Australian Government

ANSTO

Determining seafood provenance

using nuclear techniques

Producing safe and high-quality food is important to ensure consumer confidence, mitigate biosecurity and food safety risks, and support industry and regulatory bodies to maintain integrity in the global supply chain.

The Australian seafood industry has a global reputation as a trusted supplier of safe and high-quality seafood. Each year thousands of tons of seafood are imported and exported with increasingly higher value and demand for high-quality Australian products.

The increased demand and higher profitability of seafood can motivate dishonest practices to mislead and exploit consumers.

Fraudulent activities include substitution, mislabelling, and adulteration of products.

Determining traceability, or *provenance*, of food using scientific methods is fundamental for industry, consumers and government.

The Australian Government anticipates the agricultural industry to become a $100 billion sector by 2030. A robust traceability or provenance framework can help Government meet its expectations.

Current practices, mostly paper-based, are inadequate and vulnerable to tampering. ANSTO's long commitment to provenance research has established that nuclear analytical techniques can be the foundation of provenance. This approach has been validated with high levels of accuracy.

Each type of seafood has a unique fingerprint that relates to the environment where it was bred, fed, and grew. ANSTO's nuclear techniques, including stable isotope analysis, elemental profiling with ITRAX X-ray fluorescence scanning and accelerator-based ion beam analysis, offer great precision in recognising these environmental fingerprints — making authentication possible.

A computational model developed at ANSTO analyses the fingerprints and confirms the source of origin, including whether it's Australian or not, and farmed or wild-caught.

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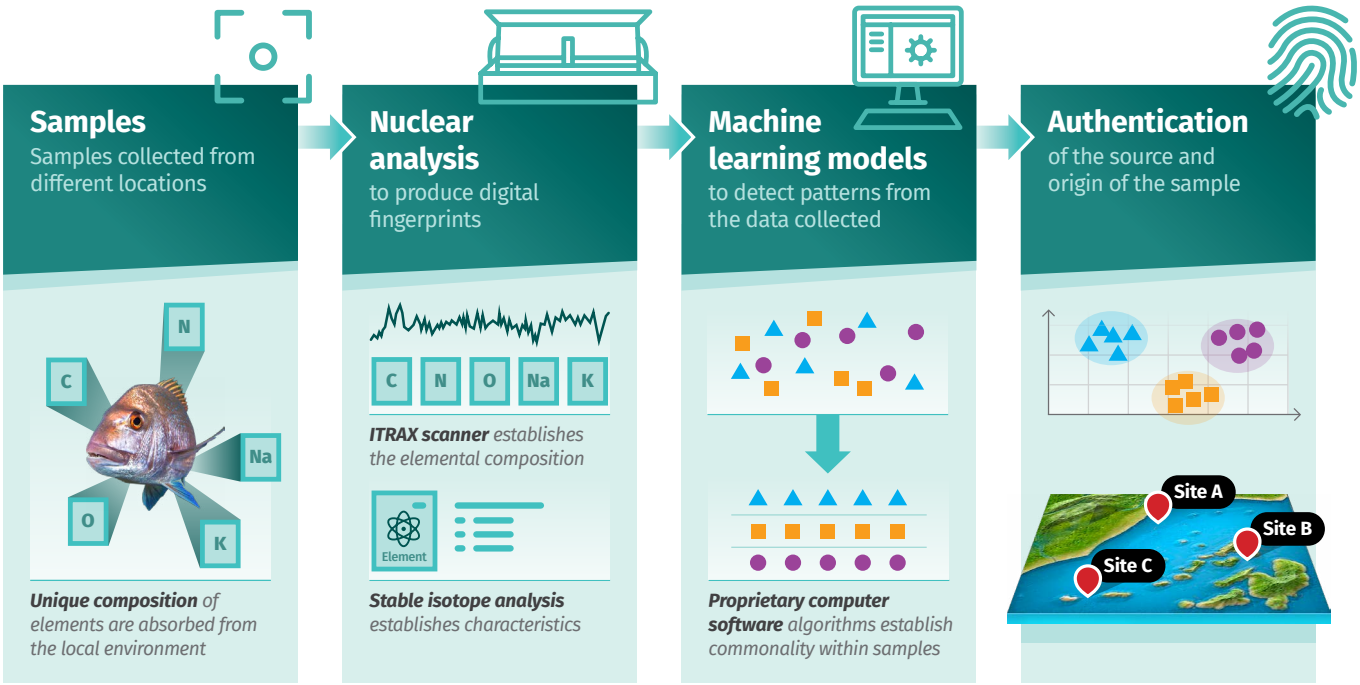

The provenance team has currently has two approaches to determine provenance. A lab-based method is based on an in-depth and robust analysis of the isotopic and elemental fingerprints using advanced laboratory instruments. These fingerprints can be linked to geographical areas to create an extensive iso-elemental fingerprint database.

A handheld X-ray fluorescence (XRF) scanner, that was modified by ANSTO, can also generate an elemental fingerprint of a seafood sample in real time.

Later the computational model analyses the fingerprints and compares them with the reference database to determine provenance.

Both the lab-based and portable handheld scanning provenance technology determine the provenance of seafood with greater than 80% accuracy.

Consumers increasingly want to consume Australian seafood and be confident of its origin.

ANSTO's iso-elemental fingerprinting provenance technology will build consumer confidence in Australian premium products, nationally and internationally. This method provides accountability, which may act as a deterrent to fraudulent practices.

ANSTO's provenance technology can support regulatory and biosecurity measures for agricultural trade, as a mitigation strategy for Australian industry and government.

The approach has great promise for the development of a market chain traceability system that can be applied to other agricultural products, such as native fruit and has potential to be applied to the wider adoption across agricultural sectors.

ANSTO capabilities

- Isotopic analysis ✔
- X-ray Fluorescence scanning ✔
- Ion beam analysis ✔
- Machine learning ✔

Collaborating stakeholders

SYDNEY FISH MARKET
UNSW SYDNEY
MACQUARIE University
Australian Government Department of Agriculture, Fisheries and Forestry
Australian Government Department of Industry, Innovation and Science
National Measurement Institute
NSW GOVERNMENT Department of Primary Industries

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