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UCT study seeks to identify elusive DNA in human remains found in the ocean

'**Extracting good quality DNA from washed up bodies is problematic if not impossible'**

The University of Cape Town (UCT) is spearheading a study that seeks to resolve the global difficulties associated with identifying human remains found in the ocean or those that wash-up ashore. Its success will help to resolve mysterious cases and provide closure to many families whose members have died at sea and could not be identified.

The pilot study by the Department of Human Biology and the Department of Pathology at UCT is titled: "Can forensically usable DNA be successfully extracted from teeth submerged in False Bay, Cape Town?". It used teeth to explore DNA preservation in a marine environment due to their demonstrated success in other degraded DNA studies.

Dr Victoria Gibbon, senior lecturer and biological anthropologist says: "In most wash-up cases, visual and fingerprint identification is unlikely, and identification through traditional anthropological methods proves especially difficult, as remains can be extensively decomposed, skeletonised, or fragmented. In many cases, the remains that are washed ashore usually have little soft tissue present."

Salt River mortuary in Cape Town frequently receives cases of human remains washing up along the beaches of Cape Town and surrounding areas in various states of decay. In these cases, extracting sufficient quantities of good quality DNA has been problematic, if not impossible due to limited research that has been performed in understanding the sea's effects on DNA degradation.

As part of a larger research project on decomposition in the sea environment of False Bay, Cape Town, by Belinda Speed (PhD) an opportunity arose to investigate DNA preservation and degradation in this environment. Under the supervision of Dr Gibbon and Laura Heathfield, Chandra Finaughty, an MPhil student, used teeth extracted from pigs (*Sus scrofa*) and prepared the samples for DNA extraction to demonstrate a proof of concept. If DNA could be extracted, it would necessitate future research by applying these findings to a more accurate human model.

The results of the study showed that obtaining 'forensically usable' DNA for forensic analysis from post-mortem pig teeth removed from the marine environment was complex,

and in some cases, not possible. This was despite multiple optimisation efforts in the DNA extraction process. Key findings included poor DNA yields, particularly in warmer fluctuating seawater temperatures, such as those experienced in summer in False Bay. In addition, in terms of extracting useable DNA, tooth type and salt water content did not seem to impact DNA recovery. However, as with terrestrial studies, temperature and the presence of microbes (in particular marine microbes) appear to inhibit DNA preservation in this environment.

Heathfield explains: “In this study nuclear DNA was the main molecular target, as the South African Police Services Forensic Science Laboratories use only nuclear DNA to generate a forensic DNA profile. However, in our study positive results were found for mitochondrial DNA that displayed better preservation over nuclear DNA in some samples.”

Dr Gibbon explains: “Forensic Pathology Services and South African Police Services are unable to deal with the volume or complexity of many of these cases due to lack of research in marine taphonomic processes. Considering taphonomic processes are greatly influenced by environmental parameters such as sea temperature and scavenger activity, it is integral to study this process in specific geographical locations in question. Furthermore, mitochondrial DNA preservation in the marine environment requires further investigation for use in routine forensic case work, as such research in this area continues.”

The study also highlighted the need for collaborative research in the local region as the effects of area-specific variables such as differences within marine ecosystems are not yet fully understood.

With these problems unresolved, identifying human remains due to unsuccessful DNA recovery, many individuals who die or wash-up ashore will remain unidentified.

“DNA is often the only method of identification and is used to confirm any probable identity. Therefore, the process needs optimisation and development on human samples, which we have applied for funding to pursue,” concludes Dr Gibbon.

Note to editors

In South Africa, approximately 2000 drowning cases occurred in 2015, of which many were fatal. Of these, 279 occurred in the Western Cape (NSRI Integrated Report, 2015) for both marine and freshwater environments. Unfortunately, due to excessive caseloads, an increase in drowning cases and problems in identifying these human remains, such as unsuccessful DNA recovery, many individuals remain unidentified.

The unique oceanic environment of the Cape peninsula poses a necessary environment to study, considering the frequency of wash-up cases in this region.

In many cases, the remains that are washed ashore have very little soft tissue present. Compounding this problem is that DNA preservation in post-mortem samples from seawater is not well documented, and methods used in the current DNA extraction workflow are not sufficient. DNA is sometimes the only method of identification, and this process needs optimisation and development.

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