Unmasking Seafood Mislabeling in U.S. Markets: DNA Barcoding as a Unique Technology for Food Authentication and Quality Control

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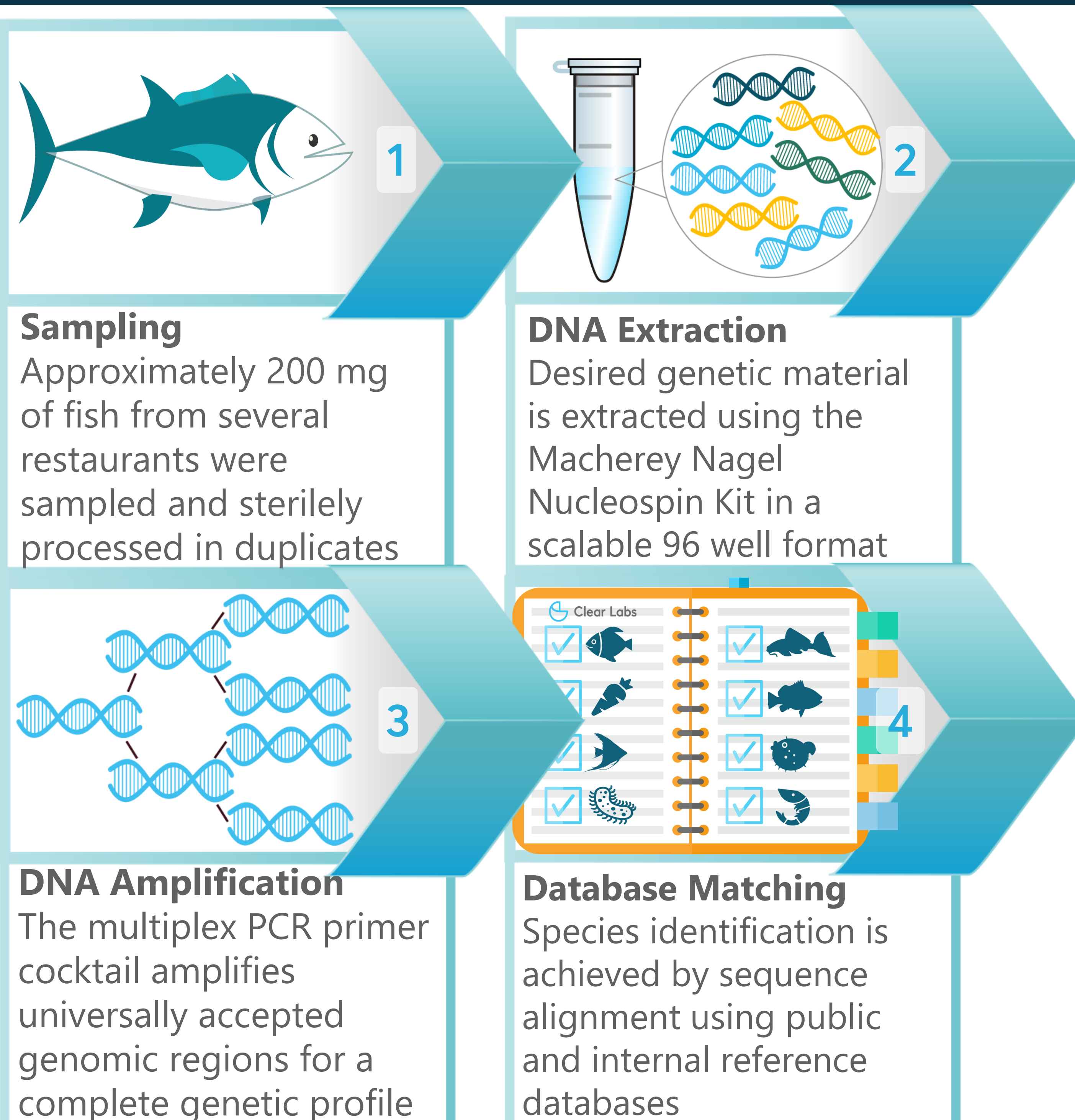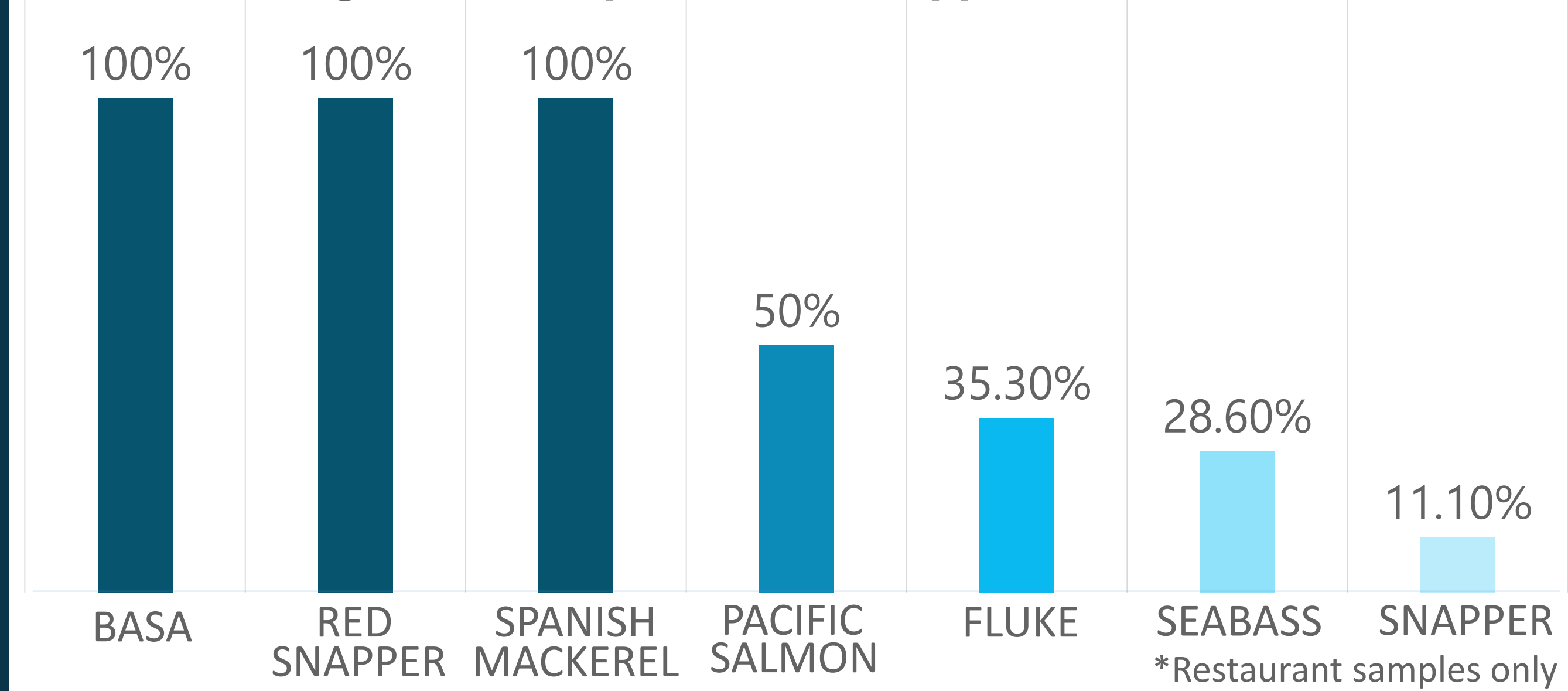IAFP 2016 — St. Louis MISSOURI

Introduction

- This study conveys the utility and scope of implementing DNA barcoding technology in discovering the precise contents of food.
- Here, we outline the application of high throughput DNA barcoding & sequencing in the analysis of seafood products from several regions across the United States.
- This novel technology, coupled with strategic, multiplexing DNA amplification comprises our proprietary, comprehensive platform.
- Sequencing acts as a blind test for authenticity and food safety, generating thorough results from a single test.
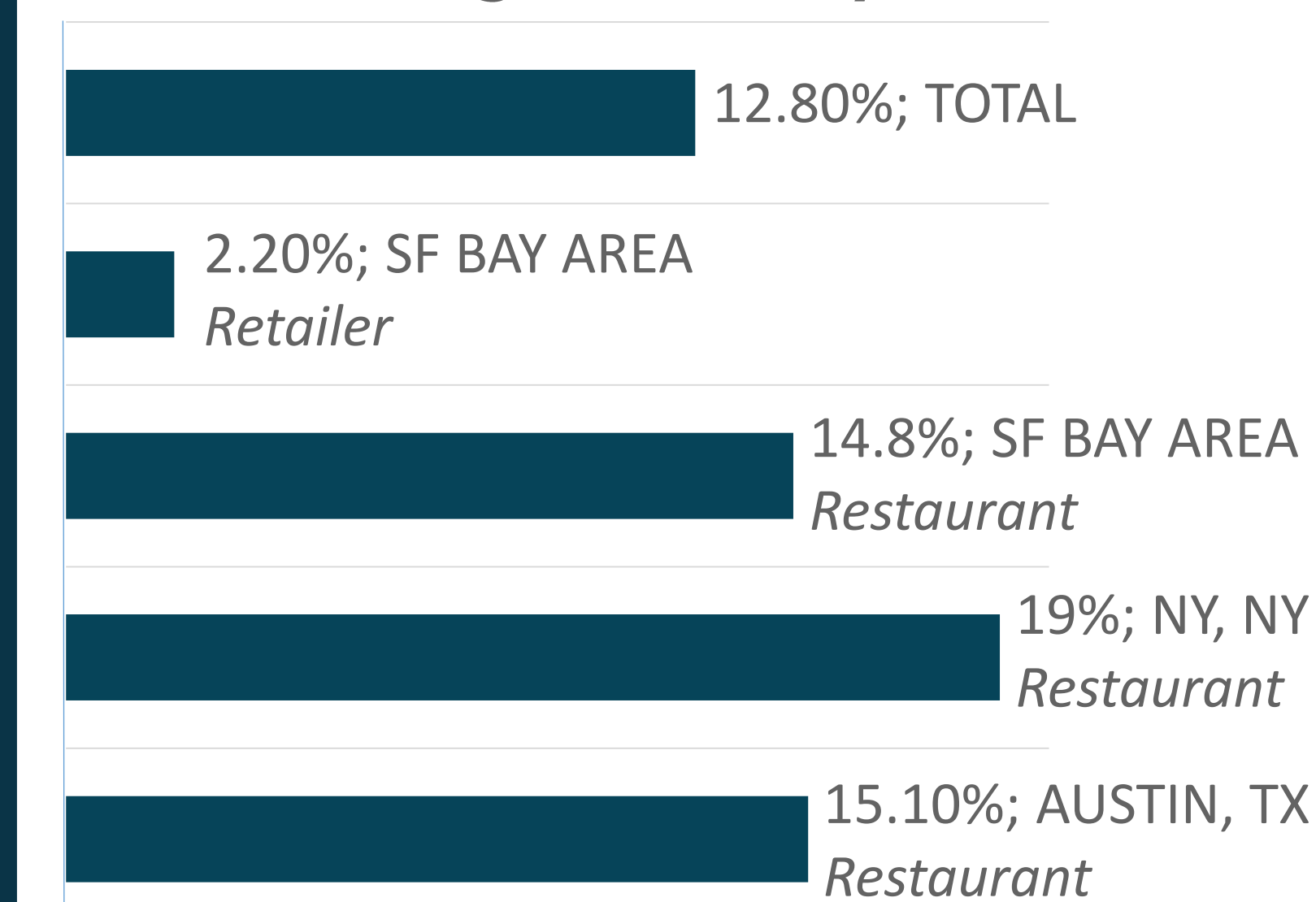
Methods

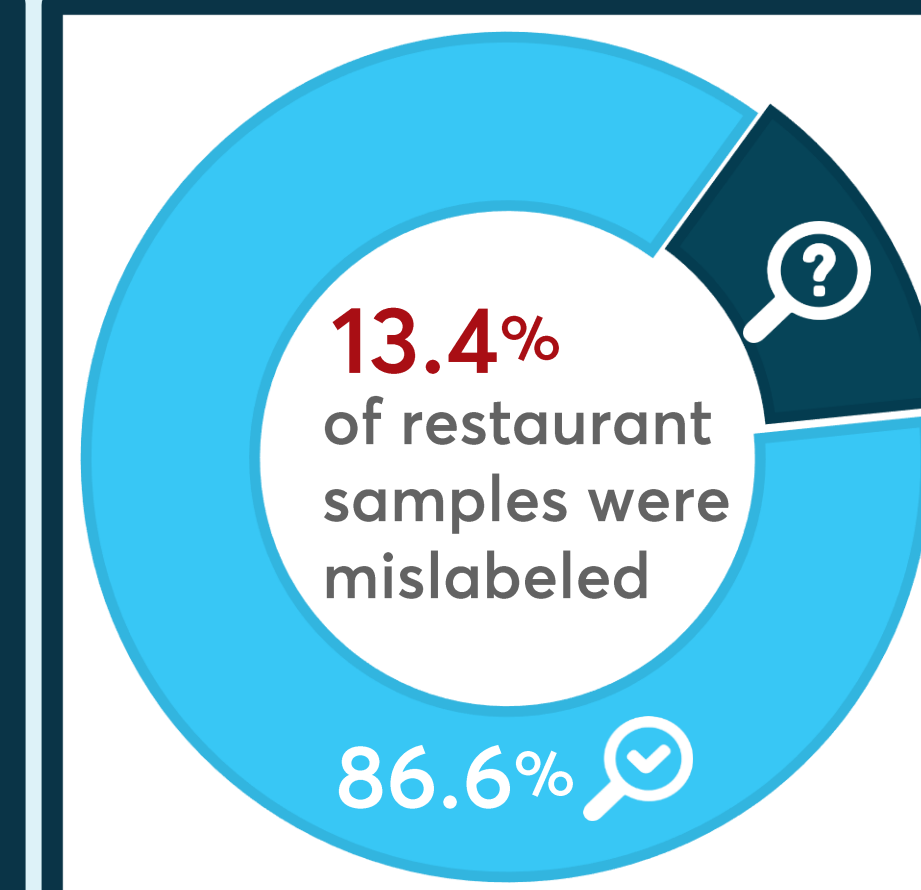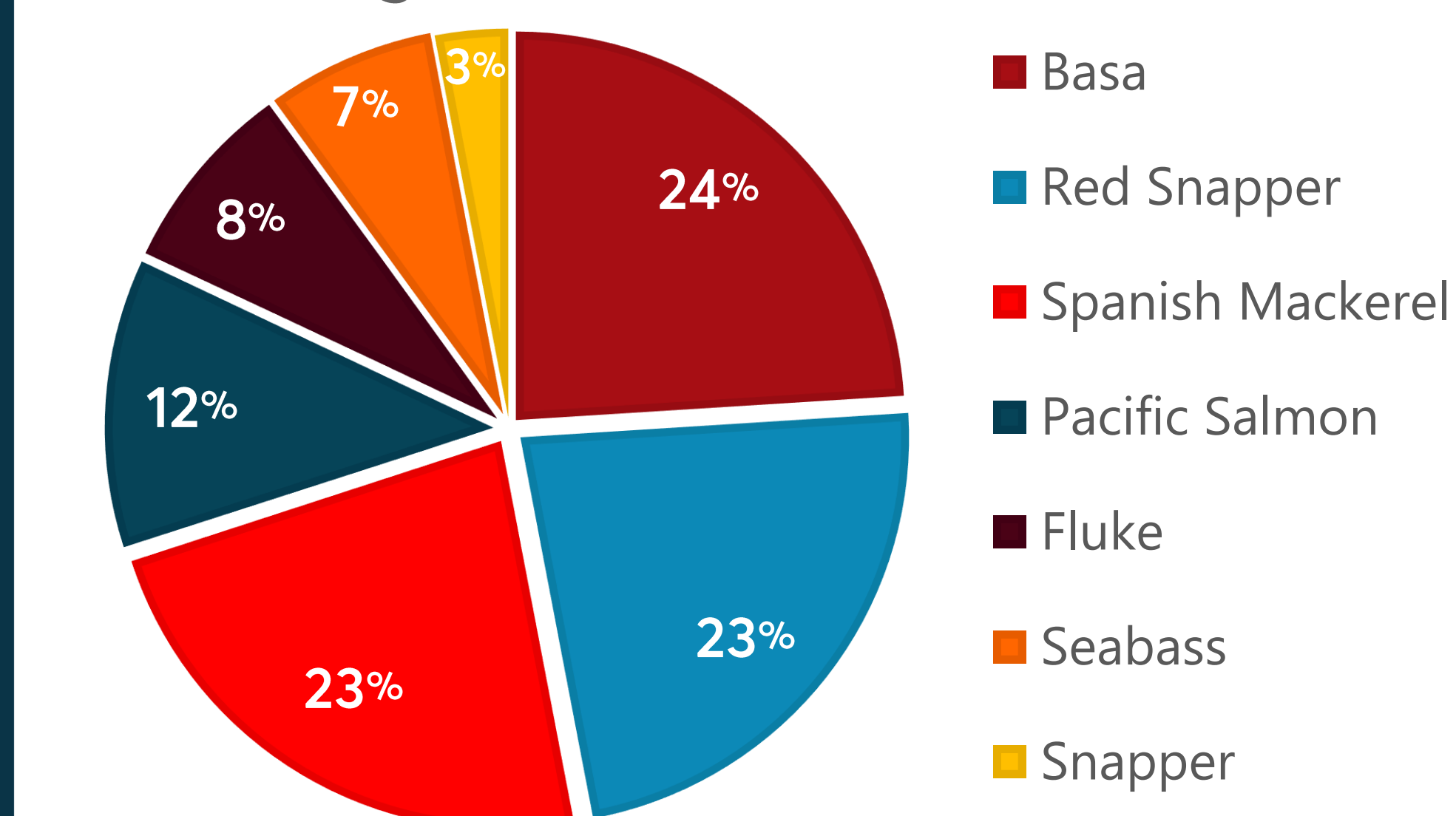**Sampling**
Approximately 200 mg of fish from several restaurants were sampled and sterilely processed in duplicates

DNA Extraction
Desired genetic material is extracted using the Macherey Nagel Nucleospin Kit in a scalable 96 well format

DNA Amplification
The multiplex PCR primer cocktail amplifies universally accepted genomic regions for a complete genetic profile

Database Matching
Species identification is achieved by sequence alignment using public and internal reference databases

Results

Mislabeling Rates By Product Type

- BASA — 100%
- RED SNAPPER — 100%
- SPANISH MACKEREL — 100%
- PACIFIC SALMON — 50%
- FLUKE — 35.30%
- SEABASS — 28.60% *Restaurant samples only
- SNAPPER — 11.10%

Mislabeling Rates By Location

- 12.80%; TOTAL
- 2.20%; SF BAY AREA *Retailer*
- 14.8%; SF BAY AREA *Restaurant*
- 19%; NY, NY *Restaurant*
- 15.10%; AUSTIN, TX *Restaurant*

Mislabeling Distribution

- Basa — 24%
- Red Snapper — 23%
- Spanish Mackerel — 23%
- Pacific Salmon — 12%
- Fluke — 8%
- Seabass — 7%
- Snapper — 3%

13.4% of restaurant samples were mislabeled / 86.6%

Common Name Key

- Atlantic Salmon — *Salmo salar*
- Fluke — *Paralichthys dentatus*
- Japanese Seabream — *Pagrus major*
- Nile Tilapia — *Oreochromis niloticus*
- Olive Flounder — *Paralichthys olivaceus*
- Pacific Salmon — *Oncorhynchus spp.*
- Red Snapper — *Lutjanus campechanus*
- Seabass — *Morone spp.*
- Snapper — *Pagrus auratus* *Lutjanus spp.*
- Tilapiine Cichlid — *Oreochromis spp.*

Species Distribution: Red Snapper

- Tilapiine Cichlid — 50%
- Japanese Seabream — 50%
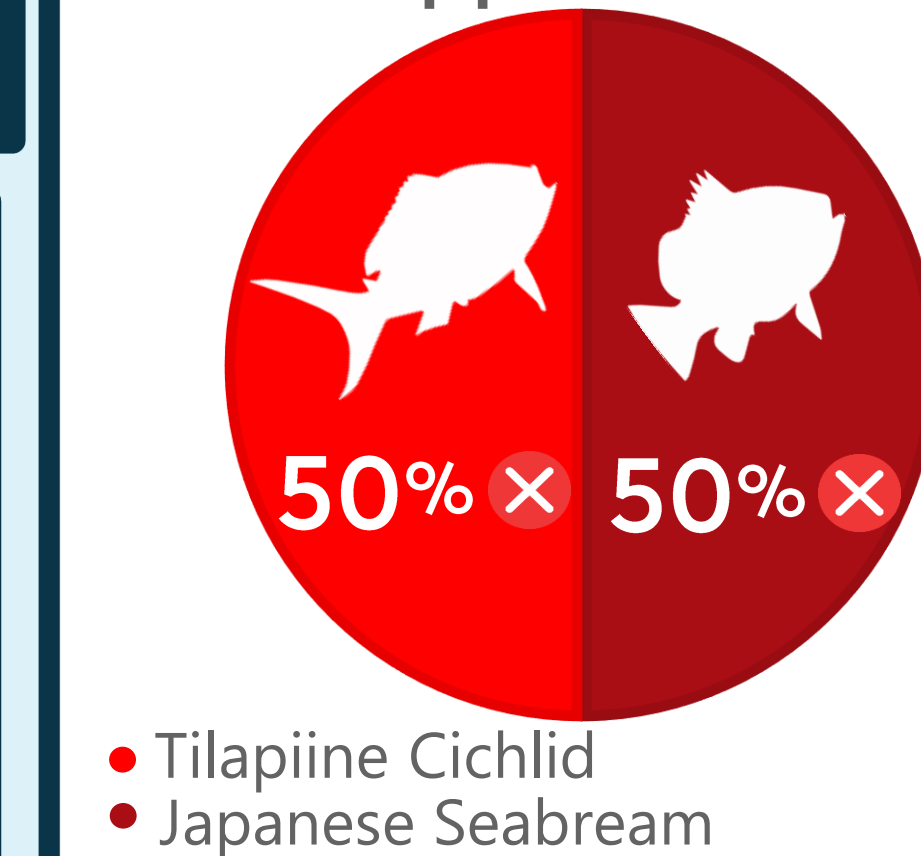
Species Distribution: Seabass

- Seabass — 72%
- Japanese Seabream — 14%
- Fluke — 7%
- Nile Tilapia — 7%

Species Distribution: Fluke

- Fluke — 65%
- Olive Flounder — 35%
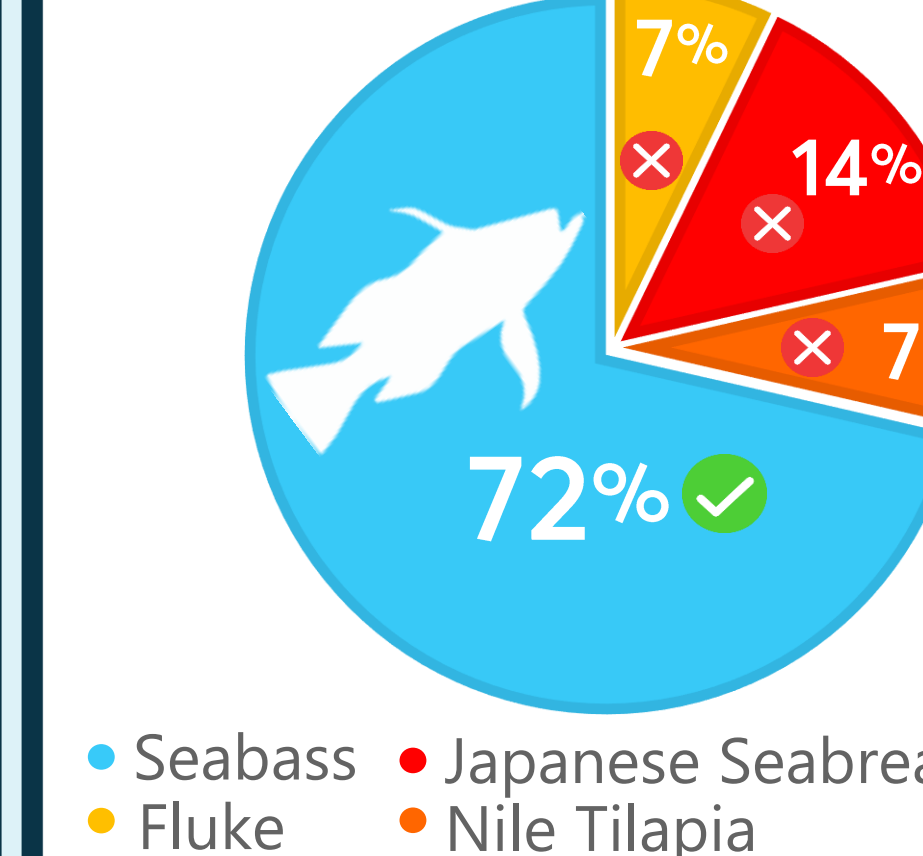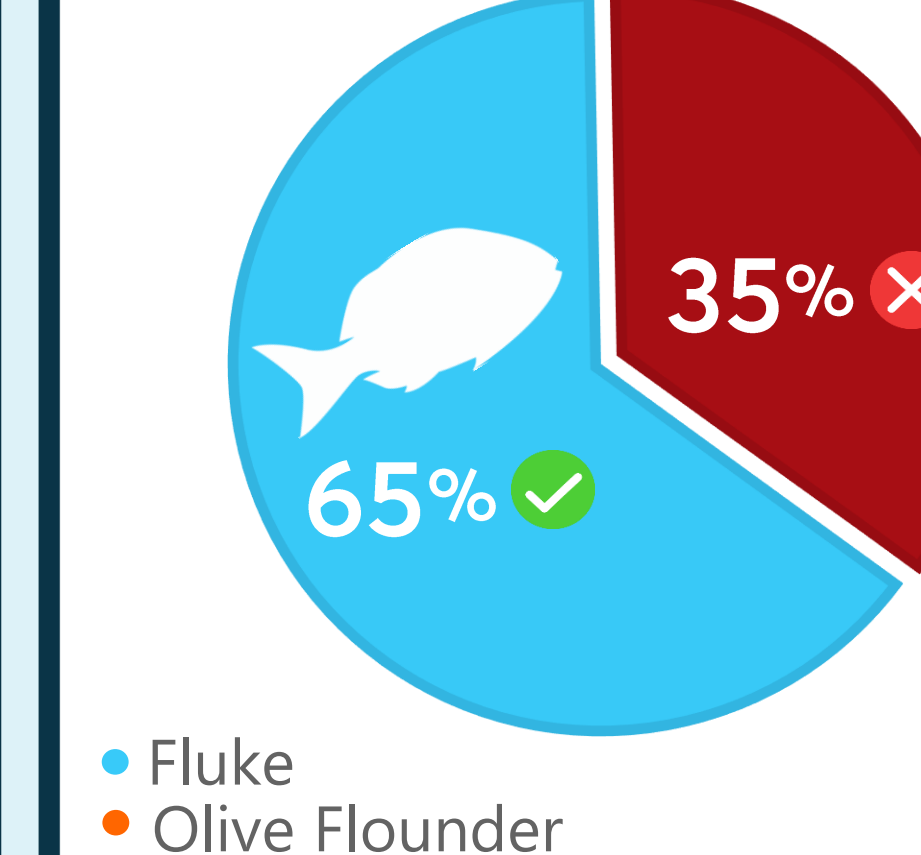
Species Distribution: Pacific Salmon

- Pacific Salmon — 50%
- Atlantic Salmon — 50%
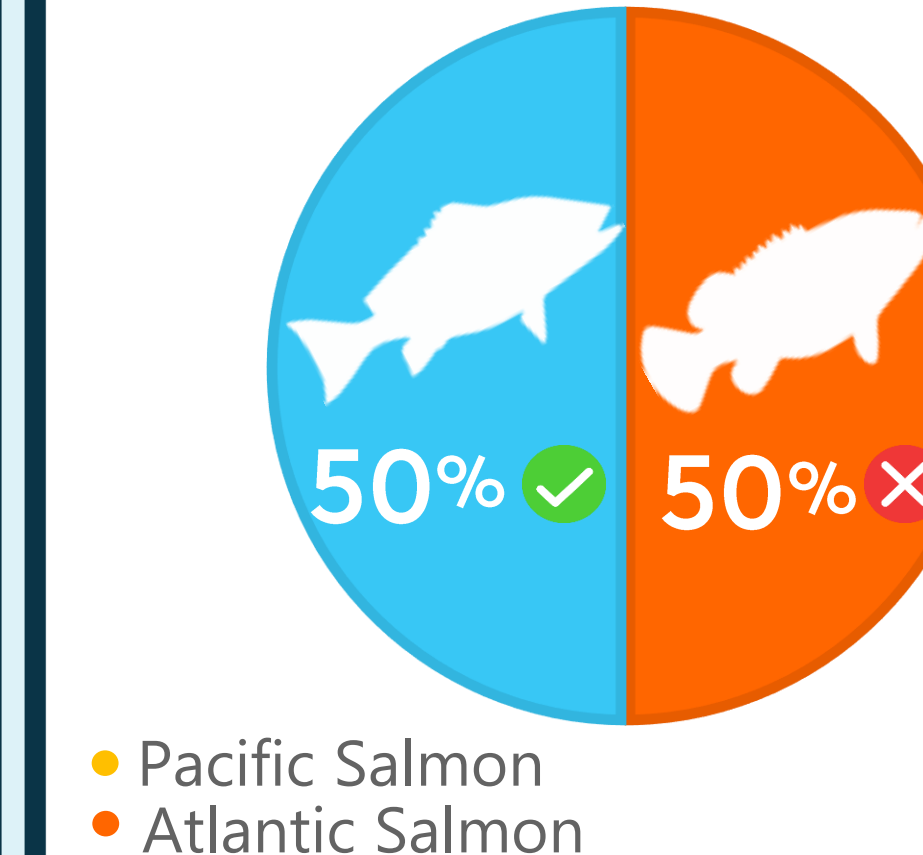
Future Innovations

At Clear Labs we are leveraging our technology to create reports that inform, engage, and surface new insights.

We have applied our proprietary molecular analysis technology towards species identification in **animals**, **plants**, pathogenic **bacteria**, toxigenic **fungi**, along with creating a comprehensive **GMO** screening.

Equipped with objective data, we hope to enable constituents of the complex food supply chain to achieve the highest standard of safety and compliance.

Conclusion

Label accuracy and verification of adequate hygiene in food are paramount in mitigating risks to consumers and constituents of the food supply chain. The study's results, revealing issues in 28 of 219 samples, highlight the risk of food label inaccuracy and other inconsistencies.

The innovative application of high throughput DNA barcoding proved capable of detecting these risks and, when implemented on a large scale, acting as a preventive measure. The analytical power of our blind, unbiased multiplexing PCR targeting a variety of genomic regions, in conjunction with our robust bioinformatics pipeline, surfaced and diagnosed such issues.

Studies like these will increase transparency and mitigate industry-specific issues. From intentional fraud to accidental contamination, such issues pose real social, health, and economic risks. Existing detection methods struggle to keep pace with said risks. Fundamentally, the use of DNA barcoding as applied in this study creates a model for a data-driven and transparent approach to food, setting a higher standard for the food industry as a whole.

Why Use the Clear Labs Platform for Food?

- **High throughput**
  - Massively parallel
  - Produces thousands of sequences at a time
- **Accurate**
  - Sequences are made more reliable by multiple repeats
  - Output from singular DNA
- **Complex sample capability**
  - Each DNA molecule is sequenced independently
- **Scalability**
  - Multiplexing feature of technology lowers cost
  - Greater coverage using fewer reagents & less DNA

Contact

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