Labeling Compliance, Species Identification, and Short-Weighting of Shrimp Sold in Southern California

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Introduction

Food fraud is a deceptive act that increases profits of a company while reducing the cost. It can take on various forms, ranging from weight and species substitution to misrepresentation on the label. Although shrimp is the most consumed seafood product in the U.S., accounting for ¼ of the country's annual per capita seafood consumption, there is currently a lack of knowledge regarding COOL compliance, species labeling, glazing, and short-weighting associated with frozen shrimp (NMFS, 2022). Country of Origin Labeling (COOL) is a law that requires Perishable Agricultural Commodities Act (PACA) licensed retailers to notify their customers of the geographic origin and procurement information for a variety of unprocessed foods, including wild and farm-raised fish and shellfish (USDA, 2022). Shrimp species can be identified through the use of DNA barcoding of the cytochrome *c* oxidase subunit 1 (COI) mitochondrial gene (Eischeid et al. 2016). Net weight evaluation is important to determine whether a product has been short-weighted. Overglazing refers to the overtreatment of frozen products, which often is implicated with short-weighting of products (Santos et. al., 2010).

Objective

The objective of the study was to examine species labeling, glazing, net weight, and compliance with country-of-origin labeling (COOL) regulations for frozen uncooked shrimp sold in Southern California.

Materials & Methods

Sample Collection

- A total of 24 shrimp products were purchased from seven grocery stores licensed under PACA (USDA, 2022). Sample collection was based on availability, and the categories of shrimp collected ranged from small (n=1), small/medium (n=1), large (n=8), extra large (n=4), extra large/jumbo (n=1), jumbo (3), extra jumbo (n=5), extra colossal/super colossal (n=1).

Determination of Net Weight and % Glaze

- Net weights and % glaze were determined according to AOAC official method 963.18(a).
- Short-weighting was determined by comparing the difference between the declared net weight and the actual net weight. Weights that were outside of the maximum allowable variation based on product label weight according to the National Institute of Standards and Technology (NIST) were considered short weighted (NIST, 2011).

DNA Extraction

- Prior to DNA extraction, tissue samples (20-30 mg) were removed from the interior of shrimp samples and stored at -20ºC.
- The DNeasy Blood and Tissue Kit (Qiagen) was used for DNA extraction on all samples.
- Reagent Blanks (RB) were included for each set of DNA extractions.

PCR & DNA Sequencing

- A negative control, or no template control (NTC) was added for range of samples that were processed in different times.
- PCR for the 5' and 3' COI regions was carried out as described in Eischeid et. al. (2016).
- PCR cycling conditions were as follows: 95°C for 2 min; 35 cycles of 95 °C for 1 min, 50 °C for 1 min, and 72 °C for 1.5 min; and a final extension at 72 °C for 10 min.
- PCR was confirmed with the pre-cast 2% agarose E-Gels ran with E-Gel™ Simple Runner Electrophoresis Device (Invitrogen, Carlsbad, CA).

Among 24 samples of shrimp, 100% were COOL compliant and 46% were short-weighted. All samples with >20% glaze were short-weighted.

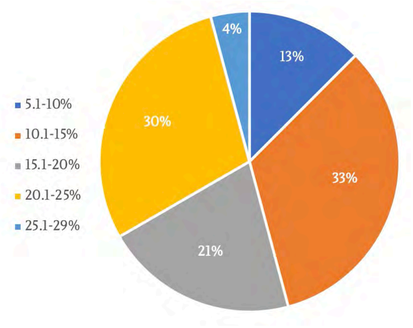

Figure 1. Percentage glaze category of samples (n=24)

Table 1. Results of number of short-weighted products per sample size

Sample Size	# of Products	# of Short-Weighted
Small	1	1
Small/Medium	1	0
Large	8	4
Extra Large	4	2
Extra Large/Jumbo	1	0
Jumbo	3	1
Extra Jumbo	5	2
Extra/Super Colossal	1	1

Results & Discussion

COOL Compliance

- All 24 samples were COOL-compliant based on the label. One sample had a conflicting production method when comparing the label and the placard; however, the placard appeared to be advertising a different product.

Glazing and Short-Weighting

- Over half (54%) of the 24 samples exceeded the maximum allowed variation (MAV) according to NIST. Two of these samples were over-weight and 11 (46%) were determined to be short-weighted.
- Glaze levels ranged from 5.1% to 29.7%. All samples with >20% glaze were found to be short-weighted.

Species Identification

- Many products were labeled as "shrimp" and contained no distinctive species names or scientific names on the packaging or signage.
- All samples failed the PCR step using Folmer primers; 8 samples passed when Tong primers were used.
- A total of 7 samples were identified as Whiteleg shrimp (*Peaneus vannamei*) and 1 sample was identified as Argentine red shrimp (*Pleoticus muelleri*).

Conclusion

- No species substitution or mislabeling was observed in the 8 sequenced samples.
- All samples had packaging that was compliant with COOL.
- A high proportion of samples was found to be short-weighted, meaning that consumers are over-paying for these products. Overglazing was a common way to short-weight products to increase economic gain. All overglazed samples of above 20% glazing were short-weighted.
- The results of this study point to a need for increased inspections and regulatory oversight with regards to short-weighting and overglazing.

References

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Acknowledgement

Thank you to the Schmid College of Science and Technology Schmidtern program and the Summer Undergraduate Research Fellowship in Earth and Environmental Science Program (SURFEES) for this special opportunity. Thank you Dr. Christopher Kim and Dr. Justin O'Neill for dedicating the time and resources needed to support this program. To Netsanet Anley from NOAA Fisheries, thank you for taking the time to train us on shrimp deglazing and net weight determination.

Alternate Text

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