

Untangling the Greek Seafood Market: Authentication of Crustacean Products Using DNA-Barcoding Methodologies

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Abstract : Along with the increase in human population, demand for seafood has increased. Despite the strict labeling regulations that exist for most marketed species in the European Union, seafood substitution remains a persistent global issue. Food fraud occurs when food products are traded in a false or misleading way. When one species is traded under the name of another, it is considered mislabeling, and it can be intentional or unintentional. Crustaceans are one of the most regularly consumed seafood in Greece. Shrimps, prawns, lobsters, crayfish, and crabs are considered a delicacy and can be encountered in a variety of market presentations (fresh, frozen, pre-cooked, peeled, etc.). With most of the external traits removed, products as such are susceptible to species substitution. DNA barcoding has proven to be the most accurate method for the detection of fraudulent seafood products. This study aims, for the first time in Greece, to use the DNA barcoding methodology in order to investigate the labeling practices for crustacean products available in the market. A total of 100 tissue samples were collected from various retailers and markets across four Greek cities. In an effort to cover the highest range of products possible, different market presentations were targeted (fresh, frozen and cooked). Genomic DNA was extracted using the DNeasy Blood & Tissue Kit, according to the manufacturer's instructions. The mitochondrial gene selected as the target region of the analysis was the cytochrome c oxidase subunit I (COI). PCR products were purified and sequenced using an ABI 3500 Genetic Analyzer. Sequences were manually checked and edited using BioEdit software and compared against the ones available in GenBank and BOLD databases. Statistical analyses were conducted in R and PAST software. For most samples, COI amplification was successful, and species-level identification was possible. The preliminary results estimate moderate mislabeling rates (25%) in the identified samples. Mislabeling was most commonly detected in fresh products, with 50% of the samples in this category labeled incorrectly. Overall, the mislabeling rates detected by our study probably relate to some degree of unintentional misidentification and lack of knowledge surrounding the legal designations by both retailers and consumers. For some species of crustaceans (i.e., *Squilla mantis*), the mislabeling appears to be also affected by the local labeling practices. Across Greece, *S. mantis* is sold in the market under two common names, but only one is recognized by the country's legislation, and therefore, any mislabeling is probably not profit-motivated. However, the substitution of the speckled shrimp (*Metapenaeus monoceros*) for the distinct, giant river prawn (*Macrobrachium rosenbergii*) is a clear example of deliberate fraudulent substitution, aiming for profit. Until now, no scientific study investigating substitution and mislabeling rates in crustaceans has been conducted in Greece. For a better understanding of Greece's seafood market, similar DNA barcoding studies in other regions with increased touristic importance (e.g., the Greek islands) should be conducted. Regardless, the expansion of the list of species-specific designations for crustaceans in the country is advised.

Keywords : COI gene, food fraud, labelling control, molecular identification

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