

Māori Perspectives on Development of an eDNA Reference Library: Summary for MfE Molecular Library of Groundwater Fauna Project

ROGENA STERLING, MAUI HUDSON & LIBBY LIGGINS

Key points

- A series of wananga / workshops have been held to canvas tangata whenua views on a DNA and DNA reference libraries.
- “Whole genome” DNA involves sequencing enough genetic material to code everything about an individual or a species. This can be used for bioprospecting and may have commercial or privacy ramifications.
- “Barcoding” involves sequencing very short sequences of DNA to enable species identification or population connectivity studies. It has very limited utility beyond this science purpose.
- A range of perspectives and views were expressed during the wananga. The majority viewed activities restricted to barcoding as low risk from a cultural perspective.
- eDNA relies on barcoding only. The library work required to enable and empower eDNA monitoring can be safely focused on barcoding.
- The role of eDNA was seen as highly valuable from hapu, community, Maturanga and scientific perspectives. It was considered generally safe from a cultural perspective and was seen to provide great benefits for environmental monitoring. Without being compromised by the risk of bioprospecting.
- A repeated message was Māori participation is required for the governance and operations of any reference libraries. Ideally the library should be hosted in Aotearoa and subject to protocols developed here in Aotearoa.
- Appropriate governance structures for reference libraries were explored.
- Research in this space continues at a rapid pace. There is a need to quickly advance co-governance structures. How this will be funded is currently unclear.
- It was generally deemed acceptable for the science work to continue in parallel to governance mechanisms being established.

Introduction

The use of eDNA as a biodiversity monitoring tool is becoming an increasingly viable option for Councils and communities however its effectiveness is dependent on access to high quality reference libraries. Over the past 12 months a range of discussions and consultations were held on the topic of eDNA and DNA reference libraries as part of the *MfE Molecular Library of Groundwater Fauna* project and the *Te Huinga Ira Taketake o Aotearoa National DNA*

*Reference Library Project*¹. Across the range of activities Māori views and perspectives on eDNA and DNA Reference Libraries including issues associated with its development and governance into the future. This report focuses on the consultation and online engagement sessions and identifies the key messages coming out of these sessions.

Method

The starting point for the analysis of issues was the identification of topics in previous literature that was relevant to Māori/Indigenous genomics and Māori/Indigenous data (Carroll et al., 2022; Garba et al., 2023; Hudson, Anderson, et al., 2021; Hudson et al., 2020, 2023; Jennings et al., 2023; Kukutai, et al., 2023). The topics identified were cross-checked against the elements of an Indigenous Metadata Bundle developed at an Indigenous Metadata Symposium in 2023. The Indigenous Metadata Bundle guides the inclusion of cultural context, data protection, and ownership for Indigenous rights holders (ENRICH et al., 2023). The primary fields of governance, provenance, lands, protocols, and Local Contexts (notices and labels), are reflected in the table below.

| Topic | Primary field for metadata bundle |
|--|-----------------------------------|
| Enables Indigenous Governance | Governance |
| Database Infrastructure | Governance |
| Governance group (who runs it) | Governance |
| Data accessibility | Governance |
| Promotes consultation with Indigenous people | Governance |
| Indigenous provenance | Provenance |
| Geographic provenance | Provenance/Lands |
| Information of sample/species retained | Provenance/Lands |
| Promotes FAIR | Protocols |
| Promotes CARE | Protocols |
| Metadata standards | Protocols |
| Indigenous metadata | Protocols/Lands |
| Linked to other databases | Protocols |
| Data sharing & Management best practices | Protocols |
| Intellectual property | Protocols |
| Recognises Nagoya Protocol | Protocols |
| Digital Rights Management (CC licence/Public domain) | Protocols |
| Utilises Local Contexts | Local Contexts |

TABLE 1: ASSESSING THE INDIGENOUS METADATA BUNDLE

The next step was to compare the topics identified in the literature against the discussions that took place in the six engagement sessions held across the two projects. The wananga

¹ The National DNA Reference Library Project was funded by the Biological Heritage National Science Challenge to identify the important social, cultural and technical requirements for the development of a National DNA Reference Library.

series consisted of online presentations and workshops on specific topics of relevance to the development of a National DNA Reference Library and included;

- W2: Māori perspectives on the use of DNA data
- W3: Database architecture, process, and pathways
- W4: Barcoding technologies and pipelines
- W5: Cross project fertilisation of best practice
- W6: Data Governance and Sovereignty²

An additional engagement focused exploring Māori Data Governance & Sovereignty in the context of eDNA was conducted as part of the Whaki webinar³ series hosted by Te Kotahi Research Institute.

Table 2 below identifies which topics were discussed in each engagement.

| | W2 | W3 | W4 | W5 | W6 | Whaki Web. |
|---|----|----|----|----|----|------------|
| Enables Indig. Gov. | Y | Y | | Y | Y | Y |
| Database infrastructure | Y | Y | Y | | Y | |
| Governance group (who runs it) | Y | Y | Y | Y | Y | Y |
| Data Accessibility | Y | Y | | Y | Y | Y |
| Promotes consultation with Indigenous peoples | Y | Y | | Y | Y | Y |
| Indigenous provenance | Y | Y | | Y | Y | Y |
| Geographic provenance | | Y | | Y | Y | Y |
| Information of sample/species retained | | | | | | |
| Promotes FAIR | | Y | | Y | | |
| Promotes CARE | | Y | | Y | | |
| Metadata standards | | | Y | Y | Y | Y |
| Indigenous metadata | | | Y | Y | Y | Y |
| Linked to other databases | Y | | | | | |
| Data Sharing and Management Best Practices | Y | Y | | | | Y |
| Intellectual Property | | Y | | Y | Y | Y |
| Recognises Nagoya Protocol | | Y | | | | |
| Digital Rights Management | | Y | | Y | Y | |
| Utilises Local Context (Labels/Notices) | | Y | Y | | Y | Y |

TABLE 2: KEY TOPICS REFLECTED IN ENGAGEMENT

The specific topics discussed across the activities were collated and then summarised. (See Appendix 1 for issues identified in each session). The list below outlines the key issues relevant to Māori rights and interests and general concerns regarding an eDNA reference library.

- Is it going to be Te Tiriti compliant (including WAI262)
- Nagoya compliant and understanding of the implications of DSI.
- Reference library – Aotearoa governed, focused, located, collaborative-focused, federated-system, preferably hosted in Aotearoa
- Effective data management plans (Supports Māori rights and interests), IP (WAI262), licence agreements, consent (FRIC), accountability (security, usage) - different types of data require

² Data Governance and Sovereignty webinar: <https://youtu.be/EOz8JGnHZso?si=2LkGTBM4JckfvK-G>

³ Whaki webinar: (https://youtu.be/E4skLQDbmcQ?si=HZOWaulMndM_hYNo)

different governance, which must be recognised in the governance structures, mechanisms and protocols

- Whakapapa recognition (source point) reflected in the process - recognition of relationships with animals, plants, and microbes from the environment – taonga (including genetics) - more study looking into the tikanga and eDNA
- Local Contexts application within the library
- Data integration across databases while still retaining metadata (certain data restricted?)
- Māori-science interface with FAIR/CARE – deliberate, not adhoc
- Acknowledge Māori data sovereignty (and CARE principles)
- Engagement with communities (in particular iwi/hapū) (ground rules for engagement) - now by some journals e.g. Molecular Ecology) – must go from collection through infrastructure - Barcodes (other uses may require another complete dialogue/engagement)
- Accessibility mechanism with kaitiaki involvement, - open access, must be only considered based on cultural interests, informed consent (free, prior, informed consent or FPIC, conditions attached, and specified limitations on use (based on operational, research, or commercial use).
- Benefit-sharing with Māori communities / Build Capacity of governance with iwi/hapū

Discussion

Identification of the Topics Discussed through Engagement

There was an acknowledgement that the generation of DNA sequence data for the reference library was for barcode purposes (i.e. to generate and catalogue the unique DNA sequence of taxa to aid in species identification) only. As the potential for using these DNA sequences for commercialisation was very limited, the discussions generally approved the idea. If innovation enabled possibilities of using such DNA for commercial purposes or the purposes of the library were expanded there would need to be more discussions as the parameters had moved.

There was general agreement that a reference library must be Te Tiriti compliant. Preferably it should be hosted in Aotearoa with governing structures that protect Māori rights and interests while enabling the use of this technology for conservation, monitoring and growth of knowledge. Governance of the platform required Māori experts and representatives of iwi/hapū.

The sessions highlighted the need to recognise the whakapapa reflected through the process. There is more recognition of whakapapa in relation to humans but little recognition generally of its importance for Māori in non-human life as well. They have relationships with animals, plants, microbes, and DNA and their interrelationships with life. As part of this more study is required to understand the mātauranga and tikanga involved with processes such as eDNA.

The sessions highlighted the need to ensure that Māori data sovereignty (MDSov), along with FAIR and CARE principles, are embedded into the library infrastructure and processes.

Engagement was an important issue that was raised through the sessions. Enhanced ground rules need to be developed around engagement and these need to encompass areas of collection, infrastructure of the platform and long-term use. Some publishers, especially

scientific journals (e.g. Molecular Ecology), now require statements indicating whether community engagement has occurred. The present discussion focused on barcodes, but if the reference database was to function beyond that or contain longer DNA sequences (i.e. including genes of function) or whole genomes, there another conversation and further engagement would be required.

The reference library should ideally be hosted in Aotearoa. If it cannot be, then it must, at minimum, have the ability to be governed using Aotearoa protocols and governance systems. It needs a Māori-science interface including an accessibility mechanism for kaitiaki. The infrastructure should be set up to encourage collaboration. There was a suggestion that it should be a federal system. Where possible data such as barcodes with associated metadata should be integrated across databases while protecting and restricting access to sensitive, cultural data and information.

Local Contexts (Notices and Labels) should be built into the infrastructure. It is an initiative that supports Indigenous local communities to manage their intellectual and cultural property, cultural heritage, environmental data, and genetic resources within digital environments.⁴

It is interesting to note that the retention of physical specimens and samples was not discussed in the sessions. This could be due to the focus on the molecular library, rather than the physical specimens themselves, however, samples remain an important part of any reference infrastructure.

There was a need for effective data management plans (DMP) for the DNA reference library. The DMP would include requirements of free, prior and informed consent (FPIC). There would be clear and transparent governance structures. Furthermore, the protocols for access and use of the data would be set out with oversight in place.

A clear message coming from the sessions was the importance of recognition of Māori rights and interests in data. This includes the implications of WAI 262, and intellectual property rights deriving from it. The infrastructure ought to include licence agreements that set out how data should be accessed, who to engage with, and what it can be used for. There were comments indicating the need to recognise obligations under the Nagoya protocol (some of which include benefit-sharing) and its implications for DSI.

The last important point to come from the sessions was related to benefit-sharing. Māori need benefit from their knowledge and data that is coming from their taonga. Benefit-sharing includes more possibilities than monetary benefit and may be context dependent. Benefit-sharing is Building Māori capacity was highlighted as necessary in various elements of this in the platform governance, though to supporting collection to aid their kaitiaki functions. To aid Kaitiaki in the capacity building and governance functions, educational materials are being

⁴ See: <https://localcontexts.org/wp-content/uploads/2023/04/What-is-Local-Contexts.pdf>

prepared to provide greater understanding and overview of necessary points for governance and protocols in the collection and use of eDNA and the reference library.⁵

Summary

There was general agreement that the reference library was a useful and necessary part of eDNA monitoring. There was some recognition that the DNA information being stored is specific to species identification (barcodes) and has limited utility beyond that purpose. As the information has no real exploitative value, the consensus was the concerns regarding potential misuse of DNA in this context were reduced and should be able to proceed. The key points revolve around ensuring Māori participation in the governance and operations of a Te Tiriti compliant reference library. Ideally the library should be hosted in Aotearoa and subject to protocols developed here in Aotearoa. Greater awareness and understanding of engagement is necessary for generating reference samples. The metadata schema should contain geographic information, fields for Indigenous knowledge, and incorporate the Local Contexts notices and labels as part of the core infrastructure. Lastly, the reference library should have effective management plans that included protections for Māori rights and interests including benefit-sharing and IP.

⁵ See: Environmental DNA Monitoring Information Sheet - <http://doi.org/10.15663/i56.28918>; Te Nohonga Kaitiaki Guidelines Information Sheet - <http://doi.org/10.15663/i56.28922>; eDNA, DNA Reference Libraries and Kaitiakitanga - <http://doi.org/10.15663/i56.28917>; DNA Information Sheet - <http://doi.org/10.15663/i56.28919>.

Appendix 1 – Summary of Māori issues discussed in Webinars

Engagement Series of Te Huinga Ira Taketake o Aotearoa | National DNA Reference Library

Wānanga 2 – Māori perspectives on the uses of DNA data

- Te Tiriti compliant
- Need to go to the source point – whakapapa – existence in whakapapa reflected in the process
- What is the Māori-science interface
- Māori have had relationships with animals, plants, and microbes from the environment
- What and how do benefits come back to Māori
- Acknowledge Indigenous data sovereignty (principles)
- Engagement should be with Māori communities, not govt, institutions.
- More understanding of tikanga involved with eDNA – can show existence, but not exact location, interaction, etc.
- Need to develop collective ground rules for interaction and engagement, and governance
- Development of reference library beyond barcodes (would that be another ‘ballgame’, would it change community reaction as opposed to just barcodes)
- FAIR/CARE

Wānanga 3 – Database architecture, process and pathways

- Build a repository based in Aotearoa, for Aotearoa focused on conservation, honours kaitiaki, CARE and governance by Māori.
- Data made available through access mechanism, controlled data by those holding kaitiaki
- Data leaving Aotearoa jurisdiction loses protection of Te Tiriti
- Has data integration between databases, collection. Metadata (interacts with spreadsheets allowing validation, integration)
- Data management – definition
- Important for collaborative research
- Technical guidance based in FAIR principles
- Data management plan includes how it will be shared, accessed and used
- Nagoya protocols and compliance
- DSI does or does not equal genetic resources.

Focus on governance, CARE, and biocultural labels. Wānanga 4 – Barcoding technologies and pipelines

- Te Tiriti guided
- Based on barcodes
- Genetic data is taonga
- Curation across databases
- Cultural engagement is required now by some journals e.g. Molecular Ecology).
- Museum species valuable to fill barcode gaps
- Data sovereignty, local contexts

Wānanga 5 – Cross-project fertilisation of best practice

Australia

- Data management that supports Indigenous peoples
- Licence agreement
- Consultation with different families, community members
- Sensitive/restrictive species
 - Exact location restricted
 - ID data
 - Attributive data
- National framework operating according to FAIR/CARE
- Project partners have Indigenous advisory committees
- National consultation underway

Canada

- No reference database for Indigenous Canadians (rare disease database)
- FAIR/CARE/OCAP
- Indigenous cultural oversight group
- Access to data, must be registered, actively monitored
- For clinical diagnosis, not research

Another speaker

- Appropriate sovereignty notices before going public
- Engagement must go from collection to infrastructure and generation and use of DNA reference libraries

Wānanga 6 – Data governance and sovereignty⁶

- Kaitiaki of mātauranga – taonga not owned by the Crown
- Most Govt. departments do not have policies to guide interaction with mātauranga
- Should be active protection, not control
- Deliberative, rather than adhoc
- WAI262 – IP rights, interests, licence agreements
- Anonymised data still contains mauri
- FRIC – consent
- Good governance does not always mean sovereignty
- Need to operationalise good governance
- Lack of infrastructure with iwi
- Need to build capacity within iwi

⁶ eDNA webinar: <https://youtu.be/EOz8JGnHZso?si=2LkGTBM4JckfvK-G>

The Whaki Webinar⁷

- Accountability to the community (iwi/hapū) is critical, but how is still open
 - Local contexts part of the answer
 - Indigenous data repository
 - More accountability mechanisms are required such as for security, and usage
- If not in iwi/hapū ownership, then kaitiaki governance group ought to be established – does not need to follow Western model
- Needs to have a Te Tiriti lens - incorporate iwi/hapū perspectives however, how can these be appropriately reflected? and the continuing advocacy around WAI262
- Preferable to host in Aotearoa, but depending on data type may be more appropriate in overseas host
- Must be conversations with the community
- Experts available to manage and administer (with tikanga knowledge)
- Federated design would be appropriate
- Different types of data require different governance, which must be recognised in the governance structures, mechanisms and protocols
- Metadata must reflect community details, purposes, and indigenous metadata
- Open access, must be only considered based on cultural interests, FRIC, conditions attached, and specified limitations on use (based on operational, research, or commercial use).

Published by

Te Mata Punenga o Te Kotahi | Te Kotahi Research Institute, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand. Email: rangahau@waikato.ac.nz

Preferred citation:

Sterling, R. Hudson, M. & Liggins, L. (2024) *Māori Perspectives on Development of an eDNA Reference Library: Summary for MfE Molecular Library of Groundwater Fauna Project*. Te Mata Punenga o Te Kotahi | Te Kotahi Research Institute, University of Waikato.

⁷ Whaki webinar: (https://youtu.be/E4skLQDbmcQ?si=HZOWaulMndM_hYNo)