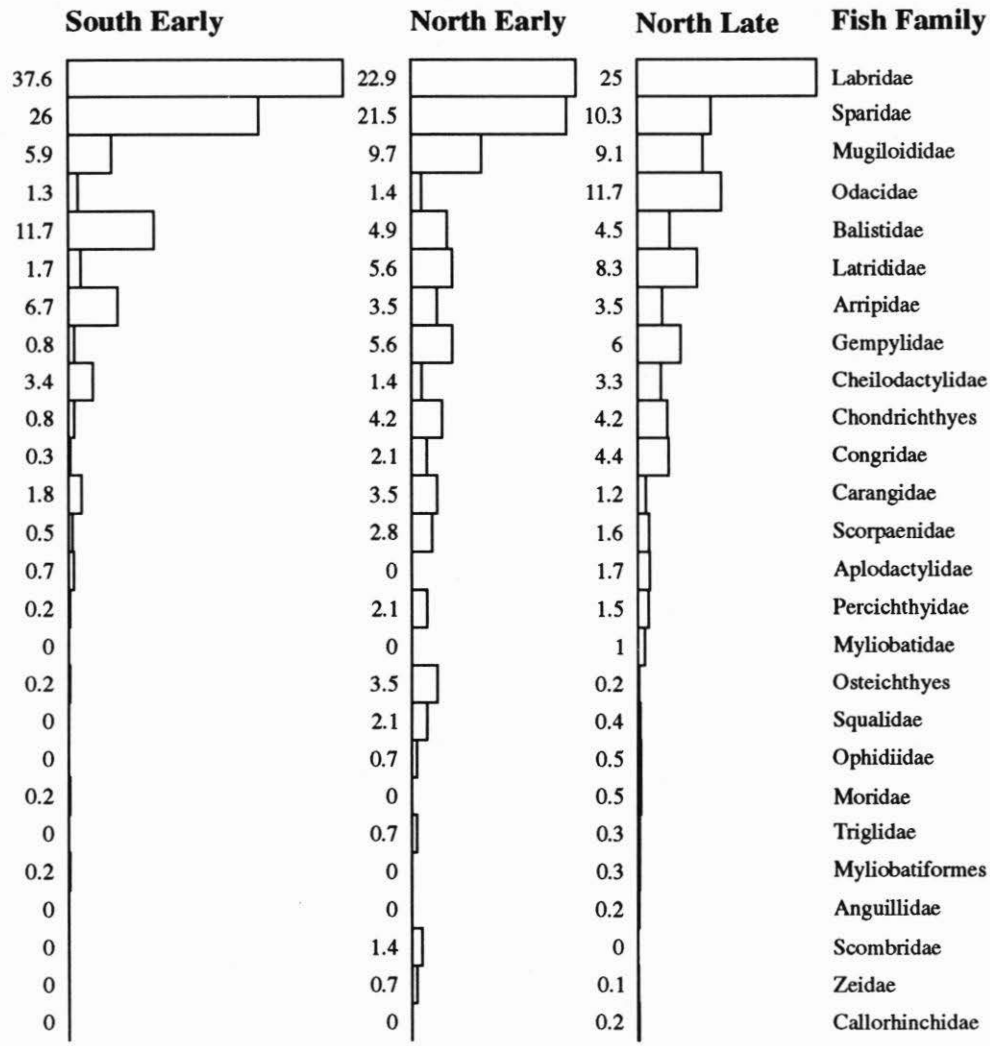

Figure 4: The proportions of fish by family in three assemblages from Mana Island.

These differences between two assemblages of similar age on the same beach ridge with access to the same marine environment are of some interest. A possible explanation may be that the small concentrated southern deposit represents the debris of a very short period of fishing activity. The northern deposit, dispersed over a greater area, may represent parts of the accumulated debris from a much more extended period. Whatever the case, the differences between these two assemblages should serve as a cautionary tale against placing too much reliance on any single assemblage as being typical of either a particular time or a particular place.

TABLE 3

Percentages of fish from the three main assemblages on Mana Island

Column 1 = Southern Midden
Column 2 = Northern Settlement Early Period
Column 3 = Northern Settlement Late Period

Family Name	**Common Name**	**1**	**2**	**3**
Labridae	spotty etc.	37.6 ± 4.0	22.9 ± 7.2	25.0 ± 2.7
Sparidae	snapper	26.0 ± 3.6	21.5 ± 7.1	10.3 ± 1.9
Mugiloididae	blue cod	5.9 ± 2.0	9.7 ± 5.2	9.1 ± 1.8
Odacidae	greenbone	1.3 ± 1.0	1.4 ± 2.3	11.7 ± 2.0
Balistidae	leatherjacket	11.7 ± 2.7	4.9 ± 3.9	4.5 ± 1.3
Latrididae	blue moki	1.7 ± 1.1	5.6 ± 4.1	8.3 ± 1.7
Arripidae	kahawai	6.7 ± 2.1	3.5 ± 3.3	3.5 ± 1.1
Gempylidae	barracouta	0.8 ± 0.8	5.6 ± 4.1	6.0 ± 1.5
Cheilodactylidae	tarakihi	3.4 ± 1.5	1.4 ± 2.3	3.3 ± 1.1
Chondrichthyes	sharks, skates, rays	0.8 ± 0.8	4.2 ± 3.6	4.2 ± 1.3
Congridae	conger eel	0.3 ± 0.5	2.1 ± 2.7	4.4 ± 1.3
Carangidae	trevally	1.8 ± 1.2	3.5 ± 3.3	1.2 ± 0.7
Scorpaenidae	scarpee, sea perch etc.	0.5 ± 0.7	2.8 ± 3.0	1.6 ± 0.8
Aplodactylidae	marble fish	0.7 ± 0.7	-	1.7 ± 0.8
Percichthyidae	groper	0.2 ± 0.4	2.1 ± 2.7	1.5 ± 0.8
Myliobatidae	eagle ray	-	-	1.0 ± 0.7
Osteichthyes	unknown species	0.2 ± 0.4	3.5 ± 3.3	0.2 ± 0.3
Squalidae	dogfish	-	2.1 ± 2.7	0.4 ± 0.4
Ophidiidae	ling	-	0.7 ± 1.7	0.5 ± 0.5
Moridae	red cod	0.2 ± 0.4	-	0.5 ± 0.5
Triglidae	gurnard	-	0.7 ± 1.7	0.3 ± 0.4
Myliobatiformes	skates and rays	0.2 ± 0.4	-	0.3 ± 0.4
Anguillidae	freshwater eels	-	-	0.2 ± 0.3
Scombridae	blue mackerel	-	1.4 ± 2.3	-
Zeidae	John dory	-	0.7 ± 1.7	0.1 ± 0.2
Callorhinchidae	elephant fish	-	-	0.2 ± 0.3
Totals		**100.0**	**100.0**	**100.0**

The late assemblage from the northern excavation is large and is particularly important because it relates largely or entirely to the Ngāti Toa occupation of the 1820s to 1840s. Ngāti Toa were an immigrant group from much further north on the North Island west coast and it is, therefore, very interesting to compare their catch with that of the presumably unrelated tribal group or groups who occupied the island some 400 years earlier.

As might be expected, this large assemblage of 1062 fish contains 29 species from 25 families. The late catch is again dominated by labrids, followed by greenbone, snapper, blue cod and moki. Eleven other families contribute one percent or more of the catch, and nine contribute less.

TABLE 4

Percent of Mana Island fish catch grouped according to likely catch methods

Nothern Settlement Layers were combined as follows:
Early = Black Layer, Layer 3
Late = Layer 0, Layer 1, Layer 2, Drain, Gravel Layer

		Southern	**Northern**	
Likely Catch Method		**All Layers**	**Early**	**Late**
Demersal Baited Hook		*74.9*	*70.8*	*61.4*
Labridae	spotty etc.			
Sparidae	snapper			
Mugiloididae	blue cod			
Cheilodactylidae	tarakihi			
Chondrichthyes	sharks			
Congridae	conger eel			
Scorpaenidae	scarpee, sea perch etc.			
Percichthyidae	groper			
Squalidae	dogfish			
Ophidiidae	ling			
Moridae	red cod			
Triglidae	gurnard			
Zeidae	John dory			
Callorhinchidae	elephant fish			
Pelagic Lure Fishing		*9.4*	*13.9*	*10.7*
Arripidae	kahawai			
Gempylidae	barracouta			
Carangidae	trevally			
Scombridae	blue mackerel			
Netting		*3.7*	*6.9*	*21.7*
Odacidae	greenbone			
Latrididae	blue moki			
Aplodactylidae	marble fish			
Basket Traps		*11.7*	*4.9*	*4.7*
Balistidae	leatherjacket			
Anguillidae	freshwater eels			
No Strong Opinion		*0.4*	*3.5*	*1.5*
Myliobatidae	eagle ray			
Osteichthyes	unknown species			
Myliobatiformes	skates and rays			
Totals		**100.1**	**100.0**	**100.0**

Two clear chronological trends can be seen. Snapper decrease significantly through time, while greenbone increase. For both these fish, the figures from the two early assemblages are similar to each other and different from the late assemblage. The reasons for these changes are not so clear. It is possible that snapper were less abundant in the nineteenth century than they had been earlier. It is unlikely that changing fishing methods are a factor, since fishing with demersal baited hook appears to have been the major catching method throughout. Historical evidence indicates that the Ngāti Toa settlement was 'permanent', suggesting that season of occupation is unlikely to be a significant factor.

The increase in greenbone, on the other hand, is likely to reflect an increase in the use of nets. The other two netted species also appear to increase in the later assemblage.

The presence of two eels in the late assemblage is probably a reflection of the connections between Ngāti Toa on Mana Island and close kin on the mainland, since these fish would not have been obtained on Mana itself.

There are several instances in which the two northern assemblages appear to differ from the southern assemblage. This is most striking in the case of labrids and leatherjackets, but also applies to blue cod, moki, Gempylidae (barracouta and gemfish) and Chondrichthyes (sharks, etc.), which are all more numerous in the north; and kahawai, which is more numerous in the south. Closer inspection suggests, however, that the strongest contrasts are between southern (early) and northern late, as the figures for northern early are less robust.

Table 4 groups the fish families according to likely catching methods. These are determined from an understanding of modern fishing methods and the habits and ecology of the various species. Obviously, many species can be caught by more than one method, and a table of this kind provides only a broad indication of the likely practices of Māori fishermen in the past.

According to this assessment, demersal fishing with baited hook was the predominant catching method in all three occupations, although it shows a slight decline through time. Trolling for pelagic species with lures was a consistent secondary method, accounting for about ten percent of the catch throughout. This type of fishing tends to be opportunistic, taking advantage of schools of pelagic species when they appear.

Netting appears to have been more important in the late occupation; it is linked to the increase in greenbone and a likely increase in moki in the late catch. Basket traps may have been more used by the occupants of the southern area. This assumes that the leatherjackets were caught in traps. It is possible, however, that these fish were caught on small hooks.

Horwood's (1991) analysis of fishing gear from the excavations showed that both bait hooks and trolling lures were present in both early and late occupations. In the late assemblage, pieces of bait hooks were far more numerous than parts of lures; in the smaller early assemblages, however, items of trolling gear were as numerous as parts of bait hooks. This possibly suggests that the effort put into trolling was disproportionate to the amount of fish caught in this way.

COMPARISON WITH OTHER COMMUNITIES IN COOK STRAIT

The total Mana Island assemblage of 1802 fish is a major addition to the data base on Māori fishing in the Cook Strait area, while the large late northern assemblage is the first significant indication of nineteenth century fish catches in the region. In a recent paper (Leach *et al.* 1997), we compared fish catches from 12 other Cook Strait sites. The total number of fish was 2351; the largest assemblage had an MNI of 583 and the smallest 24. The importance of the Mana assemblage is obvious.

The other Cook Strait sites fall into four geographic groups. There are five sites on the west coast of the North Island close to Mana: Paremata at the harbour entrance immediately opposite Mana, two sites at Makara a little to the south, and two at Te Ika a Maru, slightly further south again (Fig. 1). There are four sites in Palliser Bay at the south-east tip of the North Island, and three in the northern South Island—one in the outer Marlborough Sounds and two in Tasman Bay.

The Cook Strait assemblages can be characterised by the range of species caught by Māori fishermen and the variability in proportions of different fish from one site to another. Although certain species occur in most or all sites and some dominate in several, there is no single species or small number of species that always stand out, like snapper in the northern North Island or barracouta in the southern South Island.

The Mana Island assemblages fit well into this Cook Strait picture, although it is perhaps surprising that they present a more consistent picture than do, for example, the four sites at Palliser Bay or the two at Te Ika a Maru.

The dominant family at Mana Island, the labrids, range widely in proportions in the Cook Strait sites, from almost 74% at Black Rocks, Palliser Bay, to 3.9% at the Glen, Tasman Bay. The Mana figures for the three assemblages fit comfortably with other Wellington west coast sites, in which labrids range from 11% to 41%. It is interesting, but perhaps typical of Cook Strait, that the two extremes in this range are the two closely adjacent middens at Te Ika a Maru Bay, with Paremata, the two Makara sites and the three Mana assemblages in between.

Snapper present a very different picture. They are dominant in Tasman Bay (90% at The Glen and 40% at Rotokura), absent or insignificant in Palliser Bay and the outer Marlborough Sounds, and variable on the Wellington west coast, where they achieve 21% at Paremata and 10% at Makara Beach but are otherwise absent or unimportant. Māori snapper fishing in Tasman Bay has been discussed in some detail by Leach and Boocock (1994) and seems to represent a specific regional feature, distinct from other parts of Cook Strait including Mana.

As noted above, several writers have commented on the fact that Kapiti and Mana are right at the southern limit of distribution of northern fish species. It seems possible that the abundance of snapper in this area may have fluctuated over time in line with climatic fluctuations, particularly the onset and decline of the 'Little Ice Age', which was characterised by colder and stormier weather (Leach and Leach 1979).

Leatherjackets are significant at Rotokura in Tasman Bay (9.6%). Apart from a single individual in Palliser Bay they have not been found in any other Cook Strait sites, including the other Wellington west coast sites. Their presence in the Mana sites may be due to an unusual abundance around the island or to a greater use of traps there.

Blue cod are found in all the sites except The Glen, but are less than 5% of the catch everywhere except Mana and the eighteenth century Pond Midden at Palliser Bay. Greenbone, while absent or insignificant in the South Island sites, achieve 10% or more at one of the Te Ika a Maru sites, both Makara sites and two Palliser Bay sites, including the eighteenth century Pond midden, where they accounted for almost 37% of the catch. Since some of these sites are relatively early, there appears to be no overall trend towards an increase in greenbone (and netting) over time, although this trend was observed on Mana Island itself.

As might be expected, the figures for pelagic species are even more variable. Gempylidae are present in all the sites, ranging from less than 1% (Palliser Bay) to almost 50% (outer Marlborough Sounds). They are actually more common in all the other Wellington west coast sites (6% to 29%) than they are at Mana. Kahawai have been found in eight sites beside Mana and were most numerous at Paremata (11.8%). Carangids have been found at five sites, and were most numerous at one of the Te Ika a Maru sites (11.1%). Blue mackerel have been found in small numbers in only two other sites.

CONCLUSIONS

The Mana Island fish assemblage is an important addition to the existing data base on Cook Strait fishing. It consists of two 'early' assemblages of 596 and 144 fish, and a 'late' assemblage of 1062 fish. These reflect the catches of two completely different groups of fishermen, separated in time by about 400 years.

The fishermen who produced the two early catches may have been related and appear to have occupied the island at about the same time. However, the larger of the two early assemblages contains a smaller range of fish and is more heavily dominated by fish of two families, labrids and snapper. There is also a significant number of leatherjackets, which is unusual in New Zealand sites. The second early assemblage is also dominated by labrids and snapper, although less strongly, and a number of other families are more strongly represented than in the first assemblage.

The large late assemblage was largely or entirely the work of Ngāti Toa fishermen who occupied the island from the 1820s to the 1840s. Their catch also was dominated by labrids, but they caught fewer snapper than the earlier fishermen and more greenbone, as well as smaller numbers of a wide range of other species.

The dominant method used by all the Mana fishermen was angling with demersal baited hook. Trolling consistently accounted for about ten percent of the total catch. Netting seems to have been more important for the Ngāti Toa fishermen, whereas the earlier occupants of the southern part of the site may have made greater use of traps.

An earlier review suggested that Māori fishermen in the Cook Strait region at various times exploited a similar range of species but in very variable proportions. This study has shown that the three different groups of fishermen on Mana Island produced catches which fit comfortably within the Cook Strait range, and which actually vary less between themselves than catches from adjacent sites in other parts of the region. The available evidence suggests that the Mana Island catches closely reflect the species which still abound in the immediate inshore environment around Mana. The main exception is snapper, which are generally believed to have declined in the last 30 years. The archaeological evidence suggests that they may also have declined between the fifteenth and nineteenth centuries.

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APPENDIX 1: RADIOCARBON DATES FROM MANA ISLAND

The results for seven radiocarbon samples from Mana Island are listed in Table 5. Charcoal was identified and selected for dating by Dr Rod Wallace, Anthropology Department, Auckland University. The six charcoal samples were dated by the Radiocarbon Laboratory of the Institute of Geological and Nuclear Sciences at Gracefield. The seventh sample, of tuatua shells (*Paphies subtriangulata*), was dated at the Radiocarbon Laboratory at the University of Waikato. Calibrations follow Stuiver and Reimer 1986. The age ranges are depicted in Figure 5.

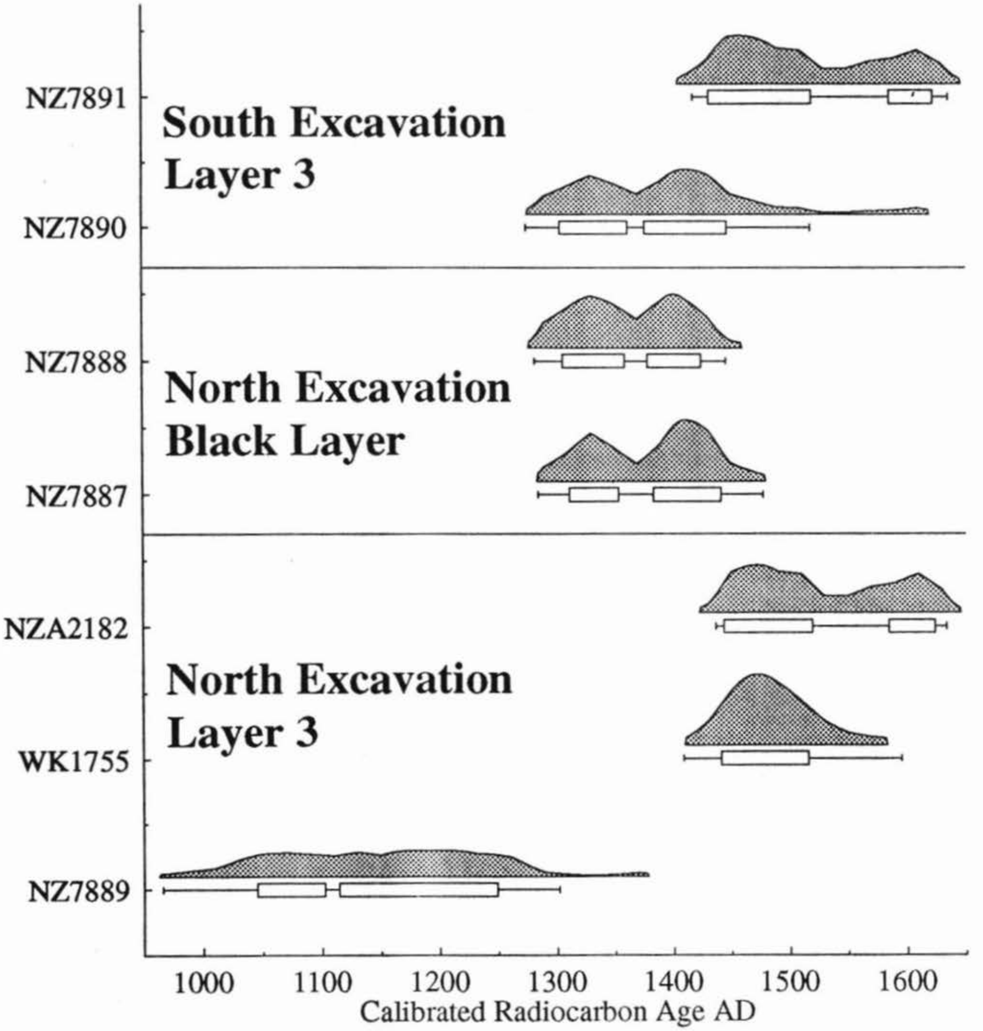

Figure 5: Calibrated radiocarbon ages of seven samples from Mana Island.

The southern excavation, as noted above, contained only one cultural layer (Layer 3). The two samples from this excavation overlap and provide a general date for this occupation, although not as precise a date as one would wish given the nature of the deposit.

The five dates from the northern excavation came from two different stratigraphic layers and two different parts of the area investigated. Layer 3 was the earliest cultural deposit in the northern excavation and rested directly on the underlying natural, a weathered yellow sand or fine gravel. Layer 3 was separated from the overlying Black Layer by a thin layer of pebbles and small stones which appeared to be the remains of a deliberately laid pavement. These layers were all shallow and could well have comprised the remains of a single occupation.

The two samples from the Black Layer and one of the Layer 3 samples, NZA2182, the sole accelerator date, were from the southern part of the excavated area, squares AB89. The shell sample and the charcoal sample NZ7889 were from the northern part of the area, squares B4, and ABYZ3 respectively.

Although at first glance there appears to be an inversion of dates from the Black Layer and two of the Layer 3 dates, it is likely that all four represent a single brief occupation, which is most likely to have been early in the fifteen century, as predicted by the excavator (Horwood 1991: 38). This may have been more or less contemporary with occupation at the southern part of the site. The dates do not support the hypothesis that the southern occupation was earlier than the northern.

It is not possible to determine whether NZ7889 is a statistical outlier of this same set of dates, or whether it represents traces of an earlier occupation at the base of the northern part of the site. The composition of the sample appears to rule out the interpretation of this sample as older drift wood burned by the first occupants of the site.

TABLE 5

Radiocarbon Dates from Mana Island
(Calibrations according to Stuiver and Reimer 1986)

Lab No	Sample	Site	Square	Layer	Depth
NZ7887	141/2	R26/141 North	AB9	Black	0.43-0.54
NZ7888	141/2A	R26/141 North	AB9	Black	0.43-0.54
NZ7889	141/3	R26/141 North	ABYZ3	3	0.55-0.63
NZ7890	141A/10	R26/141A South	All	3	0.12-0.40
NZ7891	141A/11	R26/141A South	All	3	0.12-0.40
NZA2182	141/1	R26/141 North	AB89	3	0.55-0.63
Wk-1755	141/6	R26/141 North	B4	3	-

Lab No	Material	Species
NZ7887	Charcoal	All twig charcoal. 15 pieces *Kunzea ericoides*, 4 pieces *Melicytus ramiflorus* twigs, 1 piece *Coprosma* twig
NZ7888	Charcoal	All twig charcoal from short lived species. 4 *Schefflera digitata*, 3 *Carpodetus serratus*, 3 *Pseudopanax arboreus*, 1 *Macropiper excelsa*, 3 *Melicylus ramiflorus*, 8 *Hoheria* sp., 4 *Coprosma* sp., 1 *Hebe* sp., 6 *Olearia* sp.
NZ7889	Charcoal	All twig charoal of short lived species. *Coprosma* sp., *Olearia* sp., *Macropiper excelsum*, *Aristotelia serrata*, *Myrsine* sp., *Kunzea ericoides*

NZ7890	Charcoal	Twig charcoal of short lived species. 2 *Macropiper excelsum*, 3 *Coprosma* sp., 2 *Pseudopanax arboreus*, 5 *Olearia* sp., 2 *Melicylus ramiflorus*, *Hebe* sp., 4 *Pittosporum eugenioides*
NZ7891	Charcoal	All twig charcoal. *Coprosma* sp., *Olearia* sp., plus twig wood of other species.
NZA2182	Charcoal	All twig charcoal. *Coprosma* sp., *Olearia* sp., *Kunzea ericoides*, *Dysoxylum spectabile*
Wk-1755	Shell	*Paphies subtriangulata* (tuatua)

			Calibrated Age cal AD			
Lab No	**$\delta^{13}C$**	**CRA**	**Two Standard Errors**	**One Standard Error**		**Median Age**
NZ7887	-26.5	556 ± 71	1285–1478 95%	1312–1354 25%	1384–1442 43%	1393
NZ7888	-25.3	588 ± 72	1282–1446 95%	1306–1359 36%	1379–1425 32%	1365
NZ7889	-26.0	891 ± 110	966–1302 94%	1045–1102 20%	1114–1249 49%	1148
NZ7890	-25.4	556 ± 89	1275–1519 93%	1304–1362 28%	1377–1447 40%	1396
NZ7891	-24.9	434 ± 65	1418–1636 95%	1432–1520 52%	1586–1623 16%	1500
NZA2182	-25.7	413 ± 53	1437–1634 95%	1444–1520 48%	1585–1624 20%	1512
Wk-1755	+1.2	820 ± 45	1409–1595 95%	1441–1516 67%	-	1481

APPENDIX 2: COMMON FISH NAMES AND THEIR EQUIVALENT SYSTEMATIC NAMES

This appendix lists common names of fish mentioned in the text, some of which are not found in the archaeological assemblages.

Common name	Binomial	Family/Order/Class
banded parrotfish	*Notolabrus fucicola*	Labridae
barracouta	*Thyrsites atun*	Gempylidae
blenny	e.g., *Parablennius laticlavius*	Blenniidae
blind eel/hagfish	*Eptatretus cirrhatus*	Myxinidae/Eptatretidae
blue cod	*Parapercis colias*	Mugiloididae
blue mackerel	*Scomber australasicus*	Scombridae
blue moki	*Latridopsis ciliaris*	Latrididae
butterfish/greenbone	*Odax pullus*	Odacidae
butterfly perch	*Caesioperca lepidoptera*	Serranidae
clingfish	e.g., *Diplocrepis puniceus*	Gobiesocidae
conger eel	*Conger verreauxi*	Congridae
dogfish	*Squalus* sp.	Squalidae
eagle ray	*Myliobatis tenuicaudatus*	Myliobatidae
eel	*Anguilla* sp.	Anguillidae
elephant fish	*Callorhinchus milii*	Callorhinchidae
gemfish	*Rexea solandri*	Gempylidae
goatfish/red mullet	e.g., *Upeneichthys lineatus*	Mullidae
groper	*Polyprion oxygeneios*	Percichthyidae
gurnard	*Chelidonichthys kumu*	Triglidae
john dory	*Zeus faber*	Zeidae
kahawai	*Arripis trutta*	Arripidae
kingfish	*Seriola lalandi*	Carangidae
labrid/wrasse	e.g., *Notolabrus celidotus*	Labridae

leatherjacket	*Parika scaber*	Balistidae
ling	*Genypterus blacodes*	Ophidiidae
mackerel	*Trachurus* sp.	Carangidae
marblefish/marble trout	*Aplodactylus arctidens*	Aplodactylidae
moki	*Latridopsis ciliaris*	Latrididae
paketi	*Notolabrus celidotus*	Labridae
rays	e.g., *Myliobatis tenuicaudatus*	Order Myliobatiformes
red cod	*Pseudophycis bachus*	Moridae
red moki	*Cheilodactylus spectabilis*	Cheilodactylidae
roughy	e.g., *Paratrachichthys traílli*	Trachichthyidae
scarlet parrotfish	*Pseudolabrus miles*	Labridae
scarpee	*Helicolenus percoides*	Scorpaenidae
sea perch	*Helicolenus* sp.	Scorpaenidae
shark, skate, rays	e.g., *Galeorhinus galeus*	Class Chondrichthyes
snapper	*Pagrus auratus*	Sparidae
spiny dogfish	*Squalus acanthias*	Squalidae
spotty	*Notolabrus celidotus*	Labridae
tarakihi	*Nemadactylus macropterus*	Cheilodactylidae
trevally	*Pseudocaranx dentex*	Carangidae
triplefin	e.g., *Tripterygion varium*	Tripterygiidae
warehou	e.g., *Seriolella brama*	Centrolophidae
wrasse	e.g., *Pseudolabrus miles*	Labridae

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