NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

# ARCHAEOLOGY IN NEW ZEALAND

## ARCHAEOLOGICAL INFORMATION AND BARCODES

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The catalogue of archaeofauna at the Museum of New Zealand has grown from zero to well over 100,000 entries in a period of five years. As a result, it has been increasingly difficult to keep track of exactly where things are, and some items are currently 'lost' — anathema in a museum. To alleviate these problems I decided to augment the cataloguing system with barcoding. To my surprise, this required considerable original research and development, because although barcoding is in widespread use in the commercial environment, there appeared to be nothing well suited to problems which archaeologists have in the laboratory or in a museum. Since I have gone to the trouble of "re-inventing the wheel", I hope this short note will be of some use, should anyone else choose to run down the same path.

The first thing I discovered was that there is not just one barcoding method, but many — the most common being UPC (universal product code), which one would see on the back of a novel at the airport bookshop. There is also Interleaved 2 of 5, Code 128, Code 11, MSI/Plessy Code, Codebar, US Postal, and many others. There are advantages and disadvantages in each of these.

Of prime importance in cataloguing is a very low error rate in capturing and deciphering barcodes. Some codes are better than others in this respect, giving more attention to checking procedures during reading. Also, some systems provide for both letters and numbers, and so on. For a number of reasons I decided on Code 39 after quite a lot of experimentation and background research. This method permits the coding of numbers, alphabetic characters in both upper and lower case, and also a range of other special characters. The barcode below illustrates the flexibility of this type of code.

MONZ Te Papa Tongarewa
Bollons Collection

Misc Adzes 1 - 14

Another very important aspect is high quality but inexpensive printing of the barcode itself. Unlike a bar of chocolate in the supermarket, catalogue barcode labels may have to be read many times and therefore must survive in good condition for many years. With assistance from the Division of Information

Technology, DSIR, I developed optimum postscript code so that an ordinary office laser printer could be used. I then wrote the necessary software for printing the barcodes onto readily available laser printer cut labels with 30 per page. I made provision for the labels to have some printed information above the barcode (such as Museum of New Zealand), and the barcode itself is decoded below the familiar but apparently unintelligible stripes. In the event of damage to the barcode, the numeric data can therefore be read by eye. If this is damaged too, the code can still be deciphered, although this is somewhat laborious. Yes, the stripes themselves can be read by eye, if you know what the method of coding is. The code basically consists of very thin black and white elements corresponding to binary code. In some barcode methods, such as Code 39, there are two kinds of stripe, one being three times the thickness of the other. If you look carefully at the example given above you will observe that the left hand side of the barcode has the following pattern for the first 15 elements:

| | |
|---|---|
| thin black stripe | 1 |
| thick white stripe | 000 |
| thin black stripe | 1 |
| thin white stripe | 0 |
| thick black stripe | 111 |
| thin white stripe | 0 |
| thick black stipe | 111 |
| thin white stripe | 0 |
| thin black stripe | 1 |

Thus, the first batch of 15 elements consists of 100010111011101, and this particular pattern is both the 'start' and 'stop' character. This batch of characters occurs at both the left and right hand side of the barcode and is something the barcode reader looks for as the start and stop of a full barcode. If you look carefully again you will find that the start character is followed by a thin white stripe or 0, and this is the character separator. The next batch of 15 elements is 111011101010001, and this corresponds to upper case M, which is the first part of the coded message "Misc Adzes 1-14".

In passing it might be noted that the advent of barcoding has been greeted with alarm by Anderson and Anderson (1989). They warn of the dangers of 666 being surreptitiously encoded into barcodes on pre-packaged food in supermarkets. This number is the mark of the Beast or the Devil's number as it is stated in Revelation XIII verse 18 "Let him that hath understanding count the number of the beast: for it is the number of a man; and his number is six hundred threescore and six". The authors give a detailed account of how this number is coded with binary on the left hand field of the UPC coding system. I have carefully looked into this serious allegation and would like to assure readers that there is no truth in it. The exposition of the coding of the left hand field is quite incorrect, and disagrees with standard reference works on the subject such as Burke (1984). However, by curious coincidence the New Zealand Product Number Association incorporates 'The

Mark' in its telephone number (04)3846669!

My enquiries with various plastic tape manufacturers turned up some interesting new products in addition to the familiar 'cellotape' which can be used to cover particularly important barcodes which might need protection from such environmental hazards such as mechanical damage or ultra violet over long periods. Coding sheets, such as illustrated below, can be sandwiched between thermo plastic film which is durable and inexpensive. There are many stationary shops which have the facilities for this at modest cost.

The implementation of barcoding varies greatly and must be customised to suit the particular circumstances involved. In the case of my cataloguing problem, I wanted to achieve two things - firstly to keep track of the location of items, and secondly to be able to pull up and modify catalogue information quickly and easily. I designed two different types of barcodes for this purpose: a location barcode, and a catalogue barcode. The first is split into five fields corresponding to Building, Room, Aisle, Bay, Shelf, with provision for up to 100 in each case. One such barcode sticker is attached to a convenient place on each shelf in the laboratory. The second barcode has two fields, the first which caters for up to 1000 different catalogues, and the second field specifies the catalogue number (10 million items for any one catalogue). I was so impressed with how easy all this was when the development work was over that I also developed a special catalogue for my offprints which means that I no longer have the problem of remembering the names of obscure authors when I want to find a paper on a certain subject. It's wonderful!

The main catalogue of course is for items on the shelves, either an individual item or a cardboard box with many inside it. The barcode itself can be stuck either onto a box, or on a plastic bag, or on a cardboard label with a string tie, or in some cases onto the object itself. The corresponding data base contains all the information about the item, such as what archaeological site it came from, the excavation square and layer, the anatomy and species identification, and any other notes about butchering marks , file cross references etc. Two extra fields are reserved for the item - one being the catalogue barcode, and the other the location barcode.

Interrogating or updating this database is as simple or complicated and as error-free or error-prone as any other database; in other words these factors are independent of the barcoding system. Different people are devoted to different spreadsheets or word processors, and the barcode reader I use will work with any of them where input is from a keyboard. The barcode reader is simply plugged in between the keyboard and the computer, and it will work with a standard PC; and yes, it will even work with a Mac. There are many different kinds of reader one could use, the main factor being how distant from the object it can read the barcode. The more expensive readers will read the barcode from a considerable distance. The price varies accordingly. The one I use in the Archaeozoology Laboratory is a bottom line variety which requires physical contact, costing $500, and was purchased with a small grant from Lottery Science.

Of course the ability to print barcodes and then read them with a barcode reader takes one only half way there. One has to design a suitable system for keeping track of the information being gathered. Thus requires a fair bit of forward thinking to anticipate all contingencies, but when this is thoroughly worked through, implementing a system is relatively straightforward. Of course if you want all the whistles and bells, then the sky is the limit. I have written a lot of other software for my cataloguing system which makes it appear rather fancy with zooming windows in various colours, pull-down user friendly menus, and so on. However none of this is really necessary — all you need is access to your favourite database program, such as Quattro or Harvard Graphics, or even a simple word processor. For my offprints catalogue which only has about **4000** items I use good old fashioned Wordstar with tilda characters ~ separating fields and this is perfectly satisfactory.

All though my prime concern was with keeping track of catalogue information, there are many potential applications of barcoding in archaeology, which would greatly simplify information gathering, and cut down on the error rate when entering data into computers. One obvious area is when one uses a recording sheet for collecting basic data. I use a recording sheet for coding identifications of bird bones (Leach 1979), and this readily lends itself to barcoding. Similarly, in identifying fish bones I used to use a coding sheet, but later developed an interactive computer program for direct data capture (Leach 1986). Although this greatly speeds up work, the fact that keyboard entry is still required means that errors are still introduced, and have to be kept track of and later corrected. An attractive alternative is illustrated below, which is a coding sheet for fish bone identifications. The species and anatomy is captured by simply scanning the appropriate barcode. This is much quicker to use, and it is intuitively closer to what one is thinking about during identification. The error rate is considerably lower than direct keyboard entry, and it is easier to detect errors when they are made.

**Species**

| | |
|---|---|
| *Anguilla australis* | *Pseudolabrus inscriptus* |
| *Anquilla dieffenbachii* | *Pseudolabrus luculentus* |
| *Anguilla* sp. | *Pseudolabrus miles* |
| Anguilladae | *Pseudolabrus* sp. |
| *Aplodactylus arctide* | *Pseudophycis bachus* |
| *Arripis trutta* | *Pseudophycis brevius* |
| *Caranx georgianus* | *Pterygotrigla picta* |
| *Chelidonichthys kumu* | *Rexea solandri* |
| *Pagrus auratus* | *Rhombosolea leporina* |
| *Conger verreauxi* | *Rhombosolea plebia* |
| *Conger* sp. | *Rhombosolea retiaria* |
| Elasmobranchii | *Rhombosolea* sp. |
| *Genypterus blacodes* | *Rhombosolea tapirina* |
| *Helicolenus papilosus* | *Sarda australis* |
| *Kathetostoma giganteus* | *Scomber japonicus* |
| *Latridopsis ciliaris* | Scombridae |
| *Latris lineata* | *Scorpaena cardinalis* |

| | |
|---|---|
| *Lepidopus caudatus* | Scorpaenidae |
| *Leptoscopus macropygus* | *Scorpis aequipinnis* |
| *Lotella rhacinus* | *Seriola grandis* |
| *Parika scaber* | *Seriolella brama* |
| *Nemadactylus macropterus* | *Thunnus alalunga* |
| *Notothenia angustata* | *Thyrsites atun* |
| *Odax pullus* | *Trachurus declivis* |
| *Parapercis colias* | *Trachurus novaezelandiae* |
| *Peltorhampus novaezeelandiae* | *Trachurus* sp. |
| *Polyprion oxygeneios* | *Zeus japonicus* |
| *Pseudolabrus celidotus* | *Hyperoglyphe antarctica* |
| *Pseudolabrus cinctus* | *Aldrichetta forsteri* |
| *Pseudolabrus fucicola* | Unknown species |

**Anatomy**

| | |
|---|---|
| Left Dentary | Right Dentary |
| Left Articular | Right Articular |
| Left Quadrate | Right Quadrate |
| Left Premaxilla | Right Premaxilla |
| Left maxilla | Right maxilla |
| Left Superior Pharyngeal | Right Superior Pharyngeal |
| Inferior Pharyngeal | Dermal Plate/Scale |
| Tooth | Dermal Spine |
| Vomer | Wing Hook |
| Operculum | Buckler |
| Rostrum | Scute |
| Dorsal or Erectile Spine | Caudal Peduncle |
| Dorsal Spine Cage | Vertebra |
| Ventral Spine/Sternum | |

## REFERENCES


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