International eDNA Standardization Task Force (iESTF) Meeting Notes

Monday, May 8, 2023 @ 1pm EST

Meeting participants

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Agenda

1. 1. **Introductions**
2. 2. Background and Scope (**MH)**
3. 3. Regulatory & Management perspectives (**JD)**
4. 4. Establishing networks: lessons from DNAquanet (**FL)**
5. 5. ISO Certified Facilities (**NF)**
6. 6. ISO Certified Protocols and Roadmap (**KM)**
7. 7. Group Discussion and Next **Steps**
8. 8. Summary of upcoming **events**

1. Introductions

RK = “Everyone wants standards but no one wants to be standardized”

2. Background and Scope (MH)

- Comprehensive bioassessment on a global scale
  - Compson et al., 2020 https://doi.org/10.3389/fevo.2020.581835
  - Complexity varies by sector with different ramifications
  - Artisanal (mostly academic led) versus industrial development and application of DNA metabarcoding
- “Validation”
  - Hajibabaei et al, 2022 https://doi.org/10.1016/j.tree.2022.06.015
  - Validation methods (experimental, ecological, statistical) versus ‘biological truth’
  - Ex. ocean industry (ship building, transport, fisheries, oil and gas) & blue economy; Drivers for standardization include biotechnology, aquaculture, tourism, renewable energy, mineral resources
  - Ex. International Association of Oil & Gas Producers (IOGP); E & P Environmental Genomics Program; they are demanding standards; request for proposals (RFPs)

on conventional vs eDNA methods, sampling guidance, lab analysis, & bioinformatics

- We need to leverage resources; avoid duplication/competition; build consensus; have a timeline for delivery of standards
- We still need common terms of reference
- We need a group comprised of people with similar needs and visions

3. Regulatory & Management perspectives (JD)

- Unable to make the call

4. Establishing networks: lessons from DNAquanet (FL)

- Biomonitoring 2.0 was published in 2012 https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-294X.2012.05519.x, what is the status of regulatory biomonitoring now?
- Issue: Variability in results derived from the use of conventional methods versus eDNA tools across laboratories using the 'same' methods. Not surprising if we detect more using DNA versus conventional methods, but how to explain so much variance when fewer taxa are detected then expected based on what went into a mock community? How to assess measurement accuracy?
- What levels are available for standardization while still leaving room for individual study freedom?

  Level 1 - quality management framework; documentation of workflows, reporting obligations, general laboratory practice, staff training, equipment testing, etc.
  Level 2 - proficiency testing for laboratory; interlaboratory/ring tests, certification
  Level 3 - minimum technical requirements; specification of sample type-specific criteria for sampling (ex. eDNA from water or Malaise trap samples); type and number of negative/positive controls, purity, white/black list of primers, sequencing depth, reference database; FAIR principles, bioinformatics, etc.
  Level 4 - quality control of the analyses; co-analysis of reference samples, blind samples, certified mock samples, quantification of the deviation to validate the measurement by the reference laboratory

5. ISO Certified Facilities (NF)

- ISO 9001 Quality management standard (QMS)
  - Benefits: international recognition, sets facilities apart from facilities without certification, is flexible/not prescriptive, it's about structure and maintaining consistency, continuous improvement, it's comprehensive covering field, lab, analysis methods
- ISO 17025 Testing and calibration labs

    - QMS elements are from 9001 and the rest is written for labs; ex. method suitability, sampling, measurement uncertainty, result validity, records, etc. Language developed with chemical testing in mind, we don't have the right kind of reference sets available to determine validity, may not suitable.
- Need to establish protocols for validating metabarcoding
    - Reference standards, assessment of factors that influence result, comparison against other methods, interlaboratory comparisons, evaluation against theoretical principals
    - Could use 9001 to start building the framework to balance research & development with service providing; use more environmental genomics specific language
    - Certification ex, X company is certified by Y company as meeting the requirements of ISO 9001:2015 for the following activities "Biodiversity monitoring solutions through collecting, genomic sequencing and analyzing various environmental and biological samples."
- MH - took 2 years and a dedicated team of 3 to set this up with the help of consultants

6. ISO Certified Protocols and Roadmap (KM)

- Reason why new methods not applied?
    - Lack of standards & agreed upon protocols for legislative & regulatory purposes
- Standards are developing within countries ex. JP, CAN, USA, GER, AUS, with imminent risk of splintering (multiple standards reduces comparability); see European EN 17805:2023 Water quality - Sampling, capture and preservation of environmental DNA from water
- There is a huge demand for *global* standards
- Points to keep in mind
    - We can now do a job better than we used to
    - Need reusable and refined standards
    - Need backward comparability
- Science Summit at UN General Assembly (SSUNGA) 77 13-30 September 2022 & UN Biodiversity Conference (COP 15) 7-19 December 2022 https://helda.helsinki.fi/handle/10138/350750
    - Need minimum requirement standards (collecting, handling, storing)
    - Need to create standards inclusively (involve developing countries from global south, not just global north)
    - Need dedicated funding to encourage inclusive participation in standards development
- ISO/TC331 Biodiversity
    - Doesn't deal with technical methods
- ISO/TC147 Water Quality
- Meeting with ISO/TC 147/SC5 Biological Methods in Finland

    - Discussed establishment of parallel group to CEN TC230 WG28 DNA and eDNA Methods
- New ISO/TC147/WG13 - eDNA, DNA, RNA Methods is under consideration by ISO
- GEOBON meeting, Montreal, 10-13 October 2023
- SSUNGA78, New York, 12-19 September 2023
- Marine eDNA Workshop follow-up meeting (US), standardization, best practices for DNA metabarcoding, intercalibration exercises to inform proficiency tests and lab accreditation

7. Group Discussion and Next Steps

KK - notes that scientists don't think like regulators, steep learning curve
-need to identify which ISO framework to target
-questions studies that claim to do the same thing but with great variability in results, are they really doing the same thing?

MH - ISO can provide structure to each of the layers of standardization discussed by FL, ex. ISO 9001 discussed by KM

DB - re: KM not just global south but should include Indigenous people as well, KM agreed

PB - currently collaborating with 'global south' countries where there are calls for standardization and validation, want new and faster methods for assessment including in remote regions, need to include guidelines for replication (field, lab)

RK - re: KG US national standards, looking for answers re: standards and use cases

FL - importance of transdisciplinary meeting groups
- establishment of an eDNA society

RK - need effective way to communicate progress and new developments

FL, MH, JD, DB - need inclusive eDNA society to move standardization and progress forward

HY - Hybrid meeting on ISO Standardization 19 May 2023 noon Tokyo time, will send zoom invite to MH to send to this group

MH - IWEG, St. John's NFLD, June 21-22, 2023 includes industry and regulators and many applications (regional meeting, need to do this on a broader scale)
- GEOBON meeting, Montreal, 10-13 October 2023, session on standardizing eDNA approaches, send abstracts, focal point to meet, strategize
- could attract funding maybe form CBD UN related bodies, formalize plans, charter, brain trust, to push standardization to the finish line
- use these connections and emails to keep each other informed

DB, FL - consider Society of Environmental Toxicology and Chemistry (SETAC) as a successful model to bring together industry, regulators, academics
MH - concerned that SETAC is heavily influenced by environmental consulting companies where eDNA is competitive to their business model, ex. CABIN heavily influenced by people who don't believe in eDNA, who make money using conventional methods

PB - we risk only talking to each other, need to reach out to see what others need
- SCB's 31st International Congress for Conservation Biology (ICCB 2023) will take place from July 23-27, 2023 in Kigali, Rwanda, course on eDNA

8. Summary of upcoming events

Hybrid meeting on ISO Standardization 19 May 2023 noon Tokyo time

IWEG, St. John's NFLD, June 21-22, 2023

SCB's 31st International Congress for Conservation Biology (ICCB 2023), July 23-27, 2023 in Kigali, Rwanda *Course: eDNA Tools for Conservation Biologists: An Introductory Course

Science Summit at UN General Assembly SSUNGA78, New York, 12-19 September 2023

GEOBON meeting, Montreal, 10-13 October 2023 *Session: Standardized eDNA-based biodiversity monitoring to inform environmental stewardship programs, accepting abstracts

Marine eDNA Workshop follow-up meeting (US)