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FIFTY YEARS IN THE FIELD. ESSAYS IN HONOUR AND CELEBRATION OF RICHARD SHUTLER JR'S ARCHAEOLOGICAL CAREER

Edited by Stuart Bedford, Christophe Sand and David Burley

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NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION MONOGRAPH

NEW FISH RECORDS FROM OUNDJO (SITE 26), LA GRANDE TERRE: FURTHER CONTRIBUTIONS OF OTOLITHS

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In 1952, near a river mouth on the west coast of New Caledonia, Edward Gifford, Dick Shutler and their local crew were sifting through the cultural sediments of the Oundjo site. It was clear to them that several curiously-shaped, thumbnail-size pieces of "shell" or "operculae" were worth saving. The investigators had found fish otoliths, hard calcareous bodies located in the neurocranium of fish. Nearly a half century later the importance of these oddities was realised. This paper reports the identification of several otoliths that were retained during the pioneering excavations of Gifford and Shutler. These identifications provide new fish records for New Caledonian prehistory, including the first record of bonefish (Albulidae *Albula glossodonta*) and javelinfish (Haemulidae *Pomadasys argenteus*), and the first identification of whiting (Sillaginidae *Sillago ciliata*) from any archaeological site in Oceania. Additionally, these records provide new insights into the prehistoric subsistence practices of people occupying the Oundjo site.

Pacific archaeofaunal analysts have been slow to recognise the importance of fish otoliths as: (1) an additional element for identifying new species; and 2) a source of a wider range of fish elements that reduces "biases introduced by screen size and cultural processing" (Butler 1988:109). There are three pairs of otoliths for each fish. The largest, sagittal otoliths in most cases, have been routinely used for species identification in fisheries research for nearly 100 years (Scott 1903). Otoliths of most fish species are retained when 3mm sieves are used (e.g. Weisler *et al.* 1999), although otoliths from a restricted range of taxa are quite large (>10mm in length) and are often found when only larger mesh sieves are used. Because some fish have bones that rarely preserve in archaeological settings, otoliths can be particularly valuable because they are sometimes more resilient than bones. Thus, for tropical Pacific archaeofaunal studies in particular, where most fish bones are generally identified only to family, an adequate reference collection of otoliths permits identification to the species level (Weisler 1993). For example, in archaeological sites in the Marshall Islands (Weisler 2001:109) and Hawaii (Weisler 1993:Fig. 6d), otoliths have permitted identification of flyingfish (Exocoetidae) which are usually archaeologically invisible. Flyingfish are an important seasonal resource that are caught by the thousands during limited times of the year. Similarly, bonefish (*Albula* spp.) which appear to have similar taphonomic qualities, are rarely identified from archaeological sites, yet bonefish have extremely large otoliths that are easily recognisable.

METHODS

Gifford and Shutler utilised uniform field methods at 11 sites excavated in New Caledonia during seven months in 1952 "In order to have comparable data" (1956:1). Grids were established with 6 by 3-foot rectangles and deposits were removed in six inch levels totalling 29.8m^3 of excavated sediments at Oundjo (Site 26). Of relevance here is the routine use of 1/2-inch (12.8mm) mesh for sieving and occasional, but not systematic, use of 1/4-inch (6.4mm) mesh screens. Gifford and Shutler's recovery techniques would have been biased towards those taxa with generally large otoliths. It is noteworthy that "no cultural material was overlooked" and we can only assume from the range of the curated collections (at the Phoebe Apperson Hearst Museum of Anthropology, University of California, Berkeley) that almost everything from the cultural deposits was retained. Additionally, sediment samples were taken at six inch intervals from three unit walls at Location B (Gifford and Shutler 1956:9). Gifford and Shutler's collection of archaeological fish otoliths were originally catalogued by lot number and stored in small cardboard boxes. This archaeological collection was compared to reference specimens at the University of Otago (listed in Weisler 2001:Appendix 3) and to a comprehensive atlas of scanning electronic microscope images representing 998 fish species from 162 families (Rivaton and Bourret 1999).

RESULTS

The analysis of the collection revealed thirteen fish otoliths and Table 1 lists the taxon identifications, otolith side,

Gifford & Shutler No.*	Provenance	Taxon	Side	Diameter	Height	Comments
11-22452a	26, loc B, A1-2, B1-2, 0-6"	*Albula glossodonta*	left	—	9,95	whole, burnt
11-22452b	26, loc B, A1-2, B1-2, 0-6"	*Albula glossodonta*	right	—	—	fragment
11-22452c	26, loc B, A1-2, B1-2, 0-6"	*Sillago ciliata*	left	12,95	6,94	whole, burnt
11-22467a	26, loc B, A1-2, B1-2, 6-12"	*Albula glossodonta*	left	19,93	10,74	whole
11-22467b	26, loc B, A1-2, B1-2, 6-12"	*Albula glossodonta*	right	20,07	10,22	whole
11-22467c	26, loc B, A1-2, B1-2, 6-12"	*Albula glossodonta*	left	22,65	10,05	whole
11-22467d	26, loc B, A1-2, B1-2, 6-12"	*Sillago ciliata*	right	11,60	7,12	whole
11-22467e	26, loc B, A1-2, B1-2, 6-12"	*Sillago ciliata*	left	11,64	7,15	whole
11-22467f	26, loc B, A1-2, B1-2, 6-12"	*Sillago ciliata*	left	12,52	6,92	whole
11-22467g	26, loc B, A1-2, B1-2, 6-12"	*Pomadasys argenteus*	right	17,97	11,80	whole
11-22669	26, loc B, A2-3, B2-3, 6-12"	*Albula glossodonta*	left	—	—	fragment, burnt
11-22693	26, loc B, A2-3, B2-3, 12-18"	*Albula glossodonta*	left	—	—	fragment
11-22738	26, loc B, A2-3, B2-3, 24-30"	*Pomadasys argenteus*	left	20,74	13,18	whole

* = Letters added by Weisler to distinguish specimens within the same lot.
Diameter is the greatest length and height is the distance from the dorsal to the ventral margin taken perpendicular to the diameter (Smale *et al.* 1995:11). Measurements, recorded in mm, are only for complete dimensions.

TABLE 1. Otoliths from Oundjo (Site 26), New Caledonia.

diameter (maximum length) and height (dorsal to ventral margins), and relevant comments, while scanning electronic images of each taxon are illustrated in Plate 1. The otoliths were well preserved with 77 percent (10) of the specimens whole. The sediments from Site 26 had a pH ranging from 7.15 to 7.87 (Leonard 1997:Table 2) which is conducive for bone and shell preservation. Evidence of burning was recorded for only three (23%) otoliths. A very slight smoothing of the more prominent features along the dorsal margins of all otoliths could be due to the effects of digestion or post-depositional, *in situ* erosion (see, for example, Smale *et al.* 1995:Fig. 2). From Unit A1-2 to B1-2 at 6-12 inches, specimens 11-22467a and b have similar dimensions suggesting that a single fish is represented. The same is true for Sillaginidae *Sillago ciliata* (specimen numbers 11-22467d and e). This suggests further that the six inch thick level was fairly intact and may not have been greatly disturbed through post-depositional mixing. A total of three species were present and included seven otoliths of bonefish (Albulidae *Albula glossodonta*), four of whiting (Sillaginidae *Sillago ciliata*) and two of the javelinfish (Haemulidae *Pomadasys argenteus*).

DISCUSSION AND CONCLUSIONS

So what has the identification of 13 otoliths told us about prehistoric marine subsistence? The three taxa identified at the Oundjo site – bonefish, whiting and javelinfish – are all species that frequent turbid inshore waters with sandy to muddy bottoms, as well as mangrove areas and river mouths (Munro 1967:314, 345; Myers 1991:58, 134 and 142), precisely the microhabitats that are within easy walking distance of the site. Bonefish inhabit mudflats of turbid inner reefs, mangroves, estuaries and sandy stretches of clear lagoons where they feed on subsurface invertebrates in very shallow water (Munro 1967:40; Myers 1991:58; Randall *et al.* 1990:32). They often congregate in schools and can form large aggregations when migrating through channels to the outer reef slope to spawn. It is at these times that they would be particularly vulnerable to mass capture and Tinker (1978:66) reports that most bonefish found in Hawaiian markets today are caught by nets. It is likely that the occupants of the Oundjo site were well aware of the habits of bonefish and netted large quantities of the fish when they aggregated.

Sharing much of the same habitats as bonefish, whiting occur in shallow sandy to muddy inshore waters, estuaries and the tidal parts of rivers where they are "normally caught in seines" (Munro 1967:345). Many species of grunts (of which the javelinfish is one member of the Haemulidae) enter estuaries (Munro 1967:314) and *Pomadasys* especially "prefers turbid inshore waters with sandy to muddy bottoms" (Myers 1991:142). Although Haemulidae can be taken by hook, given the habitat preference for these three species, it is likely that these fish were captured by net, perhaps Haemulidae as a by-catch while targeting bonefish and whiting. It is true that bonefish are a favourite target of contemporary sport enthusiasts, but netting is a common and practical capture technique for acquiring large quantities of this species in an efficient manner.

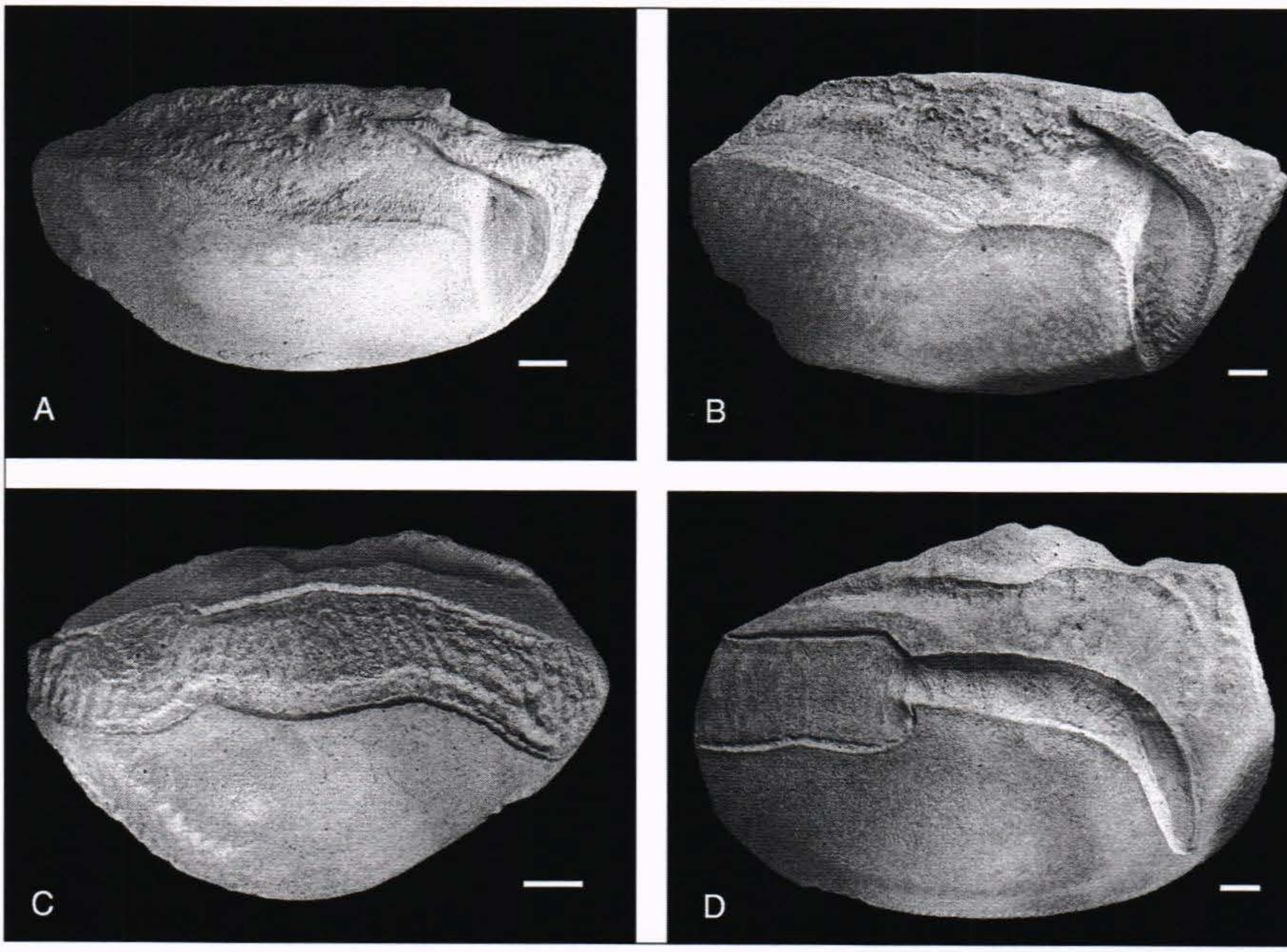

PLATE 1. Scanning electron micrographs of Oundjo (Site 26) otoliths, all right side: A, reference specimen of bonefish, Albulidae *Albula glossodonta*; B, *Albula glossodonta* (specimen 11-22452a; Rivaton and Bourret 1999:Pl. 4:9-12); C, whiting, Sillaginidae *Sillago ciliata* (specimen 11-22467d; Rivaton and Bourret 1999:Pl. 30:9-14); and D, javelinfish, Haemulidae *Pomadasys argenteus* (specimen 11-22467g; Rivaton and Bourret 1999:Pl. 54:8-11). Scale bars are 1mm.

Recent studies have shown a correlation of screen size with the recovery of identifiable fish bones in some tropical Pacific assemblages (Gordon 1993; Nagaoka 1994). Increasingly, attention has been directed towards the taphonomy of fish bones (Butler and Schroeder 1998; Jones 1986; Nicholson 1992). Understanding the possible roles of taphonomy in structuring the archaeological record is vital for adequate interpretations of prehistoric marine subsistence. For example, bonefish and whiting have very fine bones (hence, the name "bonefish") that have never preserved, or haven't been recognised, from Oceanian archaeofaunal assemblages. This is despite the long-term and comprehensive studies of Leach and colleagues who have identified 21,051 fish bones belonging to 48 different families from 126 archaeological sites on 24 different island groups (Leach and Davidson 2000:414). Consider also the well-collected Moturakau Rockshelter, southern Cook Islands where Allen (1992) recovered more than 11,000 fish bones that were identified to family. It seems that certain fish species have such fragile bones that they may only be identified from otoliths. This is essentially the case for mullet (*Mugil cephalus*) that was raised in the thousands in walled fishponds along the leeward shores of Moloka'i (Hawaiian Islands) during late prehistory, yet the taxon has only been identified by otoliths (Weisler 1993:145, Figs. 4e and f). While it is true that increasing the amount of elements used for identification will have an effect on taxonomic abundance for some species (Butler 1994:Table 4), not using otoliths will almost guarantee that certain fish species will rarely, if ever, be inventoried for Pacific archaeofaunal assemblages.

The identification of bonefish (Albulidae *Albula glossodonta*), whiting (Sillaginidae *Sillago ciliata*) and javelinfish (Haemulidae *Pomadasys argenteus*) has added three new species to the inventory of fish captured during New Caledonian prehistory. To my knowledge, bonefish was only known previously from three sites in Hawaii where it was identified by otoliths (Weisler 1993:148). Whiting is a new record for Oceania and this "first class food fish" (Munro 1967:345) was undoubtedly netted in quantity along with bonefish and may have contributed significantly to prehistoric diets. Although five bones of Haemulidae have been inventoried from Lapita sites (Butler 1994:Table 4), the more specific identification of *Pomadasys argenteus* within this family has been possible with otoliths.

It is likely that Gifford and Shutler gave little thought to the significance of the few small "shells" or "operculae" recovered from their investigations at Site 26. Due to their careful excavations, detailed recording and superb curation, the significance of these oddities has come to light a half century later.

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