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An empirical assessment of common or usual names to label cell-based seafood products

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Abstract: An important consideration in the commercialization of cell-based meat, poultry, and seafood is what common or usual name to use on package labels to meet U.S. Food and Drug Administration (FDA) regulations. However, naming these products has been the subject of considerable debate. This study used a 3×10 between-subjects online experiment involving a quota sample of 3,186 U.S. adult panel participants to test common or usual names using images of realistic packages of three types of seafood that a consumer might encounter in a supermarket. The terms tested were, “cell-based seafood,” “cell-cultured seafood,” “cultivated seafood,” and “cultured seafood” and the phrases, “produced using cellular aquaculture,” “cultivated from the cells of _____,” and “grown directly from the cells of _____,” where the blanks are filled by the name of the seafood product. Five criteria were used for evaluation, including each term’s ability to: enable consumers to distinguish cell-based seafood from wild and farmed fish, to signal potential allergenicity, be seen by consumers as an appropriate term to identify the product, not disparage either cell-based or conventional products, and not evoke thoughts, images, or emotions that are inconsistent with the idea that the products are safe, healthy, and nutritious. The results showed that “cell-based seafood” outperforms the other names tested. It enables consumers to recognize that the products are neither wild caught nor farm raised, signals potential allergenicity, is seen as an appropriate name for describing the technology/process, and it performs well with respect to measures of consumer acceptance, particularly in comparison to conventional products.

Keywords: Cell-Based, Cell-Cultured, Common or Usual Name, Nomenclature, Seafood

Practical Application: Creating consensus around a single common or usual name for cell-based meat, poultry, and seafood products is clearly important both for regulatory reasons and for shaping public perceptions and understanding of the products that are labeled with it. Our findings suggest that “cell-based” is the best common or usual name for seafood products that both meets FDA regulatory requirements and performs well with respect to potential consumer acceptance. Consistent use of this term by industry, advocates, and regulators would help orient consumers to what is likely to be a transformational food technology.

1. INTRODUCTION

The production of cell-based meats, poultry, and seafood involves new technologies that directly produce only the parts of animals that people prefer to eat, rather than deriving these from whole animals. Through *in vitro* production of specific muscle, fat, and connective tissues, producers are able to create food products that duplicate the taste, texture, nutritional, and culinary attributes of their conventional counterparts (Stephens et al., 2018).

Investment, research, and development in the technology are proceeding rapidly. Although no products have yet been approved for sale in any country, several companies have held events exhibiting various prototypes, and others are at various stages of planning and scaling up production (Kateman, 2020).

An important consideration in the pathway to commercialization is what to call the products derived from this technology. U.S. Food and Drug Administration (FDA) regulations (21CFR101.3) require that all foods that do not have defined *standards of identity*

(21CFR130.8) be labeled with a “common or usual name” as a *statement of identity* so that consumers can make informed choices about the products they buy. Similarly, the U.S. Dept. of Agriculture (USDA) requires that common or usual names be used to label meat (9CFR317.2) and poultry products (9CFR381.117). Under 21CFR102.5, which is most prescriptive, the general principles for establishing the common or usual name of a food include:

The common or usual name of a food, which may be a coined term, shall accurately identify or describe, in as simple and direct terms as possible, the basic nature of the food or its characterizing properties or ingredients. The name shall be uniform among all identical or similar products and may not be confusingly similar to the name of any other food that is not reasonably encompassed within the same name. Each class or subclass of food shall be given its own common or usual name that states, in clear terms, what it is in a way that distinguishes it from different foods.

Assuming that meat, poultry, and seafood products produced through *in vitro* tissue production are nutritionally equivalent to their conventionally produced counterparts, and are similar in form, taste, texture, and in nutritional and culinary attributes, the obvious dissimilarity that needs to be clearly communicated to consumers is that the product did not involve the growing or

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harvesting of whole animals. However, there is little consensus about what name to use to refer to either the technology or its products.

In part, this lack of consensus is because choosing what common or usual name to use on product labels goes beyond regulatory issues. There is power inherent in labeling a concept, because the name given to it can evoke images, emotions, metaphors, and meanings that profoundly shape public perceptions and acceptance (Broad, 2020). What to call these products have unsurprisingly been the subject of considerable debate among consumers, advocates, regulators, and the producers of both cell-based and conventional meat products, with various stakeholders proposing terms likely to elicit very different reactions from consumers (Ong, Choudhury, & Naing, 2020).

Skeptics of the products, as well as some consumer organizations, have proposed the adoption of terms that they argue is necessary to clearly distinguish these products from conventional meat (Hansen, 2018). These terms include, “lab-grown meat,” “synthetic meat,” “artificial meat,” “fake meat,” and “schmeat.” Each of these names has been rejected by the producers of cell-based products as scientifically inaccurate and as calculated to portray their foods as unnatural and unappetizing (AMPS Innovation, 2020).

In contrast, advocates of the rights and humane treatment of animals and some companies have referred to the products as “clean meat,” “animal-free meat,” “slaughter-free meat,” and “cruelty-free meat.” However, these terms have been rejected by traditional meat producers as derogatory to conventional products (Greene & Angadjivand, 2018). In response, some advocates have proposed using the term “cultivated” (Friedrich, 2019), suggesting that a more appealing name is necessary to encourage consumers to purchase meat products that do not require the slaughter of animals. However, this term has not been embraced by manufacturers (Siegener, 2019).

Producers of cell-based products would prefer to call these foods “cell-based,” “cell-cultured,” or “cultured,” or to refer to them as the products of “cellular agriculture” or “cellular aquaculture.” They argue that these names are scientifically accurate and can differentiate their products from conventional meat without denigrating either (Corbyn, 2020).

Creating consensus around a single common or usual name is clearly important both for regulatory reasons and for shaping public perceptions and understanding of the products that are labeled with it. The production of these meat, poultry, and seafood products entails the use of a new process with which most Americans are likely to be unfamiliar. Although consumer knowledge and awareness will evolve over time and with the approval and introduction of the products into the marketplace, many consumers will likely first encounter them by seeing a packaged product in a store. Therefore, there is an opportunity to help familiarize consumers with what is likely to be a transformational technology through the selection and consistent use of a descriptive term that transparently references how these products are made and thus, how they are different from conventional products.

There have been multiple efforts to evaluate consumer perceptions, acceptance, and potential purchase of meat products produced through the technology (Bryant & Barnett, 2018). These include qualitative studies involving focus group participants responding to various terms, including reactions to “lab grown meat” in Manchester, UK (O’Keef, McLachlan, Gough, Mander, & Bows-Larkin, 2016); New Zealander’s reactions to “*in vitro* meat” (Tucker, 2014); and responses to “synthetic meat” in the

United Kingdom, Belgium, and Portugal (Verbeke, et al., 2015). They also include analyses of comments posted to U.S. news stories about “*in vitro* meat” (Laestadius, 2015; Laestadius & Caldwell 2015), and word association tasks involving small numbers of graduate students from the Netherlands, Ethiopia, and China responding to “cultured meat” (Bekker, Tobi, & Fischer, 2017).

Online surveys have also been conducted to gauge consumer perceptions and acceptance of “clean meat” in the United States, China, and India (Bryant, Szejda, Deshpande, Parekh, & Tse, 2019), and “cultured meat” in France (Hocquette et al., 2015). Wilks and Phillips (2017) recruited mTurk participants to respond to “*in vitro* meat,” though also informing participants that, “*in vitro* meat is also referred to as cultured meat, schmeat, or synthetic meat.” Valente, Fiedler, Sucha Heidemann, & Molento (2019) also conducted an online survey of reactions to “*in vitro* meat,” among highly educated participants from two large cities in Brazil, recruited using a snowball sampling technique.

Several experiments have also been conducted to compare proposed terms with respect to consumer perceptions of, and willingness to purchase cell-based products bearing different names. In a nonpeer-reviewed study, The Good Food Institute (2017) reported that they used mTurk participants to test the terms “clean meat,” “meat 2.0,” “pure meat,” “safe meat,” and “cultured meat.” Consistent with its recommendation that “clean meat” be adopted by the industry (Friedrich, 2016), the experimental data suggested that “clean meat” should be the preferred term because it outperformed the others with respect to participant’s stated willingness to purchase products bearing that name. Grieg (2017) attempted to replicate the Good Food Institute study, again using mTurk participants. The results, reported in an online blog, suggested that “clean meat” outperformed “cultured” with respect to self-reported purchase preferences.

Focused on “optimizing consumer acceptance,” the Good Food Institute worked with food product consulting firm Mattson to generate a list of 74 names provided by stakeholders, ultimately testing the performance of the terms, “clean meat,” “cultured meat,” “craft meat,” “cell-based meat,” and “slaughter-free meat” (Szejda, 2018). Participants were asked to rate how appealing the name is, how accurately it describes the product, and how well it differentiates from conventional meat. The results suggested that “slaughter-free,” “craft,” “clean,” and “cultured” performed best in name appeal, “slaughter-free” and “cell-based” performed best in descriptiveness and differentiation from conventional meat, and “slaughter-free” and “craft” performed best in likelihood of trying and of purchasing the product (Szejda & Urbanovich, 2019).

Finally, in a peer-reviewed study using 185 mTurk participants, Bryant and Barnett (2019) concluded that “clean meat” and “animal-free” meat performed better than “lab-grown meat” and “cultured meat” with respect to positive participant attitudes and behavioral intentions.

Unfortunately, none of these studies were designed to evaluate the terms for use as common or usual names on product labels. In particular, none of the studies examined the ability of the terms to help consumers distinguish cell-based products from conventional products, which is key from a regulatory perspective. Instead, they focused mainly on measuring perceptions of the technology, or on ways to frame that technology to improve public acceptance.

Most of the studies also used sampling methods likely to result in highly unrepresentative samples, making it difficult to generalize the results. These methods included snowball sampling, data collected from convenience samples of students, and the use of

crowdsourced convenience samples consisting of mTurk respondents, which have been shown to differ from the population as a whole in several important ways (Chandler & Shapiro, 2016).

All of the studies also described the technology to participants using text, graphics, or videos *before* they answered questions measuring the key dependent variables. This is problematic with respect to evaluating the effectiveness of a common or usual name, because the name needs to communicate the “characterizing properties” of a food, and what distinguishes it from other foods, *on its own*; that is, without the benefit of additional explanatory text or other supporting materials.

To address this gap in the literature, the goal of this research is to assess the performance of proposed common or usual names to best meet the regulatory criteria established in 21CFR102.5, and are also likely to be acceptable to the relevant stakeholders. The study uses a between-subjects experimental design to test proposed common or usual names using images of realistic packages of three types of seafood that a consumer might encounter in a supermarket. Seafood is used as the basis for the stimulus materials because all of the previous peer-reviewed studies examining public perceptions of the various names proposed for cell-based products have focused on meat. However, the development of cell-based seafood products is also well underway (Krueger, Rubio, Datar, & Stachura, 2019), with at least six companies actively working to bring cell-based seafood products to market (Leschin-Hoar, 2019).

Moreover, while the best performing common or usual name should ideally be applied to cell-based meat, poultry and seafood products alike, cell-based seafood products must contend with additional regulatory issues not faced by cell-based meat products, which adds complexity to the choice of an appropriate name. For example, while meat and poultry products require a common or usual name that will distinguish them from conventional products, those conventional products are generally derived from domesticated animals. Yet, many cell-based seafood products must distinguish themselves from *both* wild caught and farm raised varieties of the same species. In addition, most consumers are very familiar with the limited variety of conventional meat and poultry products available in supermarkets. However, recent FMI (2019, 2020) surveys have found that less than a third of seafood consumers consider themselves “very knowledgeable” about how to purchase or prepare seafood, its nutritional benefits, how to recognize the freshness or quality of seafood products, or even about the different types of seafood available, potentially creating additional challenges in distinguishing cell-based seafood products from conventional products.

Certain combinations of proposed terms with the word seafood may also be problematic. For example, the term “cultured fish” already has a meaning associated with aquaculture (Watson, 2018), and “cultivated” is already associated with the production of farmed mussels.

Similarly, the term “cultured seafood” might be mistakenly interpreted by consumers as one of the existing kinds of “fermented seafood” products already available for purchase, and “clean fish” may be mistaken for conventional fish that have been gutted or free from contaminants.

The Food Allergen Labeling and Consumer Protection Act (FALCPA) of 2004 (Public Law 108-282) also requires that the label of a food with an ingredient that contains protein from a “major food allergen” declare the presence of that allergen. Because cell-based seafood products will involve the propagation of muscle, fat, and connective tissues from conventional fish, they will likely contain the same level of allergenic proteins as conven-

tional seafood products. Therefore, the labels of cell-based fish will also need to appropriately signal to consumers that those allergic to fish should not eat the product. In addition, FALCPA requires that the type of fish or shellfish be declared on product labels.

Therefore, to meet FDA regulatory requirements, the best performing terms should, at minimum:

- A. Enable consumers to distinguish cell-based seafood from wild and farmed fish.
- B. Signal that those with allergies to other seafood products should not consume cell-based seafood products.

In addition to these FDA regulatory requirements, to meet the needs of the various stakeholders expected to use them, the best performing terms should:

- C. Be seen by consumers as an appropriate term to identify the product.
- D. Not be disparaging to cell-based seafood products or to the conventional products to which they might logically be compared.
- E. Not evoke thoughts, images, or emotions that are inherently inconsistent with the idea that the cell-based food products are safe, healthy, and nutritious.

In addition to these five criteria, the terms should ideally be able to be used as modifiers of “meat,” “poultry,” and “seafood,” or be a phrase that accurately describes the technology that could be used after a product name. They should anchor consumer perceptions within a network of associations that are not inherently negative. They have to be available for use by any producer, so terms that are already trademarked or copyrighted are unusable. They should not be perceived as oxymoronic (for example, animal-free meat). Finally, they should not have existing meanings not associated with the technology or its products (for example, sustainable seafood, clean fish, and cultured fish) that might be confusing or misleading to consumers.

The terms chosen to test are currently attached to “meat” but also appear in articles and blogs about seafood. These are: “cultured seafood,” which is used by the companies Wild Type, Mosa Meat, Just, and Integriculture; “cell-based seafood” which is used by the companies BlueNalu and Shiok meats, “cell-cultured seafood,” which is used by USDA/FDA in their joint press releases regarding joint regulatory oversight of these products; “cultivated seafood,” the term currently being used and recommended by the Good Food Institute; the phrase “produced using cellular aquaculture,” used by BlueNalu to describe the process, as well as the phrases “cultivated from the cells of ____” and “grown directly from the cells of ____,” where the blanks are filled by the name of the fish.

2. MATERIALS AND METHODS

2.1 Experimental design

The seven proposed common or usual names described in the introduction were tested, along with terms “wild caught,” “farm raised,” and a control condition that had no common or usual name. Each of the 10 resulting terms was tested in association with three types of seafood (salmon, tuna, and shrimp), which account for 55% of all of the seafood consumed in the United States (Seafoodhealthfacts.org, 2018) increasing the likelihood of participant familiarity with the products that were labeled. To eliminate potential priming effects, each participant was randomly

assigned to consider only one of the 30 packages created in this 3 × 10 between-subjects design.

2.2 Materials

High-resolution images of the front of packages of Atlantic Salmon, Ahi Tuna, and Shrimp were created for this experiment (see Figure 1). The top one-third of each package showed the image of the cooked seafood product, noted as a “serving suggestion,” which is typical of conventional seafood packages already in the marketplace. The middle third contained the product title, as well as the common or usual name to be tested, printed in a font size half that of the product title. The bottom third of each package contained a clearly visible, and accurate Nutrition Facts Label (NFL), reflecting the values equivalent to conventional products, as well as the net weight of the package contents, and statements indicating that the product “Contains salmon/tuna/shrimp,” and is “Perishable,” and to “Keep Frozen” and “Cook Thoroughly.” Just above the NFL, the packages of shrimp had a statement indicating that they were “Large, 31–40 Shrimp Per Pound.”

2.3 Participants

Study participants were recruited from a web-based consumer panel with more than 3.2 million active members enrolled in the United States. The experiment was administered during an 18-day period in February and March 2020. A total of 8,485 randomly selected E-rewards panel members were sent an e-mail invitation to participate in the study. Demographic information (education level, year of birth, ethnicity, race, and gender) was used to produce a sample balanced to 2010 U.S. Census data. A total of 5,527 individuals clicked on the link in the e-mail invitation and 3,644 individuals completed the questionnaire, for a completion rate of 42.9%. Of these, 3,186 participants completed one of the 30 experimental conditions reported here. The remaining participants were assigned to complete a different task that will be reported in a separate article.

2.4 Procedure

After providing informed consent and confirming that they were aged 18 or older, the participants read a description of the term “seafood”:

“The term *Seafood* refers to both Fish (like salmon, tuna, tilapia, flounder, catfish, cod, sardines, herring, and other species) and Shellfish, including Mollusks (like oysters, clams, mussels, scallops, octopus, squid) and Crustaceans (like shrimp, crabs, lobsters, crayfish). Seafood is eaten raw, baked, broiled, grilled, poached, breaded, and fried. It is also an ingredient in many dishes, including stews, gumbos, dips, and spreads.”

With this in mind, they were then asked how often they had consumed seafood in the previous year. They were then shown a high-resolution image of the package associated with the condition to which they had been randomly assigned and asked to provide the “first thought, image, or feeling that comes to mind when seeing this package.” These open-ended responses were recorded as text and later coded into relevant categories by two independent coders. To ensure that each participant actively examined and thought about the package and its contents, the participants repeated this exercise twice more; looking at the package and providing a reaction to it using an open-ended response box. They then were shown the same package a fourth time, and asked for their overall reactions, their interest in tasting it, and how likely they would be to purchase the product in the next six months if it were sold in their grocery store.

The participants were then shown an enlarged picture of the cooked product on the package and asked about their familiarity with the seafood depicted *in general*, whether it is a good source of Omega 3 fatty acids and whether pregnant women should limit consumption of that seafood. They were then asked if they had ever tasted salmon/tuna/shrimp, whether they liked the taste, had ever ordered it in a restaurant, purchased it in a store, cooked it, and if they or anyone in their households were allergic to it, or to any type of seafood.

An enlarged image of the name of the seafood and the common or usual name was then displayed. While still in view, the participants were asked, “Which of the following best describes this salmon/tuna/shrimp?” The response categories were “Wild Caught,” “Farm Raised,” and “Neither Wild Caught nor Farm Raised.” They then were asked whether it would be safe to eat the product if one were allergic to fish/shrimp, and how safe it would be to eat if one were not allergic. They were then asked to indicate how natural they thought the product is, and how likely it is that the product is genetically modified (GM), made from plants, fermented, or contains “an unhealthy amount of mercury.”

An enlarged, high-resolution image of the NFL was then shown, and while still in view, the participants were asked how nutritious they believed the product is. They were then asked whether pregnant women should eat it, whether children should eat it and to compare the product to wild-caught and farm-raised salmon/tuna/shrimp.

Up to this point, the participants were not provided with any additional information about the meaning of the common or usual names that they viewed on the packages. So, in the final part of the experiment, those randomly assigned to view one of the seven common or usual names tested were shown the following description (modified as appropriate with the name of the seafood and common or usual name to which they had been assigned).

“The term Cell-based Seafood indicates that this salmon differs from both wild-caught and farmed salmon. It tastes, looks, and cooks the same and has the same nutritious qualities as Atlantic Salmon produced in traditional ways. Yet, it involves a new way of producing just the parts of Salmon that people eat, instead of catching or raising them whole. Cell-based Seafood means that a small number of cells from Atlantic Salmon were placed in a nutrient solution, where they grew and reproduced many times. The resulting meat was then formed into fillets that can be cooked or eaten raw.”

The participants were asked how familiar they were with “the *idea* of producing just the parts of salmon/tuna/shrimp that people eat, instead of catching or raising them whole,” and, how appropriate the term was “for describing this new way of producing just the parts of salmon/tuna/shrimp that people eat, instead of catching or raising them whole?” They indicated how clear the term was in communicating that the product was not caught in the ocean and that it was not farm-raised. They reported how much they agreed or disagreed with the ideas that producing the product will have benefits for society, is wise, is ethical, and that the idea of eating it is disgusting. Finally, they responded as to whether the product should be sold in the same section of the supermarket as wild-caught and farm-raised fish and then answered a series of sociodemographic questions.

2.5 Statistical analyses

The experimental data were analyzed using IBM SPSS Statistics for Windows (version 25; IBM Corp., Armonk, NY, USA). Differences in means were analyzed using Analysis of Variance,



Figure 1—Examples of package images.

with *post hoc* comparisons made using the Tukey's HSD test. Differences in proportions were analyzed using z -tests of column proportions with Bonferroni correction. In all statistical tests, a significance level of 0.05 was established to distinguish significant differences.

3. RESULTS AND DISCUSSION

The median length of the completed survey was 11.2 minutes. Of the 3,186 participants, 51% were male. Mean age was 49.66, $SD = 15.85$, 27.9% reported children under 18 in the household. An overview of the sociodemographic characteristics of the sample is shown in Table 1.

The majority (91.7%) of the participants reported eating at least some seafood in the prior 12 months, with 62.0% reporting they had eaten at least one meal a month containing seafood, 32.4% at least one meal a week, and 1.9% one or more meal per day. The majority of the participants had eaten shrimp (72.7%), tuna (64.9%), and salmon (58.4%) in the prior year. In addition, the participants reported having consumed crab (42.3%), cod (40.1%), tilapia (36.1%), and lobster (30.7%). The participants also indicated they were moderately to very familiar with the general type of seafood they viewed; shrimp ($M = 3.66$, $SD = 1.20$), salmon ($M = 3.49$, $SD = 1.24$), tuna ($M = 3.33$, $SD = 1.24$) $F(2, 3,185) = 18.96$, $P < 0.001$, $\eta^2 = 0.012$ (scale: 1 (*not familiar at all*), 2 (*slightly*), 3 (*moderately*), 4 (*very*), 5 (*extremely familiar*)).

The remainder of the results is organized to address the regulatory and other criteria discussed in the introduction. There were no statistically significant interaction effects at the $P < 0.05$ level between the type of seafood and the common or usual name seen on the package with respect to any of the dependent measures discussed below. Therefore, only the main effects of the common or usual name are presented.

3.1 Criterion A: Distinguish from conventional products

A key criterion for establishing a common or usual name is the ability of consumers to distinguish the products labeled with it

from the traditional products with which they are already familiar. After seeing the product packages and asked to provide reactions to them four times, the participants were asked, "Which of the following best describes this salmon/tuna/shrimp?" The response categories were "wild caught," "farm raised," and "neither wild caught nor farm raised." The proportion of participants placing the products in each response category differed by product name tested, $X^2(18, N = 3,186) = 1,474.57$, $P < 0.001$.

As shown in Table 2, 92.6% of those who saw packages labeled as wild caught and 89.4% of those who saw packages labeled as farm raised correctly identified them as such. This was as expected, as the task only required participants in these conditions to match the response category with what they had seen on the label.

Of those in the control condition (with no common or usual name displayed), 52.8% responded that the seafood was "neither wild caught nor farm raised." However, nearly a third (31.6%) reported that it was "wild caught" and 15.5% responded that it was "farm raised."

Of the common or usual names seen by the participants, the four names incorporating the word "cell" ("Cultivated from the Cells of," "Cell-Based," "Cell-Cultured," and "Grown Directly from the Cells of") resulted in the largest percentage of participants (60.9%, 58.4%, 55.0%, 53.7%, respectively) correctly identifying the seafood as "neither wild caught nor farm raised." A z -test of column proportions with Bonferroni correction indicated that there were no statistically significant differences in these percentages.

The terms "cultured" (40.8%) and "produced using cellular aquaculture" (40.3%) were less successful in signaling that the seafood was "neither wild caught nor farm raised." Moreover, nearly equal percentages (41.1% and 39.3%, respectively) mistakenly assumed that the seafood was "farm raised."

Finally, the term "cultivated" performed most poorly in distinguishing the seafood from conventional products. Only 29.9% of the participants correctly identified it as "neither wild caught nor farm raised," and more than half (53.8%) misidentified it as "farm raised."

Sociodemographic characteristic	% of total
Gender	
Male	51.0%
Female	49.0%
Marital status	
Married	46.1%
Single, never married	28.8%
Divorced or separated	13.6%
Living with partner	5.8%
Widowed	5.4%
Educational level	
Less than high school	2.2%
High school/GED	20.7%
Some college	20.1%
Two-year college degree (Associate)	10.9%
Four-year college degree (BA, BS)	27.7%
Master's degree	14.2%
Doctoral degree	1.8%
Professional degree (MD, JD)	2.4%
Ethnicity ^a	
Caucasian	76.1%
African American	16.2%
Hispanic/Latino	11.0%
Asian	5.5%
Native American	2.2%
Other	3.1%
Household income	
Less than \$10,000	9.6%
\$10,000 to \$19,999	12.1%
\$20,000 to \$29,999	10.9%
\$30,000 to \$39,999	7.6%
\$40,000 to \$49,999	7.1%
\$50,000 to \$59,999	7.4%
\$60,000 to \$69,999	5.7%
\$70,000 to \$79,999	6.7%
\$80,000 to \$89,999	5.1%
\$90,000 to \$99,999	5.3%
\$100,000 to \$149,999	12.9%
\$150,000 or more	9.7%
Shopping for household	
I do all of it	60.9%
I do most of it	17.0%
I do about half of it	15.7%
Someone else does most of it	5.2%
Someone else does all of it	1.3%

3.2 Criterion B: Signal potential allergens

3.3 Criteria C and D: Not be disparaging

Table 2-Percent describing the product as wild caught, farm raised, or neither, by common or usual name.

	Common name									
	Cultivated from the cells of	Cell-based	Cell-cultured	Grown directly from the cells of	Cultured	Produced using cellular aquaculture	Cultivated	Wild caught	Farm raised	Control
Neither wild caught nor farm raised	60.9% _a	58.4% _a	55.0% _a	53.7% _a	40.8% _{b, c}	40.3% _{b, c}	29.9% _c	4.6% _d	4.7% _d	52.8% _{a, b}
Farm raised	22.1% _{a, b}	21.9% _{a, b}	29.1% _{b, c}	29.0% _{b, c}	41.1% _{c, d}	39.3% _c	53.8% _d	2.8% _e	89.4% _f	15.5% _a
Wild caught	16.9% _a	19.7% _a	16.0% _a	17.4% _a	18.1% _a	20.4% _{a, b}	16.4% _a	92.6% _c	5.9% _d	31.6% _b
N	318	320	313	328	326	313	318	323	322	316

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Table 3—Ratings of first thought or image and overall reactions by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Rating of First thought or image				9.514	<0.001	0.026
Wild caught	5.56 ^a	1.58	323			
Produced using cellular aquaculture	5.32 ^{ab}	1.69	313			
Cultivated	5.25 ^{ab}	1.76	318			
Farm raised	5.25 ^{ab}	1.73	322			
Control	5.24 ^{ab}	1.77	316			
Cell-based	5.16 ^{abc}	1.74	320			
Cultured	5.09 ^{bc}	1.74	326			
Cell-cultured	4.99 ^{bc}	1.92	313			
Grown directly from the cells of	4.75 ^{cd}	1.90	328			
Cultivated from the cells of	4.47 ^d	1.98	307			
Overall reactions				11.18	<0.001	0.031
Wild caught	5.53 ^a	1.58	323			
Control	5.27 ^{ab}	1.76	316			
Farm raised	5.26 ^{ab}	1.75	322			
Cultivated	5.20 ^{ab}	1.80	318			
Produced using cellular aquaculture	5.18 ^{bc}	1.67	313			
Cell-based	5.00 ^{bc}	1.81	320			
Cultured	4.99 ^{bc}	1.76	326			
Cell-cultured	4.85 ^{bcd}	1.96	313			
Grown directly from the cells of	4.55 ^{cd}	1.99	328			
Cultivated from the cells of	4.43 ^d	1.99	307			

Notes: Scale: 1 (*extremely negative*), 2 (*moderately negative*), 3 (*slightly negative*), 4 (*neither positive nor negative*), 5 (*slightly positive*), 6 (*moderately positive*), 7 (*extremely positive*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using the Tukey HSD *post hoc* test.

feeling that comes to mind when seeing this package? For ease of coding, the participants were informed that they should list only one response, as they would have the chance to record to additional responses in subsequent questions. Each of the 3,168 first responses was coded into one of 28 categories developed using a grounded theory approach (see Table S1 in the supplemental materials). Two trained researchers independently coded each response and these were compared. Any discrepancies were resolved by consensus. The terms, “grown directly from the cells of salmon/tuna/shrimp,” and “cultivated from the cells of salmon/tuna/shrimp” evoked the smallest percentages of initial open-ended responses suggesting that the product was appetizing (18.3% and 16.9%). On average, 26.0% of the participants who saw the other five common or usual names wrote responses clearly indicating that the product was appetizing.

The participants were also asked to rate how positive or negative their first thought, image, or feeling was, using a scale ranging from 1 (*extremely negative*) to 7 (*extremely positive*) (Table 3). While all of initial reactions to the packages were in the positive range (that is, above 4.0), “wild caught” was rated most positively, “grown directly from the cells of” and “cultivated from the cells of” received the least positive ratings. A similar pattern was observed with respect to the overall ratings given after having seen the package four times (Table 3). The correlation between the initial and the overall rating was 0.78.

Asked how safe it would be to eat the seafood if not allergic to it, all of the products (including wild caught and farm raised) were rated as “somewhat” to “moderately” safe to eat

Table 4—How safe is it for you to eat this if you are not allergic to seafood by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Safe to eat				5.63	<0.001	0.016
Wild caught	6.13 ^a	1.36	323			
Farm raised	5.97 ^{ab}	1.59	322			
Control	5.93 ^{ab}	1.51	316			
Cultivated	5.90 ^{ab}	1.60	318			
Cultured	5.90 ^{ab}	1.42	326			
Produced using cellular aquaculture	5.86 ^{abc}	1.43	313			
Cell-based	5.73 ^{bc}	1.56	320			
Grown directly from the cells of	5.60 ^{bc}	1.64	328			
Cell-cultured	5.58 ^{bc}	1.67	313			
Cultivated from the cells of	5.47 ^c	1.74	307			

Notes: Scale: 1 (*very unsafe*), 2 (*moderately unsafe*), 3 (*somewhat unsafe*), 4 (*neither safe nor unsafe*), 5 (*somewhat safe*), 6 (*moderately safe*), 7 (*very safe*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using the Tukey HSD *post hoc* test.

Table 5—How nutritious by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Nutritious				5.63	< 0.001	0.016
Farm raised	3.80 ^a	1.05	322			
Wild caught	3.80 ^a	0.99	323			
Produced using cellular aquaculture	3.74 ^{ab}	1.06	313			
Cultivated	3.70 ^{abc}	1.09	318			
Control	3.67 ^{abc}	1.07	316			
Cell-based	3.65 ^{abc}	1.07	320			
Cultured	3.62 ^{abc}	1.01	326			
Grown directly from the cells of	3.56 ^{abc}	1.04	328			
Cell-cultured	3.53 ^{bc}	1.08	313			
Cultivated from the cells of	3.45 ^c	1.12	307			

Notes: Scale: 1 (*not at all nutritious*), 2 (*slightly nutritious*), 3 (*moderately nutritious*), 4 (*very nutritious*), 5 (*extremely nutritious*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$.

(Table 4). They were also rated as “moderately” nutritious, with products labeled as “produced using cellular aquaculture,” “cultivated,” “cell-based,” “cultured,” and “grown directly from the cells of,” and the Control product rated as equally nutritious as the conventional “wild caught” and “farm raised” products (Table 5). However, the seafood with the names “cell-cultured” and “cultivated from the cells of” were judged to be slightly less nutritious than the conventional products.

Each of the products was also imagined to taste “slightly” to “moderately” good (Table 6). Products labeled as “cultivated,” “produced using cellular aquaculture,” “cell-based,” and “cultured” were thought to be as good tasting as “wild caught” and “farm raised,” while those labeled as “cell-cultured,” “grown directly from the cells of,” and “cultivated from the cells of” were imagined to taste less good than wild caught and farm raised seafood.

The participants indicated that they were “moderately” interested in tasting all of the products (Table 7), expressing equal interest in tasting the products labeled as “wild caught,” “produced using cellular aquaculture,” “farm raised,” “cell based,” and the control product. They were least interested in tasting products labeled with the phrases, “cultivated from the cells of” and “grown directly from the cells of.” However, they were equally as

Table 6—Imagined taste by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Taste				16.49	< 0.001	0.018
Wild caught	5.67 ^a	1.53	323			
Farm raised	5.58 ^a	1.57	322			
Cultivated	5.48 ^{ab}	1.62	318			
Produced using cellular aquaculture	5.47 ^{ab}	1.48	313			
Control	5.38 ^{abc}	1.73	316			
Cell-based	5.35 ^{abc}	1.57	320			
Cultured	5.34 ^{abc}	1.50	326			
Cell-cultured	5.15 ^{bc}	1.61	313			
Grown directly from the cells of	5.01 ^c	1.62	328			
Cultivated from the cells of	5.00 ^c	1.65	307			

Notes: Scale: 1 (*extremely bad*), 2 (*moderately bad*), 3 (*slightly bad*), 4 (*neither good nor bad*), 5 (*slightly good*), 6 (*moderately good*), 7 (*extremely good*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using the Tukey HSD *post hoc* test.

Table 7—Interest in tasting by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Taste				6.41	<0.001	0.018
Wild caught	3.68 ^a	1.36	323			
Produced using cellular aquaculture	3.45 ^{ab}	1.40	313			
Farm raised	3.44 ^{ab}	1.43	322			
Control	3.41 ^{ab}	1.46	316			
Cell-based	3.35 ^{abc}	1.48	320			
Cultivated	3.34 ^{bc}	1.51	318			
Cultured	3.29 ^{bc}	1.45	326			
Cell-cultured	3.21 ^{bc}	1.49	313			
Cultivated from the cells of	3.01 ^c	1.49	307			
Grown directly from the cells of	3.00 ^c	1.51	328			

Notes: Scale: 1 (*not at all interested*), 2 (*slightly interested*), 3 (*moderately interested*), 4 (*very interested*), 5 (*extremely interested*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using Tukey HSD *post hoc* test.

interested in tasting the seafood with the other proposed common or usual names as they were in tasting the “farm raised” product.

Similarly, they indicated that they were equally likely to purchase the seafood labeled as “wild caught,” “farm raised,” “produced using cellular aquaculture,” “cultivated,” “cell-based,” and “cultured,” and the control products. However, they were less likely to purchase products labeled as “cell-cultured” than the “wild caught” product and less likely to purchase products with the phrases “grown directly from the cells of,” or “cultivated from the cells of” (Table 8) than both the conventional “wild caught” and “farm raised” products.

Perceptions of the products’ naturalness fell into five slightly overlapping groups, with the “wild caught” seafood viewed as most natural (Table 9). The control product, and the products labeled as “farm raised” and as “cultivated” are seen as less natural than “wild caught.” Those labeled as “cultured,” “produced using cellular aquaculture,” and “cell-based” form the middle group and are seen as equally natural. “Cell-cultured” overlaps with those in the middle group, but also with those labeled with the phrases “grown directly from the cells of” and “cultivated from the cells of” which were seen as the least natural of all of the products tested.

Judgments of the likelihood that the products were GM followed a similar pattern (Table 10). The “wild caught” product,

Table 8—Likelihood to purchase in next six months by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
Likelihood to purchase				6.86	<0.001	0.019
Wild caught	5.04 ^a	2.02	323			
Farm raised	4.85 ^{ab}	2.13	322			
Control	4.80 ^{ab}	2.14	316			
Produced using cellular aquaculture	4.79 ^{ab}	2.07	313			
Cultivated	4.71 ^{ab}	2.19	318			
Cell-based	4.64 ^{abc}	2.16	320			
Cultured	4.56 ^{abcd}	2.12	326			
Cell-cultured	4.41 ^{bcd}	2.23	313			
Grown directly from the cells of	4.12 ^{cd}	2.29	328			
Cultivated from the cells of	4.07 ^d	2.24	307			

Notes: Scale: 1 (*extremely unlikely*), 2 (*moderately unlikely*), 3 (*slightly unlikely*), 4 (*neither likely nor unlikely*), 5 (*slightly likely*), 6 (*moderately likely*), 7 (*extremely likely*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using the Tukey HSD *post hoc* test.

Table 9—Rating of “How Natural” by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
How natural				49.57	<0.001	0.123
Wild caught	6.30 ^a	1.18	322			
Control	5.62 ^b	1.38	316			
Farm raised	5.53 ^b	1.66	320			
Cultivated	5.29 ^{bc}	1.66	318			
Cultured	4.91 ^{cd}	1.67	324			
Produced using cellular aquaculture	4.91 ^{cd}	1.72	311			
Cell-based	4.87 ^{cd}	1.85	319			
Cell-cultured	4.54 ^{de}	1.99	312			
Grown directly from the cells of	4.09 ^e	2.12	327			
Cultivated from the cells of	4.09 ^e	2.16	307			

Notes: Scale: 1 (*very unnatural*), 2 (*moderately unnatural*), 3 (*somewhat unnatural*), 4 (*neither natural nor unnatural*), 5 (*somewhat natural*), 6 (*moderately natural*), 7 (*very natural*). Means with the same superscript letter are not significantly different from each other at $P < 0.05$ using the Tukey HSD *post hoc* test.

rated as “slightly unlikely” was viewed as least likely to be GM. The control and “farm raised” products were seen as “neither likely nor unlikely” to be GM, as were the “cultivated” and “cultured” products, while products labeled as “cell-based,” “produced using cellular aquaculture,” and “cell-cultured” were seen as “slightly likely” to be GM. Finally, those labeled with the phrases “grown directly from the cells of” and “cultivated from the cells of” were seen as the most likely to have been GM. Thus, the terms containing the word “cell” were perceived (in general) as more likely to be GM than those without it. However, while some companies may ultimately use genetic modification in the production of their cell-based foods, others will not.

All of the seafood products were seen as unlikely to have been made from plants. Products labeled as “cell-cultured” and “cell-based” products were seen as “slightly unlikely” to have been made from plants, followed by the phrases, “produced using cellular aquaculture,” “cultivated from the cells of,” and “grown directly from the cells of.” The products labeled as “cultivated” and “cultured” were rated as “moderately unlikely” to have been made from plants, followed by the control product. The “wild caught” and “farm raised” products, with which consumers are

Table 10—Ratings of likelihood that the seafood is genetically modified, made from plants, and “Contains an Unhealthy Amount of Mercury” by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P</i> -value	η^2
How likely it is genetically modified				196.41	<0.001	0.156
Cultivated from the cells of	5.62 ^a	1.63	307			
Grown directly from the cells of	5.48 ^{ab}	1.69	328			
Cell-cultured	5.18 ^{bc}	1.64	313			
Produced using cellular aquaculture	4.94 ^{cd}	1.71	313			
Cell-based	4.94 ^{cd}	1.75	320			
Cultured	4.60 ^{de}	1.68	326			
Cultivated	4.49 ^e	1.77	318			
Farm raised	4.24 ^{ef}	1.85	322			
Control	4.03 ^f	1.66	316			
Wild caught	2.95 ^g	1.93	323			
How likely it is made from plants				25.52	<0.001	0.067
Cell-based	3.73 ^a	1.95	320			
Cell-cultured	3.39 ^{ab}	1.91	313			
Produced using cellular aquaculture	3.06 ^{bc}	1.92	313			
Cultivated from the cells of	3.04 ^{bc}	1.88	307			
Grown directly from the cells of	2.98 ^{bc}	1.97	328			
Cultivated	2.73 ^{cd}	1.97	318			
Cultured	2.71 ^{cd}	1.83	326			
Control	2.44 ^{de}	1.81	316			
Farm raised	2.14 ^e	1.77	322			
Wild caught	2.03 ^e	1.74	323			
Contains unhealthy amount of mercury				6.39	<0.001	0.018
Wild caught	4.14 ^a	1.66	323			
Control	4.08 ^{ab}	1.61	316			
Cultivated	3.92 ^{abc}	1.71	318			
Cell-based	3.78 ^{bcd}	1.72	320			
Cell-cultured	3.66 ^{bcd}	1.72	313			
Grown directly from the cells of	3.61 ^{cd}	1.77	328			
Cultured	3.60 ^{cd}	1.58	326			
Produced using cellular aquaculture	3.57 ^{cd}	1.81	313			
Farm raised	3.47 ^d	1.80	322			
Cultivated from the cells of	3.47 ^d	1.75	307			

Notes: Scale: 1 (*extremely unlikely*), 2 (*moderately unlikely*), 3 (*slightly unlikely*), 4 (*neither likely nor unlikely*), 5 (*slightly likely*), 6 (*moderately likely*), 7 (*extremely likely*). Means with the same superscript letter are not significantly different from each other at $P < .05$ using the Tukey HSD *post hoc* test.

already familiar, were seen as the least likely to have been made from plants.

None of the products were viewed as likely to be fermented (See Table in S2). The products labeled as “wild caught” and “farm raised” were seen as least likely to have been fermented. However, there were no statistically significant differences among the terms tested as common or usual names.

None of the products were thought likely to “contain an unhealthy amount of mercury (Table 10). The “wild caught,” control, and “cultivated” products, which were judged as “neither likely nor unlikely” were seen as the most likely to contain an unhealthy amount of mercury. The remaining names were judged to be “slightly unlikely” to “neither likely nor unlikely” and were not significantly different from each other.

The participants were divided as to whether pregnant women should eat *any* of the seafood products, (including both “wild caught” and “farm raised” products). Coded as 1 (*definitely not*), 2 (*probably not*), 3 (*probably yes*), and 4 (*definitely yes*), the overall median was 2.00. A Kruskal–Wallis test indicated that there were no statistically significant differences among the common or usual names. There was a small negative Spearman’s rank-order correlation between the likelihood that the product contains an unhealthy amount of mercury and whether pregnant women should eat it $r_s(3,186) = -0.129$, $P < 0.001$.

In contrast, using the same scale, the majority indicated that children *should* eat each of the products ($Mdn = 3.00$). A Kruskal–Wallis test indicated that the participants thought that children should eat some products with common or usual names more than others, $H(9) = 40.497$, $P < 0.001$. Pairwise comparisons with adjusted P -values indicated that the participants were less likely to believe that children should eat “cell-cultured seafood” than “cultivated” ($P = 0.028$), “wild caught” ($P = 0.012$), or “farm raised” products ($p < 0.001$). They were also less likely to believe that children should eat seafood “cultivated from the cells of” than “wild caught” ($P = 0.036$), or “farm raised” products ($P = 0.004$). Similarly, they were less likely to believe that children should eat “cultured seafood” ($P = 0.037$) or products “grown directly from the cells of” than “farm raised” ($P = 0.036$). There was a small negative Spearman’s rank-order correlation between the likelihood that the product contains an unhealthy amount of mercury and whether children women should eat it $r_s(3,186) = -0.158$, $P < 0.001$. There was also a positive Spearman’s rank-order correlation between whether the participants thought that pregnant women should eat any of the seafood and whether children should eat it ($r_s(3,186) = 0.555$, $P < 0.001$).

The participants were asked to compare the product with the proposed common or usual name to the properties of farm raised and wild caught varieties. They were asked, in a randomized order, whether the product had more, less, or the same amount of “heart-healthy omega 3s,” protein, microplastics, mercury, antibiotics, bacteria, artificial colors, growth hormones, pesticides, and “other environmental contaminants.” They were also asked whether the product was better, the same, or worse with respect to taste, texture, nutrition, cost, the environment, and “the sustainability of ocean fish.” Using a Bonferroni corrected P value of $P < 0.001$ to account for multiple tests using the same dependent measure, only the comparisons of the amount of pesticides in the products with the common or usual names to their wild caught counterparts were significant $F_{(6,2224)} = 5.44$, $P < 0.001$, $\eta^2 = 0.015$ (see Table S3).

3.4 Criterion E: Be seen as an appropriate term

After reading the description of the proposed common or usual name to which they had been assigned, the majority of the participants (61%) indicated that they were “not familiar at all” “with the *idea* of producing just the parts of seafood that people eat, instead of catching or raising them whole.” The remainder reported that they were “slightly” (9%), “Moderately” (13%), “very” (10%), or “extremely familiar” (9%) with the concept. Coded on a corresponding scale of 1 to 5, there were no statistically significant differences among the common or usual names with respect to familiarity with the concept.

The participants were then asked to indicate how appropriate the common or usual name they viewed is “for describing this new way of producing just the parts of salmon/tuna/shrimp that people eat, instead of catching or raising them whole.” Using a

Table 11—Rating of clarity in communicating that the product was not “Caught in the Ocean” or “Farm Raised” by common or usual name.

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>F</i>	<i>P-value</i>	η^2
Not caught in the ocean				17.22	<0.001	0.045
Grown directly from the cells of	5.50 ^a	1.85	328			
Cultivated from the cells of	5.25 ^{ab}	1.82	307			
Cell-cultured	4.89 ^{bc}	1.92	313			
Cultivated	4.59 ^{cd}	2.08	318			
Produced using cellular aquaculture	4.54 ^{cd}	2.06	313			
Cell-based	4.46 ^{cd}	2.17	320			
Cultured	4.21 ^d	2.00	326			
Not farm raised				18.54	<0.001	0.048
Grown directly from the cells of	5.30 ^a	1.87	328			
Cultivated from the cells of	5.18 ^{ab}	1.77	307			
Cell-cultured	4.80 ^{bc}	1.90	313			
Cell-based	4.49 ^{cd}	2.13	320			
Produced using cellular aquaculture	4.46 ^{cd}	2.01	313			
Cultivated	4.18 ^d	2.14	318			
Cultured	4.06 ^d	2.06	326			

Notes: Scale: 1 (extremely unclear), 2 (moderately unclear), 3 (slightly unclear), 4 (neither clear nor unclear), 5 (slightly clear), 6 (moderately clear), 7 (extremely clear). *N* = 2,225. Means with the same superscript letter are not significantly different from each other at *P* < 0.05 using the Tukey HSD *post hoc* test.

scale of 1 (extremely inappropriate) to 7 (extremely appropriate), none of the names proposed was judged to be “inappropriate” (*M* = 4.97, *SD* = 1.81) and there were no statistically significant differences in ratings of appropriateness among the names.

The participants were also asked how clear the term is “in communicating that the salmon/tuna/shrimp was not caught in the ocean” and in communicating that it was not “farm raised.” As shown in Table 11, none of the proposed common or usual names was judged as “unclear” in communicating either of these concepts. The phrases “grown directly from the cells of” and “cultivated from the cells of” rated as “slightly clear” were perceived to be clearest and “cultured” was perceived to be least clear in communicating that the products were not caught in the ocean and were not farm raised.

Using a set of agree–disagree questions coded as: 1 (*strongly disagree*) and 7 (*strongly agree*), the participants indicated no differences between the names in the level of agreement that producing the seafood product will have benefits for society (*M* = 4.69, *SD* = 1.59, *N* = 2,225), that producing it is wise (*M* = 4.49, *SD* = 1.70, *N* = 2,223), and is ethical (*M* = 4.58, *SD* = 1.67, *N* = 2,221). Moreover, there were no differences between the names in the level of agreement that the idea of eating the product is disgusting (*M* = 4.35, *SD* = 1.84, *N* = 2,222). Finally, there were no differences between the names as to whether each seafood product should be sold in the same section of the supermarket as wild caught and farm raised seafood (*M* = 4.47, *SD* = 1.83, *N* = 2,223).

3.5 Determining the best performing common or usual name

Assessments of each of the five criteria were used to establish which of the seven candidate names performed best in meeting both the regulatory requirements and the needs of stakeholders.

The terms performed equally well with respect to criterion B (signaling allergenicity) and E (seen as an appropriate name). Unfortunately, the terms “cultivated,” “cultured,” and “produced using cellular aquaculture” performed least well in signaling that the product is neither “wild caught” nor “farm raised.” In fact, more than half of those viewing “Cultivated” and more than 40% of those who saw “cultured” and “produced using cellular aquaculture” mistakenly thought these terms meant “Farm Raised.” Because these terms failed to meet the key regulatory criterion (A) the ability of the common or usual name to distinguish the product from its conventional counterparts, they were removed from further consideration.

The phrases “cultivated from the cells of” and “grown directly from the cells of” were also removed from further consideration. They performed well in distinguishing the labeled product from those that are wild caught and farm raised. However, they received among the least positive overall reactions and were seen as most likely to be GM. Compared to the conventional “wild caught” and “farm raised” products with which they must compete, they are also consistently in the bottom tier with respect to perceptions of safety, nutrition, taste, naturalness, interest in tasting, and likelihood to purchase.

The remaining two names, “cell-based” and “cell-cultured” both did a good job at signaling that the product is different from both “wild caught” and “farm raised” seafood (meeting criterion A). In direct comparisons between the two, the terms “cell-based” and “cell-cultured” are also not significantly different from each other on most of the other key dependent measures.

However, “cell-based” outperforms “cell-cultured” when comparing the pattern of results for each term to those associated with the conventional “wild caught” and “farm raised” seafood products with which consumers are already familiar. In contrast to “cell-cultured” products, the participant’s initial reactions to “cell-based” were as positive as they were to “wild caught” and “farm raised” and overall reactions were as positive as “farm raised.” They judged “cell-based” as nutritious as both “wild caught” and “farm raised” seafood, while “cell-cultured” products were not. Unlike “cell-cultured” seafood, “cell-based seafood” was imagined to taste as good as both “wild caught” and “farm raised” seafood and the participants indicated that they were equally interested in tasting and in purchasing “cell-based seafood” as they were “wild caught” and “farm raised” seafood. In contrast, they were only equally interested in tasting and purchasing “cell-cultured” seafood as they were in tasting and purchasing “farm raised” seafood products. Finally, the participants were less likely to indicate that children should eat “cell-cultured seafood” than both “wild caught” and “farm raised” products, while they were equally likely to indicate that children should eat “cell-based seafood” as “wild caught” and “farm raised.” Thus, the overall pattern of results suggests that the term “cell-based” is the better of the two names with respect to likely consumer acceptance and purchase of these novel products.

4. CONCLUSION

“Cell-based seafood” appears to be the best candidate name considered in this study. It meets the regulatory requirements to distinguish products from those already known to consumers and to signal allergenicity. It is seen as an appropriate name for describing the technology/process and it performs as well or better than other terms with respect to key measures related to consumer perceptions and acceptance. As such, the term “cell-based seafood”

should be considered the best common or usual name to be used to label seafood products produced using the technology.

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AUTHOR CONTRIBUTIONS

W. Hallman is responsible for all aspects of the study design, data analysis, and production of the manuscript. W. Hallman II assisted with the review of the literature, coding of open-ended responses, preparation of tables, and review and editing of the manuscript.

CONFLICTS OF INTEREST

None to declare.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. First Thought, Image, Or Feeling Categorized.

Table S2. Rating of the Likelihood that the Seafood is Fermented By Common or Usual Name.

Table S3. Compared to Wild Caught ____ Does This ____ Have More, Less, or the Same Amount of.