U.S. Consumer Preferences for Seafood Traceability

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Summary: Whole-chain seafood traceability in America remains a challenge despite recent government mandates such as tighter import regulations and the Seafood Import Monitoring Program (SIMP) as well as efforts from retail and supply chain players. While government and industry drive existing traceability implementations, the role of consumer preferences as a driver remains largely unexplored. A study of consumer preferences' role and ability to drive traceability shows that consumer preferences play a lesser role as compared to other drivers, due to several exogenous reasons. Additional analysis of results show that high propensity for seafood traceability preferences may be triggered by frequency of consumption, high income levels, higher education and urban / coastal living. An integrated inclusive approach towards developing harmonized standardized Key Data Elements (KDEs) needs to be explored to move the traceability agenda forward.

KEY INSIGHTS

1. Findings show that consumers, as an aggregate, do not wield enough influence in traceability. They are constrained by exogenous factors.
2. Results show as consumers become educated, earn a higher income, they consume more seafood frequently which increases the demand for traceability. This segment is bound to increase.
3. An integrated approach to harmonize KDEs at the intersection of all three drivers, managerial, regulatory and consumer, drive adoption of traceability and informational governance.

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Introduction

The U.S. is the second largest consumers of seafood globally. However, most seafood consumed today, between 85 to 95 percent, is imported. This lends a high level of opaqueness to the global seafood industry creating several challenges such as intentional species substitution, illegal unreported and unregulated (IUU) fishing, co-mingling of seafood species, high incidence of foodborne illnesses, fraudulent labeling, unsustainable fishing practices and human rights violations. Traceability does appear to provide a mechanism to alleviate these concerns through enabling structured information flows across the entire value chain (Bailey, Bush, Miller, & Kochen, 2016). Seafood traceability systems were introduced by the supply chain management sector to coordinate value chain activities, efficiently manage food recalls and increase brand awareness and reputation. They permeated to government sectors soon after. There is a long history of policies around seafood traceability starting from the Lacey Act of 1900s to the recent Seafood Import Monitoring Program (SIMP) in 2017. However, there are still are open questions and gaps in that the information gathered does not specify unique attributes such as specific fishing methods,

processing steps, scientific nomenclatures, and additional credence attributes. There is lack of consistent common data standards, unharmonized global regulations, lack of interoperability between systems of record and lack of a common attribute list causing impediments in whole chain information flows.

Effective seafood traceability systems are dependent on various underlying drivers: (a) government regulation of seafood and its safety, (b) consumer-facing and brand aware supply chain actors, and (c) consumers who demand to know more about the credence attributes of their seafood. These “credence” attributes such as harvest location, quality, origin and processing information are difficult for consumers to obtain and are not a priority today. Consumer preferences are regarded as insignificant according to traceability literature. Their preferences, attitudes and motivation to engage in traceability is under-researched. However, consumers can drive a change in the behavior in the industry, going by past-campaigns such as “dolphin-safe” tuna and bans on shark fin soup. The aim of this research is to understand the existing literature around seafood traceability from the perspective of consumer preferences in the U.S. and explore the potential role of consumer preferences as a driver of traceability. The paper further discusses the results of the study related to consumer characteristics, the implications of the findings to various stakeholders and the recommendations to strengthen the value proposition and to foster adoption of traceability systems.

Methodology

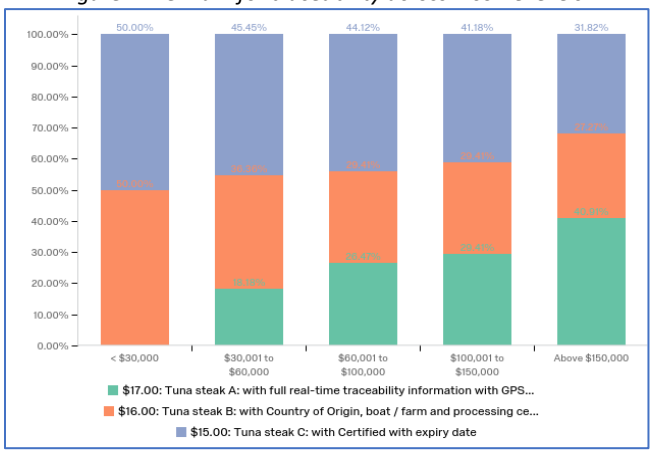
A detailed literature review helped in developing the research design. The methodology of data collection was divided into primary research using direct survey, interviews with industry, NGO and government stakeholders and consumer focus groups and secondary research using thematic content analysis. A 15-part questionnaire was designed to focus attention on 4 dimensions: seafood consumption patterns, socio-economic demographics, seafood purchase patterns and traceability data preferences. The direct survey was executed using direct emails, social media and snowball sampling methods. A total of 282 responses were received, out of which 208 were included in the final analysis. The semi-structured interviews were open-ended and focused on three sub-segments (i) US retailers and retail stakeholders such as Kroger, Ahold Delhaize, Walmart, Food Marketing Institute (FMI) and Fishcoin (ii) Industry, Standards and Regulatory stakeholders such as the Food and Drug Administration (FDA), GS1, Wildlife Fund (WWF), Global Dialogue on Seafood Traceability, Gulf of Maine Research Institute and National Fisheries (ii) consumer focus groups. Thematic content analysis included literature review, the results of previous surveys, current use cases for seafood traceability and existing expansive research related to seafood traceability KDEs were studied. A detailed quantitative analysis of the data was conducted using statistical summary, classification tree, clustering techniques using machine learning, data validation using Principal Component Analysis (PCA), regression analysis and data visualization techniques.

Findings and Discussion

In keeping with the results from other surveys which state low level of consumption for seafood as compared to other sources of protein and low influence of consumer preferences, most consumers tended to choose Low-Traceability KDEs in general. Most were unaware of the fraudulent practices in the seafood supply chain. For instance, during seafood purchase, consumers tended to prefer Brand Name or market name rather than COOL or Latin Series name on the package label. Among location preferences, processing

center information ranked highest (31%) followed by retailer information (24%). Overall between Low, Medium and High traceability, consumers as an aggregate did not show any variation. When ranking between sensor + GPS real time data, trusted brand and certification, a majority (46%) ranked certified seafood as their first choice, followed by trusted brand (35%). This was consistent with other data that consumers, as an aggregate, did not influence traceable KDEs. Only consumers with advanced degrees (except doctoral) and high incomes tended to choose High-Traceability KDEs and were willing to pay marginally higher to access real-time traceable information **(Figure 1)**. Consumers generally tended to prefer "freshness" and therefore a majority (32%) preferred wild caught rather than farmed, erroneously perceiving the former to be more sustainable.

Figure 1 Premium for traceability across income levels



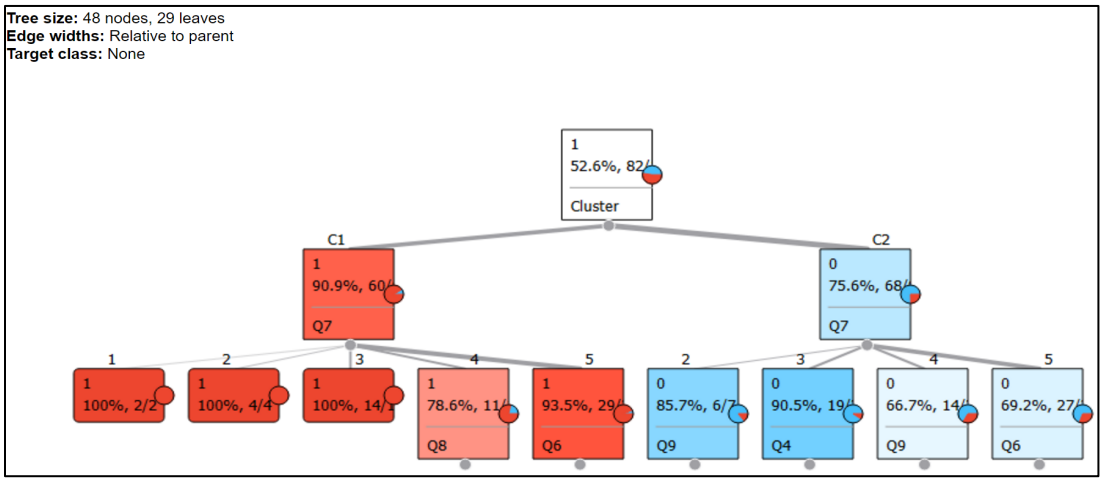


Figure 2 Cluster Analysis of survey data using classification tree

Some interesting results were obtained from the cluster analysis, which splits the respondents distinctly into two groups: C1 and C2 **(Figure 2)**. Validation of these clusters shows a high significance with an Area Under Curve (AUC) of 70% and a p-value of < 0.001 with an R^2 of 84.95. C1 consisted mostly of Low Traceability respondents affirming that consumers do not wield enough influence in traceability. They may be constrained by factors such as too many intermediaries, masking of data about seafood's challenges, and the lack of knowledge about purchasing and preparing seafood.

High Traceability cluster (C2) on the other hand was correlated significantly with frequency of consumption (91%). Results show that as consumers become more affluent, they consume more seafood and as they further become more educated, they care more about traceability and are willing to pay a premium for High traceability KDEs. Dividing respondents into quadrants, we can define consumers better with Quadrant 4 being those who prefer high traceability and frequently consume seafood **(Figure 3)**. Data also shows that consumers who prefer traceable KDEs are more than twice as likely to eat seafood more than four times a month and are twice as likely to consider sustainability important. Retailers stand to gain by educating consumers and upstream supply chain players as well as implementing traceability systems which command premium pricing.

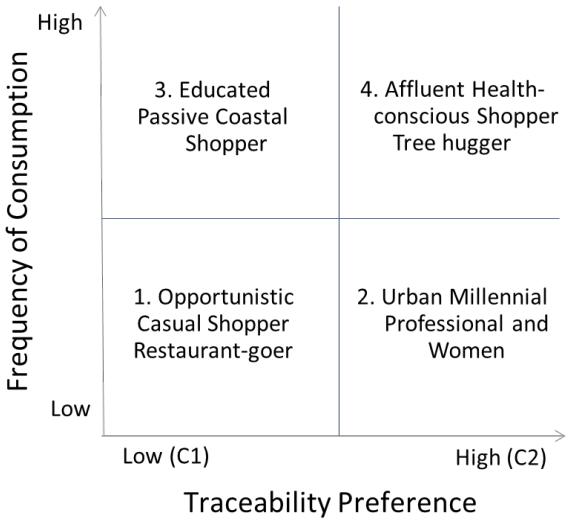


Figure 3 U.S. Seafood Traceability Preferences Matrix

Conclusion

Seafood traceability systems are an essential part of informational governance **(Figure 4)**. The steps to establish a universally adoptable seafood data governance are to establish: (i) an understanding of what is driving whole-chain traceability, (ii) an inclusion of the scope, needs and goals of traceability, (iii) a globally accepted standardized seafood attribute naming list, (iv) a universal list of harmonized rules and identified stakeholders, and (v) an accountable integrated approach to establish a global interoperable harmonized seafood traceability data governance framework. An integrated approach to harmonize KDEs – with a global minimum viable KDE list layered by local-scale country-specific level - at the intersection of all three drivers, managerial, regulatory and consumer, will not only reinforce traceability and informational governance but also result in higher adoption rates and sustainable practices globally.

Figure 4 Integrated approach combining drivers for governance

Value Chain Category*+	Management Transparency	Regulatory Transparency	Communication Transparency
Information Flows*+	Between value chain actors	Between value chain actors to regulators	Between value chain actors to consumers
Example: Information Flows*	Total quality management	EU tracking and tracing system	Eco-labels, certifications
Example: Players	Seafood retailers, Grocery Manufacturers' Association (GMA), Food Marketing Institute (FMI), National Fisheries Institute, GS1	FAO, NOAA, U.S. FDA, State Department, U.S. Agency for International Development (USAID), United Nations' Port State Measures Agreement	NGOs such as World Wildlife Fund (WWF), Conservation Alliance, Gulf of Maine Research Institute, Global Fishing Watch, Global Dialogue on Seafood Traceability
Sustainable Governance Impact+	Low	High	**Medium**
Accountable (A) KDEs (example)	Net Weight, Processing Ingredients	Harvest Location, Latin Series Name	Unique Physical ID, Processing Methods
Voluntary (V) KDEs (example)	Pallet Identifier, Storage Temperatures	Fishing method (Line, Net, Farm), Processing locations	Certification & CoC Status, Vessel Name

* Based on different categories of drivers (Coff et al. 2013) & information flows (Mol, 2015); + Based on sustainable governance impact (Bailey et al, 2016)