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Demian A. Willette

Loyola Marymount University, demian.willette@lmu.edu

Samantha H. Cheng

Jerry A. Greenberg

Paul H. Barber

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Rethinking solutions to seafood fraud

Seafood mislabeling is a pervasive problem that economically defrauds consumers, weakens the stability of marine fisheries, undermines food security, and potentially compromises human rights (Pauly *et al.* 2005; Mendoza *et al.* 2016). Research on seafood mislabeling in restaurants follows a common pattern: publication of results, immediate media coverage and calls for action, decreased media attention over time, and subsequent publication of another study with renewed calls for action. For example, three recent DNA-based surveys of Los Angeles (California) restaurants found mislabeling rates of up to 52% (Warner *et al.* 2012; Khaksar *et al.* 2015; Willette *et al.* 2017), generating substantial media coverage. While helping to inform proposed legislation on counteracting seafood fraud in the US (Upton 2015), including the implementation of new programs targeted at foreign imports (eg NOAA Seafood Import Monitoring Program 2016), these and other studies have unfortunately done little to reduce seafood mislabeling rates in restaurants in Los Angeles or elsewhere in North America, Europe, and Asia (Warner *et al.* 2013; Nagalakshmi *et al.* 2016; Christiansen *et al.* 2018).

There are, however, success stories of labeling accuracy increasing in some seafood sectors. For instance, mislabeling of cod declined from 34% to 0% in supermarkets in Ireland after extensive media coverage raised public awareness (Mariani *et al.* 2014). Likewise, rates of mislabeling in traditional markets and by fishmongers in Europe have dropped precipitously to <5% as a result of improved reporting requirements for suppliers and processors (Mariani *et al.* 2015; D'Amico *et al.* 2016). A key difference between these successes and the aforementioned studies that fell short was the focus on engaging the general public in monitoring efforts to promote seafood awareness and literacy among consumers more broadly (Naum and Hanner 2015).

Another critical factor in ensuring positive outcomes was engaging industry in the process of improving regulatory requirements. In the face of the persistent challenge of seafood mislabeling in restaurants, these successes highlight the need for an integrated, comprehensive, local-scale strategy that engages the seafood community in developing solutions.

Composed of stakeholders from local universities, seafood restaurants, and non-profit organizations, as well as from local, state, and federal government agencies, the Los Angeles Seafood Monitoring Project (hereafter “Project”) aims to eliminate seafood mislabeling widely through the seafood sector using a two-tiered approach. First, the Project works to clarify ambiguity in government labeling requirements for vendors that result in the majority of mislabeling. In particular, the US Food and Drug Administration’s “Seafood List” (FDA 2018) defines acceptable market and common names that restaurants can use. However, this list is problematic for sushi restaurants. For instance, “Amberjack” is the *only* acceptable market name for five of six *Seriola* species, despite variation in both price and taste, and also that these species are traditionally sold under separate names in Japan. Requiring vendors

to adhere to the single legal name “Amberjack” denies biological reality and Japanese culture, and constrains consumers’ ability to make informed choices. The latter issue is particularly salient as wild-caught *Seriola rivoliana* can harbor ciguatoxins, which may cause paralysis or death (Perez-Arellano *et al.* 2005). By encouraging the FDA’s Center for Food Safety and Applied Nutrition to propose scientifically and culturally based revisions to “The Seafood List”, the Project is working toward improving the list for fish species such as *Seriola*. By removing mislabeling that results from current guideline limitations, regulators can then focus on intentional seafood fraud.

Second, in cooperation with seafood restaurant owners, the Project is using blind sampling and DNA barcoding to monitor fish that wholesalers sell to restaurants. As part of undergraduate laboratory classes, students from Loyola Marymount University, California State University Los Angeles, and the University of California Los Angeles are conducting monthly sampling at local sushi restaurants, followed by DNA barcoding as described in Willette *et al.* (2017). Aggregate data are then reported to Project stakeholders in an annual workshop and shared with the public through

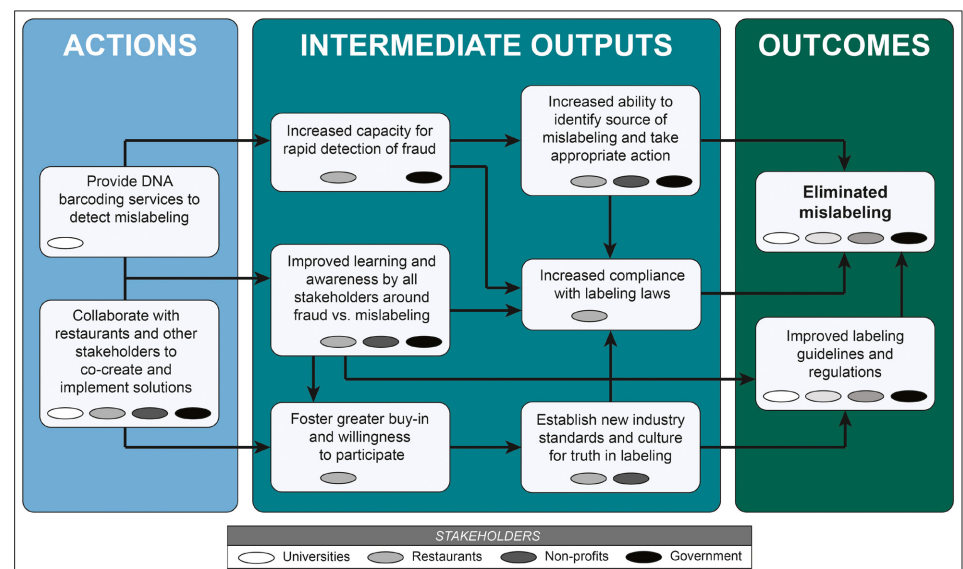


Figure 1. A conceptual model for eliminating seafood mislabeling in Los Angeles’ seafood restaurants by building a highly collaborative network of stakeholders with a vested interest in seafood sustainability and providing DNA-barcoding services to monitor for mislabeled seafood. Stakeholder involvement is indicated by colored ovals (Universities – white, Restaurants – light gray, Non-profits – dark gray, Government – black).

press releases and publications. Such workshops were held in 2017 and 2018, while sushi sampling – which started in April 2018 – is currently ongoing.

As compared with typical reporting-only mislabeling studies, this new model has numerous advantages (Figure 1). To begin with, it is based on fostering partnerships with stakeholders, from restaurateurs to regulators, who have a vested interest in the sustainability of the seafood industry. Furthermore, it is proactive and constructive, rather than responsive and punitive; results from individual restaurants are communicated directly and confidentially to owners and management so that they can address any mislabeling and engage with regulators to concentrate on labeling accuracy that occurs earlier in their supply chain. In addition, this model is focused on increasing public awareness, and the joint release of aggregate data targeting consumers makes the restaurant industry a key partner in this outreach. Lastly, the use of students' coursework for sampling makes this city-wide and longitudinal study feasible and sustainable, directly exposing students to real-world problems that lead to actionable science and policy. Altogether, this integrative approach should provide an impactful, replicable model to reduce seafood mislabeling at the city-scale, and beyond.

**Demian A Willette^{1*},
Samantha H Cheng², Jerry A Greenberg³,
and Paul H Barber⁴**

¹*Biology Department, Loyola Marymount University, Los Angeles, CA* (demian.willette@lmu.edu); ²*Center for Biodiversity Outcomes, Arizona State University, Tempe, AZ*; ³*Sushi Nozawa Group, Los Angeles, CA*; ⁴*Department of Ecology and Evolutionary Biology, University of California–Los Angeles, Los Angeles, CA*

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