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1 **Meta-analysis of Queensland's coastal Indigenous fisheries: Examining the**
2 **archaeological evidence for geographic and temporal patterning**

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11

12 **Abstract**

13 Marine fisheries have been a critical part of Aboriginal and Torres Strait Islander people's
14 connection to land and sea country in Queensland, Australia for millennia. However, no
15 archaeological studies have examined regional variability in the role of fish within subsistence
16 regimes or the distribution of targeted fish species throughout the Holocene. We utilised a
17 meta-analysis approach to conduct the first comprehensive assessment of Indigenous fisheries
18 along the eastern Queensland coast. Data from 44 archaeological sites were grouped according
19 to marine bioregion to facilitate broad comparison between sites across the study area. These
20 sites were predominantly associated with mid-to-late Holocene occupation, and provided an
21 assemblage of 45,052 recovered fish bones, of which 6,606 were identified most commonly to
22 family-level. Results indicate clear geographic patterning in the ubiquity of fish species
23 captured, and for some marine bioregions an increase through time in the range of species
24 targeted. Archaeological data indicate mixed species fisheries, with a complex range of habitats
25 and diverse fish species harvested by people in relative proximity to the sites. These harvesting
26 decisions were mediated by local ecological knowledge, awareness of fish behaviour, and
27 cultural preference for certain species. These outcomes support existing models for the region,
28 which document a shift in subsistence regimes during the mid-to-late Holocene, particularly an
29 increased reliance on marine resources and expansion in diet breadth. Future research needs to
30 address geographic gaps in data availability and implement globally recognised
31 ichthyoarchaeological quantification and identification protocols to comprehensively examine

32 geographic and temporal variability in Queensland's Holocene Indigenous fisheries, and
33 contribute to regional models of long-term subsistence change.

34

35 **Keywords:** fisheries; ichthyoarchaeology; coastal foragers; meta-analysis; zooarchaeology;
36 Australia; Great Barrier Reef

37

38 **Highlights**

- 39 • Archaeological evidence of Queensland's Indigenous fisheries examined
- 40 • Ubiquity measures tracked commonly occurring fish species across space and time
- 41 • Multiple species from diverse habitats were targeted as part of mixed fisheries
- 42 • Some indications that range of targeted species increased throughout the Holocene
- 43 • Local ecological knowledge and cultural preference guided species selection

44

45 **1. Introduction**

46 The sea holds pivotal economic, social, cultural, and spiritual significance for Aboriginal and
47 Torres Strait Islander traditional owners of Queensland's coasts and islands. Oral histories,
48 documentary sources and archaeological evidence clearly demonstrate that over millennia,
49 coastal foraging and fishing were fundamental to lifeways across this region (e.g. Barker 1989;
50 Haddon 1912; Johannes and MacFarlane 1991; McNiven 2004; McNiven *et al.* 2006; Petrie
51 1904; Rowland 1982; Sharp 2002; Steele 1972; Ulm and Vale 2006; Weisler and McNiven
52 2016). Archaeological research along the eastern coast of Queensland, including the Torres
53 Strait Islands, has been intensive over the past 50 years, and in the case of southeast
54 Queensland, the region has been characterised as one of the most extensively investigated
55 coastal zones in Australia (Smith and McNiven 2019; Ulm and Hall 1996).

56 An increase in the establishment of new archaeological sites throughout the Holocene,
57 including offshore island colonisation and use, has been reported for the Queensland coast.
58 However, the majority of coastal site occupation sequences and evidence for increases in site
59 use post-date the mid-Holocene (e.g. Barker 2004; McNiven 1999; Ulm 2006; Walters 1989).
60 This broad regional trend in Queensland coastal Holocene occupation has been attributed to an
61 interplay between diverse social, cultural, environmental, and climatic factors operating at both
62 local and regional scales, such as population expansion, enhanced land-use activities, sea-level
63 stabilisation, increased predictability of marine resource communities, and the emergence of
64 marine specialist economies embedded in social-cultural connections to the coastal landscape
65 and seascape (e.g. Barker 2004; Beaton 1985; McNiven and Feldman 2003; Morwood 1987;
66 Ulm 2011; Walters 1992). The earliest direct dates for the exploitation of coastal resources in
67 this region are from the Whitsunday Islands on the central Great Barrier Reef, where oyster
68 (*Saccostrea* sp.) was dated to 7069-7366 cal BP (ANU-11381, 6700±60 BP) from Nara Inlet 1
69 and 6700-7150 cal BP (Beta-56976, 6440±90 BP) from Border Island 1 (Barker 2004; Lamb
70 and Barker 2001). It has been suggested that from the mid-to-late Holocene broad changes in
71 subsistence regimes occurred throughout this region, with more engagement with the marine
72 environment and an expansion in diet breadth, potentially driven by a shift to more generalised
73 shore-based foraging strategies (Barker 2004; David and Weisler 2006; McNiven 1999;
74 Morwood 1987; Ulm 2006; Ulm and Hall 1996; Walters 1989).

75 The role of stone-walled intertidal fishtrap construction in late Holocene cultural change has
76 been widely discussed (e.g. Lourandos 1997), however, dating the construction and use of these

77 structures has proven challenging, and generally achieved through dating adjacent deposits
78 (e.g. Bowen 1998; Ulm 2006). These structures serve important economic functions, but are
79 also key components of the cultural and social landscape (McNiven 2004). Rowland and Ulm
80 (2011) reported 159 coastal weir and fishtrap sites for Queensland. The distribution of these
81 sites along the east coast is variable, with fishtraps rare south of Mackay when compared to
82 higher densities to the north, particularly from Mackay to Cairns and the Torres Strait. Few
83 fishtraps sites have been recorded in southeast Queensland, but the greatest concentration is in
84 the Great Sandy Strait at Booral, a region afforded protection by Fraser Island. While it is
85 possible that recent development activities have impacted sites in this region, traps and weirs
86 appear to have been less frequently constructed in southeast Queensland (McNiven 1994;
87 Rowland and Ulm 2011).

88 Walters (1986, 1989, 1992) argued for the intensification of southeast Queensland Holocene
89 fisheries from ~3000 BP, as indicated archaeologically by increases in fish bone discard rates
90 and the number of sites with evidence of fish exploitation through time. Contrarily, Ulm (2002)
91 reported spatial and temporal variability in the discard of fish remains, indicating the available
92 evidence did not support a regionally uniform intensification of late Holocene southeast
93 Queensland fisheries. However, Ulm (2002) was specifically interested in discard rates and
94 presence/absence of fish remains, rather than variability in species selected and ecological
95 communities exploited across southeast Queensland throughout the Holocene.

96 The most comprehensive archaeological records of mid-to-late Holocene marine fisheries for
97 the entire east Queensland coast are currently from the western Torres Strait (Crouch *et al.*
98 2007; David *et al.* 2008; David and Weisler 2006; Ghaleb 1990; McNiven *et al.* 2006; McNiven
99 *et al.* 2008; McNiven *et al.* 2015; Weisler and McNiven 2016). Significantly, these fish bone
100 assemblages are unique when compared to other tropical Pacific archaeological sites, due to
101 high relative abundances of shark and ray remains, low taxonomic richness, and the small size
102 of captured fish and sharks (Weisler and McNiven 2016). However, the western Torres Strait
103 fishing evidence has yet to be considered in the wider context of Great Barrier Reef Indigenous
104 fisheries, which is largely due to an absence of comparative datasets throughout this region. A
105 similar trend is evident when examining the documentary sources of Queensland Indigenous
106 marine fisheries, whereby the most comprehensive ethnographic studies are from the Torres
107 Strait (e.g. Haddon 1912; Johannes and MacFarlane 1991), but with almost no equivalent
108 studies available to facilitate a broader regional examination. Most frequently historical

109 accounts of this region emphasised turtle and dugong hunting (e.g. Haddon 1912; Thomson
110 1934).

111 The importance of the marine landscape and seascape throughout the Holocene along the
112 Queensland coast is apparent, as was the increased interaction with and exploitation of diverse
113 marine resources (e.g. molluscs, fish, turtle, dugong, cetacean, etc.) by Aboriginal and Torres
114 Strait Islander peoples (e.g. Crouch *et al.* 2007; McNiven *et al.* 2015; Rowland 1982; Smith
115 and McNiven 2019; Ulm 2006; Walters 1992). Yet, large gaps in archaeological knowledge
116 along this vast coastline have hindered systematic consideration of the local and regional
117 factors driving variability in subsistence regimes across millennia. In recent years, a
118 comprehensive re-analysis of key coastal southeast Queensland sites was undertaken by Smith
119 (2016), with a strong focus on the molluscan records, to examine human behavioural variability
120 throughout the mid-to-late Holocene. Additionally, recent zooarchaeological analyses on sites
121 from the northern Great Barrier Reef have focused on mollusc assemblages (e.g. Aird 2014;
122 Ulm *et al.* in press; Wright 2018). With the exception of the Torres Strait Islands (e.g. Ghaleb
123 1988; Weisler and McNiven 2016), researchers working on Queensland coastal sites have
124 frequently reported low abundances of fish bone when compared to mollusc remains (e.g.
125 Barker 2004; Beaton 1985; McNiven 1990), a trend potentially driven by preservation,
126 recovery techniques or cultural activity, such as spatially separated discard of fish bone remains
127 (McNiven 1991; Ross and Tomkins 2011; Ulm 2002; Ulm and Vale 2006). Regional variability
128 in targeted finfish species exploited throughout the Holocene has not previously been
129 synthesised, nor has the broader role of finfish exploitation in subsistence regimes been
130 assessed in the context of the wider documented changes in coastal economies occurring during
131 the mid-to-late Holocene, such as the localisation of resource use and settlement (e.g. Ulm
132 2011).

133 In this paper, we adopt a meta-analysis approach, which has been employed widely in
134 archaeology to examine regional drivers of ecological, social, and cultural change, across a
135 range of proxies, including faunal records (Conolly *et al.* 2011), palaeoclimate (Macklin *et al.*
136 2015), demography (Armit *et al.* 2013), palaeopathology (Holloway *et al.* 2011), and
137 vegetation histories (Payne *et al.* 2013). In the case of zooarchaeology, meta-analyses facilitate
138 consideration of the broad-scale factors that have influenced resource availability, providing
139 an opportunity to explore geographic and temporal variability in resource exploitation (Gaastra
140 *et al.* 2019), and consider cultural practices and preferences that directly mediate resource
141 selection through time (McKechnie and Moss 2016; Nims and Butler 2019). Here we utilised

142 a meta-analysis approach to examine available fish bone evidence to assess the long-term role
143 of finfish exploitation on the Queensland coast, and specifically explore geographic and
144 temporal patterning of Holocene Indigenous fisheries across the region.

145 **2. Environmental Context**

146 Queensland's mainland coastline is some 6,900 km in length, and its 1955 islands contribute
147 an additional ~6,400 km of coastline. The eastern Queensland coastal region is
148 characteristically diverse in marine faunal distributions and habitat complexity.

149 **2.1. Queensland coastal palaeoenvironmental variability**

150 Coastal conditions were not consistent along the eastern Queensland coast throughout the
151 Holocene, which has been attributed to variation in the width of the continental shelf among
152 other local factors and their corresponding influence on sea level change across the region (e.g.
153 Hineyrosa *et al.* 2019; Lewis *et al.* 2013). Particularly, the magnitude of Queensland's mid-
154 Holocene sea level highstand and the timing of the successive fall to modern sea levels still
155 requires refinement (Chappell *et al.* 1982; Lewis *et al.* 2013; Lewis *et al.* 2015; Nakada and
156 Lambeck 1989; Sloss *et al.* 2018). Records predominantly from the Great Barrier Reef suggest
157 the occurrence of a drowning event during the early Holocene with more of the shelf flooded
158 and increased sediment flux all prior to the modern Holocene reef turn-on ~9,000 years ago
159 (Webster *et al.* 2018). Evidence for the eastern Queensland coast broadly indicates that sea
160 levels reached modern levels by ~8,000 years ago (Woodroffe 2009), then continued to rise,
161 reaching a +1.0 to 1.5 m highstand by the mid-Holocene, approximately 7,000 to 4000 years
162 ago, prior to falling to modern levels (e.g. Lewis *et al.* 2008; Perry and Smithers 2011).
163 However, whether this fall was stepped or smooth is unclear (e.g. Perry and Smithers 2011),
164 and regardless it was likely variable across the region. However, current estimations indicate a
165 sustained highstand did occur with a marked fall post-2000 cal BP across the region (Lewis *et*
166 *al.* 2008; Lewis *et al.* 2015; Woodroffe 2009).

167 **2.2. Characterising marine bioregions and associated biodiversity**

168 The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) provides a spatial
169 framework to classify Australia's marine environments, and facilitates regionally targeted
170 planning and management initiatives (Commonwealth of Australia 2006). Regionalisation
171 allows spatial patterning in the relationship between distributions of species and ecosystems to
172 be evaluated. The provincial bioregions utilised in this study reflect modern biogeographic

173 patterns in the distributions of demersal (or bottom-dwelling) fish, and by extension these
174 bioregions are assumed to reflect broader patterns in marine biodiversity in extant marine
175 environments (Heap *et al.* 2005; Last *et al.* 2005). There are 41 provincial bioregions in
176 Australia's waters. Provinces are regions of biotic endemism, and transitions are areas of
177 mixing, where overlap in species distributions between provinces occur. There are four
178 bioregions represented within the study area, one temperate bioregion, the Central Eastern
179 Shelf Transition (CEST), and three tropical bioregions, the Northeast Shelf Province (NESP),
180 Northeast Shelf Transition (NEST), and Cape Province (CP) (Figure 1).

181 The CEST bioregion is situated in southeast Queensland. The input of riverine sediments
182 occurs along the length of the coast in this region (e.g. Logan/Albert Rivers, Brisbane River,
183 and Mary River). Wave action and longshore drift have successively moved sand northwards
184 along the inner shelf, and continues to form Moreton and Fraser (K'gari) Islands (Department
185 of Environment 2007). Moreton Bay is one of the largest estuarine systems in Australia, its
186 waters extend from Caloundra to the southern tip of South Stradbroke Island, and this region
187 is associated with diverse biota and ecosystem complexity. For instance, extensive seagrass
188 beds provide important feeding habitats for turtles and dugongs, and mangrove forests offer
189 critical nursery habitats for juvenile fish (Dennison and Abal 1999; Morelli and Gasparon
190 2015). Intertidal sand and mudflats are expansive along the coastline of this region (e.g. Great
191 Sandy Strait, Hervey Bay, and Moreton Bay). Recreational fishers in this region most
192 commonly capture whiting (Sillaginidae) and yellowfin bream (*Acanthopagrus australis*)
193 (Webley *et al.* 2015). The total annual commercial finfish catch in Queensland over the past
194 five years has been between 8,000-9,000 tonnes and it is valued at ~\$65 million annually
195 (Heaven 2018). Key line and net commercial fisheries in this region include the Rocky Reef
196 Finfish Fishery, which primarily targets snapper (*Chrysophrys auratus*), and the East Coast
197 Inshore Finfish Fishery, Queensland's largest multispecies fishery; subtropical species are
198 normally captured in the southern extent of this fishery, such as mullet (Mugilidae), whiting,
199 and yellowfin bream (Heaven 2018).

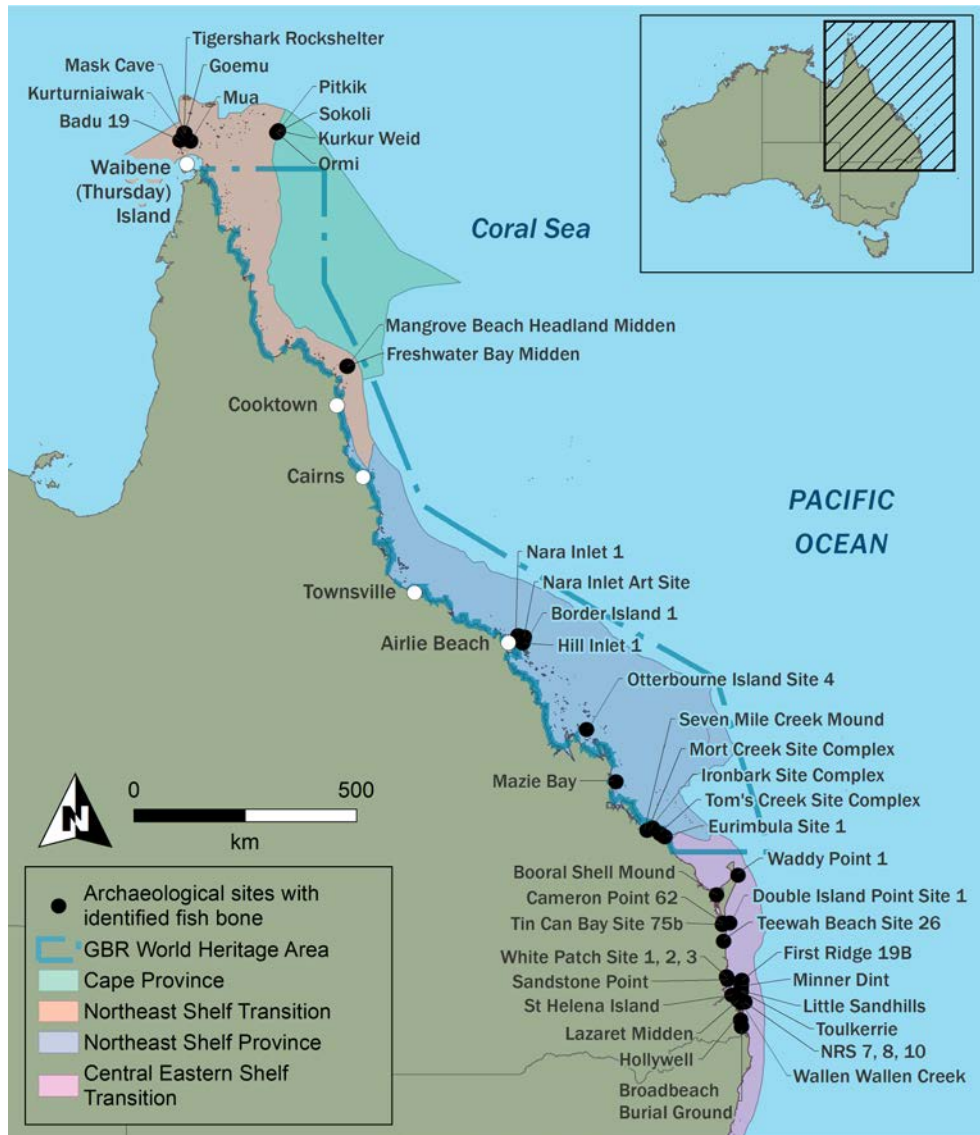
200 The NESP is broadly associated with the waters of the central and southern Great Barrier Reef
201 region, NEST, western Torres Strait Islands, CP, eastern Torres Strait Islands, and collectively
202 these marine bioregions are considered a tropical climatic zone. The surface waters of this
203 northeast Queensland region are associated with low primary productivity, and the shallow
204 waters are dominated by coral, which supports diverse faunal communities. Sediment inputs,
205 the frequency and intensity of tropical storms, and strength and distribution of currents

206 differentially impact the oceanography across these bioregions (Department of Environment
207 2007). The Great Barrier Reef World Heritage Area (GBRWHA), which extends from the tip
208 of Cape York in the north to Lady Elliot Island in the south, incorporates the Great Barrier Reef
209 Region and the Queensland internal waters and islands within its boundary. The 348,000 km²
210 region incorporates ~1050 islands, more than half of the islands in Queensland's waters (Great
211 Barrier Reef Marine Park Authority 2014). The marine ecosystem is unique and biologically
212 diverse, including ~3061 hard and soft coral species and sponges, 3000 mollusc species, 1625
213 bony fish species, and 136 species of sharks and rays; this biodiversity is an aspect of the
214 region's outstanding universal value (Lucas *et al.* 1997; Mapstone *et al.* 2008; Veron *et al.*
215 2009). Recreational fishers commonly capture mullet, whiting, coral trout (*Plectropomus* spp.
216 and *Variola* spp.), snapper (*Lutjanus* spp.), grass emperor (*Lethrinus laticaudis*), parrotfish
217 (Scaridae), and herring (Clupeidae) (Webley *et al.* 2015). The Torres Strait (NESP and CP
218 bioregions) connects Australia to Papua New Guinea, and is bordered on the east by the ribbon
219 reefs of the Great Barrier Reef. The 275 islands of the Torres Strait extend across 50,000 km².
220 The waters are generally shallow (<20 m), dominated by individual and patch reef complexes,
221 and the most extensive seagrass beds in the world (Coles *et al.* 2003; Harris *et al.* 2008;
222 Haywood *et al.* 2007). The marine ecosystems of this region have been characterised as some
223 of the healthiest documented globally, and are associated with sizeable populations of finfish,
224 dugong and turtle (Johnson *et al.* 2015). There are 326 coral reef associated fish species
225 documented in the Torres Strait, and these communities are considered to be more similar to
226 northern Great Barrier Reef populations than those from Papua New Guinea (Osborne *et al.*
227 2013). Recreational fishers in this region predominantly capture yellowtail scad (*Trachurus*
228 *novaezelandiae*), shark mackerel (*Grammatorcynus bicarinatus*), coral trout, pilchard
229 (Clupeidae), and trevally (Carangidae) (Webley *et al.* 2015).

230 There are diverse line and net commercial fisheries operating in Queensland's tropical waters
231 (approximately north of Fraser Island). The Coral Reef Finfish Fishery operates within the
232 waters of the GBRWHA and this line fishery predominantly targets common coral trout
233 (*Plectropomus leopardus*) and red throat emperor (*Lethrinus miniatus*) (Tobin *et al.* 2010). The
234 East Coast Spanish Mackerel Fishery targets the entire east Queensland coast, but the largest
235 effort annually is focused between the waters of Bowen and Ingham, given this region provides
236 important spawning habitats for Spanish mackerel (*Scomberomorus commerson*). The East
237 Coast Inshore Finfish Fishery operates within all east coast waters, but predominantly captures
238 tropical species from northern Queensland waters, including barramundi (*Lates calcarifer*),

239 blacktip shark (*Carcharhinus limbatus*), and grey mackerel (*Scomberomorus semifasciatus*)
 240 (Heaven 2018).

241



242

243

244 Figure 1: Map of Australia, showing the location of Queensland, with all island and coastal
 245 archaeological sites with fish bone reported and identified labelled. The dotted line shows the
 246 extent of the Great Barrier Reef World Heritage Area and the shaded areas are the IMCRA 4.0:
 247 Provincial Bioregions established by Commonwealth of Australia (2006). Spatial data: Great
 248 Barrier Reef Marine Park Authority (2012) and Natural Earth.

249

250 **3. Methods**

251 *3.1. Establishing a database of available ichthyoarchaeological evidence*

252 A database was compiled of all fish bone identifications from Queensland island and coastal
253 archaeological sites. The study area included the New South Wales/Queensland border and
254 extended north to Torres Strait (Figure 1). All available literature was examined for relevant
255 data including published books, edited volumes, journal articles, and unpublished consultancy
256 reports and theses. Few consultancy reports were available for use, and it is assumed this data
257 source is underrepresented in the study. The database records key site information, excavation
258 methods, radiocarbon determinations, zooarchaeological analytical protocols, and fish bone
259 identification and quantification data. Each site was also grouped according to the four marine
260 bioregions represented within the study area (Figure 1).

261 Taphonomy, volume/area excavated, mesh size, sample size recovered, and fish bone
262 identification protocols are all factors that can influence the comparability of sites across a
263 region (Lambrides and Weisler 2016; Nims and Butler 2019). The data compiled for this study
264 revealed many inconsistencies in recovery and analytical approaches between investigators.
265 The majority of studies did conduct some fine mesh screening (≤ 3 mm), however, it was
266 frequently unclear whether the fine meshed samples were analysed (Supplementary Table 1).
267 There was inconsistent reporting of the range of fish bone elements considered for
268 identification, and when this data was reported, the majority of analysts considered only a
269 limited selection of elements, such as cranials (i.e. most commonly dentaries and premaxillae),
270 teeth and otoliths, which is not consistent with current zooarchaeological standards (e.g. Allen
271 2017; Bouffandeau *et al.* 2019; Giovas 2016; Lambrides and Weisler 2015; McKechnie *et al.*
272 2014). For some sites an expanded range of elements was analysed, such as vertebrae and
273 additional cranial elements, including the hyomandibular, posttemporal, and supraoccipital
274 (e.g. Ulm and Vale 2006; Vale 2002, 2004; Walters 1979, 1986; Weisler and McNiven 2016).
275 The majority of analysts completed taxonomic identifications without access to extensive
276 reference collections, but there are key exceptions, such as the majority of western Torres Strait
277 archaeological sites (Weisler and McNiven 2016). Additionally, most analysts did not describe
278 the quality of the reference collection or provide basic overview data to characterise its
279 suitability and facilitate data quality assessments (e.g. number of specimens, capture
280 techniques, range of species present, key gaps, etc.). There was also inconsistent reporting of
281 quantification protocols and raw bone counts, necessary for inferring identification rates. Some

282 studies reported only minimum number of individuals (MNI) values with limited justification
283 of how these values were derived (Barker 2004; Bowen 1989; Hall and Bowen 1989; Hermes
284 1984).

285 The cited above examples of inconsistent reporting of key primary data (e.g. mesh size, volume
286 excavated, sampling procedures, identification, and quantification protocols, etc.) from sites
287 across the study area made it challenging to directly test the influence of analytical decisions
288 on taxonomic identification, and more broadly their effects on conducting a regional meta-
289 analysis of Holocene Queensland Indigenous fisheries. This is critical given previous
290 zooarchaeological meta-analyses have demonstrated that analytical decisions can
291 systematically bias outcomes and should be directly accounted for prior to formal modelling
292 (e.g. Orton *et al.* 2016). As the primary data were not consistently available for all sites, no
293 data cleaning or directives for site exclusion from the meta-analysis could be applied, and all
294 available fish bone evidence from the study area was included where possible. Furthermore,
295 the decision was made to utilise ubiquity measures and exploratory data analyses, rather than
296 adopt formal modelling approaches that rely on relative taxonomic abundance (i.e. NISP and
297 MNI). For these reasons, the outcomes of the following meta-analysis are considered to be
298 coarse-grained, with results intended to highlight broad scale trends in geographic and temporal
299 patterning of Indigenous fisheries across the region, which should usefully inform future
300 research directives (e.g. Koricheva and Gurevitch 2014).

301 ***3.2. Ubiquity measures and taxonomic representation***

302 Ubiquity was the only measure of taxonomic abundance utilised to explore patterning in this
303 regional dataset. Ubiquity measures presence and absence of a species in any given context
304 (e.g. stratigraphic units, sites, regions, etc.), which is displayed as a percentage of the total
305 number of contexts in which the species was identified (e.g. Lambrides *et al.* 2018; McKechnie
306 and Moss 2016; Weisler *et al.* 2016). Ubiquity measures are less influenced by individual bone
307 counts and do not rely on the relative proportion of other species (Lyman 2008), which are
308 particularly impacted by variability in sampling, identification and quantification procedures
309 between contexts. For this reason relative abundance measures including number of identified
310 specimens (NISP) and MNI were not evaluated in this study. Following McKechnie and Moss
311 (2016), we consider ubiquity to be a measure of the regularity any given species is used or
312 present across the study area. Ubiquity values are useful for examining local and regional

313 patterning in species use, as well as temporal continuity or discontinuity in the exploitation of
314 a taxon.

315 Ubiquity values are still influenced by sample size and analytical procedures. Well sampled
316 and comprehensively analysed fish bone assemblages would predictably be associated with
317 more representative ubiquity values (i.e., identification of rare species), and in the opposite
318 case, only the most common species are likely to be identified (McKechnie and Moss 2016).
319 A Spearman's correlation coefficient (r_s) was calculated to test whether NISP was correlated
320 with NTAXA (number of taxa identified) across all sites and verify whether sample size was
321 driving NTAXA estimations. Toulkerrie (1989), Border Island 1, Hill Inlet 1, Mazie Bay, and
322 Nara Inlet 1 were excluded from this test as only MNI values were reported for these sites
323 (Supplementary Table 1). A correlation between NISP and NTAXA was reported ($r_s = 0.79$, p
324 $= <0.001$). Further examination of this trend suggests that on average NTAXA is very low at
325 ~ 4.0 across all sites. In addition, the sites in the lowest 20th percentile—determined using
326 NISP—have a lower than average NTAXA of 1.0, and the sites in the 80th or higher percentile
327 range have a larger than average NTAXA of ~ 8.0 . When each archaeological site is grouped
328 according to the four IMCRA Provincial Bioregions (CEST, NESP, NEST, and CP)
329 represented in the study area, it is apparent that each bioregion is associated with a relatively
330 even distribution of both small and large assemblages. As such, we concur with McKechnie
331 and Moss (2016) and argue that given ubiquity tracks the most regularly occurring taxa, even
332 for those assemblages with comparatively low sample size, the most common taxa should still
333 be represented in these cases. Therefore, ubiquity measures are particularly useful in this study
334 to facilitate broad comparison between sites distributed across each bioregion.

335 ***3.3. Examining geographic and temporal patterning in taxonomic ubiquity***

336 The evaluation of geographic and temporal patterning in taxonomic ubiquity follows methods
337 established by McKechnie and Moss (2016) for a meta-analysis of Indigenous fisheries of the
338 northwest coast of North America. NTAXA values were used to examine geographic and
339 temporal variability in Holocene Queensland Indigenous fisheries to provide a conservative
340 approximation of taxonomic richness at each site. The use of NTAXA in this case was intended
341 to account for inter-analyst variability in analytical protocols and also instances of potential
342 over-identification given comprehensive reference collections were not consistently available.
343 All fish bone identifications allocated a cf. or uncertain taxonomic designation were collapsed

344 to the highest certain taxonomic rank, however, uncertain identifications at the family level or
345 above were excluded from analysis and reassigned to ‘unidentified fish bone’.

346 Geographic variability was tested by grouping archaeological sites according to IMCRA
347 Provincial Bioregions (Figure 1) to characterise broad differences in species selection along
348 the eastern Queensland coast. Due to inconsistent availability of radiocarbon dates between
349 sites, temporal patterning could only be examined across 500 year intervals, whereby broad
350 scale changes in fisheries exploitation were examined for each bioregion. A number of sites
351 and excavation units were excluded from consideration of temporal variability. Specifically,
352 11 sites were excluded entirely from consideration of temporal variability, however 75% of
353 sites identified within the study area were suitable for analysis. For some sites, no dates were
354 directly associated with the identified fish bone remains – Broadbeach Burial Ground (Square
355 P53), Hollywell (Square 3B), NRS 7, NRS 8, NRS 10, Sandstone Point (Squares 31F and 50F),
356 White Patch Site 1, and White Patch Site 2. At other sites the vertical distribution of fish bones
357 (e.g. XUs and/or XU depths) into 500 year temporal units was compromised by either
358 insufficient reporting or chrono-stratigraphic complexities (Border Island, Goemu (1985), Hill
359 Inlet, Mask Cave, Nara Inlet 1, Nara Inlet Art Site, and Wallen Wallen Creek). Correspondence
360 analysis (CA) was used to test similarity and dissimilarity in faunal composition using ubiquity
361 data aggregated by NTAXA. This broad scale exploratory data analysis is useful for examining
362 whether a taxon is more associated with a particular bioregion and how this may change
363 through time. CA was conducted to explore associations between taxonomic composition and
364 (a) IMCRA Provincial Bioregions (geographic patterning), and (b) 500 year temporal units
365 within IMCRA Provincial Bioregions (temporal variability). This approach was adopted to
366 identify geographic gaps in the archaeological knowledge for the study area, as well as
367 highlight preliminary local and regional trends in the Indigenous fisheries literature that will
368 require further examination.

369 **4. Results**

370 The study area is represented by 44 archaeological sites associated with the recovery and
371 taxonomic identification of fish remains. The majority of sites have mid-to-late Holocene
372 occupation sequences (Supplementary Table 2). These sites excavated over the past 50 years
373 provide a dataset of 45,052 recovered fish bones, and of these, 14.3% have been identified to
374 family, genus or species by 19 different analysts, and as such, the NISP of 6,606 was the
375 complete dataset examined for this study. It should be noted that total fish bone counts and

376 NISP values were not consistently reported in the literature, nor were identifications
377 systematically completed for all sites, as in the case of the Lazaret Midden and eastern Torres
378 Strait sites where the fish bone assemblages were sub-sampled for analysis, and this is expected
379 to have influenced counts of recovered and identified fish bone remains (Supplementary Table
380 1). This study sourced data from grey literature where available, including unpublished theses
381 (42.9%) and consultancy reports (9.5%), and peer-reviewed literature, such as books, edited
382 volumes and journal articles (47.6%).

383 Across all sites, the reported NTAXA was 31, and when grouped by bioregion, lower NTAXA
384 values were associated with each bioregion (CEST=20, NESP=15, NEST=15, and CP=6),
385 demonstrating the variability in the range of taxa represented at archaeological sites grouped
386 within each bioregion (Table 1). Sparids and sillaginids are the most ubiquitous taxa across the
387 study area, and are represented at approximately half of the sampled sites (Figure 2). An
388 additional five taxa—labrids, mugilids, scarids, elasmobranchs, and lethrinids—were present
389 at ~20% of sites within the study area.

390

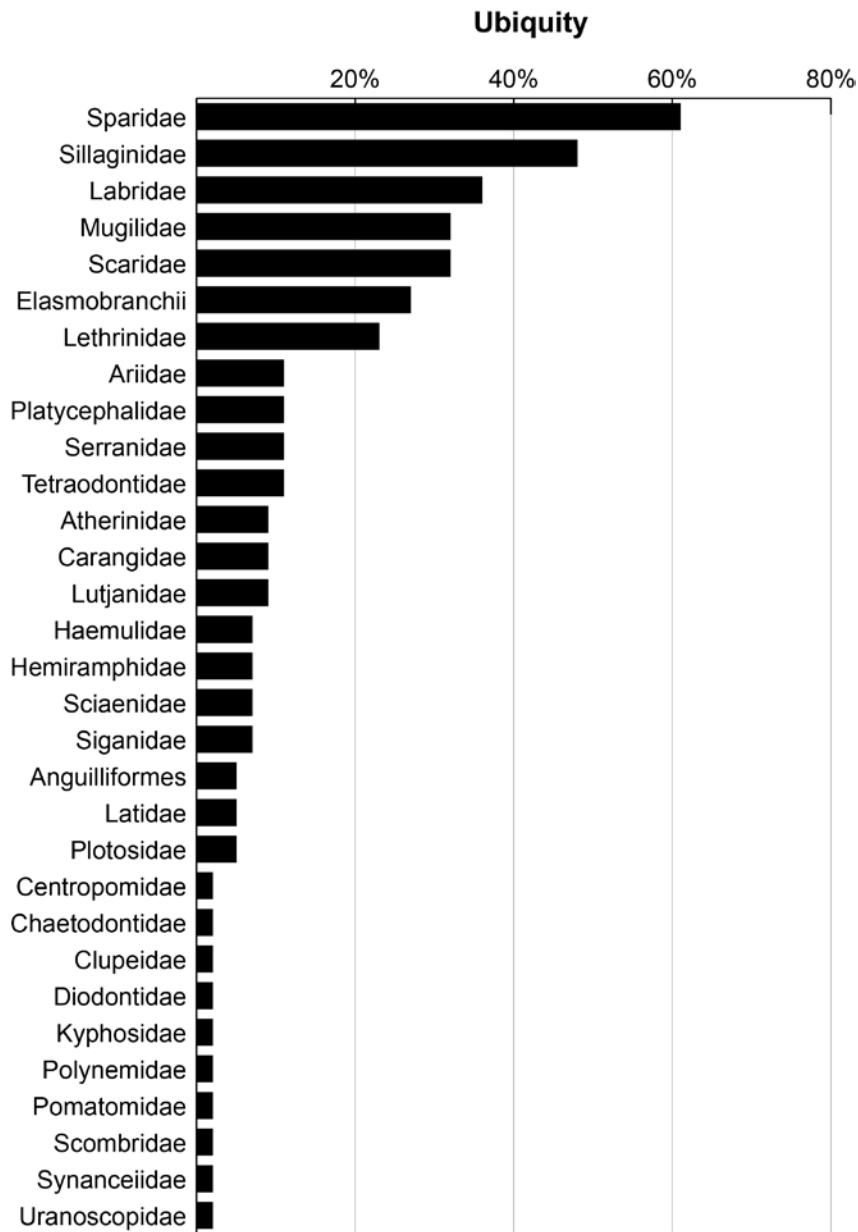
391 Table 1: Ubiquity values for fish identified from all island and coastal sites in Queensland
 392 within the study area. Sites are grouped by IMCRA 4.0: Provincial Bioregions established by
 393 the Commonwealth of Australia (2006) and fish identifications were aggregated by mutually
 394 exclusive categories (NTAXA). Taxa that are associated with greater than 20% of sites are
 395 shaded grey.

396

Taxon	Common name	All sites n = 44 (%)	Central Eastern Shelf Transition n = 21 (%)	Northeast Shelf Province n = 11 (%)	Northeast Shelf Transition n = 8 (%)	Cape Province n = 4 (%)
Sparidae	Breams	61	81	82	13	-
Sillaginidae	Whiting	48	67	64	-	-
Labridae	Wrasses	36	5	45	75	100
Mugilidae	Mulletts	32	43	27	25	-
Scaridae	Parrotfishes	32	-	36	100	50
Elasmobranchii	Sharks, Skates and Rays	27	5	9	100	25
Lethrinidae	Emperors	23	-	36	50	50
Ariidae	Catfish	11	19	9	-	-
Platycephalidae	Flatheads	11	10	27	-	-
Serranidae	Groupers	11	-	9	50	-
Tetraodontidae	Pufferfish	11	-	-	63	-
Atherinidae	Hardyheads	9	10	18	-	-
Carangidae	Jacks	9	-	-	38	25
Lutjanidae	Snappers	9	-	18	25	-
Haemulidae	Grunts	7	5	9	13	-
Hemiramphidae	Halfbeaks	7	14	-	-	-
Sciaenidae	Drums	7	14	-	-	-
Siganidae	Rabbitfish	7	14	-	-	-
Anguilliformes	True Eels	5	-	9	13	-
Latidae	Barramundi	5	5	9	-	-
Plotosidae	Eeltail Catfish	5	10	-	-	-
Centropomidae	Snooks	2	-	-	13	-
Chaetodontidae	Butterflyfishes	2	-	-	13	-
Clupeidae	Herring	2	5	-	-	-
Diodontidae	Porcupinefish	2	-	-	13	-
Kyphosidae	Sea Chubs	2	5	-	-	-
Polynemidae	Threadfins	2	5	-	-	-
Pomatomidae	Tailor	2	5	-	-	-
Scombridae	Mackerel, tuna and bonito	2	-	-	-	25
Synanceiidae	Stonefishes	2	5	-	-	-
Uranoscopidae	Stargazers	2	5	-	-	-

397

398



399

400

401 Figure 2: Ubiquity values of all fish identified from island and coastal sites ($n = 44$) in
 402 Queensland within the study area. Fish identifications were aggregated by mutually exclusive
 403 categories (NTAXA).

404

405 ***4.1. Geographic patterning in taxonomic ubiquity***

406 Figure 3a presents the correspondence analysis of taxonomic ubiquity across bioregions, with
 407 all data grouped to broadly characterise geographic variability in species selection. Axis 1
 408 accounts for 63.7% of variance and axis 2 accounts for 22.7%. Axis 1 discriminates between

409 IMCRA Provincial Bioregions; positive axis 1 scores are associated with the CEST (a
410 temperate bioregion) and the NESP (a tropical bioregion). Given the Curtis Coast sites are
411 situated near estuarine habitats and represent 45% of the sites for the NESP bioregion, this
412 likely accounts for the higher than expected taxonomic similarity between sites grouped in the
413 CEST and NESP. Negative axis 1 scores are associated with the NEST and CP, both tropical
414 bioregions, and are characterised by waters that tend to be dominated by coral. Accordingly,
415 axis 1 scores are positively loaded by estuarine and inshore coastal species (e.g. sparids,
416 sillaginids, and ariids), and negatively loaded by reef dwelling species (e.g. scarids,
417 elasmobranchs, lutjanids, and serranids). Together the NEST and CP bioregions are the most
418 distinct in terms of unique taxonomic categories from the CEST bioregion. Specifically, there
419 are four families that only occur at sites within the NEST (Chaetodontidae, Centropomidae,
420 Diodontidae, and Tetraodontidae), one family within the CP (Scombridae), and ten families
421 unique to sites within the CEST (Clupeidae, Hemiramphidae, Kyphosidae, Plotosidae,
422 Polynemidae, Pomatomidae, Sciaenidae, Siganidae, Synanceiidae, and Uranoscopidae).

423 *4.2. Temporal variability in taxonomic ubiquity*

424 Figures 3b-d present the correspondence analyses on temporal variability in taxonomic
425 ubiquity for each bioregion. Variability was assessed across 500 year temporal periods due to
426 the uneven representation of radiocarbon dates for each site across the study area. Hence, a
427 high-resolution consideration of change through time was not feasible. In terms of sample size,
428 the most detailed records available are for the last ~2000 years, and accordingly the majority
429 of fish bone taxonomic identifications are associated with the late Holocene. There were
430 insufficient records available for the Cape Province bioregion to consider temporal variability,
431 and the sites grouped within this bioregion were excluded from analysis.

432 *4.2.1. Central Eastern Shelf Transition*

433 Axis 1 accounts for 43.1% of the variance and axis 2 accounts for 17.7% (Figure 3b). Positive
434 axis 1 scores are associated with temporal units that post-date 2000 cal BP (0-2000 cal BP),
435 and are characterised by more taxonomic categories, when compared to negative axis 1 scores,
436 which are associated with temporal units that pre-date 2000 cal BP (2000-3500 cal BP), and
437 are associated with only three families (ariids, sciaenids, and sparids). In terms of variability in
438 the representation of distinct taxa through time, five families only occur in 0-500 cal BP
439 deposits (Clupeidae, Kyphosidae, Labridae, Platycephalidae, and Uranoscopidae), one family

440 500-1000 cal BP (Polynemidae), and two families were unique to 1500-2000 cal BP deposits
441 (Latidae and Synanceiidae).

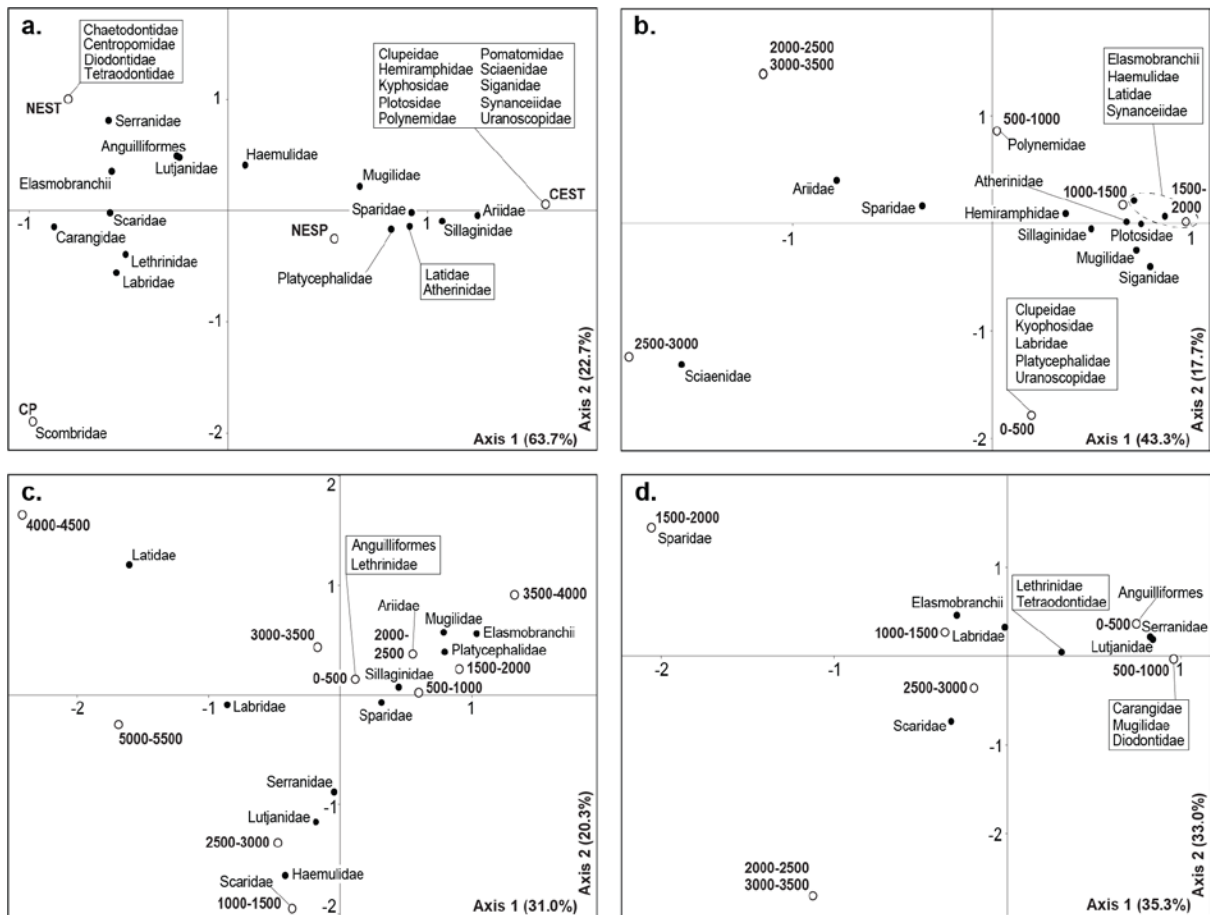
442 *4.2.2. Northeast Shelf Province*

443 Axis 1 accounts for 31.0% of the variance and axis 2 accounts for 20.3% (Figure 3c), which
444 suggests limited association of axis 1 scores with temporal units. The majority of taxonomic
445 categories are associated with all temporal units, particularly labrids, sillaginids, and sparids,
446 which are reported from sites across the majority of temporal units (0-5500 cal BP). Two
447 distinct taxonomic categories are associated with 0-500 cal BP deposits (Anguilliformes and
448 Lethrinidae), and one family was unique to 1000-1500 cal BP (Scaridae) and 2000-2500 cal
449 BP (Ariidae) deposits.

450 *4.2.3. Northeast Shelf Transition*

451 Axis 1 accounts for 35.3% of the variance and axis 2 accounts for 33.0% (Figure 3d). Negative
452 axis 1 scores are associated with temporal units that pre-date 1000 cal BP (1000-3500 cal BP,
453 and are strongly associated with three taxonomic categories (elasmobranchs, scarids, and
454 sparids). Positive axis 1 scores are associated with temporal units that post-date 1000 cal BP
455 (0-1000 cal BP), and are characterised by the majority of taxonomic categories. Distinct taxa
456 were associated with some temporal units, including 0-500 cal BP (Anguilliformes), 500-1000
457 cal BP (Carangidae, Diodontidae, and Mugilidae), and 1500-2000 cal BP (Sparidae) deposits.

458



459

460

461 Figure 3: Correspondence analysis of taxonomic ubiquity. (a) geographic patterning between
 462 IMCRA Provincial Bioregions, and temporal variability across 500 year temporal units for the
 463 (b) Central Eastern Shelf Transition (CEST), (c) Northeast Shelf Province (NESP), and (d)
 464 Northeast Shelf Transition (NEST). Temporal variability for Cape Province (CP) was not
 465 considered due to low sample size.

466

467 5. Discussion

468 The east Queensland coast is an expansive region and throughout the Holocene was associated
 469 with significant cultural and ecological variability (e.g. Barker 2004; Smith and McNiven
 470 2019; Ulm 2011), and this study aimed to synthesise the available archaeological evidence for
 471 Holocene Indigenous fisheries across this region. The majority of sites in the study area have
 472 mid-to-late Holocene occupation sequences, and the most detailed records of finfish
 473 exploitation currently available are for the late Holocene. Given the acknowledged limitations
 474 of the dataset, ubiquity rather than taxonomic abundance was considered the most meaningful

475 measure for assessing the regularity any given species was used or present across the study
476 area, and for examining coarse-grained geographic and temporal patterning within and across
477 the designated marine bioregions (CEST, NESP, NEST, and CP). Broadly, results indicate that
478 multiple species were targeted across Queensland by Aboriginal and Torres Strait Islander
479 peoples during the late Holocene as part of mixed fisheries, in contrast with single species
480 fisheries that have been documented in other global settings (e.g. Orton *et al.* 2014). This result
481 importantly indicates that Queensland Indigenous peoples interacted with a complex range of
482 marine and estuarine habitats, and developed locally and regionally diverse subsistence
483 regimes.

484 Clear geographic variability was documented across marine bioregions, with no single fish
485 species associated with the majority of sites in the study area. This variability in targeted
486 species was pronounced between the temperate (CEST) and tropical (NESP, NEST, and CP)
487 zones, and is likely a result of habitat variability and the associated range of species available
488 for acquisition. However, there are some commonalities in the distribution of species; for
489 instance sparids, sillaginids, labrids, mugilids, and scarids are associated with >30% of sites
490 across the study area. These trends are largely driven by sites situated in the CEST bioregion,
491 which account for almost 50% of all sites within the study area, but the majority of the fish
492 bone analyses were completed pre-2000 (e.g. Frankland 1990; Walters 1986), and analytical
493 methods have since developed. Overall, results indicate that people were exploiting the marine
494 and estuarine habitats in relative proximity to the occupation sites and targeting readily
495 available fish species, such as sillaginids and sparids from more temperate and inshore waters
496 of southeast Queensland, and further north, labrids and scarids, where more tropical reef
497 dwelling species occur. While local ecology will influence the range of species available for
498 exploitation, cultural practice and preference also importantly determine resource selection
499 (Barber 2004; Jones 2009; Leach and Davidson 2000; McKechnie and Moss 2016; Speller *et*
500 *al.* 2005). In the western Torres Strait, one of the few regions in the study area where sufficient
501 evidence is available, indications suggest cultural preference was a critical factor in mediating
502 resource selection (Weisler and McNiven 2016). Western Torres Strait fisheries are unique
503 within a tropical Pacific context; specifically, the archaeological record indicates low fish
504 species richness, small exploited fish size, and a dominance of sharks and rays (e.g. Crouch *et*
505 *al.* 2007; David *et al.* 2008; McNiven *et al.* 2006; Weisler and McNiven 2016). Ethnographic
506 and archaeological evidence suggests western Torres Strait fish catch composition relates to
507 both cultural dictates and the overall role of fish within subsistence regimes, given the

508 preference for dugong and turtle hunting due to the associated social, spiritual and ritual
509 significance (e.g. Ghaleb 1990; Haddon 1912; Johannes and MacFarlane 1991; McNiven and
510 Bedingfield 2008).

511 Temporal variability in taxonomic ubiquity was considered across bioregions and some
512 changes in the acquisition of species through time were documented by this study. The CEST
513 and NEST bioregions, situated at the southern and northern extents of the study area
514 respectively, provided the most comprehensive fish bone records by which to consider
515 temporal variability. Broadly, there is evidence for an increase in the range of fish species
516 exploited through time (CEST and NEST bioregions). However, to what extent this is a
517 reflection of changes in resource selection or a product of taphonomy, given identification rate
518 is higher for the more recently deposited assemblages, requires further examination such as
519 targeted taphonomic studies. These preliminary outcomes do support existing models for the
520 region that document a shift in subsistence regimes during the mid-to-late Holocene,
521 specifically an expansion in diet breadth, potentially related to the adoption of more generalised
522 shore-based foraging strategies (e.g. Barker 2004; McNiven 1999; Ulm 2011; Ulm and Hall
523 1996; Walters 1989).

524 In the case of southeast Queensland (CEST bioregion), Walters (1986) argued that an
525 intensification of fisheries in this region occurred from ~3000 BP, as supported by increases
526 through time in fish bone discard rates and the number of sites with evidence of fish bone
527 discard. Conversely, Ulm's (2002) review of the available fish bone evidence documented
528 regional variability in fish bone discard rates, rather than a uniform late Holocene
529 intensification. Alterations through time in fish species acquisition across southeast
530 Queensland had not previously been considered, and the results of this preliminary study
531 suggest an increase in diet breadth or range of fish species targeted throughout the late
532 Holocene. These outcomes do highlight a research avenue that requires further analysis,
533 particularly the local and regional drivers for this previously unreported increase in the range
534 of fish species targeted across southeast Queensland over the past ~3500 years. A combination
535 of reanalysing existing fish bone collections and renewed excavation and recovery efforts will
536 provide additional datasets necessary for assessing the long-term dynamics of Indigenous
537 fisheries in this region.

538 This meta-analysis of Holocene Aboriginal and Torres Strait Islander finfish exploitation along
539 the east Queensland coast has demonstrated that the available sample of identified

540 archaeological fish bone remains is limited. The region is associated with ~13,000 km of
541 expansive coastline, but there are only 6,606 fish bone identifications (an average of only one
542 identified fish bone for every 2 km of coastline) available to examine local and regional
543 variability in fisheries. Comparability between sites in the study area is hindered by a
544 combination of factors, such as variability in analytical techniques, sampling protocols, and
545 inconsistency in the quality and availability of comparative reference collections over the past
546 50 years. However, it is the inconsistent reporting of this primary data (e.g. mesh size, volume
547 excavated, sampling procedures, identification, and quantification protocols, etc.) that limits
548 our ability to directly test the effects of sampling and analytical decision-making on taxonomic
549 identifications (Nims and Butler 2019).

550 Due to the uneven representation of sites across the study area, variable fish bone assemblage
551 size between sites, and the non-uniform reporting of primary data by analysts, this study was
552 principally concerned with tracking variability in the occurrence of the most commonly
553 targeted species across space and time, to report broad changes in subsistence regimes and
554 directives for future research. The most comprehensive datasets currently available from the
555 study region are southeast Queensland and western Torres Strait, however, unquestionably the
556 Torres Strait records provide an unparalleled record of Queensland Indigenous fisheries (e.g.
557 Weisler and McNiven 2016). There are currently significant geographic gaps in our knowledge
558 of Holocene Indigenous fisheries throughout the islands of the Great Barrier Reef and the
559 coastline of central Queensland. Given the majority of research detailed in this study was
560 conducted 20+ years ago, where possible, reanalysis of these fish bone assemblages would
561 produce renewed insights into the fisheries of this region.

562 **6. Conclusion**

563 This study documented local and regional variability in the fish species captured by Aboriginal
564 and Torres Strait Islander peoples along Queensland's east coast throughout the Holocene.
565 Results demonstrate that these were mixed fisheries, where diverse fish species and a complex
566 range of marine and estuarine habitats were exploited, likely in accordance with local
567 ecological knowledge, understandings of fish behaviour and seasonality, and cultural
568 preference for certain species. However, available archaeological records of Indigenous
569 fisheries are geographically patchy and heavily weighted towards the late Holocene, which
570 restricts our ability to disentangle these complex human-environmental interactions, as well as
571 peoples changing connections with the marine landscape and seascape over millennia. The

572 potential of meta-analyses for discerning temporal and geographic patterning in Queensland's
573 Indigenous fisheries has been established by this study. Future research will aim to target the
574 islands of the Great Barrier Reef, implement fine mesh screening, and globally recognised
575 ichthyoarchaeological quantification and identification protocols. This approach will enhance
576 our ability to build local and regional models of long-term subsistence change along
577 Queensland's east coast, and importantly discern the economic and cultural role of fish and
578 fishing practices at diverse spatial and temporal scales.

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854

855 **Supplementary material**

856 Supplementary Table 1: Summary of available archaeological fish bone evidence from all island and coastal sites ($n = 44$) in Queensland within
 857 the study area. Note — total recovered fish bone calculation method: For sites where total bone count was provided, this number was used. For
 858 sites where only NISP was provided, this number was used. For each site, NISP *or* total bone count was summed to find the total number of bones
 859 recovered for the study area.

Bioregion ^a	Site	Area excavated ^b (m ²)	Volume excavated ^b (m ³)	Mesh size (mm)	Total bones	NISP ^c	% identified	NTAXA	Reference
<i>Central Eastern Shelf Transition</i>									
	Booral Shell Mound	0.25	0.34	5 & 2	1470	47	3.2	8	Frankland 1990
	Broadbeach Burial Ground	228	-	-	-	6	-	1	Bartholomai 1976
	Cameron Point 62	0.5	0.26	3	2	2	100	1	McNiven 1990; Smith 2016
	Double Island Point 1	13.21	2.10	3	-	4	-	1	McNiven 1990
	First Ridge 19B	0.25	0.50	6 & 3	-	1	-	1	Robins 1983
	Hollywell	1.50	0.75	6 & 3	56	50	89.2	4	Robins <i>et al.</i> 2005
	Lazaret Midden	0.75	0.38	6, 3 & 1	572	2	0.3	1	Ross and Tomkins 2011
	Little Sandhills	90	4.50	6 & 3	-	18	-	3	Robins 1983
	Minner Dint	2	2.80	6 & 3	-	33	-	4	Walters 1979
	NRS 7	0.75	0.38	3	126	37	29.4	4	Neal 1984; Walters 1986
	NRS 8	1	0.13	3	61	27	44.3	2	Neal 1984; Walters 1986
	NRS 10	0.25	0.17	3	87	25	28.7	5	Neal 1984; Walters 1986
	Sandstone Point (1972)	5	2.50	-	-	57	-	4	Crooks 1982; Haglund 1974
	Sandstone Point (1984)	0.5	0.60	3	906	166	18.3	7	Walters 1986
	Sandstone Point (1985)	1	0.50	3	1871	762	40.7	10	Nolan 1986

	St Helena Island	0.25	0.13	2	576	177	30.7	7	Alfredson 1984; Walters 1986
	Teewah Beach Site 26	2.25	6.21	3	-	4	-	1	McNiven 1990
	Tin Can Bay Site 75b	0.5	0.46	3	5	1	20	1	McNiven 1990; Smith 2016
	Toulkerrie (1978)	5.5	7.18	6, 3 & 1	1599	1594	99.7	6	Hall 1984; Walters 1979, 1980
	Toulkerrie (1985)	0.5	-	3	738	180	24.4	5	Walters 1986
	Toulkerrie (1989)	0.75	0.41	3	-	57 ^d	-	4	Bowen 1989; Hall and Bowen 1989
	Wallen Wallen Creek	4	-	-	297	48	16.2	3	Neal and Stock 1986; Walters 1986
	White Patch Site 1	3	-	-	-	2	-	1	Crooks 1982; Haglund 1974
	White Patch Site 2	3	-	-	-	3	-	1	Crooks 1982; Haglund 1974
	White Patch Site 3	4.5	-	-	-	36	-	3	Crooks 1982; Haglund 1974
<i>Northeast Shelf Province</i>									
	Border Island 1	0.25	0.10	3	-	10 ^d	-	5	Barker 2004
	Eurimbula Site 1	1	0.81	3	1044	16	1.5	3	Ulm 2004, 2006b; Vale 2002, 2004
	Hill Inlet 1	0.25	0.20	3	-	8 ^d	-	4	Barker 2004
	Ironbark Site Complex	0.5	0.17	3	3	3	100	1	Ulm 2004, 2006b; Vale 2002, 2004
	Mazie Bay	12	-	3.2	-	94 ^d	-	6	Hermes 1984; Rowland 1981, 1985
	Mort Creek Site Complex	0.25	0.16	3	1635	34	2.1	4	Ulm 2004, 2006b; Vale 2002, 2004
	Nara Inlet 1	0.75	-	3	-	36 ^d	-	6	Barker 1989, 2004
	Nara Inlet Art Site	0.5	-	3	103	14	13.6	3	Barker 2004; Brian 1994
	Otterbourne Island Site 4	1	0.41	2.1	233	152	65.2	6	McNiven <i>et al.</i> 2014
	Seven Mile Creek Mound	0.25	0.25	3	1346	54	4.0	4	Ulm 2004, 2006b; Vale 2002, 2004
	Tom's Creek Site Complex	1.25	1.07	3	2633	15	0.6	4	Ulm 2004, 2006b; Vale 2002, 2004
<i>Northeast Shelf Transition</i>									

	Badu 19	1	0.52	3	63	29	46.0	5	Crouch <i>et al.</i> 2007; Weisler and McNiven 2016
	Freshwater Bay Midden (1992)	0.25	0.30	5 & 2.5	60	53	88.3	3	Mills 1992
	Freshwater Bay Midden (2009)	0.24	0.34	4	-	1	-	1	Lentfer <i>et al.</i> 2013
	Goemu (1985)	0.75	0.30	4 & 2	19176	767	4.0	10	Ghaleb 1990
	Goemu (2005)	1	2.02	2.1	4519	1538	34.0	8	McNiven <i>et al.</i> 2015; Weisler and McNiven 2016
	Kurturnaiwak	0.5	0.51	3	931	24	2.6	7	David and Weisler 2006; Weisler and McNiven 2016
	Mangrove Beach Headland	1	1.52	2.36	63	31	49.2	2	Aird 2014; Ulm <i>et al.</i> in press
	Mask Cave	0.25	0.28	3	94	39	41.5	3	McNiven <i>et al.</i> 2006; Weisler and McNiven 2016
	Mua	0.25	0.15	3	48	10	20.8	4	David <i>et al.</i> 2008; Weisler and McNiven 2016
	Tigershark Rockshelter	0.25	0.08	3 & 1	338	288	85.2	10	McNiven <i>et al.</i> 2008; Weisler and McNiven 2016
<i>Cape Province</i>									
	Kurkur Weid	1	1.3	6 & 3	30	1	3.3	1	Carter 2004
	Ormi	2	4.6	6 & 3	2121	23	1.1	3	Carter 2004
	Pitkik	1	0.5	6 & 3	34	1	2.9	1	Carter 2004
	Sokoli	2	4.7	6 & 3	1842	26	1.4	6	Carter 2004

860 ^a Following IMCRA 4.0: Provincial Bioregions established by the Commonwealth of Australia (2006).

861 ^b Area and volume excavated was calculated only for the units where fish bone was recovered and identifications attempted.

862 ^c NISP values exclude unidentified and tentatively identified specimens.

863 ^d Represents MNI values as NISP values were not published for these sites.

864 Supplementary Table 2: Radiocarbon determinations for island and coastal archaeological sites in Queensland within the study area. Radiocarbon
865 ages were only included for the sites and squares where fish bone identifications were reported and available site data allowed grouping of these
866 in 500 year temporal units. Dates were calibrated using OxCal 4.3 (Bronk Ramsey 2009). For organics and charcoal dates, SHCal13 calibration
867 dataset (Hogg *et al.* 2013) were used for sites south of and including the Northumberland Group, and IntCal13 calibration dataset (Reimer *et al.*
868 2013) for sites north of and including Lizard Island. Note all dated organics and charcoal samples were unidentified. For marine shell, a Marine13
869 calibration dataset (Reimer *et al.* 2013), with a ΔR of -12 ± 10 was used (Ulm 2006a). * = date may extend out of range.

Bioregion ^a	Site	Lab. Code	SQ.	XU	Depth (cm)	Sample	¹⁴ C Age (years BP)	Calibrated Age BP (95.4%)	Median Calibrated Age BP	Reference
<i>Central Eastern Shelf Transition</i>										
	Booral Shell Mound	Beta-37394	A	2	9.5	charcoal	980±60	734-954	846	Frankland 1990
	Booral Shell Mound	Beta-36303	A	7	39.5	charcoal	1750±60	1434-1805	1624	Frankland 1990
	Booral Shell Mound	Beta-36304	A	11	59	charcoal	2480±60	2353-2711	2519	Frankland 1990
	Booral Shell Mound	Beta-38415	A	14	75	charcoal	2660±60	2490-2869	2744	Frankland 1990
	Booral Shell Mound	Beta-38242	A	17	91.2	charcoal	2790±80	2740-3070	2863	Frankland 1990
	Booral Shell Mound	Beta-32046	A	25	137.1	charcoal	2950±60	2869-3223	3049	Frankland 1990
	Broadbeach Burial Ground	ANU-67/2	T52-53	-	65-97	charcoal	440±100	154-630	429	Haglund 1976
	Broadbeach Burial Ground	ANU-67/3	T52-53	-	65-97	charcoal	460±100	283-636	449	Haglund 1976
	Broadbeach Burial Ground	ANU-68/1	Q54-55, R55	-	49-72	charcoal	1190±100	820-1280	1063	Haglund 1976
	Broadbeach Burial Ground	ANU-68/2	Q54-55, R55	-	49-72	charcoal	1390±100	988-1470	1246	Haglund 1976
	Cameron Point 62	Beta-34400	B	6	14-17	charcoal	190±50	0*-291	164	McNiven 1990
	Cameron Point 62	Beta-34401	B	10	27-30	charcoal	950±60	690-930	823	McNiven 1990
	Double Island Point 1	Beta-34059	T3/3	6	47-54	charcoal	160±90	0*319	149	McNiven 1990
	First Ridge 19B	Beta-1946	D	1-2	0-12	marine shell ^j	1150±70	555-849	696	Kelly 1982

	Hollywell	Wk-15967	1D	4	-	marine shell ^c	644±30	147-386	279	Robins <i>et al.</i> 2005
	Hollywell	Wk-15968	1D	7	-	marine shell ^c	1167±39	636-785	702	Robins <i>et al.</i> 2005
	Hollywell	Wk-15969	1D	14	-	marine shell ^c	1430±39	882-1070	965	Robins <i>et al.</i> 2005
	Hollywell	Wk-15970	2D	4	-	marine shell ^c	717±35	276-437	353	Robins <i>et al.</i> 2005
	Hollywell	Wk-15971	2D	7	-	marine shell ^c	984±37	504-634	567	Robins <i>et al.</i> 2005
	Hollywell	Wk-15972	2D	9	-	marine shell ^c	1248±42	685-889	779	Robins <i>et al.</i> 2005
	Lazaret Midden	Wk-8012	B4	1	0	marine shell ^a	480±50	0*-230	91	Ross 2000
	Lazaret Midden	Wk-8009	B4	12	30	charcoal	500±50	332-557	507	Ross 2000
	Lazaret Midden	Wk-8013	B4	12	30	marine shell ^a	840±50	331-532	460	Ross 2000
	Lazaret Midden	Wk-8014	B4	17	47	marine shell ^a	1420±50	824-1082	957	Ross 2000
	Little Sandhills	Beta-1945	F4	-	0-7	marine shell ^j	0±0	26*-48*	36	Kelly 1982
	Minner Dint	I-11095	B	SUB2	-	charcoal	520±75	325-642	513	Hall 1980
	Sandstone Point (1972)	SUA-478	42/G	3	-	charcoal	620±95	466-722	585	Gillespie and Temple 1977
	Sandstone Point (1972)	SUA-479	42/G	3b	-	charcoal	780±95	540-904	681	Gillespie and Temple 1977
	Sandstone Point (1984)	SUA-2358	1	24	60-62	charcoal	500±50	332-557	507	Walters 1986
	Sandstone Point (1984)	SUA-2357	1	32	87-90	charcoal	740±50	559-722	644	Walters 1986
	Sandstone Point (1985)	Beta-15805	2	15-20	40-58	charcoal	1190±100	820-1280	1063	Nolan 1986
	Sandstone Point (1985)	Beta-15806/A	4	6-7	10-15	charcoal	320±50	154*-487	373	Nolan 1986
	Sandstone Point (1985)	Beta-15806/B	4	6-7	10-15	charcoal	340±70	152*-500	376	Nolan 1986
	Sandstone Point (1985)	Beta-16837	4	8-9	15-20	charcoal	810±80	557-903	703	Nolan 1986
	Sandstone Point (1985)	Beta-15807	4	15-18	31-40	charcoal	1500±110	1094-1606	1369	Nolan 1986

	Sandstone Point (1985)	Beta-16838	5	9	18-23	charcoal	1600±80	1302-1690	1454	Nolan 1986
	Sandstone Point (1985)	Beta-15810/A	5	10-11	23-33	charcoal	1990±60	1739-2040	1900	Nolan 1986
	Sandstone Point (1985)	Beta-15810/B	5	10-11	23-33	charcoal	2290±100	2000-2694	2245	Nolan 1986
	Sandstone Point (1985)	Beta-15808	7	11	23-25	charcoal	0±0	124*-135*	130	Nolan 1986
	Sandstone Point (1985)	Beta-15809	7	21-23	49-57	charcoal	740±80	542-763	646	Nolan 1986
	St Helena Island	Beta-6140	1	9	18.5-21.5	marine shell ^m	1370±60	759-1045	901	Alfredson 1983
	St Helena Island	Beta-6141	1	13	33-36	marine shell ^m	2240±70	1635-2003	1829	Alfredson 1983
	Teewah Beach Site 26	Beta-30401	H15-4	3	146-150	charcoal	340±70	152*-500	376	McNiven 1990
	Teewah Beach Site 26	Beta-25511	H16-3&-4	19-20,19-20	173-177	charcoal	950±100	664-1046	825	McNiven 1990
	Teewah Beach Site 26	Beta-30399	I16-3+-4&H16-1	23,23,24	181-185	charcoal	1070±70	773-1067	930	McNiven 1990
	Teewah Beach Site 26	Beta-30400	H16-1+-2&I16-3	27-28,28,26	190-195	charcoal	3140±100	3005-3559	3291	McNiven 1990
	Teewah Beach Site 26	Beta-25512	H16-3	27	199-206	charcoal	4780±80	5305-5640	5470	McNiven 1990
	Tin Can Bay Site 75b	Beta-19421	A	7	18-21	marine shell ⁿ	700±70	147*-480	340	McNiven 1990
	Toulkerrie (1978)	I-11096	G50/16/C	SU2	~97	charcoal	370±75	154*-516	391	Hall 1984
	Toulkerrie (1989)	Beta-32049	Tr 3	III	56	charcoal	310±80	0*-501	333	Hall and Bowen 1989
	Toulkerrie (1989)	Beta-32796	Tr 2	I	25	charcoal	350±70	153*-503	382	Hall and Bowen 1989
	Toulkerrie (1989)	Beta-32048	Tr 2	II	72	charcoal	2150±80	1919-2317	2100	Hall and Bowen 1989
	Toulkerrie (1989)	Beta-32047	Tr 1	II	70	charcoal	2290±80	2017-2459	2240	Hall and Bowen 1989
	White Patch Site 3	SUA-480	C50b	SUb	0	charcoal	450±95	284*-630	442	Gillespie and Temple 1977

	White Patch Site 3	SUA-481	C50d	SUd	25	charcoal	670±95	502-730	607	Gillespie and Temple 1977
<i>Northeast Shelf Province</i>										
	Eurimbula Site 1	Wk-10967	A	5	9.68-12.44	charcoal	379±121	0*-555	376	Ulm 2004
	Eurimbula Site 1	Wk-10968	B	12	34.4-38.04	charcoal	2218±126	1838-2677	2176	Ulm 2004
	Eurimbula Site 1	Wk-7688	A	17	43.66-46.64	charcoal	2390±70	2162-2705	2408	Ulm 2006b
	Eurimbula Site 1	Wk-7687	D	15	45.4-47.92	charcoal	2770±110	2499-3166	2856	Ulm 2006b
	Ironbark Site Complex	Wk-8556	O	9a	27.38	marine shell ^c	910±55	430-620	512	Ulm 2004
	Ironbark Site Complex	Wk-8557	P	7	16.3	charcoal	200±140	0*-455	204	Ulm 2002a
	Ironbark Site Complex	Wk-8558	P	7	17.6	marine shell ^c	590±60	0*-328	202	Ulm 2002a
	Mazie Bay	ANU-2488	A1	1	5-10	marine shell ^o	670±50	147-436	310	Rowland 1983
	Mazie Bay	ANU-2489	A1	2	15-20	marine shell ^o	1520±50	932-1180	1061	Rowland 1983
	Mazie Bay	Beta-1243	A1	3	55-60	marine shell ^o	3450±70	3119-3485	3307	Rowland 1983
	Mazie Bay	Beta-1244	A1	5	125-130	marine shell ^o	4190±80	4038-4492	4258	Rowland 1983
	Mazie Bay	Beta-1245	A5	6	165-170	marine shell ^o	4030±90	3801-4327	4037	Rowland 1983
	Mazie Bay	Beta-1246	A5	7	180-190	marine shell ^o	4190±80	4038-4492	4258	Rowland 1983
	Mazie Bay	ANU-2393	A5	9A	240-250	marine shell ^o	4160±100	3935-4495	4216	Rowland 1983
	Mort Creek Site Complex	Wk-7458	C	6	11.3-15.8	charcoal	1970±80	1702-2086	1876	Ulm 2002a
	Mort Creek Site Complex	Wk-6987	C	7	15.8-18.1	marine shell ^c	2260±50	1715-1980	1853	Ulm 2002a
	Mort Creek Site Complex	Wk-7836	C	6	11.3-15.8	marine shell ^c	2320±50	1797-2072	1923	Ulm 2002a

	Mort Creek Site Complex	Wk-6988	C	18	53.6-56.4	marine shell ^c	3380±90	2970-3440	3222	Ulm 2004
	Mort Creek Site Complex	Wk-6986	B	19-20	65	marine shell ^c	3430±140	2915-3626	3277	Ulm and Lilley 1999
	Otterbourne Island Site 4	Wk-14636	B	1	0-3.9	marine shell ^l	586±35	95*-294	206	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32249	B	2	3.9-9.4	charcoal	128±25	0*-255	89	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-26911	B	3	9.4-14.2	charcoal	470±30	340-527	496	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32250	B	4	14.2-16.8	charcoal	768±25	573-723	669	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32251	B	5	16.8-20.9	charcoal	771±25	575-723	671	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-26912	B	6	20.9-26.4	charcoal	751±30	566-719	659	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32252	B	7	26.4-32.6	charcoal	972±25	775-918	853	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32253	B	8	32.6-38.6	charcoal	1129±25	932-1058	982	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32254	B	9	38.6-45.3	charcoal	1514±25	1307-1405	1348	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-26913	B	10	45.3-52.6	charcoal	1229±30	985-1183	1101	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-26914	B	11	52.6-58.8	charcoal	2785±30	2761-2925	2831	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32255	B	12	58.8-65.1	charcoal	3474±25	3591-3826	3683	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-26915	B	13	65.1-69.5	charcoal	3834±32	3996-4350	4175	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-12990	B	14	69.5-76.6	charcoal	4068±62	4296-4813	4512	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32256	B	15	76.6-85	charcoal	4534±25	4985-5298	5167	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32257	B	16	85-89.7	charcoal	4456±25	4865-5271	4988	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-32258	B	17	89.7-93	charcoal	4494±25	4892-5286	5109	McNiven <i>et al.</i> 2014
	Otterbourne Island Site 4	Wk-12991	B	17	89.7-93	charcoal	4580±45	4986-5438	5166	McNiven <i>et al.</i> 2014

	Seven Mile Creek Mound	Wk-8324	A	4	7.14	marine shell ^c	3540±80	3210-3615	3418	Ulm 2000
	Seven Mile Creek Mound	NZA-12117	A	13	38.96-43.64	charcoal	3500±60	3572-3884	3726	Ulm 2002b
	Seven Mile Creek Mound	Wk-8326	A	13	40.44	marine shell ^c	3610±70	3338-3677	3496	Ulm 2000
	Seven Mile Creek Mound	NZA-12273	A	20	67.84-71.46	charcoal	3570±60	3641-3976	3803	Ulm 2002b
	Seven Mile Creek Mound	Wk-8327	A	20	67.84	marine shell ^c	3780±60	3549-3871	3706	Ulm 2000
	Seven Mile Creek Mound	NZA-12118	A	26	88.68-92.18	charcoal	3660±60	3723-4143	3932	Ulm 2002b
	Seven Mile Creek Mound	Wk-8328	A	26	88.24	marine shell ^c	3750±60	3500-3835	3667	Ulm 2000)
	Tom's Creek Site Complex	Wk-7681	D	3	3.9	charcoal	0±0	124*-135*	130	Ulm 2002a
	Tom's Creek Site Complex	Wk-10966	D	8	22.24-25.52	charcoal	269±125	0*-486*	261	Ulm 2004
	Tom's Creek Site Complex	Wk-7682	D	3	3.3	marine shell ^c	620±50	100*-396*	248	Ulm 2002a
	Tom's Creek Site Complex	Wk-7684	D	17	55.7-59.5	charcoal	880±70	666-912	757	Ulm 2004
	Tom's Creek Site Complex	Wk-7683	D	15	50	marine shell ^c	940±50	464*-628	534	Ulm 2004
	Tom's Creek Site Complex	Wk-7685	D	18	59.5-64	charcoal	1110±70	801-1173	975	Ulm and Lilley 1999
	Tom's Creek Site Complex	Wk-7686	S	8	20.52-23.96	charcoal	540±50	470-630	526	Ulm 2002a
	Tom's Creek Site Complex	Wk-7838	S	8	20.52-23.96	marine shell ^c	630±50	120*-407*	261	Ulm 2002a
	Tom's Creek Site Complex	Wk-10965	S	11	31.7-35.02	charcoal	1070±115	689-1185	935	Ulm 2004
	Tom's Creek Site Complex	NZA-13385	R&S (core)	-	62.5-67	organics	1956±57	1730-1998	1860	Ulm 2004
<i>Northeast Shelf Transition</i>										
	Badu 19	Wk-16464	L10	1	0-5.7	marine shell ^f	2826±36	2426-2700	2573	Crouch <i>et al.</i> 2007

	Badu 19	Wk-16465	L10	3	10.7-16.7	marine shell ^f	2860±36	2477-2720	2617	Crouch <i>et al.</i> 2007
	Badu 19	Wk-9675	L10	5	20.7-25.5	marine shell ^p	2859±88	2345-2765	2586	Crouch <i>et al.</i> 2007
	Badu 19	OZH-968	L10	8B	41.3-51.5	marine shell ^d	4060±50	3912-4233	4074	Crouch <i>et al.</i> 2007
	Freshwater Bay Midden (1992)	Wk-2689	Tr 1	1	0-5	marine shell ^k	450±55	0*-227	74	Mills 1992
	Freshwater Bay Midden (1992)	Wk-2690	Tr 1	7	30-35	marine shell ^k	2150±60	1564-1869	1725	Mills 1992
	Freshwater Bay Midden (1992)	Wk-2691	Tr 1	20	120-130	charcoal	2970±80	2928-3360	3136	Mills 1992
	Freshwater Bay Midden (2009)	Wk-30014	Tr 2	7	60-70	charcoal	1059±29	926-1052	962	Lentfer <i>et al.</i> 2013
	Freshwater Bay Midden (2009)	Wk-30012	Tr 2	12	110-120	charcoal	2919±34	2961-3165	3062	Lentfer <i>et al.</i> 2013
	Freshwater Bay Midden (2009)	Wk-30013	Tr 2	14	130-140	charcoal	3408±31	3575-3812	3656	Lentfer <i>et al.</i> 2013
	Goemu (2005)	Wk-29690	A	3	1.5-3.4	marine shell ^e	710±25	280-419	345	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29691	A	7	9.5-12.5	marine shell ^e	654±28	233-402	287	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29692	A	11	24.1-28.3	marine shell ^e	730±25	289-434	361	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29693	A	15	37.5-41.1	marine shell ^e	1163±25	647-758	695	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29694	A	18C	49.8-54.9	marine shell ^e	1213±25	669-813	736	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29695	A	23	81.6-90.1	marine shell ^e	1273±25	729-891	806	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29696	A	25	98.3-104.7	marine shell ^e	2018±25	1500-1672	1568	McNiven <i>et al.</i> 2015
	Goemu (2005)	Wk-29697	A	32	156.2-171.2	marine shell ^e	1892±25	1346-1512	1427	McNiven <i>et al.</i> 2015
	Kurturniaiwak	Wk-14181	A	6	17.9-21.8	charcoal	331±44	305*-489	392	David and Weisler 2006
	Kurturniaiwak	Wk-16234	B	8	21.3-23.4	charcoal	409±42	318-525	468	David and Weisler 2006

	Kurturniaiwak	Wk-16235	B	15	39.9-42.7	charcoal	705±43	559-727	663	David and Weisler 2006
	Kurturniaiwak	Wk-14184	A	13	42.5-44.1	marine shell ^e	953±38	486-623	541	David and Weisler 2006
	Kurturniaiwak	Wk-14182	A	15	46.9-50.6	marine shell ^e	986±35	505-634	568	David and Weisler 2006
	Kurturniaiwak	Wk-14183	A	22	77.4-81.1	marine shell ^e	1005±38	514-645	580	David and Weisler 2006
	Mangrove Beach Headland	Wk-38696	A	3	5.12-7.54	charcoal	747±21	665-723	681	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38697	A	10	23.32	charcoal	1836±21	1711-1824	1772	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38698	A	16	39.92	charcoal	3144±21	3268-3444	3372	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38699	A	20	50.02	charcoal	3151±21	3275-3445	3377	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38700	A	24	60.62	charcoal	3149±21	3273-3445	3376	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38701	A	27	66.42	charcoal	3148±21	3272-3445	3375	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38702	A	30	72.42	charcoal	3136±21	3258-3441	3365	Aird 2014; Ulm <i>et al.</i> in press
	Mangrove Beach Headland	Wk-38703	A	44	108.82	charcoal	3689±21	3932-4090	4036	Aird 2014; Ulm <i>et al.</i> in press
	Mua	Wk-11941	K40	1	0-1.7	marine shell ^b	559±37	0*-277	181	David <i>et al.</i> 2008
	Mua	Wk-16432	K41	6	11.3-13.9	marine shell ^b	532±42	0*-248	149	David <i>et al.</i> 2008
	Mua	Wk-11942	K42	13	31.7-33.8	charcoal	727±35	569-728	675	David <i>et al.</i> 2008
	Mua	Wk-11943	K40	19	58.8	charcoal	1333±36	1182-1306	1270	David <i>et al.</i> 2008
	Tigershark Rockshelter	Wk-8496	A	1	0-2	charcoal	490±45	474-634	524	McNiven <i>et al.</i> 2008
	Tigershark Rockshelter	Wk-8497	A	7	13.9-16.6	charcoal	830±45	675-901	743	McNiven <i>et al.</i> 2008
	Tigershark Rockshelter	Wk-19548	A	9	19.4-22.7	charcoal	1102±29	938-1064	1006	McNiven <i>et al.</i> 2008

	Tigershark Rockshelter	Wk-7304	A	11	25.7-28.8	charcoal	1390±50	1185-1390	1308	McNiven <i>et al.</i> 2008
<i>Cape Province</i>										
	Kurkur Weid	Wk-13368	1	-	25	marine shell ⁱ	949±38	484-620	538	Carter 2004
	Kurkur Weid	Wk-13369	1	-	72	marine shell ⁱ	1623±38	1069-1263	1179	Carter 2004
	Kurkur Weid	Wk-6749	SE (1,2,7)	17	130	marine shell ^g	1290±50	705-924	822	Carter 2001
	Ormi	Wk-10161	1	-	15.2	marine shell ⁱ	2074±48	1517-1773	1634	Carter 2002
	Ormi	Wk-8885	1	7	40	marine shell ⁱ	2370±50	1856-2121	1982	Carter 2001
	Ormi	Wk-10162	1	-	99	marine shell ⁱ	2148±48	1589-1854	1723	Carter 2002
	Ormi	Wk-8917	1	16	110	charcoal	2050±80	1826-2304	2023	Carter 2001
	Ormi	Wk-10163	1	-	178	marine shell ⁱ	2435±48	1917-2240	2060	Carter 2002
	Ormi	Wk-8918	1	24	210	marine shell ^h	2840±60	2388-2726	2577	Carter 2001
	Pitkik	Wk-13366	1	-	30	marine shell ⁱ	726±38	280-446	360	Carter 2004
	Pitkik	Wk-13367	1	-	69	marine shell ⁱ	1314±38	745-928	845	Carter 2004
	Pitkik	Wk-6750	1	8	110	marine shell ⁱ	1270±50	690-910	803	Carter 2001
	Sokoli	Wk-7444	SE (1,21)	7	33	marine shell ^g	1180±45	636-822	714	Carter 2001
	Sokoli	Wk-7480	SE (1,21)	11	70	marine shell ^g	2280±50	1729-2005	1877	Carter 2001
	Sokoli	Wk-10164	SE (1,21)	-	125	marine shell ^g	1951±43	1370-1602	1486	Carter 2002
	Sokoli	Wk-10165	SE (1,21)		170	marine shell ^g	2044±51	1470-1752	1601	Carter 2002
	Sokoli	Wk-7481	SE (1,21)	23	195	marine shell ^g	2230±50	1686-1951	1818	Carter 2001

	Sokoli	Wk-7445	SE (1,21)	25	235	marine shell ^g	2840±50	2411-2720	2583	Carter 2001
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870 ^a Following IMCRA 4.0: Provincial Bioregions established by the Commonwealth of Australia (2006).

871 Marine shell (species identified for dating): ^b *Anadara antiquata*, ^c *Anadara trapezia*, ^d *Asaphis violascens*, ^e *Atactodea striata*, ^f *Chama* sp., ^g *Conomurex luhuanus*, ^h *Conus*

872 sp., ⁱ *Lambis lambis*, ^j *Plebidonax deltoides*, ^k *Rochia nilotica*, ^l *Saccostrea cucullata*, ^m *Saccostrea glomerata*, ⁿ *Saccostrea glomerata* and *Pyrazus ebeninus*, ^o *Saccostrea*

873 *scyphophilla*, ^p *Tapes sulcarius*, and ^q *Trichomya hirsuta*.

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