



Department
for Environment
Food & Rural Affairs

Food authenticity –challenges and priorities

**Food Fraud, analytical Tools Conference
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Summary

- This presentation will:
 - Outline drivers for food fraud, horizon scanning and intelligence and how these impact on the analytical tools we need for detection
 - Review some of the technical challenges and limitations of developing these tools
 - Summarise future technical needs to stay ahead of the fraudsters

Food fraud drivers

- **Deliberate criminal fraud for financial gain** (adulteration/substitution – premium products)
- **Rising commodity prices** – durum wheat
- **Shortage of supply** – speciality tea, olive oil
- **Raw material quality** – poor yields, variable composition
- **Avoidance of tariffs** – eg basmati rice
- **Sustainability factors** – e.g. IUU fishing

Substitution and adulteration which inform method development

FOOD OR BEVERAGE	FRAUD
Protected food names: PDO (protected designation of origin-eg Orkney lamb, Scotch beef), PGI (protected geographic indication - Welsh beef, traditional Cumberland sausage) and TSG (traditional speciality guaranteed-traditional farm fresh turkey).	Substitution with similar foods from other regions, e.g. 3,000 tonnes of fake Swiss Emmentaler cheese is sold each year
Organic and free-range foodstuffs	Substitution with non-organic or conventionally-farmed produce e.g. eggs
Extra virgin olive oil	Specialty oils from specific regions adulterated with lower-priced oils; addition of or replacement with hazelnut oil
Honey	Extended with high fructose corn syrup and rare single component honeys (Manuka, Corsica) mixed with other honeys
Alcoholic beverages	Synthetic alcohol used to manufacture 'vodka'; methanol used to extend branded alcohol; vintage wines and spirits (whisky, cognac) substituted with non-vintage material

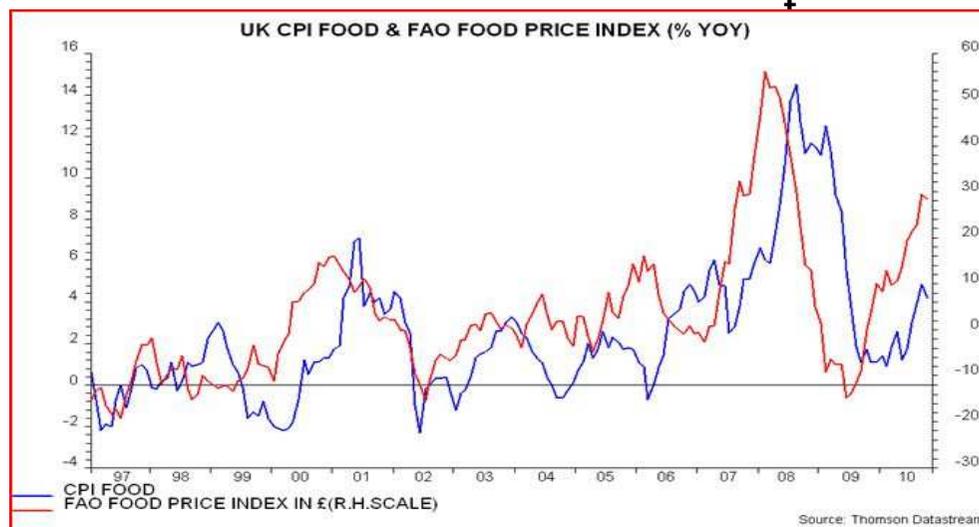
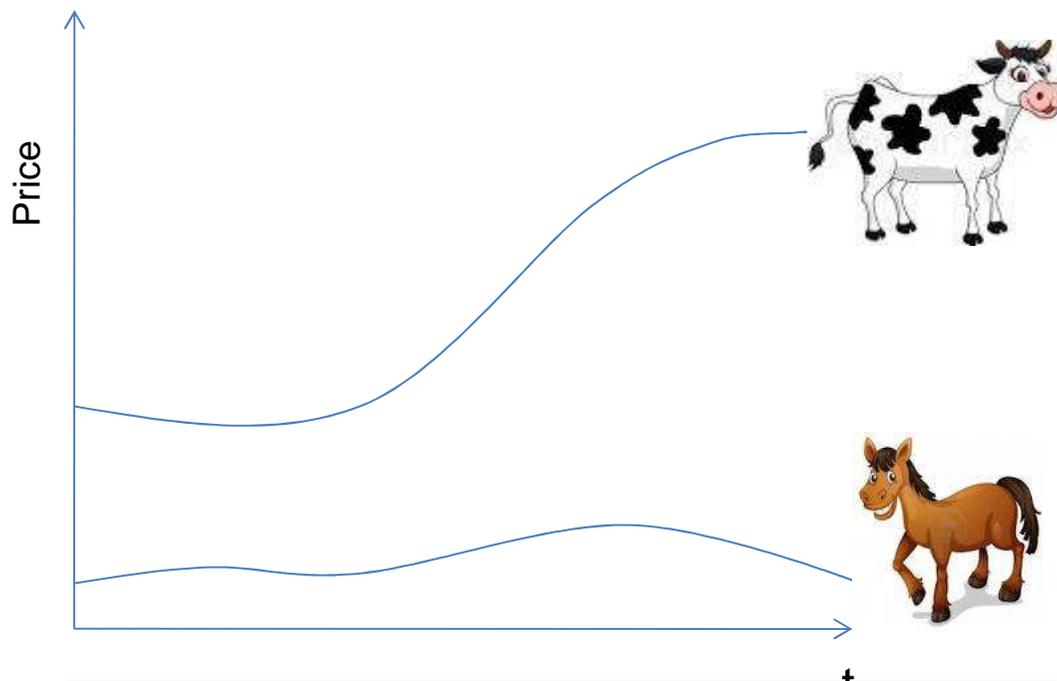
Better intelligence – predicting food fraud



- **Better intelligence sharing between Government, industry, enforcers**
- **Raising awareness of food authenticity and strengthening links**
- **Resources - targeted and risk based**

Economics -: horizon scanning

- Economic incentives, opportunities, pressures eg food prices and availability
- Developing a conceptual & applied economic model of food fraud
- Objective is to highlight areas of increased likelihood of fraud
- Using information on substitutes, prices, price changes.



Technical Challenges in detecting food misdescription

3 key difficulties:

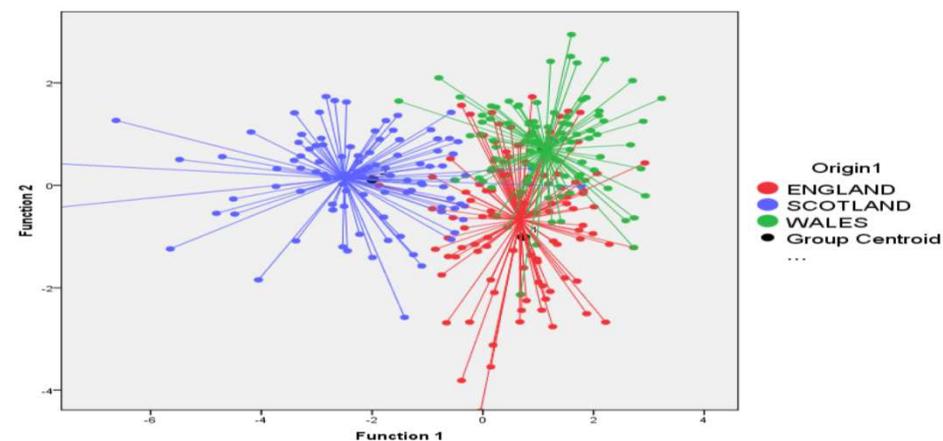
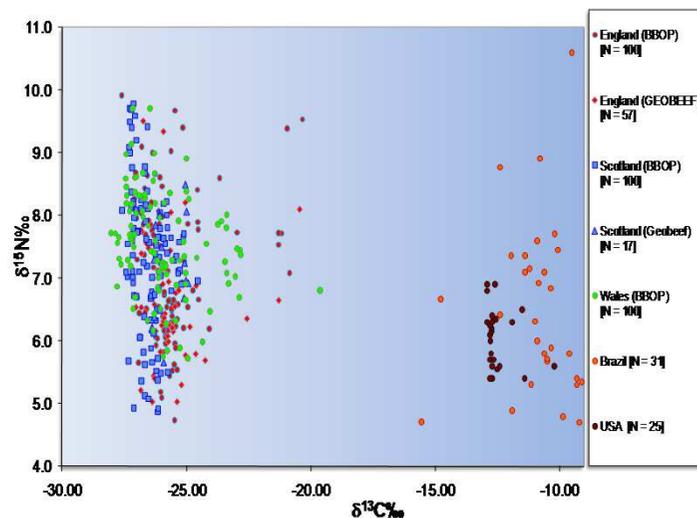
1. Issue is linked to a legal requirement, standard or guidance; **conclusion must be beyond reasonable doubt, but data interpretation is made against a background of analytical uncertainty, natural variation etc**
2. Finding a **marker** that characterises the food, one of its ingredients, the **adulterant(s)**, or the **processing, production or geographic origin**
3. **Availability of authentic samples (databases)**

Current food authenticity challenges

CATEGORY	EXAMPLES
Origin of food from sustainable sources	Palm oil, fish, exotic meats
Method of food <u>production</u>	Organic, free-range or Halal food
<u>Substitution</u> - Quantification of ingredients	Meat species in processed foods
<u>Designation of geographical origin</u> (Food Information legislation)	Meat, fish , composite foods
Specialty foods	Vanilla, saffron, honey, balsamic vinegar, Basmati rice
<u>Adulteration</u> - Alcoholic and non-alcoholic beverages	Fruit juices, wine, spirits
Miscellaneous	High protein foods

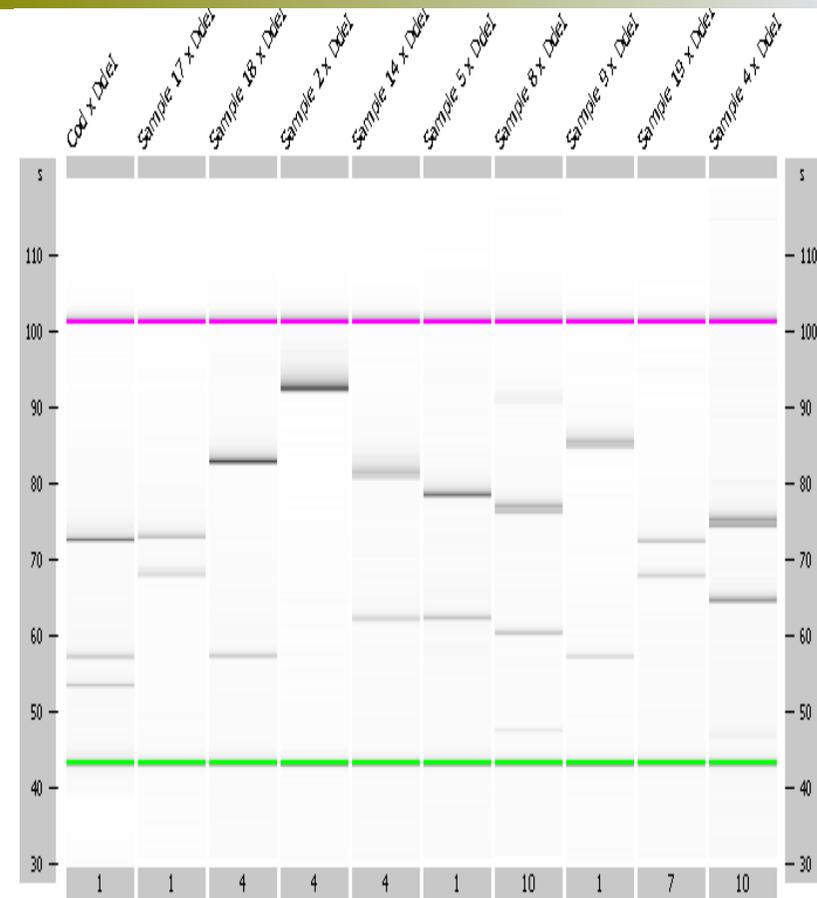
Stable isotope analysis – origin challenges

- Ratios of light and heavy H, C, N, O stable isotopes vary- in soil and animal issue
- Isotopic signatures of the food can be used to trace where the food came from - geographically and method of production
- Highly dependent on authentic reference databases to assess likelihood of origin
- Results are influenced by how foods have been fed, produced and grown
- Screening technique only
- Not applicable to all foods – composite products very challenging!



Analytical tool box – how do I test for??

- DNA-methods
- Stable isotope analysis
- Proteomics
- Metabolomics
- Spectroscopy
- Metagenomics/NGS



Current work – supporting testing and enforcement

Meat speciation

DNA quantitation

breed authentication

Detection of offal and serum in meat products

Gelatine speciation (water-retention, chicken plumping agents)



Fish speciation

geographic traceability

EU harmonisation of fish DNA methods

Nitrogen factors for fish quantitation



Knowledge transfer for DNA sequencing and extraction

Future challenges

- ***Authentic reference material provision*** - for method development, QC, UKAS accreditation, proficiency testing.
- ***Reducing Measurement uncertainty (DNA)*** in PCR-based methods and variability of DNA extraction/amplification to support their use as a rapid tool.
- **‘Non targeted’ multi-analyte methods – multi species/variety** (molecular methods); **multi-analyte** (chemical methods)
- **Portable rapid authenticity tools** - use in in the field
- ***Step change on molecular methods – next generation sequencing***
- ***Novel quantification methods*** - novel molecular biology, genomic and proteomic methods and their application to food
- ***Method standardisation, validation and database sharing.*** Recognition and standardisation of robust analytical methods within EU. ***Collaborative***

Future challenges: Technology Transfer (KT)

- simple, rapid, cheap reliable methods transferable to official control laboratories
- validate methods across laboratories (UK, EU);
- pilot studies – commercial foods challenge exercises for food control laboratories
FAPAS proficiency testing
- upskilling on novel techniques; training/knowledge exchange
- publish methods



E.g. PCR-RFLP (DNA fingerprint) method to identify major species
Transferred to a simple capillary electrophoresis lab-on-a-chip platform

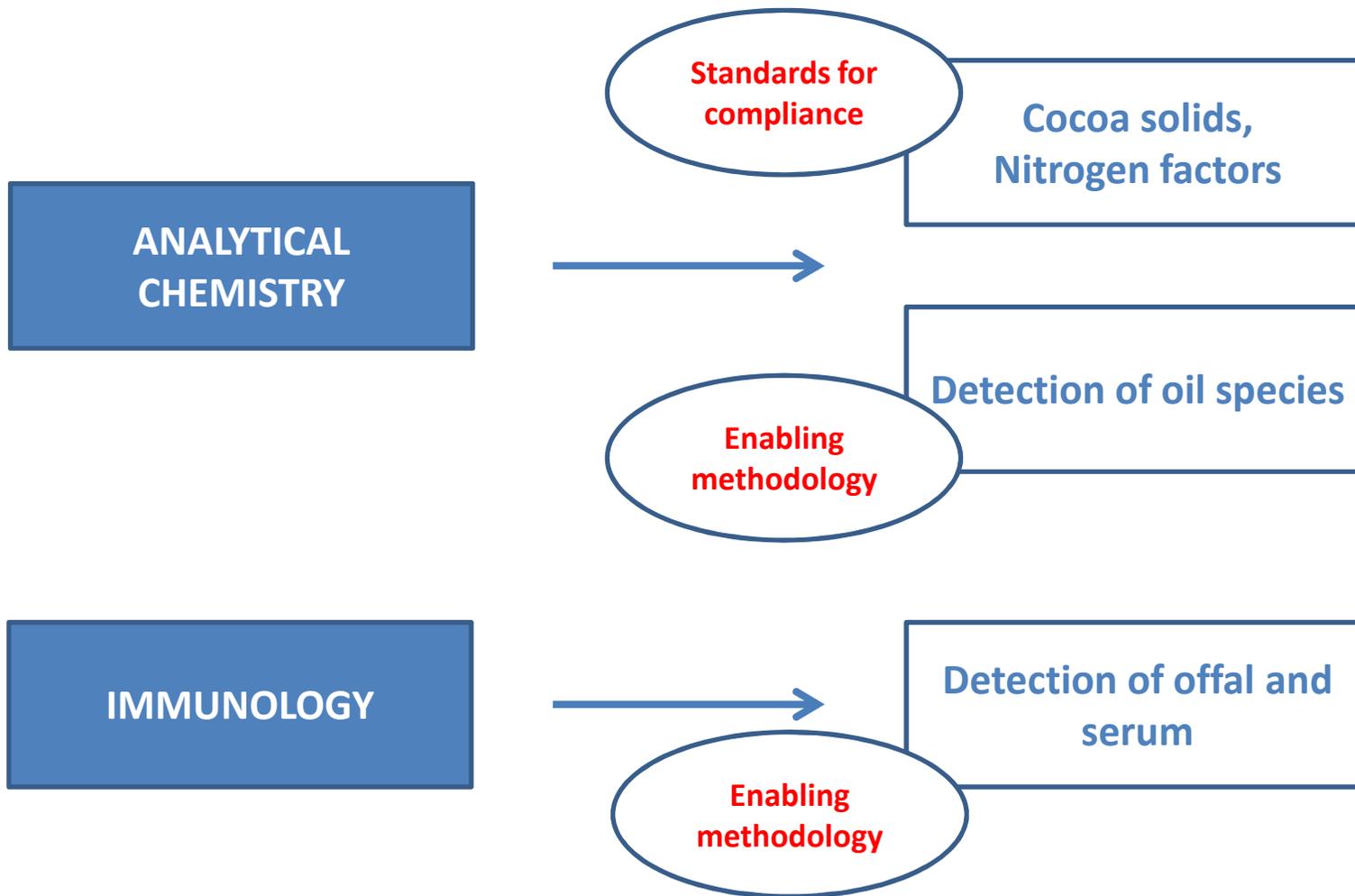
Extended to >100 species

Can test a wide range of food commodities with the same technique:

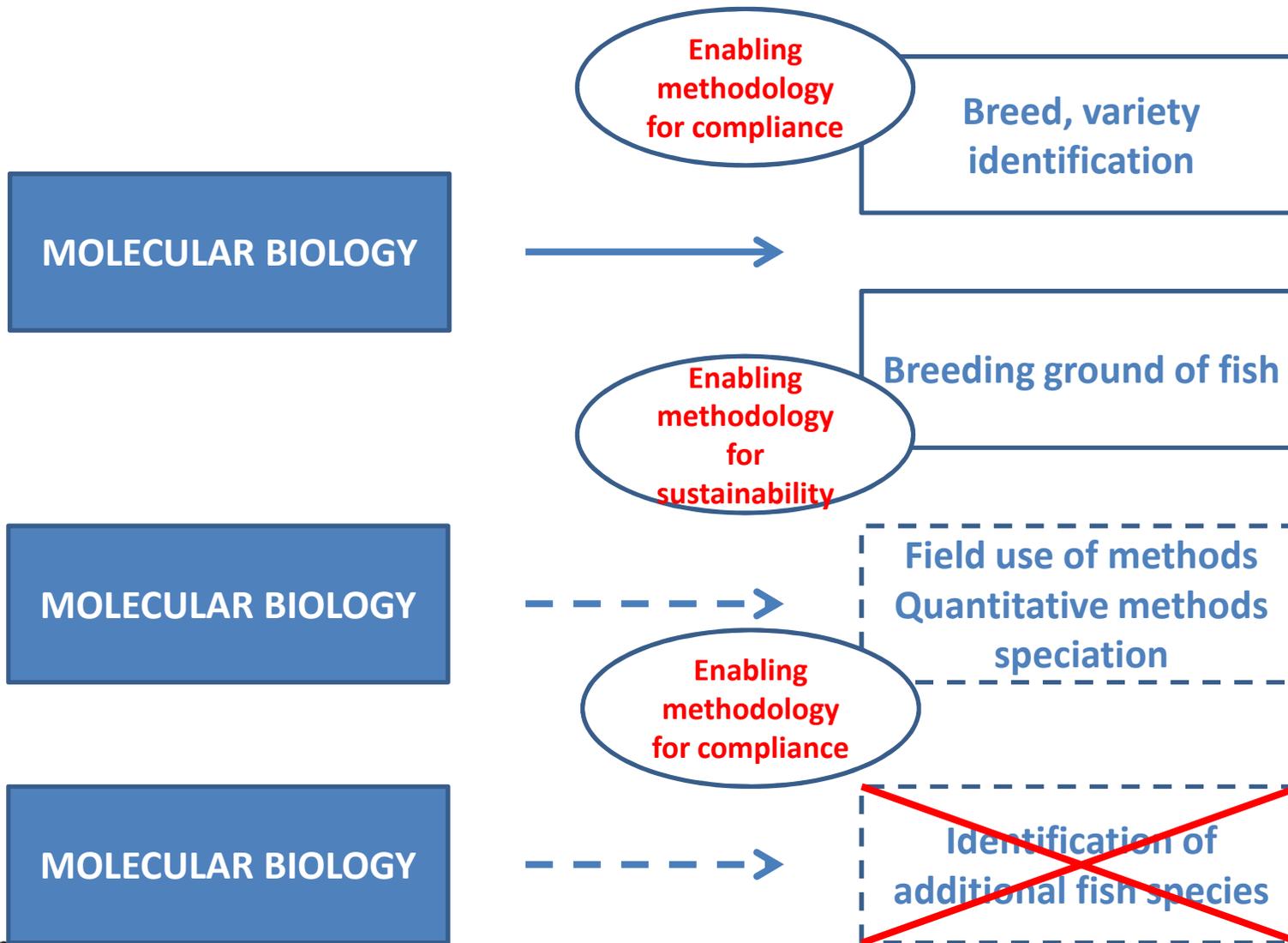
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PRIORITIES FOR THE PROGRAMME



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Simplification/knowledge transfer for enforcement

**ENABLING
METHODOLOGY**

Major focus

**DEVELOP NEW
STANDARDS**

Minor focus



Summary – remaining ahead of the game and meeting consumer demand!

Methodology development

- Problems of uncertainty /quantification in measurement
- Need markers and authentic databases
- Practical , transferable methods, knowledge transfer - enforcers, PAs, industry –

EU food authenticity research

- standardise methods and tools to support integrity of food chain – joint working on issues



Emerging issues

- Regulatory developments, economic drivers, climatic impacts, sustainability
- Cutting edge techniques to meet the challenges
- Cheap, reliable, rapid, non-targeted multi-analyte methods
- Building intelligence – ahead of the curve

Thank you for listening
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