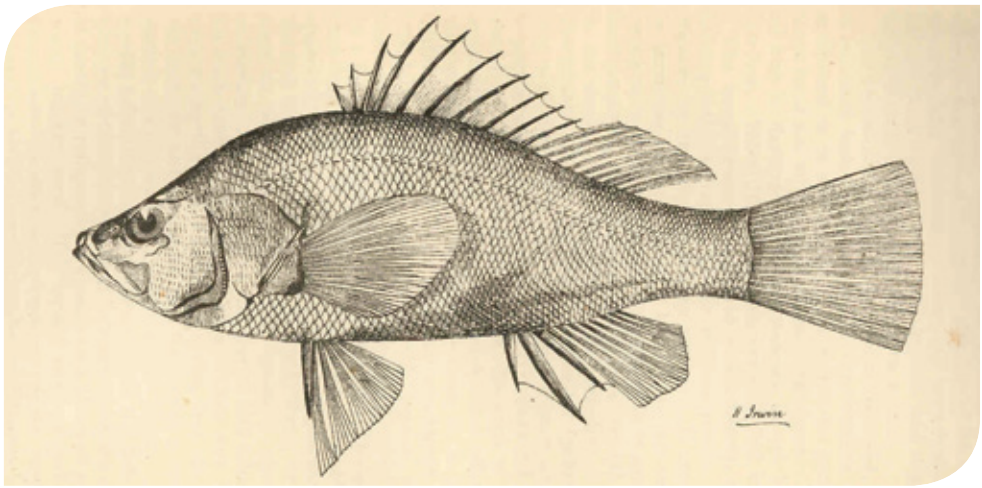
Baarka/Darling Perch: Morphological and chemical analysis of archaeological otoliths from western NSW



Golden Perch from *History of the Fisheries of New South Wales*, Lindsay G. Thompson, 1893 (University of Washington)

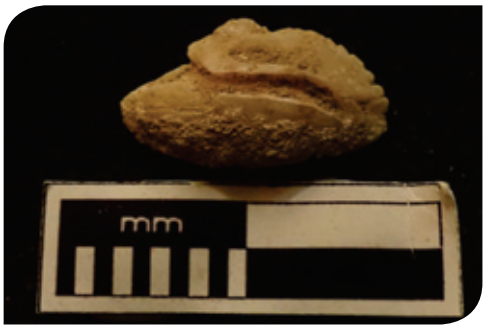
Introduction

Fish otoliths (n=19) were recovered during archaeological excavations associated with the development of the Wentworth to Broken Hill Pipeline.

The otoliths originated from a midden site, named MBHP AFT 7 (AHIMS ID#39-5-0154), located on the bank and floodplain of the Baarka/Darling Anabranch to the north of Wentworth in New South Wales, Australia.

Species

Based on the morphology of the otoliths, they were all identified as golden perch, *Macquaria ambigua*, a common native species widespread throughout the region today.



Proximal surface of archaeological otolith (MBHP05)

Fish size

The relationship between otolith weight and fish total length (TL) for *M. ambigua* (TL(mm)=(LOG(Otolith weight (g)/0.02354))/0.0026393+23.9293329) was obtained from Anderson et al (1992).

The weights of the otoliths indicated that the fish ranged in length from 147 mm to 419 mm.

All lengths were close to, or less than, the species average size of 400 mm; however, as the majority of the otoliths have been broken and are deteriorated, this needs to be taken as minimum lengths.

Age of fish and season of death

An estimate of the individual age of each fish at the time of death was determined by counting the annuli visible in the sectioned otolith following methods described in detail in Campana and Jones (1992). The edge annulus was also recorded as being translucent (clear) or opaque (dark), as this information indicates the season during which the fish was caught.

The fish were aged between two and six years old.

Section of archaeological otolith (MBHP05)

None of the fish were significantly old when compared with the maximum validated age of *M. ambigua* (26 years), or even the average age of 10 - 11 years.

The edge increment analysis revealed that the fish were caught year-round at this location, rather than being seasonally targeted.

Trace element analysis

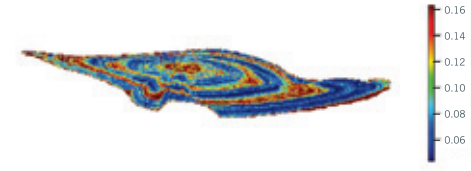
The entire internal surface of four of the otoliths were mapped using an ESI NW213 laser ablation platform at 213 nm, coupled to an Agilent 7700 ICP-MS at the GARG facility at Southern Cross University. The following elements Li^{7}, Mg^{24}, P^{31}, Zn^{66}, Ca^{43}, Ca^{44}, Sr^{88}, Ba^{138}, Ce^{140}, Pb^{208} and U^{238} were analysed, and are expressed as ratios with Ca^{43}. The final array of baseline-corrected, Ca-normalised parallel lines was assembled to generate the maps of the elemental distributions.

Using the natural relationships of increasing ambient and otolith Ba:Ca with decreasing salinity, fish from fresh and salt-water environments are distinguishable.

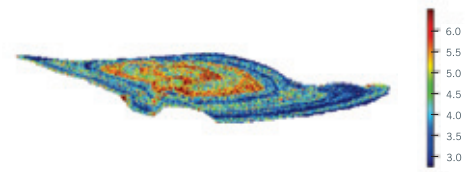
Trace element analyses from all of the otoliths are similar in that the Ba:Ca ratio fluctuates throughout the life of each fish, in dynamic relationships with the age annuli, induced by seasonal environmental changes.

These fluctuations of otolith Ba:Ca, and therefore salinity, are likely the result of fish movement further up or down stream between slightly different water conditions, or seasonal fluctuations within the Baarka/Darling River environment.

Within the samples, where Ba:Ca concentrations are greater during the warm season than in the cool season this is potentially a result of increased freshwater inflow from further upstream as a result of rainfall and runoff during spring, which is when the fish spawn. What the fluctuations reveal, is that the river was a highly dynamic environment, and the species is capable of tolerating varying salinity levels.



BaCa ratio for archaeological otolith (MBHP05)



SrCa ratio for archaeological otolith (MBHP05)

Radiocarbon dating

Accelerated Mass Spectrometry (AMS) radiocarbon dating of six otoliths was carried out at the Radiocarbon Dating Laboratory, University of Waikato.

The radiocarbon dates obtained from the fish otoliths range from 2750–2490 to 540–500cal. BP.

What does this tell us about the people who inhabited the site?

The size and species of fish present in the archaeological record may be indicative of the fishing techniques that were employed by local Aboriginal populations (Balme, 2013; O'Connor, 2000:141-3).

Based on the size of the fish present at MBHP MFT 07, their desired prey, and the low number of samples, it is possible that the fish were captured with hook and line.

It is unlikely that fish traps or nets were used, as this would likely result in a higher number of samples, although taphonomic processes may have resulted in removal of some samples from the archaeological record. The fish were caught at various seasons throughout the year, indicating that people frequented this area year-round.

Evidently, the fishing activities of the Barkandji People have been taking place for many generations. The Darling River and Darling Anabranch are highly significant to the Barkandji people, with fish being a major resource in the area. In a statement for the Murray Darling Basin Royal Commission, Badger Bates discussed his memories of fishing on the Baarka/Darling:

..we could always get a feed of fish, or yabbies, duck or turtle or something. Our river water should be a slightly milky colour from the clay, settling to a clearer colour after freshes settle down. We used to catch fish with a line, or net, or if the water was still and clear we would use spears we made. Our fish are beautiful to eat, we used to get cod, perch, black bream, catfish and bony bream.

Dr Morgan Disspain
Niche Environment and Heritage

Clare Anderson
Niche Environment and Heritage and Virtus Heritage

Dr Renaud Joannes-Boyau
Southern Cross University

Warren Clark
Barkindji Traditional Owner

Water NSW

References

Anderson, J.R., Morison, A.K., Ray, D.J., 1992b. Validation of the use of thin-sectioned otoliths for determining the age and growth of Golden perch, *Macquaria ambigua* (Perciformes: *Percichthyidae*), in the Lower Murray-Darling Basin, Australia. *Australian Journal of Marine and Freshwater Research* 43, 1103–1128.

Balme, J. 2013. Of boats and string: the maritime colonisation of Australia. *Quaternary International* 285: 68-75.

Campana, S.E., Jones, C.M., 1992. Analysis of otolith microstructure data, in: Stevenson, D.K., Campana, S.E. (Eds.), Otolith Microstructure Examination and Analysis. *Canadian Special Publication of Fisheries and Aquatic Sciences*, pp. 73–100.

O'Connor, T. 2000. The Archaeology of Animal Bones. Gloucestershire: Sutton Publishing.

Excellence in your environment