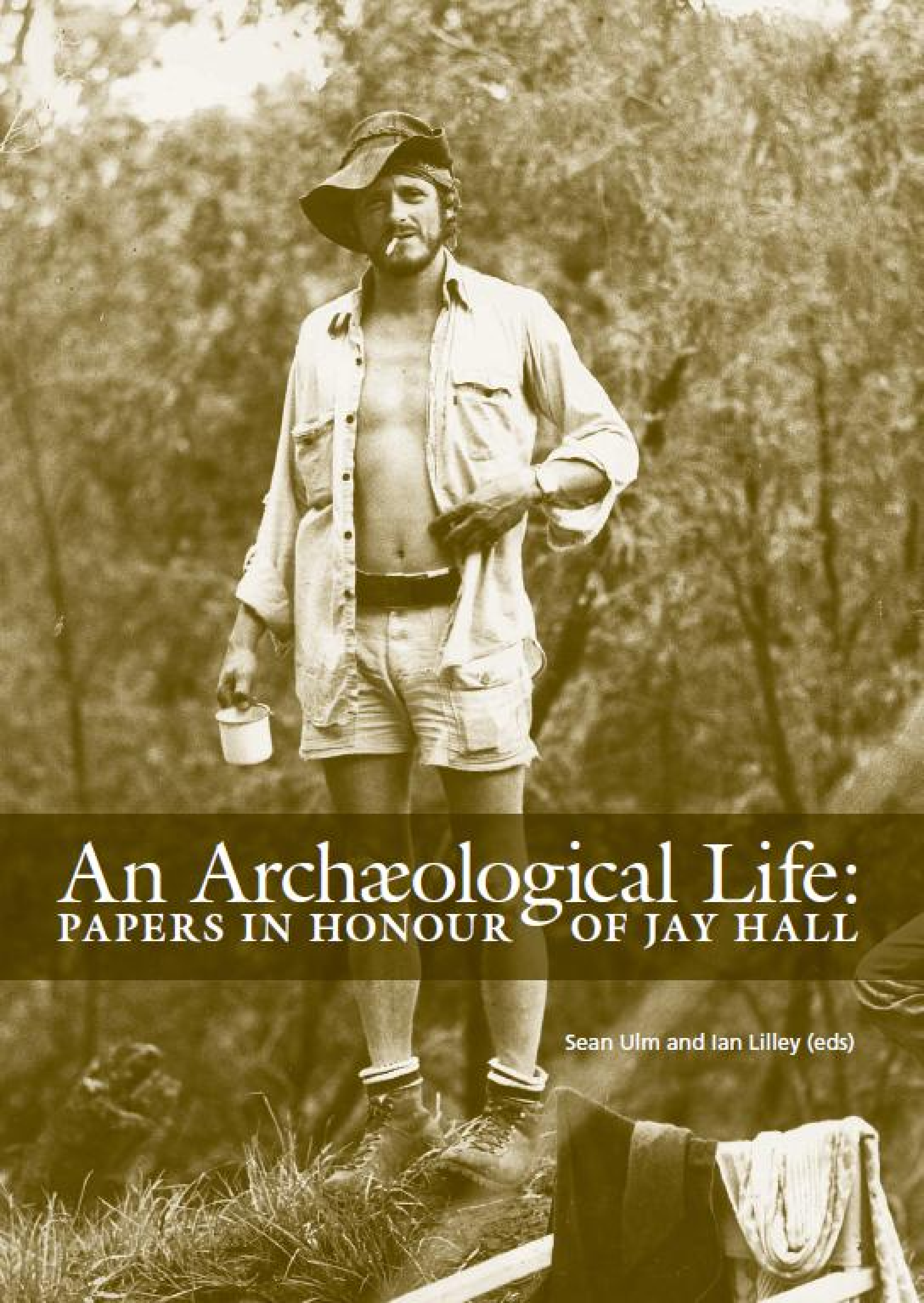

An Archæological Life:
PAPERS IN HONOUR OF JAY HALL

Sean Ulm and Ian Lilley (eds)

The Antiquity of Marine Fishing in Southeast Queensland: New Evidence for Pre-2000 BP Fishing from Three Sites on the Southern Curtis Coast

Sean Ulm and Deborah Vale

Abstract

The antiquity of marine fishing in southeast Queensland has been debated since the mid-1980s. Walters has argued that systematic marine fishing was only adopted in the last 2000 years as a response to the marginality of terrestrial landscapes fringing the coast, while Hall, McNiven, Ross, and Ulm, among others, have maintained that fishing was always an integral component of coastal settlement, but that a variety of taphonomic processes and recovery problems under-represent fish remains dating to before the late Holocene. Zooarchaeological data from shell midden deposits on the southern Curtis Coast at the northern end of the southeast Queensland bioregion shed new light on this debate, with fish remains recovered from three deposits dating prior to 2000 BP and up to 4000 BP. Implications for understanding the antiquity of marine fishing in the wider region are considered and directions for future research identified.

Introduction

A major feature of archaeological accounts of Aboriginal lifeways in southeast Queensland is an apparent intensification of marine fishing over the last 2000 years (e.g. Hall 2000; Morwood 1987; Walters 1989, 1992a). Walters (1986, 1989, 1992a, 1992b, 1992c, 2001) has forcefully argued that marine fishing was only regularly incorporated into Aboriginal subsistence and settlement regimes in southeast Queensland in the last 2000 years as part of permanent and intensifying coastal settlement. In fact, he argued that there was no firm evidence for fishing in southeast Queensland before 2000 years ago (Walters 1992b). Others, however, have pointed to limitations imposed by taphonomic factors, recovery techniques and the presence of earlier fish remains to the north and south of the region as the basis for alternative interpretations (McNiven 1991; Ross and Coghill 2000; Ulm 1995, 2002a). Clearly, understandings of the antecedents of the systems observed ethnographically and inferred from the late Holocene archaeological record, and the role that fish played within them, are hampered by the limited number of deposits containing faunal material dating to before the late Holocene. Determining the antiquity and nature of marine fishing in the region has therefore been an important focus for various southeast Queensland studies (e.g. Bowen 1989; Frankland 1990; Hall and Bowen 1989; McNiven 1991; Ross and Duffy 2000; Walters *et al*. 1987). This paper reports the recovery of pre-2000 BP fish remains from three sites on the southern Curtis Coast: Seven Mile Creek Mound, Mort Creek Site Complex and Eurimbula Site 1.

Table 1. Southeast Queensland sites with fish bone dating to before 2000 BP. NA= fish remains present, but quantification data are not available.

Site	Earliest Fishing	Number Specimens	Weight (g)	NISP	MNI	References
New Brisbane Airport	4830±110 BP (Beta-33342)	NA	NA	NA	NA	Hall 1990:180, 1999:174; Hall and Lilley 1987; Ulm and Hall 1996
Booral Shell Mound	2950±60 BP (Beta-32046)	695	–	11	9	Bowen 1998; Frankland 1990:Tables 6-7
Wallen Wallen Creek	c.3000 BP	NA	NA	NA	NA	Neal and Stock 1986; Walters 1986:244-246
Toulkerrie	2290±80 BP (Beta-32047)	384	NA	NA	0	Hall and Bowen 1989: Tables 5, 7

Fishing and Archaeology in Southeast Queensland

Jay Hall's (1982) early synthesis of ethnographic and archaeological material from Moreton Bay identified the centrality of marine fishing to Aboriginal lifeways in the region, informed by the patterns revealed at early excavations undertaken at Minner Dint and Toulkerrie on Moreton Island (Hall 1980, 1984). The key role of marine resources in the subsistence economy was further supported by ecological studies demonstrating the marginality of coastal landscapes in terms of low terrestrial mammal diversity and abundance (e.g. Dwyer *et al*. 1979a, 1979b). Hall's work was elaborated by Walters (1986, 1988, 1989, 1992a, 1992b, 1992c, 2001), who argued that many of the changes observed in the archaeological record of southeast Queensland were ultimately related to the late Holocene development and intensification of a marine fishery. Although Walters (e.g. 2001:61) has always allowed that people may have fished occasionally prior to 2000 years ago, a key observation underpinning his model is the fact that there is little evidence for an established marine fishery until the last 1000 years.

Fish remains are a rare component in southeast Queensland faunal assemblages before the late Holocene (Ulm 2002a; McNiven 2006; Walters 1992b). Only four sites in southeast Queensland have been reported to contain marine fish remains dating to before 2000 BP (Table 1, Figure 1). All contain very low numbers of fish remains dating to this time, leading Walters (2001:61) to comment that older sites reported in the region 'have been uncontaminated by evidence for a fishery'. The oldest fish remains have been reported from the New Brisbane Airport site where 'fragmentary fish bone' (Hall 1999:174) dating to the mid-Holocene occur encased in the ironstone conglomerate matrix of the lower excavation units. Walters (1992b:35) noted that only a few fragments of fish bone were recovered from the site and argued that these remains have not been demonstrated to be cultural. Stratigraphic and other details published to date do not provide a clear cultural context for the fish remains (Hall and Lilley 1987). The Booral Shell Mound on the shores of Great Sandy Strait has the largest number of fish bone specimens dated to before 2000 years ago, but even here it amounts to only a NISP of 11 and an MNI of nine (Frankland 1990). At Wallen Wallen Creek, Walters (1986:244-246) reported the distribution of fish remains by excavation unit from the undated square WWC-M28-B. Although Neal (Queensland Environmental Protection Agency, pers. comm., 1995) indicated that fish remains are restricted to the last 3000 years, it is unclear which of the data reported by Walters belong to the pre-2000 BP assemblage. The site of Toulkerrie on Moreton Island has abundant fish remains dating to the last 1000 years, however, less than 1% of the fish bone specimens reported by Hall and Bowen (1989) belong to pre-2000 BP deposits. It should be noted that Ulm (2002a:Table 3) incorrectly reported fish remains dating to before 2000 BP at Sandstone Point. However, re-examination of Nolan's (1986:Table 31) results for square SSP 5-G, the deposit at Sandstone Point dated to before 2000 BP, does not show fish in excavation units before 2000 years ago. The paucity of fish remains in older sites is reinforced by the complete absence of fish remains from other sites in southeast Queensland pre-dating 2000 BP, including Hope Island (Walters *et al*. 1987), Teewah Beach Site 26 (McNiven 1991), King's Bore Sandblow Site 97 (McNiven 1992) and Sandstone Point (Nolan 1986).

From a wider perspective, coastal archaeological sites containing faunal remains dating to before the late Holocene are not common anywhere on the Queensland coast (see Ulm *et al*. 1995; Ulm and Reid

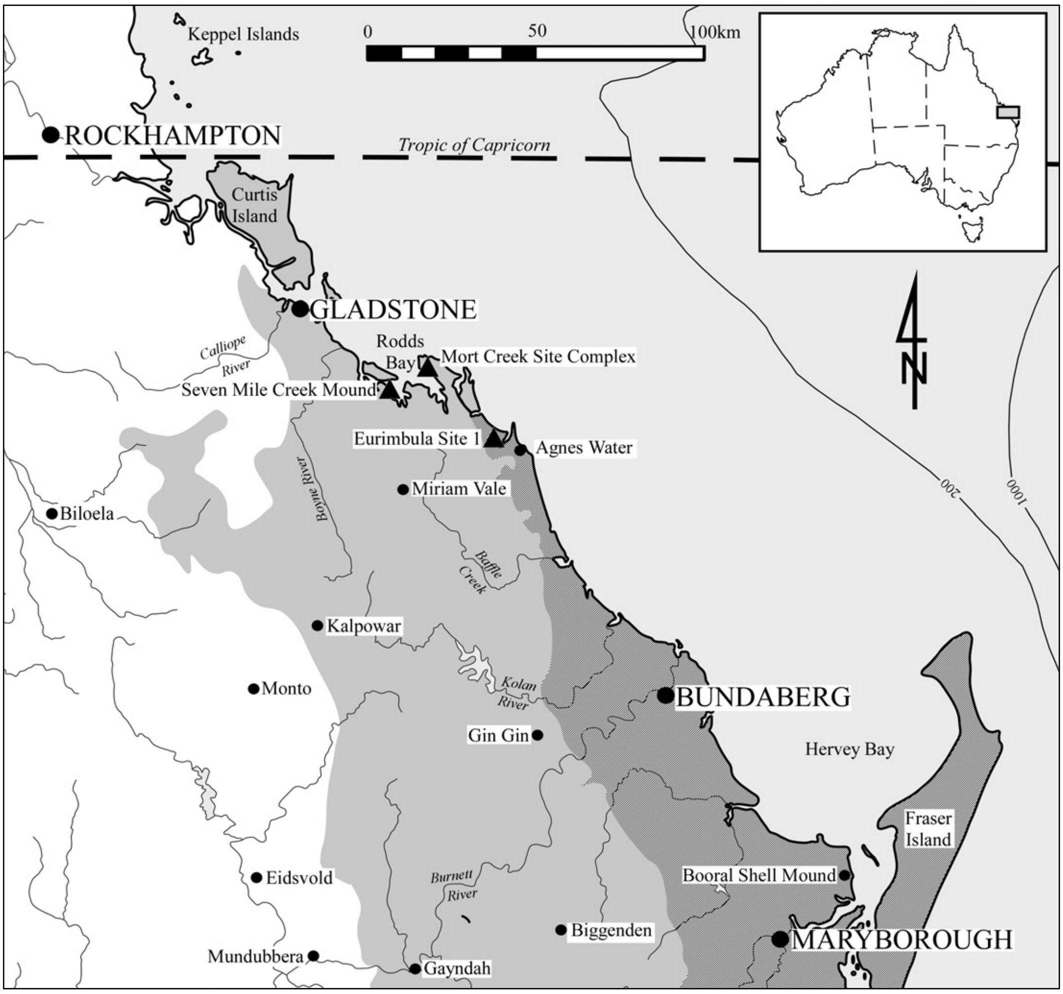

Figure 1. Northern southeast Queensland, showing sites mentioned in the text. The southeast Queensland bioregion is shaded, with the darker shading indicating the extent of the coastal lowlands or 'wallum' (after Young and Dillewaard 1999).

2000 for a review). Although several rockshelters containing evidence for marine resource exploitation in the Whitsunday Islands (Barker 1989, 1991, 2004) and Princess Charlotte Bay areas (Beaton 1985) date to around or before the mid-Holocene, only two open sites on the Queensland coast have evidence for focused marine resource exploitation before 3000 BP. The Hope Island site on the Coomera River, dated on charcoal to 4350±220 BP (Beta-20799), contains abundant shell remains, although fish bone is reportedly absent (Walters *et al*. 1987). Mazie Bay on North Keppel Island is dated on charcoal to 4274±94 BP (NZA-456), but quantities of shell and fish bone are only present in deposits dated to shortly before 3000 BP (Rowland 1999). In all other open coastal sites in Queensland pre-dating 3000 BP (n=7) faunal remains are either entirely absent, represented in minute quantities or restricted to deposits dated to the last 3000 years.

The absence of faunal remains from early deposits is commonly attributed to a combination of recovery strategies, taphonomic considerations and/or differential site preservation (Ulm 2002a). Ulm (1995, 2002a) and Ross (2001; Ross and Coghill 2000; Ross and Duffy 2000) have suggested that the routine use of large sieve mesh sizes (e.g. 3mm) may have biased against the recovery of fish remains. Ross (2001:63) has argued that '[f]ish bone may have been more prevalent in these older sites had more effective recovery techniques been used'; specifically, the use of 1mm mesh. Walters (2001:61) countered that the use of 'tiny mesh sizes is not the solution' as it has 'not produced evidence of an earlier focus on fishing'.

McNiven (1991:21) suggested that Walters underestimated the 'role of fishing in the mid-Holocene due to an analytical bias towards fish remains recovered from late Holocene shell middens'. He suggested that fish remains would only have a high survival potential if incorporated into a shell matrix and concluded that 'as most coastal shell middens in southeast Queensland date to the last 1000 years … most preserved fish bones will similarly date to this period and few valid inferences can be made concerning fishing conditions prior to 1000 BP' (McNiven 1991:21; see also McNiven *et al*. 2002:15, Ulm 2002a). However, Walters (1992b:36-37) responded that the prominence of late Holocene shell middens in the sample 'is not so much a bias, as it is a reflection of the data available', and he pointed to the lack of evidence from sites known to span this period to demonstrate that a developed fishery was not evident until late Holocene times. In a recent review Ulm (2002a) demonstrated that fish remains are more common in southeast Queensland sites after 2000 BP, and especially in the last 1000 years, although no simple pattern towards increasing marine fish production could be identified. In fact, many sites dating to the last 1000 years contain no fish remains at all. However, variability in data recovery techniques and analytical methods combined with poorly developed site chronologies inhibit meaningful integration of these data (see Ulm 2002a). Recent work in northern southeast Queensland provides new data relevant to this debate.

Southern Curtis Coast Regional Archaeological Project

Since 1993, archaeological surveys and excavations have been conducted along the southern Curtis Coast as a component of the Gooreng Gooreng Cultural Heritage Project (see Lilley and Ulm 1995, 1999; Lilley *et al*. 1996; Ulm 2000, 2002b, 2002c, 2004, in press; Ulm *et al*. 1999, 2005; Ulm and Lilley 1999). The study area extends along the coast from Baffle Creek in the south to Rodd's Bay in the north and inland to Miriam Vale in the west. It falls within the northern end of the well-defined southeast Queensland bioregion and comprises two major landscape provinces – the Burnett-Curtis Coastal Lowlands in the southeast and the Burnett-Curtis Hills and Ranges in the north and west (Figure 1) (Sattler 1999; see also Coaldrake 1961). The former are a part of Coaldrake's (1961) 'wallum' and are characterised by fine-grained sediments; alluvium; coastal and estuarine sediments; a broad coastal plain; high rainfall (1100mm); low elevation (<50m); and eucalypt and melaleuca forests and woodlands (Young and Dillewaard 1999). The latter are characterised by acid volcanics; metamorphics; localised basic volcanics; small areas of elevated sediments; hills and ranges; alluvial valleys; high rainfall (900mm); medium elevation (<250m); and eucalypt woodlands and araucarian microphyll rainforest (Young and Dillewaard 1999). Like elsewhere in southeast Queensland, the coastal components of the bioregion are characterised by the low diversity and abundance of terrestrial mammals (e.g. Dwyer *et al*. 1979).

The southern Curtis Coast exhibits a rich and diverse suit of marine fauna, including a number of whale species (including the humpback *Megaptera novaeangliae*), four species of dolphins (including the common bottle-nose *Tursiops truncatus*), dugong (*Dugong dugon*) and turtles (including loggerhead *Carreta caretta* and green *Chelonia mydas*). A total of 148 species of fishes from 69 families is recorded for the Curtis Coast (QDEH 1994:68). Useful data are provided by Lupton and Heidenreich's (1996) detailed study of Baffle Creek just to the south of the study area. The lower estuarine component of this fisheries resource assessment covered habitats similar to the coastal estuaries in the study area. Despite significantly depressed regional rainfall levels (25% under the annual average) before and during the survey period, 55 fish and nine crustaceans were recorded. The larger fish species were (in order of abundance) flat-tail mullet (*Liza dussumieri*), sand mullet (*Myxus elongatus*), whiting (*Sillago ciliata, S. maculata* and *S. sihama*), yellowfin bream (*Acanthopagrus australis*), blue-tail mullet (*Valamugil seheli*), sea mullet (*Mugil cephalus*) and garfish (including *Arrhamphus sclerolepis* and *Hyporhamphus ardelio*) (Grant 1993; Lupton and Heindenreich 1996). Commercial finfish catches for the region reflect this pattern, with mullet, whiting and bream accounting for 64.1% of commercial catches (Olsen 1980:11). Early European historic accounts suggest that fish may have been more abundant in the past, with both Banks and Parkinson impressed by the quantities of fish in the bay and estuary (Banks in Beaglehole 1963; Parkinson 1773). Mud crabs (*Scylla serrata*) and sand crabs (*Portunus pelagicus*) are also common.

The environmental context and archaeological signature of Aboriginal occupation, dominated by shallow shell middens located on landforms dating from the mid-Holocene, is shared with the wider southeast Queensland region, providing the ideal context for new research to contribute to continuing debates, including the antiquity of marine fishing, using targetted recovery and analysis techniques. Excavations and analyses of eight open coastal sites located on six separate estuaries were undertaken, with three sites yielding evidence for pre-2000 BP fishing, discussed below.

Methods

An important sampling consideration was to recover data to evaluate the role and antiquity of marine fishing in the region. Experiments have demonstrated that sieve mesh sizes create significant biases in faunal recovery (e.g. Ross and Duffy 2000; Shaffer 1992; Shaffer and Sanchez 1994). Walters (1979) found that as much as 80% of fish remains passed through 3mm mesh (based on analysis of a single 661.6g bulk sample). Walters' study also demonstrated that the use of larger mesh sizes biased recovery against some fish taxa with small diagnostic skeletal elements, such as Mugilidae (mullet) and Sillaginidae (whiting) (see also Hall 1980:105-106). Experiments which have included fish bones indicate that mesh sizes between 0.5mm and 2mm are required for maximum representative recovery (Casteel 1970, 1972, 1976; Colley 1990; Gordon 1993). Indeed, Casteel (1976) has argued that column- or core-sampling is the only reliable method for representative recovery of fish remains. Recent studies by Butler (1994) and Vale and Gargett (2002), however, have found that the relative abundance of fish taxa across different mesh sizes is similar, with smaller screen sizes (e.g. 1mm) increasing the abundance only of undiagnostic bone elements. In southeast Queensland, 3mm mesh is almost universally the smallest screen size used (Ulm 2002a:Table 1). The use of different sieve sizes makes it difficult to compare the representation of fish remains between sites. To ensure comparability with fish bone assemblages recovered from elsewhere in southeast Queensland, 3mm mesh was used in this study. This recovery strategy yielded large numbers of fish bones from several sites, including identifiable elements of mullet and whiting, the main regional taxa thought to be under-represented by large mesh sizes (Walters 1979).

All fish bone recovered from analysed squares was separated from the faunal assemblage and subject to basic characterisation studies, including body part representation, vertebral sizing, identification rate, number of fragments, number of identified specimens (NISP) and minimum number of individuals (MNI). MNI was calculated for each excavation unit, which may overestimate the MNI for the site as a whole. Fish taxa were identified using a comparative reference collection assembled for northern New South Wales and southern Queensland and adapted for the study area (for example, the tiger flathead, *Platycephalus indicus*, uncommon in New South Wales, was included). Owing to the limitations of the reference collection, however, taxonomic identifications were only made to the family level, with the exception of the bream, *Acanthopagrus australis*, which was identified on the basis of distinctive diagnostic cranial elements.

A variety of abundance measures has been employed in the analysis of fish remains from archaeological sites in southeast Queensland. For example, Walters (1986) used NISP, McNiven (1990) used both weight and MNI and Frankland (1990) used MNI and NISP. These abundance measures are not necessarily comparable (see Grayson 1979, 1984). NISP is particularly prone to problems of intersite comparability, given the potential effects of fragmentation and differences in the way that different investigators calculate the measure (Lyman 1994:38). This is a particular problem in southeast Queensland, where all investigators who have used NISP as a measure of fish abundance have adopted the Class (i.e. fish) as the basic unit of identification, exacerbating the potential for spurious results derived from site-specific fragmentation patterns. This measure is more accurately characterised as a specimen count. In this study, fish NISP is calculated on the basis of the number of specimens identified to family or species only (Vale and Gargett 2002). The number of specimens is also reported to allow comparison to NISP data reported for other sites in the region.

Results

Seven Mile Creek Mound

The Seven Mile Creek Mound is a discrete shell mound located on a low, sandy ridge isolated on tidal flats fringing Seven Mile Creek, approximately 35km southeast of Gladstone (Figure 1). The site measures 20m east-west x 10m north-south x 0.8m high. A single 1m² pit divided into four 50cm x 50cm quadrants (Squares A–D) was excavated into the highest part of the mound to a maximum depth of 117cm. Excavation revealed an 85cm thick deposit of dense shell resting on well-rounded beach sands containing occasional pieces of shell and degraded pumice. Eight radiocarbon determinations were obtained for the deposit, demonstrating extremely rapid accumulation over a period of about 350 years with initial occupation around 3950 cal BP and abandonment shortly after 3600 cal BP. Fish bone data are available for Square A. For further site details see Ulm (2000, 2002c, 2004, in press).

Fish bone is present throughout the cultural deposit, totalling 34.4g and consisting of 1346 pieces of bone, a NISP of 54 and an MNI of 37 (Table 2). The weight of bone identified to taxon was 1.6g,

Table 2. Fish bone abundance, Seven Mile Creek Mound, Square A.

XU	Number Specimens	Weight (g)	NISP	MNI
1	0	0	0	0
2	14	0.5106	0	0
3	47	1.2786	3	2
4	74	1.1613	1	1
5	53	0.9165	2	1
6	98	1.3380	5	3
7	60	1.4591	5	4
8	16	0.2120	0	0
9	27	0.6474	2	2
10	18	0.2565	0	0
11	169	4.8736	6	3
12	115	2.2661	3	2
13	61	3.5652	8	6
14	176	4.7367	10	5
15	132	3.9176	6	5
16	52	2.0026	0	0
17	47	0.7844	0	0
18	8	0.1657	0	0
19	22	0.2808	0	0
20	12	0.4353	0	0
21	69	0.8567	0	0
22	16	0.3883	2	2
23	17	0.3532	0	0
24	14	0.1496	1	1
25	7	0.1879	0	0
26	18	1.5749	0	0
27	2	0.0260	0	0
28	1	0.0113	0	0
29	1	0.0299	0	0
30	0	0	0	0
31	0	0	0	0
Total	1346	34.3858	54	37

giving an identification rate of 4.75%. Identified taxa in descending order of abundance include flathead (Platycephalidae), whiting (Sillaginidae), Sparidae (including bream, *Acanthopagrus australis*) and mullet (Mugilidae). Size-classing of vertebrae showed that 69% have a centrum diameter of 3mm or less. These represent very small fin fish. Some larger fish are represented by vertebrae from XU9–15.

Mort Creek Site Complex

The Mort Creek Site Complex is located on the west bank of Mort Creek, on the west coast of Rodds Peninsula (Figure 1). Natural and cultural shell deposits extend discontinuously over an area of about 6ha, characterised by a complex of beach ridges, cheniers, shell middens and tidal inlets. Test excavations undertaken in 1995 (reported in Carter *et al*. 1999) revealed cultural deposits dating to before 2000 BP. In 1998, a further 1m² pit divided into four 50cm x 50cm squares (Squares A–D) was excavated in the area identified in the earlier investigations as having the oldest cultural deposits. Excavation revealed approximately 65cm of sediments overlying microgranite bedrock. Large quantities of shellfish remains, dominated by mud ark (*Anadara trapezia*), were recovered from a shell layer across the upper 20cm of the deposit. Remains of dugong (*Dugong dugon*) and turtle, probably loggerhead (*Caretta caretta*), were recovered towards the middle of the deposit immediately below the shell layer. Fish bone was recovered from every excavation unit. Twelve radiocarbon determinations are available suggesting first occupation shortly before c.3300 cal BP and abandonment around 2000 years ago. Fish bone data are available for Square C. For further site details see Carter (1997), Carter *et al*. (1999), Lilley *et al*. (1996, 1999), Rosendahl (2005) and Ulm (2004, in press).

Fish bone is present throughout the cultural deposit, consisting of 1635 pieces of bone totalling 38.4g and a NISP of 34 and an MNI of 21 (Table 3). The weight of bone identified to taxon was 4g, giving an identification rate of 10.5%. Identified taxa in descending order of abundance include Sparidae, flathead (Platycephalidae), whiting (Sillaginidae) and catfish (Ariidae). Size-classing showed that 71% of all vertebrae have a centrum diameter of 3mm or less, representing very small fin fish. Some larger fish are represented by single vertebrae recovered from XU5 and XU9. Three Sparidae otoliths from XU7 range in size from 12.4–21.5mm which represent very large fish. Comparative Sparidae otoliths from bream (*Acathopagrus australis*) with total lengths of 305mm and 365mm had otoliths measuring 9.8mm and 11.1mm in length respectively. In addition, a Platycephalidae dentary fragment from XU7 measured 6.9mm at the symphysis, much larger than a comparative Platycephalidae dentary with a symphysis length of 4.3mm for a 418mm fish. There is discordance between the presence of at least several large individual fish represented by cranial elements (dentary and otoliths) and the very few vertebrae recovered above 3mm in centrum diameter. This pattern may relate to differential representation of skeletal elements caused by butchering practices on large fish, with post-cranial elements discarded elsewhere. Although fish bone occurs in every unit, it is most abundant in units where shell is also abundant.

Sixty-eight pieces of bone weighing 26.2g could not be assigned to a fish skeletal element. The small size of these specimens and the lack of diagnostic attributes generally prevented identification to taxon. However, positive identification of bone elements at a similar depth towards the base of SUII in adjacent squares as dugong (*D. dugon*) and turtle, probably loggerhead (*C. caretta*), suggest that many of the unidentified small bone fragments in Square C derive from these taxa. Dugong remains were recovered from Squares A–C in association with the lower half of the shell layer between 13.6–21.3cm below ground surface. Although the turtle carapace fragments recovered from between 24.5–35.2cm in Squares B and D are associated with occasional *A. trapezia* valves, they are clearly located below the major shell layer.

Table 3. Fish bone abundance, Mort Creek Site Complex, Square C.

XU	Number Specimens	Weight (g)	NISP	MNI
1	0	0	0	0
2	36	1.0086	0	0
3	64	0.9123	0	0
4	97	2.1781	2	1
5	90	2.3407	5	4
6	272	7.0749	7	2
7	313	10.7277	7	5
8	332	6.7944	8	5
9	82	1.9631	1	1
10	74	1.1594	0	0
11	73	0.9109	2	1
12	69	0.8443	0	0
13	28	0.4571	1	1
14	8	0.0957	0	0
15	13	0.1390	0	0
16	5	0.0587	0	0
17	18	0.2461	0	0
18	49	1.1300	1	1
19	12	0.3115	0	0
Total	1635	38.3525	34	21

Eurimbula Site 1

Eurimbula Site 1 is a large, stratified midden complex intermittently exposed in a steep erosion section on the west bank of Round Hill Creek (Figure 1). The site is approximately 2km long (north-south) and up to 100m wide (east-west), although surface exposures of shell and stone artefacts are mainly confined to a 50m wide band parallel to the creek bank. It was formed on and in a series of low Holocene beach ridges and swales which run roughly parallel to the modern coastline forming Bustard Bay. Test excavations undertaken in 1995 (reported in Ulm *et al*. 1999) revealed cultural deposits dating to before 3000 BP and recovered small numbers of fish bones (n=76) in deposits dating to shortly before 2000 years ago (see Ulm 2004:Table 12.1, 12.4). In 1999 a further 1m² pit divided into four 50cm x 50cm squares (Squares A–D) was excavated in the area identified in the earlier investigations as having the oldest cultural deposits. Excavation revealed approximately 55cm of sediments containing cultural material overlying culturally-sterile sands. Fish bone was recovered from every excavation unit in the top 35cm, with occasional specimens present to the base of the cultural deposit. Twelve radiocarbon determinations are available, demonstrating occupation from around 3000 cal BP into the historical period. Fish bone data are available for Squares A–D. For further site details see Ulm *et al*. (1999; see also Ulm 2004, in press).

Fish bone is present throughout the cultural deposit, totalling 26.93g and consisting of 1345 pieces of bone with a NISP of 18 and an MNI of 15 (Tables 4–5). Identified taxa in descending order of abundance include Sparidae (bream, tarwhine, snapper) (NISP=8; MNI=8), Sillaginidae (whiting) (NISP=10; MNI=7) and Mugilidae (mullet) (NISP=1; MNI=1). Although fish bone occurs in every unit, it is most abundant in units where shell is also abundant. In Square A, three Sparidae identifications were made, two from XU6 identified from a vertebra and an otolith and one from XU7 from a dentary. The otolith was identified as bream (*Acanthopagrus australis*). In Square B, XU4, a single vertebra each was identified as Sillaginidae and Mugilidae and a Sparidae otolith was identified as snapper (*Chrysophrys auratus*). XU5 contained two vertebrae identified as Sparidae and Sillaginidae, and two otoliths identified as Sillaginidae. The centrum diameter of the Sillaginidae vertebrae from the adjacent XUs is similar suggesting that they derive from the same individual. A single vertebra and three otoliths in Square C, XU6, were identified

Table 4. Fish bone abundance, Eurimbula Site 1, Squares A–B. * indicates deposits dated to pre-2000 BP.

	Square A				Square B			
XU	Number Specimens	Weight (g)	NISP	MNI	Number Specimens	Weight (g)	NISP	MNI
1	0	0	0	0	0	0	0	0
2	0	0	0	0	2	0.02	0	0
3	9	0.06	0	0	32	0.69	0	0
4	20	0.25	0	0	187	4.04	3	3
5	49	1.54	0	0	28	0.75	4	2
6	72	2.05	2	2	50	0.57	0	0
7	52	0.82	1	1	36	0.44	0	0
8	25	0.36	0	0	3	0.01	0	0
9	16	0.24	0	0	4	0.09	0	0
10	20	0.44	0	0	25	0.37	0	0
11	12	0.13	0	0	8	0.07	0	0
12*	5	0.08	0	0	5	0.01	0	0
13*	5	0.08	0	0	4	0.04	0	0
14*	7	0.11	0	0	4	0.02	0	0
15*	6	0.04	0	0	0	0	0	0
16*	2	0.01	0	0	4	0.02	0	0
17*	0	0	0	0	6	0.06	0	0
18*	0	0	0	0	0	0	0	0
19*	0	0	0	0	5	0.01	0	0
20*	0	0	0	0	2	0.02	0	0
21*	1	0.01	0	0	2	0.01	0	0
22*	1	0.01	0	0	0	0	0	0
23*	0	0	0	0	0	0	0	0
24*	1	0.03	0	0	0	0	0	0
25*	0	0	0	0	NA	NA	NA	NA
Total	303	6.26	3	3	407	7.24	7	5

as Sparidae, two of which are snapper, and two further otoliths were identified as Sillaginidae. XU9 contained an otolith identified as snapper. Square D, XU4, contained a Sparidae otolith. Around 6% of the fish bone assemblage recovered from Squares A–D is estimated to date to before 2000 BP.

Discussion

Evidence from the three sites presented above demonstrates a pre-2000 BP antiquity for systematic marine fishing within the southeast Queensland bioregion. Significantly, the data show continuities in the general antiquity of marine fishing at sites spanning the boundary of the coastal lowlands ('wallum') landscape province (Eurimbula Site 1) with the Burnett-Curtis Hills and Ranges to the north (Seven Mile Creek Mound and Mort Creek Site Complex). The data from the southern Curtis Coast indicate a well-developed marine fishery, including predation of dugong, turtle, crustaceans and shellfish, in operation before 2000 years ago. Table 6 shows that the pre-2000 BP southern Curtis Coast fish assemblage almost trebles the number of specimens reported for the entire southeast Queensland bioregion. In fact, the quantity of fish remains is more akin to that reported for sites dating to the last 1000 years (see Ulm 2002a:Table 3). Fish are likely to have provided most of the protein for people on the southern Curtis Coast despite the relatively low representation of this material compared with shellfish (but see Erlandson 1988, 1991) (compare Figures 2 and 3). Identified fish remains indicate targetting of a range of shallow water estuarine species, including whiting (Sillaginidae), flathead (Platycephalidae), bream,

Table 5. Fish bone abundance, Eurimbula Site 1, Squares C–D. * indicates deposits dated to pre-2000 BP.

	Square C				Square D			
XU	Number Specimens	Weight (g)	NISP	MNI	Number Specimens	Weight (g)	NISP	MNI
1	0	0	0	0	0	0	0	0
2	5	0.50	0	0	5	0.01	0	0
3	7	0.09	0	0	2	0.01	0	0
4	20	0.33	0	0	15	0.31	1	1
5	95	1.98	0	0	128	1.86	0	0
6	97	3.99	6	5	44	0.87	0	0
7	75	0.97	0	0	40	1.41	0	0
8	26	0.46	0	0	2	0.01	0	0
9	8	0.28	1	1	13	0.19	0	0
10	13	0.08	0	0	4	0.04	0	0
11	9	0.10	0	0	1	0.19	0	0
12*	6	0.02	0	0	6	0.06	0	0
13*	2	0.01	0	0	1	0.03	0	0
14*	3	0.01	0	0	0	0	0	0
15*	0	0	0	0	1	0.01	0	0
16*	2	0.01	0	0	0	0	0	0
17*	0	0	0	0	0	0	0	0
18*	0	0	0	0	0	0	0	0
19*	0	0	0	0	0	0	0	0
20*	2	0.01	0	0	0	0	0	0
21*	1	0.03	0	0	0	0	0	0
22*	0	0	0	0	0	0	0	0
23*	2	0.01	0	0	0	0	0	0
24*	0	0	0	0	NA	NA	NA	NA
25*	0	0	0	0	NA	NA	NA	NA
26*	0	0	0	0	NA	NA	NA	NA
Total	373	8.43	7	6	262	5.00	1	1

tarwhine and snapper (Sparidae), mullet (Mugilidae) and catfish (Ariidae). These findings are in keeping with findings from adjacent regions to the north of southeast Queensland indicating continuous use of marine resources throughout the marine transgression (e.g. Barker 2004). These data suggest that fish were always a key resource along the southern Curtis Coast and were not recently incorporated as a regular feature of subsistence production systems.

The pattern of fish bone distribution on the southern Curtis Coast closely follows that of shellfish, with a decrease between 1000–1500 years ago and major increases in the last 1000 years (Figures 2–3). The shell and fish bone datasets should not be considered entirely independent, however, as it is likely that fish bone survival in the archaeological record is closely linked to shell abundance (McNiven 1991). For the Waddy Point Rockshelter 1 on Fraser Island, McNiven *et al*. (2002:15) demonstrated that fish bone is only consistently represented in the faunal assemblage after shell densities exceed 9–10g/kg of deposit. McNiven (1991:21; McNiven *et al*. 2002:15) suggested that the survival of fish bone in southeast Queensland deposits may be correlated with the occurrence of shell, as these shellfish remains provide a protective matrix, altering the chemical properties of the sedimentary matrix towards conditions conducive to fish bone preservation. At the Mort Creek Site Complex, however, fish bone is represented throughout the deposit, including excavation units where shell densities are well below 1g/kg of deposit. Nonetheless, there is generally a positive relationship between the abundance of fish bone

Table 6. Southeast Queensland sites with fish bone dating to before 2000 BP, including data from the southern Curtis Coast. NA= fish remains present, but quantification data are not available.

Site	Earliest Fishing	Number Specimens	Weight (g)	NISP	MNI	References
New Brisbane Airport	4830±110 BP (Beta-33342)	NA	NA	NA	NA	Hall 1990:180, 1999:174; Hall and Lilley 1987; Ulm and Hall 1996
Seven Mile Creek Mound	3660±60 BP (NZA-12118)	1346	34.4	54	37	Ulm 2004, in press
Mort Creek Site Complex	3380±90 BP (Wk-6988)	1635	38.4	34	21	Ulm 2004, in press
Booral Shell Mound	2950±60 BP (Beta-32046)	695	–	11	9	Bowen 1998; Frankland 1990:Tables 6-7
Wallen Wallen Creek	c.3000 BP	NA	NA	NA	NA	Neal and Stock 1986; Walters 1986:244-246
Eurimbula Site 1	2390±70 BP (Wk-7688)	86	0.76	0	0	Ulm 2004, in press
Toulkerrie	2290±80 BP (Beta-32047)	384	NA	NA	0	Hall and Bowen 1989: Tables 5, 7

and shellfish remains, particularly in the upper deposit. As McNiven *et al*. (2002:15) warned, whether this indicates patterns of subsistence or patterns of bone survivorship remains to be determined, although the presence of fish bone in the lower deposits of the Mort Creek Site Complex indicates that fish bone may survive under certain conditions without an accompanying shell matrix.

The Mort Creek Site Complex is the only site in the study which has evidence for the procurement of large marine animals, such as dugong and turtle, as a component of the marine fishery. Despite several detailed eighteenth and nineteenth century ethnohistoric accounts of dugong and turtle hunting in southeast Queensland (e.g. Backhouse 1843; Colliver and Woolston 1978; Fairholme 1856; Petrie 1904:24-25, 65-69, 82-83; Watkins 1891), archaeological remains are relatively rare and very recent. The oldest evidence appears to be from Wallen Wallen Creek on North Stradbroke Island, where dugong remains were identified in the late Holocene deposits, but the chronology of the remains is unclear from the reported data (Neal and Stock 1986). At the site of St Helena Island in Moreton Bay, dugong bone was recovered from the top 15cm of the deposit, which Alfredson (1984:73) dates to the mid-to-late nineteenth century. On Moreton Island, several bone fragments have been tentatively identified as dugong at the Little Sandhills site, where the radiocarbon date indicates a probable post-contact chronology (Robins 1983, 1984). Walters (1979:47, 1980) identified nine specimens of dugong bone from Trench B at Toulkerrie on Moreton Island, although no provenance is available and the entire analysed assemblage appears to date from the last 400 years (see Ulm 2002a:86-87). The secure dating of dugong remains to before 2000 BP at the Mort Creek Site Complex therefore provides some of the earliest evidence for dugong hunting in southeast Queensland.

Taken together this evidence points to the existence of a well-developed and broad-ranging marine fishery dating from the start of the regional chronology some 4000 years ago, coincident with local sea-level stabilisation (Larcombe *et al*. 1995). Later patterns of fish bone discard across sites excavated on the southern Curtis Coast dating to the last 1000 years support Walters' contention that an expanded focus on marine fish production occurred across the region in the recent past (Figure 2). Analyses of the vertebrate and invertebrate faunal assemblages from the unanalysed squares excavated at the early sites of Seven Mile Creek Mound and the Mort Creek Site Complex have the potential to shed further light on fishing, subsistence and occupation activities from this poorly understood period of southeast Queensland archaeology. Detailed analysis of fish remains including study of differential body part representation may also help elucidate butchering patterns such as those thought to be represented at the Mort Creek Site Complex.

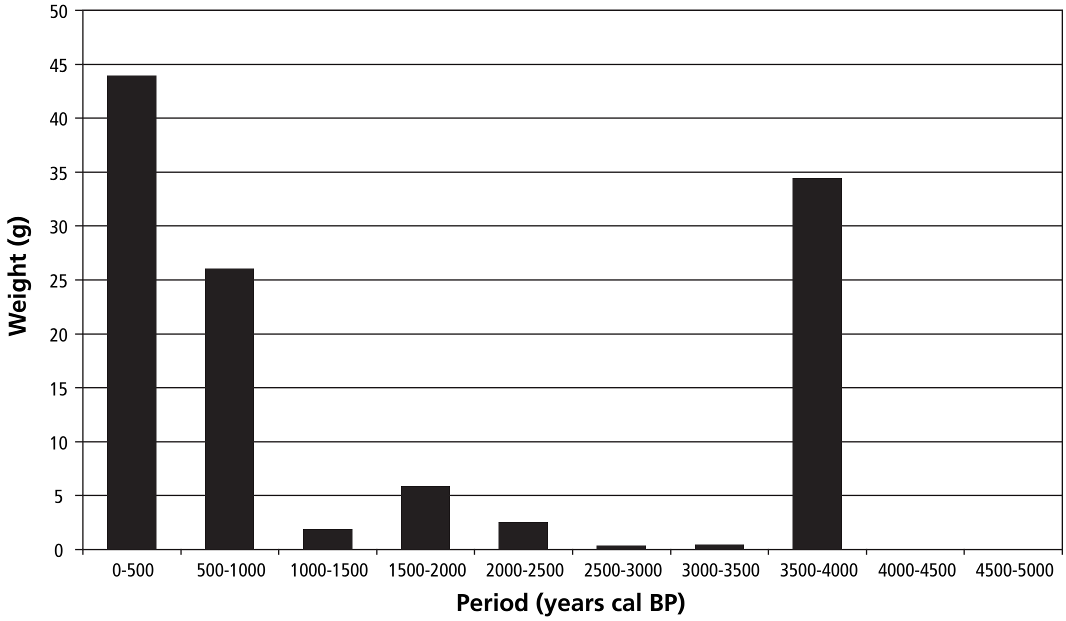

Figure 2. Total weight of fish bone recovered from all southern Curtis Coast sites per 500 year interval (Ulm 2004, in press).

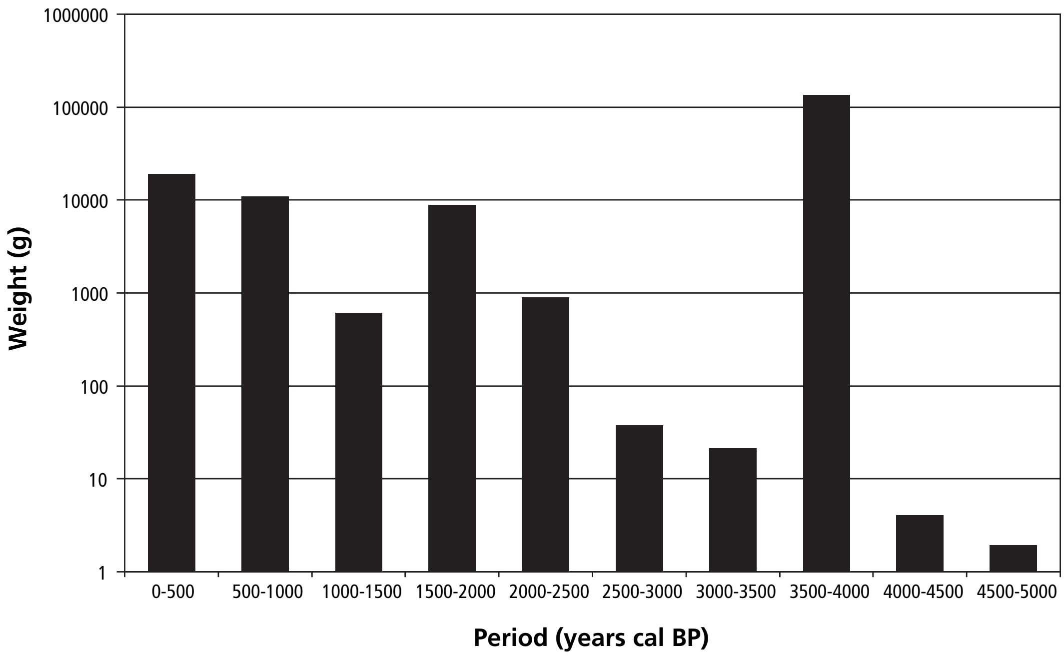

Figure 3. Total weight of shell recovered from all southern Curtis Coast sites per 500 year interval (Ulm 2004, in press). Note logarithmic scale on y axis.

Conclusions

Data from the Seven Mile Creek Mound, Mort Creek Site Complex and Eurimbula Site 1 demonstrate that a marine fishery was in place well before 2000 years ago in the northern section of the southeast Queensland bioregion. The findings from the southern Curtis Coast conform with patterns of continuous use of marine resource use demonstrated elsewhere and do not suggest that southeast Queensland was an anomaly (cf. Walters 1992b:35). There is strong evidence that fish resources have been an important component of food production strategies in coastal and riverine contexts since initial occupation of the continent (e.g. Allen *et al*. 1989; Balme 1995) with a range of studies confirming Pleistocene use of marine resources throughout Australia at sites which have always been in close proximity to the sea (e.g. Morse 1988; O'Connor 1999; Smith and Sharp 1993; Veth 1993). Early marine resource use, however, is poorly documented in most regions owing to a dearth of coastal sites dating from the early Holocene, many of which were presumably drowned by marine transgression.

The southern Curtis Coast fish bone data contribute to our understanding of the role of marine resource use in early post-transgressive marine-based economies in southeast Queensland. From around 5000 BP, and broadly coincident with the final stages of the last marine transgression, increasing numbers of open coastal sites are known, with dates of 4830±110 BP (Beta-33342) at New Brisbane Airport and 4350±220 BP (Beta-20799) at Hope Island in the Moreton Bay Region, 4780±80 BP (Beta-25512) at Teewah Beach 26 in the Great Sandy Region and 4274±94 BP (NZA-456) at Mazie Bay in the Keppel Islands (Ulm and Reid 2000). The first evidence for occupation on the southern Curtis Coast at the Seven Mile Creek Mound at 3780±60 BP (Wk-8327) conforms well with these findings, suggesting continuity rather than disjunction in patterns of coastal occupation.

As always, caution needs to be exercised in interpreting data from early periods of occupation owing to reduced 'archaeological visibility' of settlement-subsistence strategies 'with low-level seasonal visitation or occupation of regions with unstable and rapidly eroding land surfaces' (Mulvaney and Kamminga 1999:179). Dortch *et al*. (1984) have also pointed out that low intensity shellfish gathering (and fishing) is unlikely to be represented in the archaeological record owing to the low probability of small shell scatters being preserved (see also Smith 1999). First evidence for occupation of the region should not, therefore, necessarily be taken as indicating the antiquity of coastal settlement or use of the coast. Following the positions advanced by McNiven (1991), Hall and Hiscock (1988) and others, we argue that marine and estuarine resources would have always been an integral feature of broad-based Aboriginal coastal economies. Although access to coastal resources may have been difficult at periods of maximum sea-level fall, expanded river valleys across the continental shelf would have offered a range of resource zones, some perhaps with no modern correlates. After rising sea-levels breeched the continental rise and began to invade the continental shelf in the terminal Pleistocene/early Holocene there is no reason to suspect that coastal environments did not always provide a range of resources, which were exploited by people even if these resources were not identical to those available today.

Postscript

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