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***B. Foss Leach***

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# **SAYING SO DOESN'T MAKE IT SO**

**PAPERS IN HONOUR OF B. FOSS LEACH**

Edited by  
**Douglas G. Sutton**

**New Zealand Archaeological Association  
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# Maori Impact on the Marine Megafauna: Pre-European Distributions of New Zealand Sea Mammals

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## INTRODUCTION

There is considerable evidence for modifications of New Zealand's pristine environment since first settlement about 1000 years ago. Most of this concerns the terrestrial biota. Significant deforestation through burning has been dated to the pre-European phase of occupation (McGlone 1983). Within the same period there were extinctions of at least 30 species of birds (Cassels 1984). These were almost all non-marine species. Terrestrial vertebrates, landsnails and insects were also affected (Ramsay 1978; Whitaker 1978).

These changes have been attributed largely to human impact. Deliberately lit fires are seen as the main cause of deforestation (McGlone 1983). Direct predation, habitat destruction and competition from introduced dogs and rats have been implicated more strongly than climatic change or other natural phenomena in recent assessments of faunal depletion (Anderson 1983a; Cassels 1984; Ramsay 1978; Whitaker 1978). However, reliable attribution of cause has not always been possible.

Impacts upon the marine environment have also been identified. In general these do not appear to have been so serious, in that no extinctions have been reported. Nevertheless, range reductions and disappearance of the larger size classes have been demonstrated for some fish, molluscs and crustaceans (e.g., Anderson 1983a; Leach and Anderson 1979; Rowland 1976; Swadling 1977). Once again, human predation and habitat modification appear to have been major causes.

This paper examines the extent and causes of impacts upon the largest members of the marine fauna; seals and whales. It is based upon a thorough survey of the archaeological evidence for their exploitation during the pre-European period (Smith 1985). Bones of seals and whales have been reported from 180 archaeological sites in New Zealand (Figure 1; Smith 1985: Appendix Three). Identifications of these are used to reconstruct former distributions of the most common species. In the case of seals, the results from detailed analysis of 100 bone assemblages from 53 sites are used to establish whether local populations were of breeding or non-breeding status. Comparisons with modern data show changes in distribution and abundance for some, but not all of these species. Radiocarbon and other chronological evidence is used to date these changes.

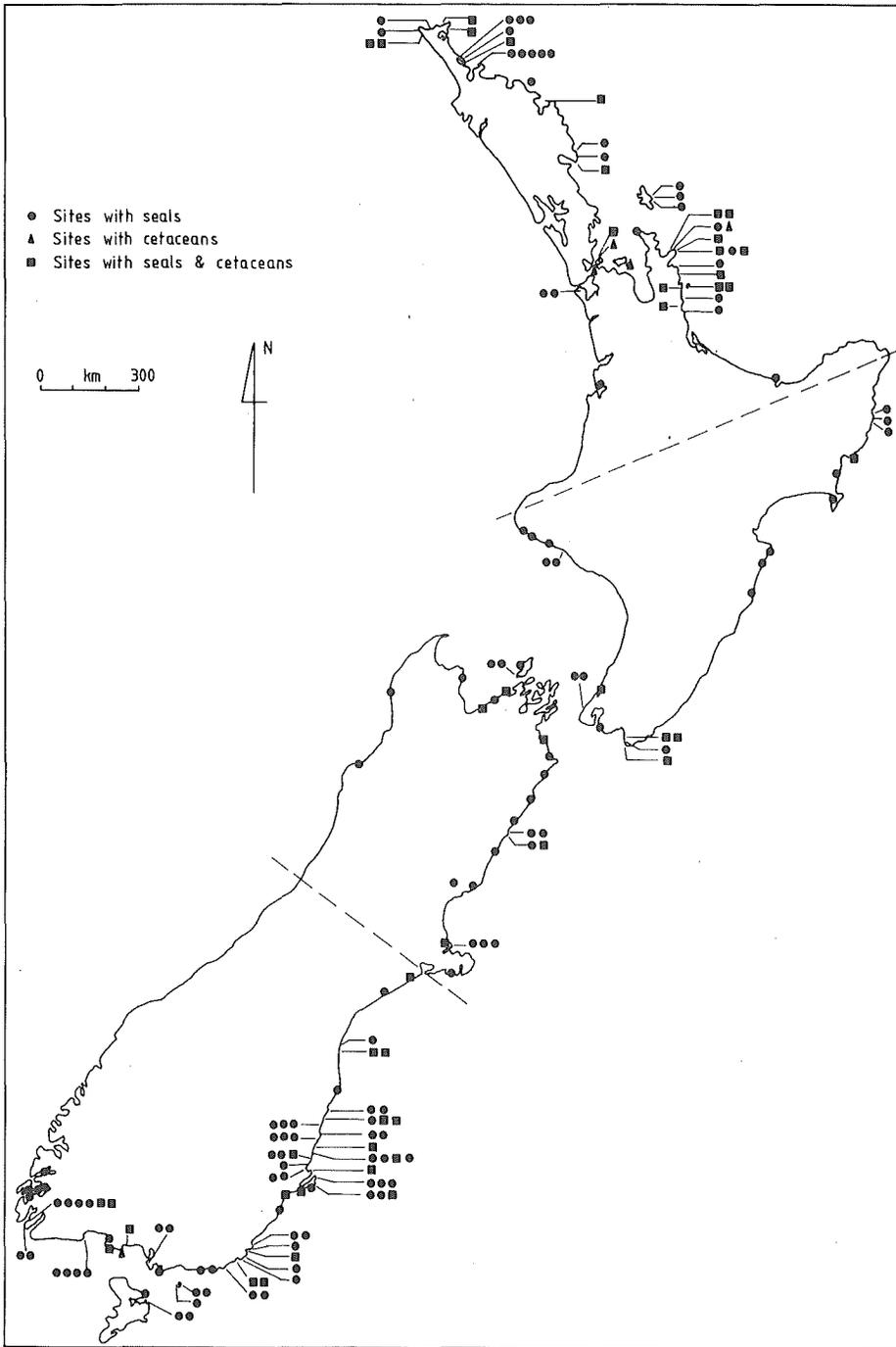


Figure 1: New Zealand archaeological sites with sea mammal remains.

Most of the information available from both archaeology and relevant zoological studies concerns the New Zealand fur seal (*Arctocephalus forsteri*). This is reviewed in the first section of this paper. Other seal species are discussed more briefly in the second section, and cetaceans in the third. The fourth section examines possible causes of distribution change.

## THE MODERN DISTRIBUTION

The modern distribution of fur seals in New Zealand (Figure 2) has been defined by Wilson (1974) on the basis of a thorough coastal survey. The animals are present in greatest number and throughout the year within the breeding range, on the south and west coasts of the South Island. They occur only seasonally on the east coast of the South Island and west coast of the North Island.

Observations by early European visitors indicate a very similar distribution at the beginning of the historic era. During his three visits between 1769 and 1777 Captain James Cook reported seals only around the South Island (Reed and Reed 1969: 124, 140, 188, 232). From 1792 the European fur sealing industry concentrated almost exclusively on the south and west coasts of the South Island (Gaskin 1972: 45-9; McNab 1907; Polack 1838: 316; Smith 1985: Appendix One). Only three commercial expeditions outside this area have been reported, two to the east coast of the South Island and one to Taranaki. None of these were successful (Begg and Begg 1979: 199, 300).

Within two decades the population was decimated and commercial sealing ceased by the mid 1820s (McNab 1907). The effect on distribution was more limited. Both ends of the breeding range appear to have retreated slightly, but vestigial populations remained throughout (Allen 1965: 13; Chapman 1893). Curiously, distributional change was most apparent beyond the sealing grounds. From as early as 1809 seals were becoming scarce on the east coast of the South Island and about Cook Strait (Smith 1985: Appendix One). It seems that plundering of the sealing grounds drastically reduced seasonal migration beyond the breeding range.

This impact was only temporary. Since they were given legal protection in 1875 fur seals have increased steadily in number to their present level of about 40,000 (Crawley and Wilson 1976: 1, 11) and reoccupied the areas which were depopulated in the nineteenth century.

## RECONSTRUCTING THE PRE-EUROPEAN DISTRIBUTION

Seal bones have been reported from 174 New Zealand archaeological sites. Their distribution is illustrated in Figure 1, and details are listed in Smith (1985: Appendix Three). Identifications to species level are available for 111 of the sites. Fur seal bone occurred in almost all of these (Table 1). The three other pinniped species were much less frequent and it is very likely that fur seals also occurred in most of the 63 sites containing seal bone not identified to species.

The distribution of these sites, along with those from which the fur seal has been positively identified, is illustrated in Figure 3.

There are clear contrasts between this distribution and the modern range of the fur seal. Most obvious is the abundance of seal bone along the east coast of the North Island where fur seals seldom occur today. Also notable is the minimal overlap between sites and the

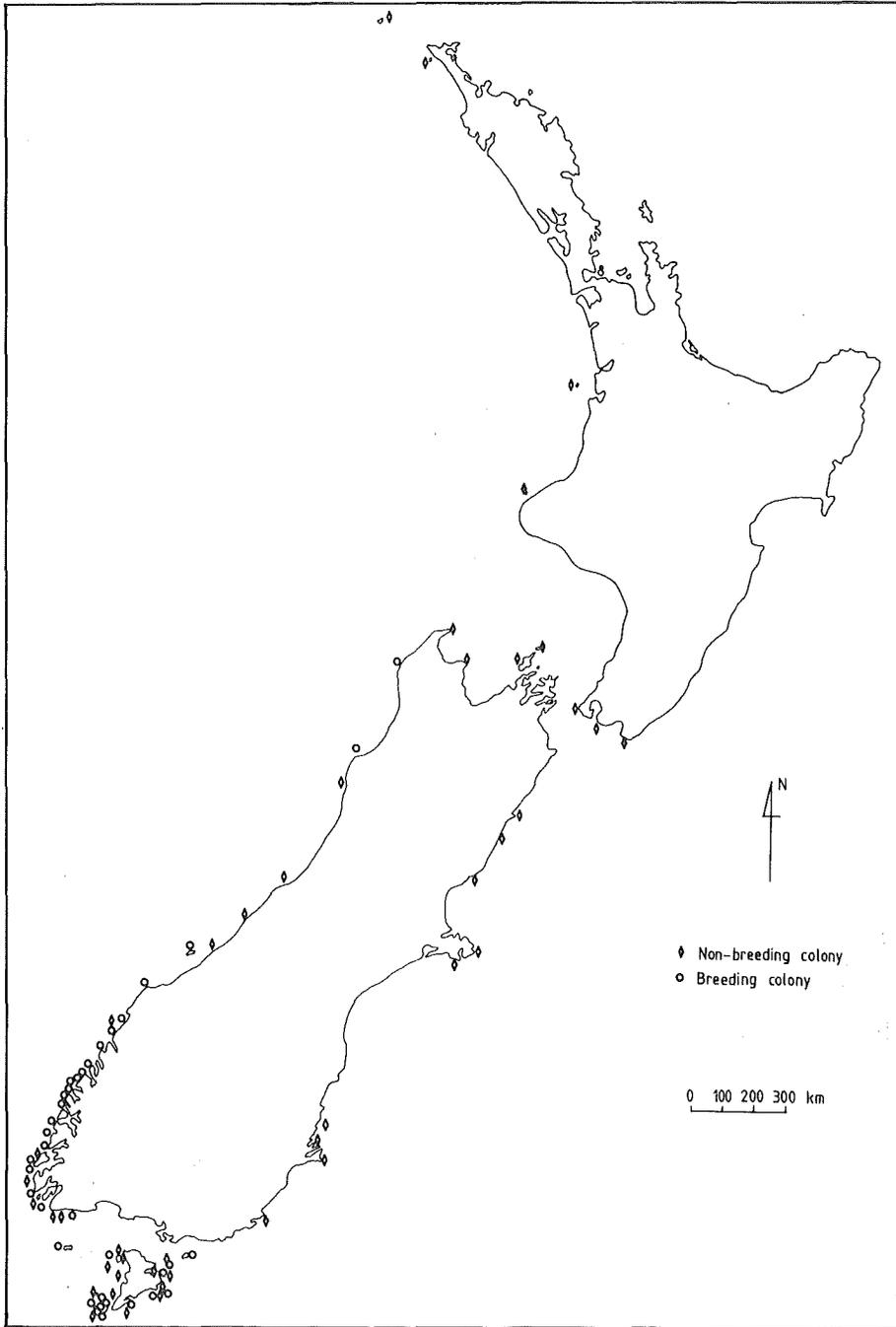


Figure 2: Modern distribution of the New Zealand fur seal.

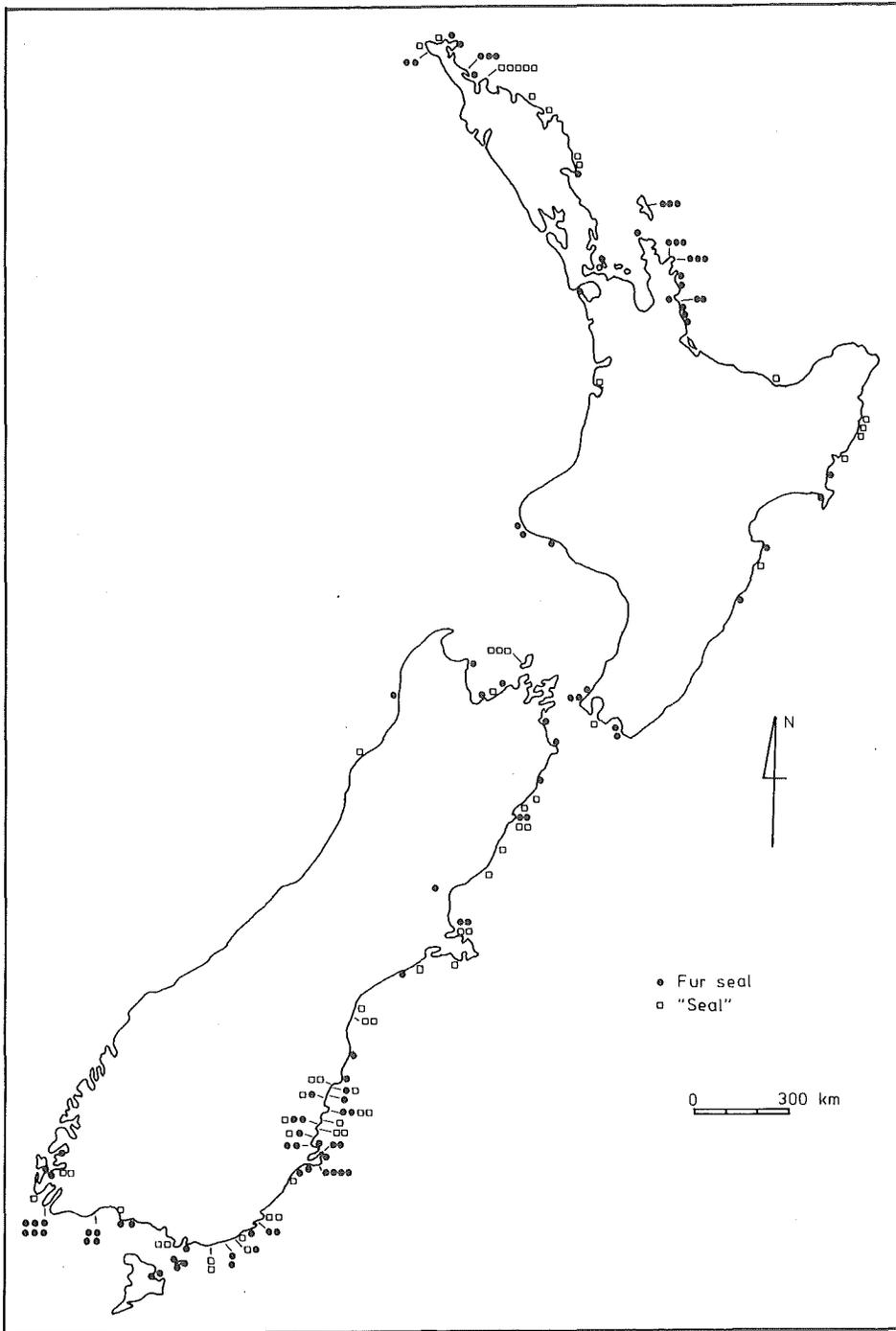


Figure 3: Sites with fur seal and 'seal' remains.

TABLE 1  
NUMBERS OF SITES WITH SEAL BONES

	No.	%
N.Z. fur seal ( <i>Arctocephalus forsteri</i> )	103	92.8
N.Z. sea lion ( <i>Phocarctus hookeri</i> )	42	37.8
Southern elephant seal ( <i>Mirounga leonina</i> )	29	26.1
Leopard seal ( <i>Hydrurga leptonyx</i> )	7	6.3
Seals identified to species	111	100.0
'Seal' not identified to species	64	
TOTAL SITES	174	

present breeding range. The first question that must be addressed here is whether this archaeological distribution reflects the former presence of live seals. Three factors must be considered. These are: the transportation of fur seal carcass parts from kill sites to living sites, the occasional straying of animals beyond their normal range, and the uneven distribution of archaeological research.

If fur seal carcasses were transported over substantial distances there would be little correlation between the species range and the archaeological distribution of fur seal bone. However, in New Zealand's temperate maritime climate, preservation of seal flesh would be essential if it was to survive long distance transport. Ethnographic data and an archaeological reconstruction of prehistoric butchering and storage methods (Smith 1985: 10-14, Appendix Seven) suggest that fur seal flesh was characteristically separated from the bones prior to preservation. Therefore, fur seal bones would not be found in sites to which flesh was transported over considerable distances. Fresh seal meat 'on the bone' may well have been transported over shorter distances. However, this factor does not explain the major differences which are apparent between the archaeological and modern fur seal distributions.

Fur seal remains in sites beyond the present distribution could be the results of chance capture of isolated animals which strayed beyond their normal range. However, the frequency and abundance of archaeological remains does not support this interpretation. For instance, fur seals occur in every early prehistoric site for which faunal remains have been reported on the east coast of the Coromandel Peninsula (Davidson 1979: 187), even though that area is well beyond their modern distribution. Furthermore, the numbers of fur seals recovered from some short term occupation sites indicate that local populations, rather than stray animals, were being exploited. For example, the nine fur seals identified at Tairua (New Zealand Archaeological Site Number N44/2) were killed during a single occupation of, perhaps, only three months duration (Smart and Green 1962; Smith 1978). Similarly, at Houhora (N6/4) 44 fur seals were identified from deposits which, according to the excavator (Shawcross 1972), represent no more than twelve summer occupations. On this basis it is reasonable to assume that wherever fur seal remains are recovered in quantity from archaeological deposits, the exploitation of local populations is indicated. With only a few exceptions the sites considered here yielded considerable numbers of bones. Therefore, the distribution illustrated in Figure 3 approximates the former distribution of fur seals.

There are several large gaps in this distribution. Most of these occur in areas of predominantly soft shoreline, such as Hawkes Bay, the Bay of Plenty, and the west coast of the North Island. This suggests that the gaps reflect the well attested preference of fur seals for

exposed rocky coasts (Crawley and Wilson 1976: 4–6). Along the west coast of the North Island fur seal bone is found only in sites near small offshore islets which are now used by fur seals as non-breeding colonies (see Figure 2). Elsewhere, the absence of reported remains probably reflects the paucity of archaeological research. This is particularly true of the south-east coast of the North Island where suitable colony sites are common, and much of the west coast of the South Island where fur seals still occur today.

## DATING THE SPATIAL DISTRIBUTION OF SEALS

Estimates of the ages of archaeological deposits containing fur seal bone can be derived from radiocarbon dates, and association with extinct avifauna and chronologically distinctive artefactual assemblages. Unfortunately, it is not possible to determine specific chronological ages from these faunal and artefactual associations. However, the approximate age ranges which can be estimated are sufficiently accurate for the present purpose. Information concerning dates for the disappearance of moa (Family: Dinornithidae) and the suite of other birds that became extinct at about the same time is available for only some parts of New Zealand. In these areas it appears that most extinctions had occurred by 400–500 B.P. (Anderson 1982a: 64–5, 1982c: 123, 1983a; Hamel 1982: 138; Law 1982: 57; Leach and Leach 1979: 236; Millener 1981: 461; Simmons 1969; Trotter 1982: 96). Later survival of moa has been suggested for only some inland areas of the southern South Island (Anderson 1983a: 3). Therefore, ages in excess of 400 B.P. can be assumed for coastal deposits containing non-industrial moa bone and/or remains of other extinct birds.

The classification of artefact assemblages as Archaic or Classic Maori (Golson 1959) is established practice in New Zealand archaeology. The relationship between these two entities and their precise distributions in time and space are not thoroughly understood. However, for the present purpose it is sufficient to note that the Archaic occurs within the earlier centuries of prehistoric occupation whereas the Classic is associated with the later time interval. The transition between the two appears to have occurred during the period 300–500 B.P. (Anderson 1983b: 29–37; Davidson 1982: 44; Law 1982: 60; Simmons 1969, 1973; Trotter 1982: 100–1), and generally somewhat earlier in the North Island than in the South. Greater precision in dating this transition may be possible for some parts of the country, but need not be explored here. The arrival of Abel Tasman in A.D. 1642 (308 B.P.) marks the earliest possible date for European artefacts, although these are more likely to date from the period after the arrival of James Cook in A.D. 1769 (180 B.P.). Most assemblages which contain European material are likely to be younger than 150 years B.P.

Ages estimates for archaeologically recovered fur seal bone from southern, central and northern New Zealand (see Figure 1) are presented below.

*Southern New Zealand* falls within the modern range of the fur seal. Therefore, this species is expected to have occurred there throughout prehistory. Radiocarbon dates (Figure 4) and indirect evidence of age (Table 2) demonstrate that this was the case. The former indicate ages ranging from the 12th to the 19th centuries, although most dates are older than 400 B.P. Similarly the indirect evidence spans the entire sequence. However, only 17 (30.91%) of the 55 sites with fur seals in Table 2 contain Classic Maori or European artefacts.

While fur seal assemblages of early prehistoric age occur throughout Southern New Zealand, those belonging to the later period are concentrated along the southern coast and in

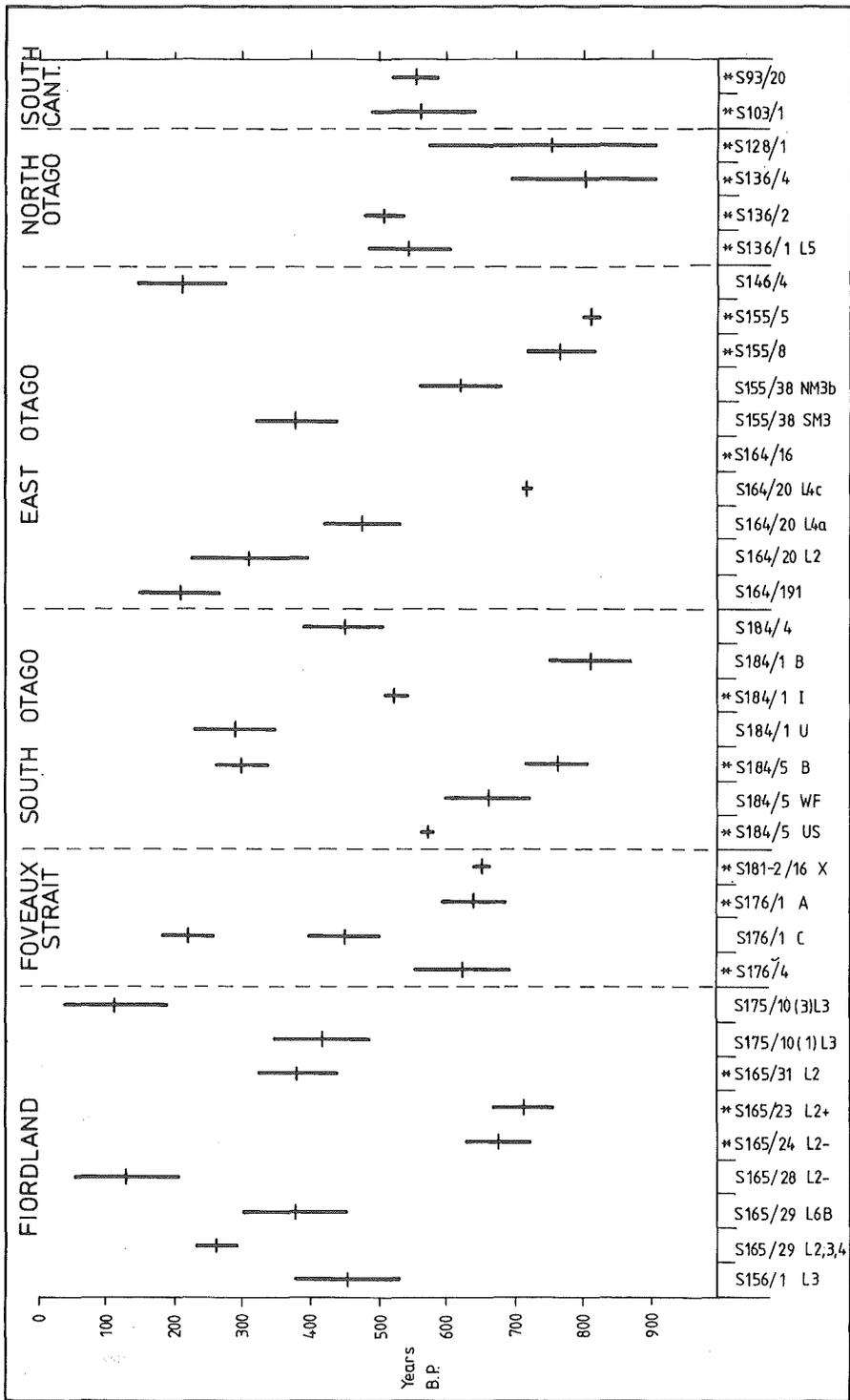


Figure 4: Southern New Zealand: radiocarbon dates for archaeological deposits for fur seal and 'seal' remains. Bar represents one standard deviation. \* = pooled estimate.

**TABLE 2**  
**INDIRECT EVIDENCE FOR THE AGES OF ARCHAEOLOGICAL DEPOSITS WITH FUR SEAL**  
**AND 'SEAL' REMAINS IN SOUTHERN NEW ZEALAND**

Site Number	Name	Ex	A	C	E
<i>Fiordland</i>					
S148/3	Breaksea Sound 1	x	x		
S156/3	Cascade Cove 1				x
S165/20	Southport 1				x
S165/24	Southport 5				x
S165/30	Southport 11				x
S175/71	Port Craig 1	x	x		
<i>Foveaux Strait</i>					
S176/4	Wakapatu		x		
S176/1	Riverton	x	x		
S181-2/16	Tiwai Point	x	x		
S189/4	Old Neck	x			
S189/7	Ringaringa	x	x		
S189/1	Native Island	x			
S187/9	Parangaio				x
S187/11	Lee Island		x		
<i>South Otago</i>					
S183/4	Haldane Estuary	x			
S184/20	Tautuku Point	x			
S184/21	Tautuku Beach North	x			
S184/6	Kings Rock	x		x	
S184/5	Papatowai Point	x	x		
S184/29	Long Point	x	x		
S184/28	Waitangi Stream East	x			
S184/1	Pounaweia	x	x		
S184/4	Cannibal Bay	x	x	?	
S179/3	Kaka Point	x	x		
<i>East Otago</i>					
S163/1	Otokaia Mouth	x	x		
S164/117	Andersons Bay	x	x		
S164/1	Little Papanui	x	x	x	
S164/1	Papanui Beach				x
S164/4	Hoopers Inlet	x			
S164/6	Tarewai Point			x	x
S164/191	Taiaroa Head			x	
S164/20	Long Beach	x	x	x	
S164/18	Purakanui	x	x		
S164/13	Mapoutahi				x
S155/38	Ross's Rocks	x			x
S155/17	Seacliff	x	x		
S155/1	Huriawa			x	
S155/8	Pleasant River 2	x	x		
S155/2	Pleasant River Mouth	x	x		
S155/5	Shag River Mouth	x	x		
S146/4	Katiki Point			x	
S146/3	Katiki Point	x			
S146/23	Waimataitai Lagoon	x	x		
S146/6	Tawhiroko Midden				x
<i>North Otago</i>					
S146/1	Waianakarua	x	x		
S136/1	Tai Rua	x	x		
S136/4	Awamoa	x	x		
S136/2	Ototara Glen	x	x		
S136/12	Kaiararo Stream	x			
S128/1	Waitaki River Mouth	x	x		

TABLE 2(cont.)

<i>South Canterbury</i>		
S115/15	Normanby 1	x x
S115/16	Normanby 2	x x
S111/1	Dashing Rocks	x x
S103/1	Wakanui	x x
S93/20	Rakaia Mouth	x x

Sources: see Smith 1985: Table 77

Ex = extinct avifauna; A = Archaic artefacts; C = Classic artefacts; E = European artefacts; x = associated with seal remains; ? = possibly associated with seal remains.

east Otago. On the present evidence it is not clear whether fur seals were absent from other parts of the region in later centuries.

On the Catlins coast of South Otago, radiocarbon dates for deposits with fur seals indicate ages ranging from the 12th to the 17th centuries. However, there are doubts as to the reliability of the dates younger than 450 B.P. for both Papatowai (S184/5) and Pounaweia (S184/1). It is likely that these sites were abandoned by about A.D. 1500 (Hamel 1982: 131), and it has been proposed (Hamel 1982: 135–6) that the whole area was abandoned or visited only rarely in the late prehistoric.

Only three sites—Kings Rock (S184/6), Cannibal Bay (S184/4) and False Island (S184/3)—contain reliable evidence of occupation after the 16th century, and the limited data from these is contradictory. Fur seals do not seem to have been present at False Island (Hamel 1977: 192), but were reported as a rare component in the upper layers at Kings Rock (Lockerbie 1940: 407). At Cannibal Bay it is not clear whether they were associated with the Classic material as well as the earlier assemblage (Hamel 1977). In these circumstances it is difficult to confirm the presence of fur seals after A.D. 1500.

A similar problem arises in North Otago and South Canterbury. The available archaeological evidence of fur seal exploitation is restricted to the early part of the prehistoric sequence. However, no late prehistoric or early historic coastal midden deposits have been investigated in these areas.

Fur seals occurred throughout *Central New Zealand* during the early prehistoric. Radiocarbon estimates in excess of 500 B.P. derive from 15 sites in all areas except the south-eastern coast of the North Island and Taranaki (Figure 5). Fur seal bone is associated with extinct avifauna and/or Archaic artefacts in 25 sites distributed throughout the region (Table 3).

Once again later evidence is more sparse and unevenly distributed. It is concentrated on the coasts immediately north and south of Cook Strait. At Kaikoura on the Marlborough coast, Pari Whakatau (S55/7), South Bay (S49/43), Takahanga (S49/13) and Rakautaura (S49/3) have all yielded fur seal or 'seal' remains in association with Classic Maori or European material. Similar associations are apparent in the upper layers of Rotokura (S14/1) in Tasman Bay, and Paremata (N160/50) near the southern tip of the North Island. Fur seals also occur in the 18th century Pond midden at Black Rocks (N168–9/77) in Palliser Bay. Therefore, at least in these areas, fur seals were present throughout the prehistoric sequence.

The absence of late prehistoric evidence on the north-west coast of the South Island almost certainly reflects the paucity of archaeological research there (cf. Anderson 1982b).

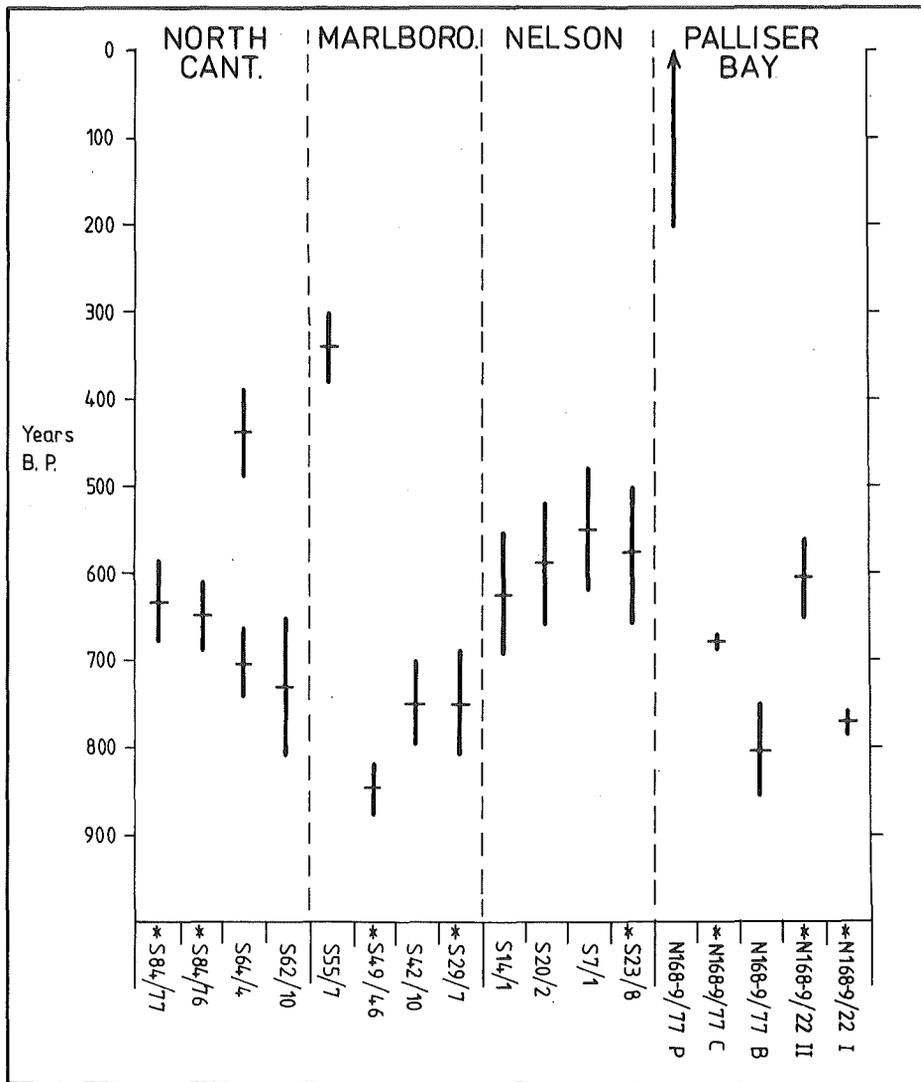


Figure 5: Central New Zealand: radiocarbon dates for archaeological deposits with fur seal and 'seal' remains. Bar represents one standard deviation. \* = pooled estimate.

Fur seals are common in that area today (Figure 2), as they were at the end of the prehistoric period (Smith 1985: Appendix One).

**TABLE 3**  
**INDIRECT EVIDENCE FOR THE AGES OF ARCHAEOLOGICAL DEPOSITS WITH FUR SEAL**  
**AND 'SEAL' REMAINS IN CENTRAL NEW ZEALAND**

Site Number	Name	Ex	A	C	E
<i>North Canterbury</i>					
S94/30	Tumbledown Bay	x	x		
S84/118	Monck's Cave	x	x		
S84/77	Moa Bone Point Cave	x	x	x	
S84/76	Redcliffs Flat	x	x		
S84/46	Bromley	x			
S61/4	Timpendean	?	?	?	
S62/10	Hurunui Mouth	x	x		
<i>Marlborough</i>					
S55/7	Pari Whakatau			x	
S49/43	South Bay			x	x
S49/13	Takahanga			x	x
S49/46	Avoca Point	x	x		
S49/3	Rakataura			x	
S42/10	Clarence River	x	x		
S36/3	Needles Point	x	x		
S29/8	Marfells Beach	x	x		
S29/7	Wairau Bar	x	x		
<i>Tasman Bay</i>					
S14/1	Rotokura	x	x	x	x
S14/20	The Glen	x	x		
S20/2	Tahunanui	x	x		
S9/13	Anapai	x			
<i>West Coast</i>					
S7/1	Heaphy River	x	x		
S23/8	Buller River	x	x		
<i>Southern North Island</i>					
N160/50	Paremata	x	x	x	x
<i>Taranaki</i>					
N129/77	Ohawe	x	x		
N128/20	Hingaimotu	x	x		
N128/96	Opuā	x	x		
<i>Hawkes Bay</i>					
	Wairarāma	x			
	Onenui	x			
	Wainui	x			

Sources: see Smith 1985: Table 78

Symbols as for Table 2 above.

The only clear evidence for the presence of fur seals in North Canterbury after about 400–500 B.P. is their presence along with Classic Maori artefacts in the upper layers of Moa Bone Point Cave (S84/77). Timpendean (S61/4), some 20 km from the coast, also contained 'seal' remains. However, the provenance of that material is unclear. Timpendean has both Archaic and Classic Maori artefacts, as well as 12th and 16th century radiocarbon dates. Several other late prehistoric midden deposits have been excavated in North Canterbury (e.g., at Kairaki S76/39 and Hohouponamu S76/71). However, no evidence of fur seals has been reported from those sites (Trotter 1982). Therefore, it is probable that this species was scarce or seldom exploited in North Canterbury during the late prehistoric period.

In the two remaining areas for which data are available, Taranaki and Hawkes Bay, all the evidence of fur seals derives from the early prehistoric. This suggests that fur seals were absent in later centuries. However, there is insufficient data from late prehistoric or early historic midden deposits to confirm this suggestion.

Virtually all of the evidence for fur seals in *Northern New Zealand* derives from the early prehistoric period. On the Coromandel Peninsula fur seal bone occurs in dated deposits at seven sites, all but one of which are older than 450 B.P. (Figure 6). Similarly, all but one of the deposits with indirect evidence of age can be assigned to the early prehistoric (Table 4).

TABLE 4  
INDIRECT EVIDENCE FOR THE AGES OF ARCHAEOLOGICAL DEPOSITS WITH FUR SEAL  
AND 'SEAL' REMAINS IN NORTHERN NEW ZEALAND

Site Number	Name	Ex	A	C	E
<i>West Coast</i>					
N64/4	Phillips Road Cave	x	x		
<i>Bay of Plenty</i>					
N69/87	Port Ohope		x		
<i>Coromandel</i>					
N53-4/4	Wheritoa		x		
N49/2	Whangamata	x	x		x
N49/16	Whitipiroua		x		
N49/48	South Bay, Slipper Is.	x	x		
N49/43	Home Bay, Slipper Is.	x	x		
N44/2	Tairua	x	x		
N44/69	Hot Water Beach	x	x		
N40/2	Parker's Midden	x	x		
N40/3	Opito Beach	x	x		
N40/6	Black's Midden	x			
N40/13	Sarah's Midden	x	x		
N40/260	Cross Creek Midden	x	x		
N40/9	Sarah's Gully	x	x		
N35-6/88	Port Jackson	x	x		
N30/5	Harataonga Western Midden	x	x		
<i>Auckland-Hauraki Gulf</i>					
N46-7/16	Manukau South Head	x	x		
LN43/1	Ponui Island		x		
N38/24	Sunde Site	x	x		
<i>Northland</i>					
N24/20	Ocean Beach		x		
N20/13	Pataua	x			
N12/374	Moturua Island		x		
N6/4	Houhora	x	x		
N1-2/976	Twilight Beach	x	x		
	Waikuku Beach	x			
	Tom Bowling Bay	x	x		
	Spirits Bay	x	x		

Sources: see Smith 1985: Table 79.  
Symbols as for Tables 2 and 3, above.

Both of the exceptional deposits, and two others which may also be of relatively recent age, contained very few fur seal remains and it seems unlikely that they represent local fur seal exploitation. Law (1972: 109) has argued that the few bones in the 17th century

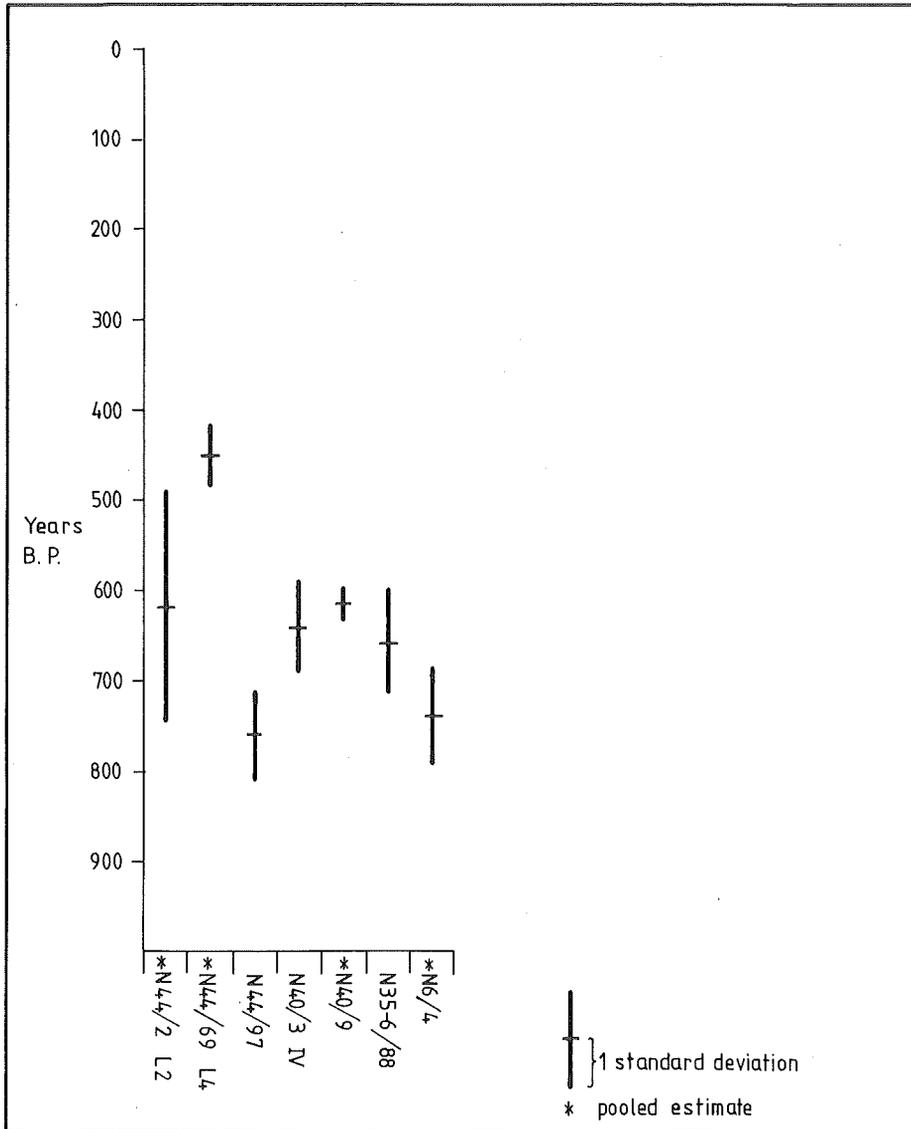


Figure 6: Northern New Zealand: radiocarbon dates for archaeological deposits for fur seal and 'seal' remains.

Eastern Midden (N30/4) at Harataonga Bay, Great Barrier Island are industrial debris rather than food remains. He has made the same argument for the single bone fragment and three teeth from the upper occupation layer at the nearby pa (N30/3). Only one fur seal bone was recovered from the upper midden at Whangamata Wharf (N49/2), which contained Classic Maori and European material (Allo 1972). Similarly, the uppermost deposit (Level 1) at the

Opito Beach Midden (N40/3), which is late prehistoric (Green 1963: 59), yielded a single fur seal fragment. In both these cases derivation of single bones from stratigraphically lower, fur seal rich deposits must be considered a strong possibility. However, even if those two bones were in primary deposition, a major reduction in the presence of fur seals after about A.D. 1500 is clearly indicated.

This is confirmed by the absence of fur seals from all other late prehistoric deposits that have been excavated in the area. These are: the upper occupation at Tairua (N49/2; Smith 1978); Level 1 at Sarah's Midden (N40/9); Phases II and III at Sarah's Gully Pa (N40/10); Occupation IV at Skipper's Ridge (N40/7; Smith 1981); and Skipper's Ridge II (N40/73; Bellwood 1969).

Evidence from elsewhere in Northern New Zealand parallels the Coromandel pattern. Three Auckland-Hauraki Gulf sites contain fur seal remains. They are: Manukau South Head (N46-7/16); Ponui Island (N43/1); and the Sunde site on Motutapu Island (N38/24). All of these can be assigned to the early prehistoric period. Similarly, the fur seal remains in Phillips Road Cave (N64/4), near Kawhia and at Port Ohope (N69/87), in the Bay of Plenty, are associated with Archaic material. Whenever direct or indirect evidence of age is available for deposits with fur seals in Northland early prehistoric ages are indicated.

Fur seal bone is absent from excavated late prehistoric middens in the north. These include: the upper layers of the Sunde site (N38/24; Scott 1970); Galatea Bay (N43/22; Terrell 1967); Ruarangi (N20/41; Hougaard 1971); the Northland Harbour Board site (N20/102; Nichol pers. comm.); Te Kuri's Village (N12/200; Groube 1966); and the upper layers of N12/374 on Moturua Island (Cassels pers. comm.). On this basis it is clear that fur seals were absent, or at least extremely rare in Northern New Zealand during the later centuries of prehistoric occupation.

## INFERRING THE STATUS OF PRE-EUROPEAN FUR SEAL POPULATIONS

Fur seals are available year round and in greatest number in the vicinity of breeding colonies, but occur only seasonally within the non-breeding range (Smith 1985: Chapters Two and Three). These population dynamics provide the key to inferring the status of former colonies. Virtually all the fur seal population congregates around permanent colonies during summer (November to February) when breeding and pupping take place. During the remainder of the year most juveniles and adult males migrate to seasonal colonies, leaving females and pups within the breeding range.

The former existence of breeding colonies in an area can be detected archaeologically by the presence of bone of animals which were killed during the breeding season, or by the presence of pup or adult female remains. The time of year at which fur seals were killed can be determined from seasonal growth zones apparent in etched longitudinal sections of their canine teeth (Smith 1985: 93-101). Pup and adult female fur seals can be identified from the dimensions of their bones (Smith 1985: 55-77).

Evidence in both of these categories was recovered in this study (Table 5). It shows that prehistoric breeding populations existed in six areas—Foveaux Strait, South Otago, the Otago Peninsula, Cook Strait, the Coromandel Peninsula, and northern Northland.

Breeding may also have occurred in Taranaki. However, evidence for this is limited to a single, fragmentary pup radius from Opua (N128/96; Table 4). The general scarcity of fur seal remains in Taranaki makes the former presence of a local breeding population there

**TABLE 5**  
**ARCHAEOLOGICAL EVIDENCE FOR EXPLOITATION OF FUR SEAL BREEDING POPULATIONS**

Area	Site	pups		females		teeth
		mni	E	mni	E	N-F
Foveaux Strait	Tiwai Point	1	21	3	18	1
South Otago	Papatowai	1	9	2	21	-
	Pounaweia	3	39	1	9	-
Otago Peninsula	Papanui Beach	1	7	2	17	1
	Long Beach	1	12	1	3	1
Cook Strait	Rotokura	4	27	-	-	-
	Paremata	7	40	2	10	3
Taranaki	Opua	1	1	-	-	-
Coromandel	Whangamata	-	-	1	3	-
	Tairua	2	11	-	-	-
	Opito	1	2	1	7	1
Northland	Houhora	4	38	3	19	9
	Waikuku Beach	1	5	-	-	-
	Twilight Beach*	1	1	-	-	-

mni = minimum number of individuals

E = number of aged-sexed elements

N-F = number of teeth indicating death between November and February

\* Further pup and female remains from this site have been reported by Taylor (1984)

Source: Smith 1985: Table 80

unlikely, and the Opua radius is probably best viewed as an isolated instance of pupping outside the normal breeding range.

Archaeological evidence of 13th century fur seal breeding at Tiwai Point, ambiguous data from three sites on Ruapuke Island (S184/4, S184/9, S184/11; Coutts and Jurisich 1972) and early historic evidence (Smith 1985: Appendix One) confirm that breeding populations existed in the Foveaux Strait region throughout the prehistoric period.

In South Otago exploitation of breeding populations is evidenced in 12th and 14th century contexts at both Papatowai and Pounaweia. However, it is unlikely that breeding colonies were present there when European sealing commenced (Smith 1985: Appendix One), and may have disappeared prior to abandonment of the area after the 16th century.

Evidence for breeding on the Otago Peninsula derives from Papanui Beach (S164/1), dating to somewhere between the 15th and 17th centuries (Davies 1980: 67, 110), and the 17th century layer 2 deposit at Long Beach (S164/20). Transformation of local colonies to non-breeding status must have occurred between then and the late 18th century, as there is no evidence of breeding colonies at the time of European contact (Smith 1985: Appendix One).

About Cook Strait, archaeological evidence of breeding occurs in layer 2 at Rotokura (S14/1), dated to the 14th century (Figure 5), and in both early and mid-to-late prehistoric contexts (Table 3) at Paremata (N160/50). At both these sites the uppermost layers, with European artefacts, have few fur seals and no indicators of breeding. This seems to indicate transformation of the population to non-breeding status in the late prehistoric.

It can also be suggested that in earlier centuries breeding populations were confined to the western shores of Cook Strait. To the east, in Palliser Bay, fur seals occur in 12th and 14th century deposits at the Washpool Midden (N168-9/22), and 12th, 13th and 18th

century middens at Black Rocks. In none of these are more than one or two individuals represented and there are no indication of breeding colony exploitation. Only non-breeding colonies appear to have existed on the north-eastern shores of Cook Strait. If these colonies were outliers of the breeding stations to the west, then it is tempting to view the absence of fur seals in the 16th century deposits at the Washpool Midden and the hiatus in the Black Rocks sequence as related to the apparent demise of the Cook Strait breeding population.

On the Coromandel Peninsula evidence of breeding occurs in the lower layers of Tairua and Opito, both dated to the 14th century, and also in the Archaic Cabana Lodge site at Whangamata. It is not clear whether breeding populations continued to exist in the area until the end of the Archaic period. Only non-breeding animals were identified from deposits which appear to represent late Archaic occupations (Hot Water Beach layers 4 and 3b, and possibly also Opito Level II). However similar results were derived from other, apparently earlier deposits. Whatever the status of the fur seal population in the late Archaic, it is clear that this species was no longer present in the area after about A.D. 1500.

Finally, the evidence for fur seal breeding in Northland is all dated directly or indirectly to the early prehistoric period. Evidence for the absence of these animals in later centuries has already been described.

## SUMMARY

It is clear that fur seals were distributed more widely at the commencement of human occupation than they are today. Their range included the southern coast of the South Island, virtually all of the east coasts of both islands and most of those parts of the west coasts for which archaeological information is available. Breeding colonies occurred along the southern and south-eastern coasts of the South Island, in Cook Strait, about the Coromandel Peninsula and in the far north. This means that the species was resident year-round through a much greater proportion of its range than at present. There is a strong modern parallel for this. The Australian population of *A. forsteri* remains within its breeding range throughout the year (Bonner 1981: 182).

Reduction of the fur seal range commenced midway through the prehistoric sequence. They disappeared from the northern North Island by about A.D. 1500. Around Cook Strait and on the east coast of the South Island local breeding populations were replaced by seasonally available non-breeding populations late in the prehistoric period. By the time European sealing commenced near the end of the 18th century breeding populations were confined to the south and west coasts of the South Island. The non-breeding range extended up the east coast of the South Island to Cook Strait.

## SEA LIONS, ELEPHANT SEALS AND LEOPARD SEALS

Information is more limited for species other than the fur seal. Data on their modern distributions derive from summaries of reported sightings, rather than detailed surveys. Archaeological information is limited by their restricted abundance in the sites, and by difficulties encountered in positively identifying their remains (Smith 1985: Appendix Six).

### SEA LIONS

Sea lions occur today only as occasional stragglers about Stewart Island and the southern South Island (Wilson 1979). Their main breeding grounds are some 500 km further south

on the Auckland Islands. Prior to European sealing the species was numerous about Stewart Island, and recent evidence indicates that a non-breeding colony has been re-established there (Wilson 1979). This species differs from the fur seal in its use of sandy rather than rocky shores for colonies (Gaskin 1972: 155–6).

Archaeological remains of sea lions have been reported from 42 sites (Figure 7; see also Smith 1985: Appendix Three). Almost half of these occur in Southern New Zealand. On Stewart Island and along the southern coast of the South Island sea lions occur in deposits from throughout the prehistoric sequence. Radiocarbon dates for Southport 5 (S165/24), Southport 10 (S165/29: upper layers), Riverton (S176/1) and Tiwai Point (S181–2/16) (Figure 4) span the 13th to the 17th centuries. Indirect evidence (Table 2) from Old Neck (S189/4), Lee Island (S187/11) and Parangai (S187/9) suggest both early prehistoric and protohistoric ages. Quantified data from all but one of these sites (Coutts 1972; Coutts and Jurisich 1972; Smith 1985) indicate that sea lions were present in low numbers. There are no clear indications of the status of sea lion populations.

In South Otago, sea lion remains are dated to the 12th century at both Papatowai and Pounaweia, the 14th century at Pounaweia and the end of the 15th century at Cannibal Bay (Figure 4). At Tautuku Point (S184/21) they are associated with indirect evidence of an early prehistoric age (Table 2). It is not possible to establish whether they were present in the late prehistoric because of the paucity of archaeological data from that period. Tentatively identified adult female remains in the 12th century deposits at both Papatowai and Pounaweia raise the possibility that this species was breeding in the area at that time. However, these identifications were based upon limited and insecurely aged and sexed reference material. Therefore, more reliable evidence would be required before this possibility could be confirmed.

Sea lion remains in East Otago are most common in the early prehistoric, but occur throughout the prehistoric sequence. They are dated to the 13th and 17th centuries at Long Beach (Figure 4). They also occur at Otokaia Mouth (S163/1), Hoopers Inlet (S164/4) and Pleasant River Mouth (S155/2), where indirect evidence indicates early prehistoric ages, and the mid-to-late prehistoric Papanui Beach site (S164/1) (see Table 2). There are no indications of breeding animals, and quantified data from Papanui Beach, Long Beach and Pleasant River Mouth (Smith 1985; Teal 1975) suggest only small numbers of animals were present.

Sites with sea lion remains occur in only three areas within Central New Zealand. On Banks Peninsula they occur only at Redcliffs (S84/76), dated to the early 14th century (Figure 5). About Cook Strait they are dated directly or indirectly to the early prehistoric period at the Washpool Midden (12th and 14th century occupations), Wairau Bar, Rotokura and Paremata (Figure 5, Table 3) and Pararaki (Smith 1985: Appendix Thirteen). Their presence at a later date is indicated in the upper layers of Rotokura and Paremata (Table 3). Tentatively identified adult female remains dated to the 12th century at the Washpool and the 14th century at Rotokura may indicate the former presence of breeding populations. Both the 14th century Rotokura deposit and the earliest prehistoric occupation at Paremata yielded greater numbers of animals than did other sites in the area.

The third concentration of sites containing sea lions in Central New Zealand is in Taranaki. Radiocarbon dates for Kaupokonui (Smith 1985: Appendix Thirteen) are older than 500 B.P., and a similar age can be suggested for Ohawe, Opuia and Hingaimotu (Table 3).

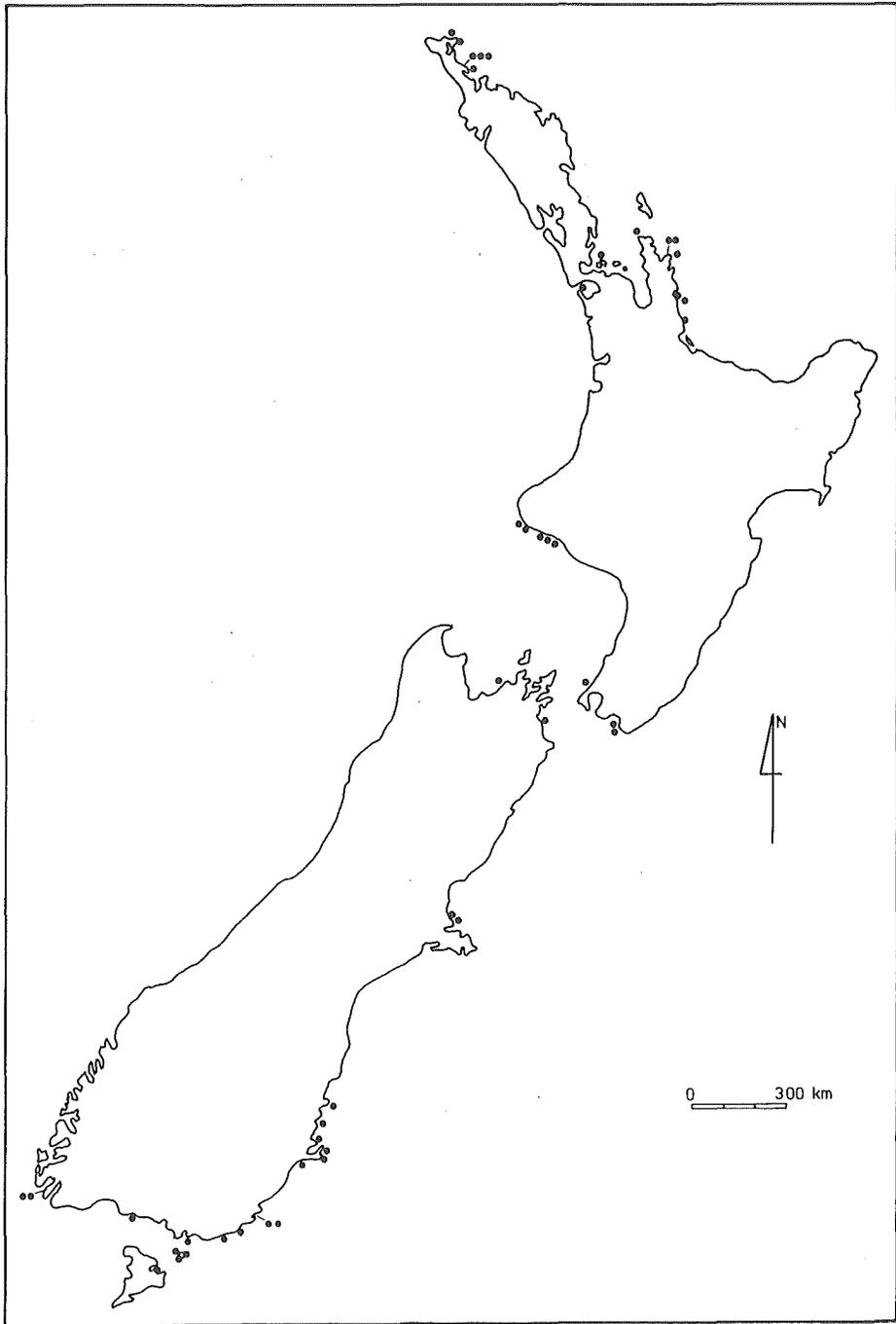


Figure 7: Sites with sea lion remains.

Reliable quantified data are available only for Kaupokonui, where 15 individuals were identified. While this is much greater than the number of sea lions identified at any other site, there were no indications that breeding animals were present. For reasons discussed above it is not possible to establish whether sea lions were still present in this area during the later centuries of human occupation.

In northern New Zealand sea lions occur in sites on the Coromandel Peninsula, in the Auckland-Hauraki Gulf area and in northern Northland. In each area they appear to be confined to the early prehistoric period. Radiocarbon dates for Tairua, Port Jackson and Houhora are all older than 600 B.P. (Figure 6) and indirect evidence for Wheritoa, South Bay, Parker's Midden, Sarah's Midden, Manukau South Head, the Sunde site, Waikuku Beach and Tom Bowling Bay suggest comparable ages (Table 4). The only sites with no temporal indications are the three sites in Henderson Bay, Northland (Smith 1985: Appendix Three). Where quantified data are available, no more than one individual is represented, except in the case of Houhora where eight sea lions were identified. This site also yielded a tentatively identified adult female, which may indicate that sea lions were breeding in the Far North at and before 600 B.P.

#### ELEPHANT SEALS

Elephant seals have a wide ranging pelagic distribution (Gaskin 1972: 148-52). Their present breeding range is confined to the circumpolar subantarctic region, but for most of the year elephant seals feed at sea over a much wider area. They occur as occasional visitors to many parts of the New Zealand coast. Virtually all the recorded sightings have been of lone individuals. Prior to European sealing this species was more common in the southern temperate zone. Breeding colonies were recorded as far north as Tasmania, and could have occurred in New Zealand (Fleming 1979: 99).

Elephant seal remains occur in 29 excavated sites throughout New Zealand (Figure 8: Smith 1985: Appendix Three). They occur in dated contexts at Tiwai Point, Papatowai (Black), Pounaweia (Layers 1 and 2), Long Beach (Layer 4c), Waitaki Mouth, and Wakanui (Figure 4); Redcliffs, Avoca Point, Wairau Bar, Rotokura and Level I of the Washpool Midden (Figure 5); Kaupokonui (Smith 1985: Appendix Thirteen); Tairua, Opito, Sarah's Gully and Houhora (Figure 6), all of which are older than 500 B.P. Similarly early ages are indicated by the indirect evidence for Ringa-ringā, Otokaia Mouth, Hoopers Inlet and Pleasant River Mouth (Table 2); Marfells Beach, Paremata (lower layers), Opuā and Onenui (Table 3) and Whangamata (Table 4).

There is only one possible indication of this species at a later date. A single elephant seal bone occurs in the uppermost occupation at Skippers Ridge which, although undated, may be of 16th or 17th century age (Davidson 1975). The virtual restriction of this species to early prehistoric contexts is surprising because it still occurs as an occasional visitor in New Zealand today. Nevertheless the present evidence suggests that elephant seals occurred here more frequently in the earlier centuries of human occupation.

Of the assemblages for which quantified data are available, only three could suggest the presence of local populations. Remains of eight elephant seals were present at Houhora (Smith 1985: 282), and six at both Tiwai Point (Smith 1985: 136) and Pleasant River Mouth (Teal 1975). However, with the possible exception of Tiwai Point, none of these sites represents a single short occupation. Therefore the elephant seals could have been acquired gradually over a period of time. All of the other assemblages have yielded only one or

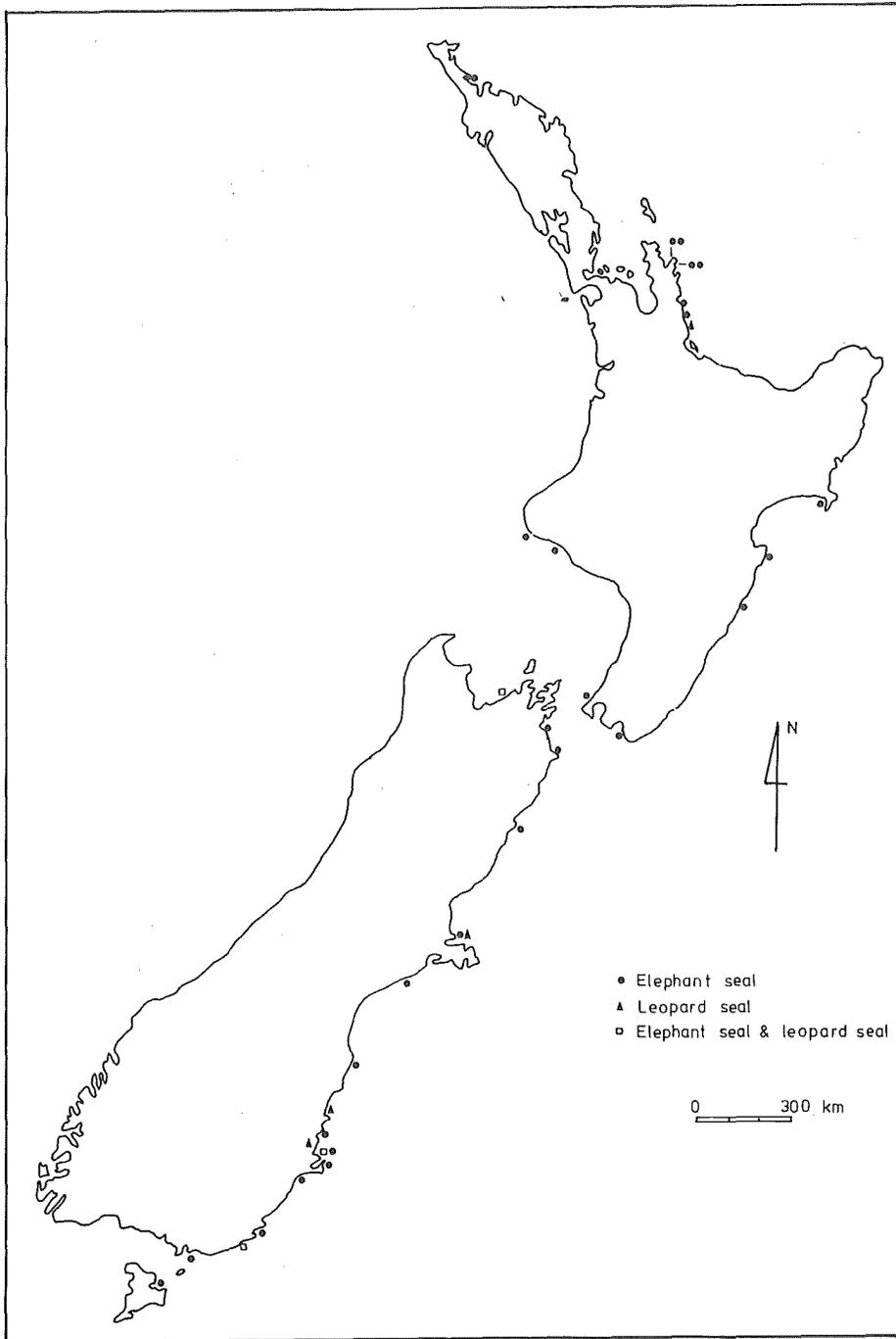


Figure 8: Sites with elephant seal and leopard seal remains.

two animals, suggesting that even during the early prehistoric this species was only an occasional visitor to New Zealand's shores. Further support for this contention can be found in the age-sex determinations made by Smith (1985). All but two of the individuals were subadult males. This age-sex group is the most wide ranging, and the most common visitor to New Zealand today (Gaskin 1972: 149). Finally, there is no firm evidence for breeding colonies. No adult female remains were recognised and only one pup, from Long Beach, was identified. Occasional instances of pupping have been recorded from locations well beyond the breeding range (Gaskin 1972). Therefore it is not necessary to postulate the presence of local breeding populations to account for this isolated individual.

#### LEOPARD SEALS

Leopard seals are the least well known of all southern pinnipedia (Gaskin 1972: 145-7). Breeding takes place on the southern subantarctic islands between September and January. For most of the year leopard seals range widely through the southern oceans as solitary animals. Sightings in New Zealand have been infrequent. Most of these have been along the east coast of the South Island and about Cook Strait.

Archaeological remains are similarly scarce. They occur in only seven sites (Figure 8; Smith 1985: Appendix Three), six of which are within the range indicated by modern sightings. The exception is Wheritoa on the Coromandel Peninsula. These remains are dated to the 12th century at Papatowai Point, the 17th century at Long Beach (Figure 4) and the 14th century at both Moa Bone Point Cave and Rotokura (Figure 5). Early prehistoric ages can be assigned to their remains at Wheritoa (Table 4) and Omimi (Hamel pers. comm.). The Lookout Bluff site is of unknown age. Each of these sites has yielded the remains of only one individual. These data indicate occasional visits by lone individuals at infrequent intervals, a pattern similar to that evident today.

#### SUMMARY

Sea lions occurred more widely during the early centuries of settlement than they do today. The archaeological data suggest that they were never as common as fur seals, but at the same time provide strong indications that they were breeding in the far north of the North Island, about Cook Strait and in South Otago. By about 1500 A.D. sea lions were confined to the coasts of Otago and Southland, and by the end of the pre-European period they occurred only in the vicinity of Stewart Island.

There was no strong evidence that either elephant seals or leopard seals ever maintained regular colonies on the New Zealand coast. Both appear to have occurred here only as occasional visitors, much as they do today. Although no changes in distribution could be identified, there are indications that elephant seals may have occurred here less frequently during the later part of the pre-European period. However, with sites of the later period forming a relatively small part of the total sample under analysis here, it would be unwise to read too much into this observation.

#### CETACEANS

Cetacean remains are more difficult to interpret than those of seals. At least 30 species of whales occur in New Zealand's coastal water (Gaskin 1972). Modern distributional data

are available for only some of these. Furthermore it is difficult to identify their archaeological remains to species level. Limitations in the available comparative material, close osteological similarities between some species, and the obscuring of distinctive morphological features by weathering or through industrial use of the bone all contribute to this problem.

Positive identifications were achieved at only 10 of the 51 sites with cetacean bones (Figure 9, see Smith 1985: Appendix Three). Each of the ten sites yielded pilot whale (*Globicephala* sp.) remains, and at one the common dolphin (*Delphinus delphis*) was also identified. A further seven sites yielded material identified tentatively as pilot whale, but in each case the possibility of derivation from one of the other medium sized odontocete whales cannot be excluded. Dolphin remains at 13 sites could not be identified to species, although at Paremata they were assigned tentatively to the common dolphin. The distributions of each of these sets of remains and evidence for their ages are outlined briefly below.

The positively identified pilot whale remains derive from sites on the western margins of Foveaux Strait, the northern shore of Cook Strait, the Coromandel Peninsula, Hauraki Gulf and Northland. All of the tentatively identified pilot whale remains also occur in these areas. This distribution coincides almost perfectly with the areas in which pilot whale strandings have been recorded over the last century (Smith 1985: 330–2). Radiocarbon dates in excess of 500 B.P. for Wakapatu (Figure 4); Level I of the Washpool Midden (Figure 5), the Washpool Camp (Smith 1985: Appendix Thirteen); Tairua, Sarah's Gully and Houhora (Figure 6) confirm their presence in the early prehistoric. Most of the remaining assemblages in which they occur appear to be of similar age (Tables 2–4). They are dated to later periods in the upper layers of Southport 9 and 10 (Figure 4), and probably belong to the later period in Level I at Opito, the upper layers of Pig Bay and at Smugglers Cove. These data indicate that there were no significant changes in pilot whale distribution during the pre-European period.

With most dolphin remains not identified to species, distributional comparisons are of limited value. It is worth noting, however, that the recorded sites, from East Otago, Cook Strait, Auckland and Northland, are all within the range of the common dolphin, the only species positively identified during this study. These sites cover a wide age range, with early radiocarbon dates from Pleasant River 2 (Figure 4), the Crescent Midden at Black Rocks, Level I of the Washpool Midden (Figure 5), and Houhora (Figure 6), and Archaic associations at Otokaia Mouth, Andersons Bay (Table 2) and Waikuku Beach (Table 4). At Ross's Rocks they are stratigraphically younger than the dated 16th century deposit (Figure 4), and in the Pond Midden at Black Rocks they are dated to the 18th century (Figure 5). Further evidence for late prehistoric or early historic ages derives from the uppermost layers of Little Papanui (Table 2), Rotokura, Paremata (Table 3) and Moturua Island (Table 4).

## SUMMARY

No distributional changes were identified for cetaceans. This may reflect the manner in which these animals were exploited. Pilot whales were not deliberately hunted. The high frequency with which these animals strand on the shore and the close correspondence between their archaeological distribution and the areas where strandings are known to occur

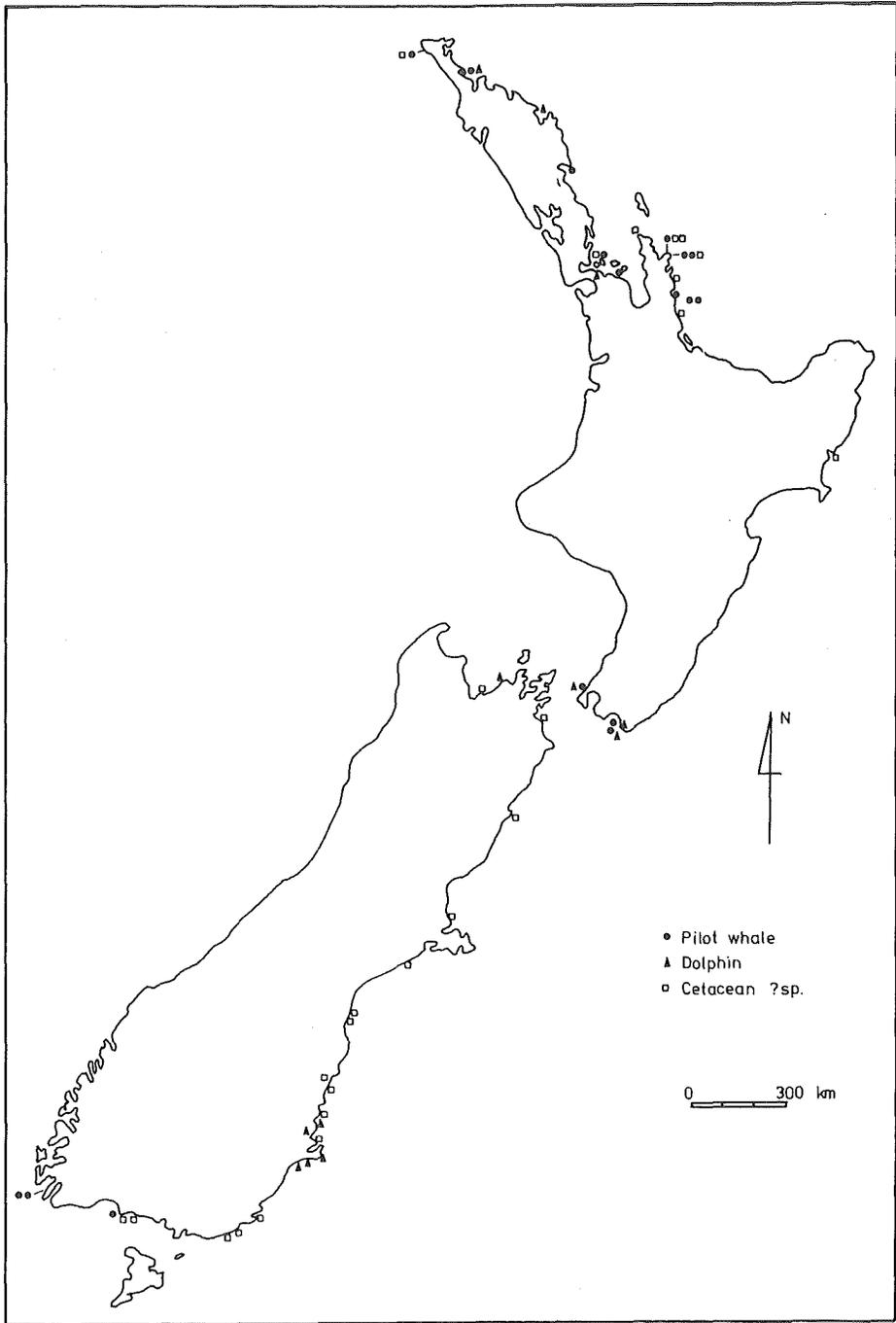


Figure 9: Sites with cetacean remains.

make it clear that their exploitation revolved around scavenging meat and other products from naturally stranded animals (Smith 1985: 330–3).

Dolphins are seldom stranded, and they appear to have been hunted at sea with harpoons (Smith 1985: 333–6). This is indicated by the close correlation between the distributions of dolphin remains and harpoons. Neither dolphins or harpoons are common in the archaeological record, suggesting that dolphin hunting was never a common activity.

## IDENTIFYING THE CAUSES OF DISTRIBUTIONAL CHANGES

Significant distributional changes have been clearly identified for fur seals and sea lions. These occurred during the pre-European period, principally before A.D. 1500. During the same period there was no evidence for changes in the distributions of other sea mammal species. The timing of these changes suggest that human predation may have been responsible. However other potential causes must also be considered.

The causes are clearest in the case of *fur seals*. Environmental factors which may influence their distribution were investigated by Wilson (1974: 32–7). He suggested environmental constraints operated only on the distribution of breeding colonies. Both Wilson (1974) and Matlin (1978) have argued that north of its present limit, breeding would be disrupted by higher air temperatures and longer hours of sunshine. These would induce heat stress, prohibiting the maintenance of breeding territories, and the bearing and suckling of young. However, no precise definition was given of levels at which these meteorological variables become detrimental. Nor were reliable data presented to demonstrate that air temperatures and hours of sunshine are significantly greater at potential breeding sites north of the present limits than they are in areas at which fur seals now breed.

If it is assumed that these variables do indeed limit the breeding range, then the distributional changes evidenced in the archaeological record could be explained by climatic change. The wider distribution of breeding colonies during the early prehistoric period would have required that summer conditions in the north and east of the country were cooler than at present. Similarly, the southward retreat of fur seals could be explained by a change towards present climatic conditions by A.D. 1500.

Neither of these conditions is indicated by the two recent reviews of the evidence for climatic change within the last millennium. Leach and Leach (1979) have proposed that there was a slightly warmer and more settled period between the 10th and 16th centuries, with a minor deterioration between the 17th and 19th centuries. This suggests that conditions for breeding beyond the present limits ought to have been less favourable during the early prehistoric period than they are today, and that they should have been optimal during the late prehistoric. Burrows and Greenland (1979) have argued that 'warming' and 'cooling' phases occurred at more frequent intervals. While the precise timing of these remains uncertain, several periods of higher and lower palaeotemperatures both before and after the reduction in fur seal distribution are indicated. Furthermore, the amplitude of these fluctuations appears to have been minor, approximately  $\pm 0.7^{\circ}\text{C}$  in mean temperatures. Therefore, neither model of climatic change provides an adequate explanation for the changes in fur seal distribution. This indicates that meteorological conditions, along with the other environmental variables, do not in fact limit the present distributions of fur seals.

Human impact on fur seal distribution could have occurred by both direct and indirect means. The latter includes predation by introduced animals, and human modifications to preferred environments. These have both been invoked to explain depletion or extinction of other faunal resources in prehistoric New Zealand (e.g., Anderson 1983a), but are not likely to have been of great importance here. Neither dogs or rats posed a serious threat to the fur seal population. As already indicated, habitats suitable for fur seal colonies still exist in areas that they no longer occupy. It has been suggested (Anderson 1983a:7) that the productivity of fur seal feeding grounds may have been reduced by silting and discoloration of inshore waters as a result of forest clearance. This seems unlikely because the major feeding grounds are influenced predominantly by offshore hydrological features such as the distribution of cold temperate water masses and localised upwellings of cold, nutrient-rich water (Wilson 1974: 33–6). Similarly, competition for food resources can be ruled out because fur seals feed mainly upon cephalopods (Mattlin 1978: 99; Street 1964) which were not a major target of prehistoric fishing strategies in New Zealand. Finally, it seems unlikely that human settlement or activity in the vicinity of colonies would have led to their abandonment. While there is no precise information in this regard available for the New Zealand fur seal, the vitality of colonies close to modern settlements at Kaikoura and on the Wellington coast (Wilson 1981) suggests that this species tolerates proximity to people.

Direct human predation remains the only viable explanation for the observed changes in fur seal distribution. Archaeological evidence for their exploitation supports this contention. It has demonstrated that these animals were hunted throughout their pre-European range. Two hunting strategies were identified (Smith 1985: 373–8). Regular seasonal cropping of the populations at breeding colonies was most important. Opportunistic hunting of lone beached seals occurred less frequently but more widely throughout their range.

The cropping strategy was concentrated in the late spring, summer and autumn months, when fur seal numbers are highest at the colonies. All age classes were hunted, although juveniles and subadult males were represented archaeologically in greater proportions than they occur in the total population (Smith 1985: 432). The animals were taken one or a few at a time at regular intervals throughout the season. This strategy persisted in the vicinity of at least some breeding colonies for several centuries (Smith 1985: Figure Sixty-one).

Fur seals would appear to be particularly susceptible to this kind of predation because of their extreme conservatism in the use of breeding sites. They have a strong tendency to return to the colony at which they were born, and females almost always breed on a colony at which they have previously given birth (Wilson 1974: 120). Therefore, even though the intensity of pre-European exploitation may never have been high, the persistent predation documented archaeologically could still have reduced the size of a breeding population until its continued survival was in danger.

A second, more subtle threat to the population may be seen in the over-representation of juveniles and subadults in the archaeological population (Figure 10).

Non-human predators commonly add little to the overall mortality rate of their prey. They focus on sections of the population with high natural mortality, thereby taking animals likely to have died soon anyway (Errington 1946). This is not the case here, as juvenile and subadult fur seals are the age classes with lowest natural mortality rates (Smith 1985: 52). The consequence of continued predation on these animals would have been a

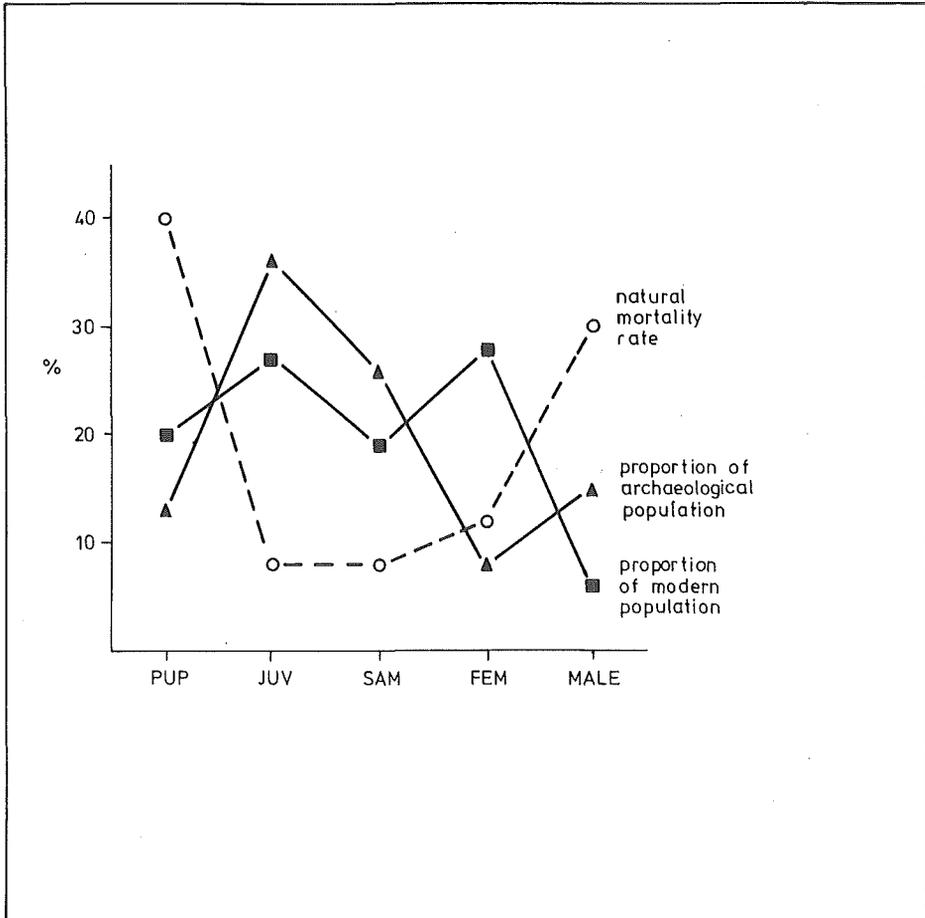


Figure 10: Fur seal population composition and mortality rates (after Smith 1985).

gradual decline in recruitment into the breeding population, and thereby a further threat to its continued survival.

These mechanisms for change would have applied equally in all parts of New Zealand. It remains to be established why fur seal populations were depleted more rapidly in the north. It is possible that from the outset these animals were less abundant in the north, and therefore more susceptible to the pressures of human predation. However, there is no reliable evidence with which to test this proposition.

An alternative, or perhaps complementary explanation is also available. The areas in which fur seal hunting declined earliest and most completely are those with the greatest potential for horticulture, while the regions in which it persisted longest are those beyond the limits of pre-European gardening as defined by Groube (1970: 156–61) and Law (1969). There is little reason to doubt that the horticultural component of the economy in northern New Zealand permitted and sustained more rapid population growth than was possible in

the south. Therefore the more rapid demise of fur seal populations in the former regions can be attributed to sustained exploitation by a larger and more rapidly growing population.

A somewhat different argument seems to apply in the case of the *sea lion*, although the evidence is by no means as clear. Environmental causes for their range reduction cannot be ruled out, simply because there is no information on variables influencing sea lion distribution. However, as both the Australian sea lion (*Neophoca cinerea*) and south American sea lion (*Otaria flavescens*) occur at latitudes well north of those occupied by their New Zealand counterparts (Vaz-Ferreira 1981; Walker and Ling 1981), environmental constraints can be considered unlikely. Likewise, most indirect impacts of human activity can be ruled out for the same reasons as applied to the fur seal. However, there is some evidence that the New Zealand sea lion is less tolerant of proximity to people than the fur seal (Begg and Begg 1979: 223).

The archaeological evidence for sea lion exploitation is also somewhat ambiguous (Smith 1985: 375-6, 409). On the one hand their bone remains indicate that breeding populations formerly existed in some parts of the country. However none of the assemblages studied to date show evidence for regular cropping of these populations. Indeed, only three sites were suggestive of predation at non-breeding colonies. The remainder indicated nothing more than occasional opportunistic hunting. In these circumstances it would be invidious to lay the blame for changes in sea lion distribution solely on pre-European hunters. Instead, the purported timidity of these animals may have caused abandonment of colonies whenever human populations settled nearby. This would have reduced the opportunities for regular hunting, and ultimately restricted sea lion distribution to the most isolated portions of its former range.

## CONCLUSION

When people first landed in New Zealand, both fur seals and sea lions occurred more widely than they do today. Fur seals were present on virtually all areas of rocky coast. Breeding populations were resident in the far north of the North Island, on the east coast of the Coromandel Peninsula, the western shores of Cook Strait, and the east and south-east coasts of Otago, as well as the Stewart Island, Fiordland and South Westland coasts where they occur today. By about A.D. 1500, fur seals no longer occurred in the northern North Island. Breeding populations were replaced with seasonally migrant visitors by about the 16th or 17th century in the Cook Strait region, and by the 17th or 18th century in East Otago. By the end of the pre-European period the breeding range was confined to the western and southern coasts of the South Island, which corresponds closely to the limits extant today.

Sea lions occurred as widely as fur seals, although much less frequently, during the early part of the pre-European period. Breeding populations may have existed in the far north, about Cook Strait and in South Otago. By about 1500 A.D. sea lions were confined to the coasts of Otago and Southland. By the end of the pre-European period their distribution appears to have been restricted to the Stewart Island region.

No clear evidence of distribution changes was found for elephant seals, leopard seals or cetaceans. The archaeological data suggest that both these seal species always occurred here only as occasional visitors rather than as resident populations. In the case of elephant seals these visits may have been more frequent during the earlier centuries of pre-European

occupation, although the more restricted evidence available for the later period limits the reliability of this conclusion.

The changes in both fur seal and sea lion distribution can be attributed directly to the effects of human activity. Hunting was only partially responsible for the retreat of sea lion colonies, the regular presence of people nearby being sufficient to cause their ultimate abandonment. In contrast, fur seals sustained persistent hunting, particularly at their breeding colonies. With their conservative breeding habits this eventually restricted recruitment into the breeding age classes and reduced the size of resident populations until they were non-viable. This impact was felt first and most completely where human populations grew most quickly. By the end of the pre-European period the fur seal breeding range was confined to the least densely populated areas.

The strategies employed to exploit the marine megafauna were essentially land-based. Seals were hunted at their colonies or when hauled out on the shore. Meat and other products were scavenged from naturally stranded whales. The only truly sea-borne strategy evidenced in the archaeological record is the hunting of dolphins with harpoons, but it is clear that this was never a common activity. This emphasis on land-based hunting inevitably led to a greater impact upon the seal species that maintained regular colonies on the New Zealand shore. Indeed, the former abundance of fur seals may have contributed to their ultimate decline. Their colonies provided such a predictable and easily won source of food that they encouraged the persistent exploitation that eventually led to their abandonment.

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