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Measuring Consumer Preferences for Ecolabeled Seafood: An International Comparison

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Robert J. Johnston
Cathy R. Wessells
Holger Donath
Frank Asche

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Robert J. Johnston, Cathy R. Wessells, Holger Donath, Frank Asche

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The authors are Assistant professor, professor and department chair, and research assistant, Department of Environmental and Natural Resource Economics, University of Rhode Island, and professor in the Stavanger University College and Centre for Fisheries Economics, Norwegian School of Economics and Business Administration. Funding for this project was provided by the Rhode Island Sea Grant Program, the Rhode Island Agricultural Experiment Station, and the Norwegian Research Council.

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Keywords: consumer preferences, contingent choice, ecolabeling, food labeling, seafood

Abstract

This paper introduces into the food labeling literature an analysis of consumer preferences for products labeled with information about environmental production process attributes. International seafood ecolabeling programs have been proposed to create market-based incentives for fisheries managers to promote sustainable fisheries. We investigate differences in consumer preferences for ecolabeled seafood across the U.S. and Norway. Using a contingent choice telephone survey of random households in each nation, findings are that a wide range of factors may influence consumers' likelihood of purchasing ecolabeled seafood products, and that consumer preferences differ by premium, species, consumer group, certifying agency, and regional demographic factors.

Introduction

Concern over the status of natural resource stocks, combined with well-known limitations of command and control management mechanisms have led to a variety of ecolabeling initiatives in resource-based industries (Swallow and Sedjo; Wessells *et al*.). In general, such programs evaluate the production process with regard to established environmental standards set by an independent third party. If the process meets these standards, the producer or marketer may buy a license to use a specific ecolabel in marketing efforts. In effect, the label conveys to the consumer otherwise unobservable information concerning a product's environmental impact. The increasing use of such programs for many consumer products notwithstanding, worldwide ecolabeling initiatives have met with varying degrees of consumer acceptance (OECD).

Within the seafood industry, both industry and non-industry groups have proposed ecolabeling as a means to promote "sustainable" management of fish stocks. For example, the Marine Stewardship Council (MSC) was created in 1996 through a cooperative effort of the World Wildlife Fund (WWF) and Unilever, a multi-national corporation (McHale; MSC). The goal of this partnership is to provide a standardized mechanism for certifying and labeling seafood products worldwide, thereby providing a market-based incentive to maintain sustainable fish stocks (Wessells *et al*.). Several large supermarket chains in the U.S. and Europe have become MSC partners, pledging to promote and buy only certified seafood only from sustainable sources, once the certification program is well-established. In contrast to the international program that the MSC is promoting, several regional governmental labeling programs are being promoted (*e.g*. through the Nordic Council), as well as national governmental programs, programs promoted by other environmental groups (*e.g*. the Audobon Society), and the seafood industry.

The economic literature regarding the potential impact of seafood ecolabels is sparse except for Wessells *et al*. and Tiesl *et al*. However, work in food product labeling establishes that the

ultimate economic impact of labels depends critically on consumer acceptance (*e.g.*, Caswell and Mojduszka; Caswell). Moreover, as certification programs often involve some degree of unavoidable cost, the extent to which consumers are willing to pay a price premium may have a significant impact on the ultimate success of such programs (Gudmundsson and Wessells; Sedjo and Swallow). Although past research indicates that most consumers prefer ecolabeled products to non-labeled products, *ceteris paribus* (Blend and vanRavenswaay; Forsyth *et al*.), and that many consumers are willing to pay a premium for such products (Nimon and Beghin), consumer acceptance of labels is likely to differ across product classes and regions. Consumer acceptance may also be influenced by such factors as the credibility of the agency providing the ecolabel; perceptions of the links between product choices and environmental impact; and understanding of the label's meaning (USEPA). Ecolabels will also face potentially disparate behavior of consumers in different countries (OECD; USEPA). For example, cultural differences may lead otherwise similar consumers in different countries to have very different reactions to product certification. Ecolabeling or certification programs based solely on research conducted in a single country may face therefore unanticipated obstacles or even outright failure, if consumers in other nations do not react to the labeling program as expected.

This paper evaluates factors that may influence consumers' acceptance of an ecolabeling program for seafood products. To evaluate potential differences in consumers' acceptance of seafood ecolabels in different countries, we compare the results of parallel consumer preference research conducted in both the U.S. and Norway. The ultimate goal is to assess: a) whether consumers prefer ecolabeled seafood; b) what factors influence those choices; and c) whether these determinants or their impacts differ across countries. As no large-scale market for ecolabeled seafood currently exists,[1] this study relies on the results of a multi-attribute contingent choice survey (Hanemann; Opaluch *et al*.). Although often used to assess tradeoffs in the design of multi-

attribute public policies, such analysis is also useful in the consideration of new or proposed market products for which there is little available data concerning consumer demand (Anderson and Bettencourt). Analysis of food markets (Blend and vanRavenswaay), and in particular, seafood markets have employed contingent choice techniques (Holland and Wessells).

The Contingent Choice Model

The contingent choice survey format asks respondents to make a discrete choice between multiple policy or product alternatives. By analyzing preferences for a variety of potential options or products (differing according to a chosen set of variables) researchers can estimate the relative importance of particular variables in determining respondents' choices. In the present case, the contingent choice approach is applied to consumers' choices of ecolabeled (certified) versus non-labeled (uncertified) seafood. An underlying assumption of the chosen model is that for any given seafood species, consumers will choose either certified or uncertified seafood on any single purchasing occasion, but will not buy a combination of the two products.

Utility from a seafood product is assumed to be a function of the attributes of the product (including certification), the money cost of the product, and the characteristics of the consumer. We assume that the principal shopper of the household has previously made a selection of the desired seafood species (*e.g.*, shrimp, cod), based on the characteristics of that species relative to substitute products. The consumer must then choose between certified and uncertified products for that species. That is, we only model the choice of certified versus uncertified products within particular species groups—we do not model the choice among different seafood species.[2]

To model discrete choice behavior, the contingent choice method relies on the random utility model, in which individual utility is divided into observable and unobservable components (Hanemann). Within this framework, the utility derived from seafood product (i) is assumed to be a function of physical characteristics of the product (vector X_i), environmental characteristics of the

product (vector L_i with L_i equal to 0 for uncertified product and 1 for certified product), the consumer's demographic attributes (vector D), the consumer's income (Y) minus the price of product i (P_i) and a vector of other goods (S). This may be formally represented as:

$$U_i(X_i, L_i, D, Y-P_i,S) = v_i(X_i, L_i, D, Y-P_i,S) + \varepsilon_i \quad (1)$$

where $U(\cdot)$ is the total utility related to the seafood purchase, $v(\cdot)$ is a function representing the empirically measurable component of utility, and ε_i is a term representing, or the unobservable component of utility.

The consumer compares the utility derived from Product A and Product B, assumed to be identical except that Product A is certified and Product B is uncertified. Thus, for Product A $L_i=L_A=1$, and for Product B $L_i=L_B=0$. The premium for certified Product A may be positive, zero, or negative, with the difference between the price of Product A versus Product B given by

$$P_A=P_B + P_L \quad (2)$$

where P_B represents the per-unit "base price" for the unlabeled product and P_L represents the premium paid over P_B for certified product A. We assume that the quantity of seafood to be purchased is fixed in the short run (*i.e.* fixed at the amount of seafood needed to feed the household). This assumption is based on the results of focus groups and survey pretests with seafood consumers; its implications are discussed in the following section.

Comparing the two products, the change in utility (dU) is given by

$$\begin{aligned} dU &= U_a(X_a, L_a, D, Y-(P_b + P_L), S) - U_b(X_b, 0, D, Y-P_b, S) \\ &= v(X_a, L_a, D, Y-(P_b + P_L), S) - v(X_b, 0, D, Y-P_b, S) - [\varepsilon_b - \varepsilon_a] \\ &= dv - \theta \end{aligned} \quad (3)$$

Although dU is unobservable to the researcher, one may observe respondents' choices between Product A and Product B. That is, the respondent compares the two products, assesses the

difference between utility under the two products, and indicates within which of two intervals the utility-difference falls by either choosing the certified product (Product A) or the uncertified product (Product B). The respondent's answer is represented by an indicator variable I_j which takes a value of one if the respondent gives answer j. That is,

$$I_j = 1 \text{ if } \alpha_{j-1} < dU \leq \alpha_j \qquad (4)$$
$$= 0 \text{ otherwise,}$$

where dU is the difference in utility between the two plans, and the respondent's choice of Product A or Product B is represented by interval indicators I_j for j = {1, 2}. While the boundaries of the intervals on the utility scale (α) are unobserved, the maximum likelihood estimation treats them as parameters, allowing the model to leverage information provided by the indicator variables (Johnston *et al*. 1999). Given two possible values for I_j, the model normalizes α_0 to $-\infty$ and α_2 to $+\infty$; α_1 is estimated as a model parameter (Maddala). For example, if the respondent chooses Product A, then I_2=1, I_1=0, and $dU > \alpha_1$ (i.e., $\alpha_1 < dU < +\infty$). If the respondent chooses Product B, then I_2=0, I_1=1, and $dU \leq \alpha_1$ (i.e., $-\infty < dU \leq \alpha_1$).

This model allows the researcher to estimate the probability that a respondent's difference in utility from the two plans is in category j.

$$\begin{aligned} \Pr(\alpha_{j-1} < dU \leq \alpha_j) &= \Pr(dU \leq \alpha_j) - \Pr(dU \leq \alpha_{j-1}) \text{ for } j = 1, 2 \\ &= [1 - \Pr(dv - \alpha_{j-1} \leq \theta)] - [1 - \Pr(dv - \alpha_j \leq \theta)] \\ &= \Pr(\theta < dv - \alpha_{j-1}) - \Pr(\theta < dv - \alpha_j), \end{aligned} \qquad (5)$$

where $\Pr(\cdot)$ is the probability operator. Given a probability density function for θ, parameters of a model for utility may be estimated by maximizing the likelihood function:

$$\mathbf{L} = \Pi_k \Pi_j [\Pr(\theta_k < dv_k - \alpha_{j-1}) - \Pr(\theta_k < dv_k - \alpha_j)]^{I_{kj}} \qquad (6)$$

where k designates individual observations (individual answers from respondents). If one assumes that θ follows a logistic distribution, (1)-(6) characterize the familiar conditional logit model (Maddala).

Note that in cases where j={1, 2,…, n}, identical equations characterize the ordered logit model, which is appropriate in cases where an indifference response is permitted (Svento). As specified, this model neither allows an indifference response, nor a "status quo" response in which survey respondents may choose to purchase neither the certified nor the uncertified product (Adamowicz *et al*.). The latter convention implies that model findings should be interpreted as *conditional* on the choice to purchase the specified seafood product (e.g., cod).

Implications of Quantity Restrictions

As noted above, we assume that the quantity of seafood to be purchased is fixed in the short run. Moreover, this fixed quantity of seafood purchased—the amount required to feed the household—is known only to the respondent. This methodological approach is based on focus group evidence that incorporation of quantity purchased in the traditional manner would produce methodological misspecification in the survey instrument (Johnston *et al*. 1995).

Focus groups and interviews with seafood consumers revealed a number of features of seafood consumption behavior which led to the exclusion of explicit quantity considerations from the survey. First, household shoppers generally buy the quantity of seafood that they perceive to be sufficient to feed household members. This quantity may differ depending on the characteristics of the seafood product (*e.g*., shellfish vs. finfish), but is generally a constant quantity for a seafood product with particular physical characteristics. More specifically, one may view seafood purchases of any given product, on a given shopping trip, as a discrete choice. Depending on the price and quality attributes of the product, the consumer will either buy an (approximately) fixed quantity of

the product, or will forgo the product entirely and substitute another seafood, meat, or other food product. Aggregating the per-trip demand over an extended period of time results in the more traditional continuous demand function.

Second, consumers in many cases use rules of thumb such as the "size of the fillet" to measure seafood quantity. That is, when purchasing seafood, consumers often purchase by, for example, the apparent size of the piece of fish, rather than according to a known weight measure. Indeed, a number of those interviewed indicated that they did not really know the number of pounds of fish they typically bought, but that they almost always bought the same size fillet or steak. Hence, introducing an explicit weight measure into choice questions would have introduced a form of methodological misspecification, as it would have presented choice scenarios different from those commonly understood by respondents.

The Data

A telephone survey format was chosen for final data collection, allowing random nationwide sampling in both Norway and the United States. Survey development involved background research, interviews with those involved in seafood ecolabeling initiatives, interviews and focus groups with seafood consumers, and extensive pre-testing. Survey pretesting was conducted both in-person and by telephone, with over 120 participants used to pre-test the final survey. Focus groups and pretests emphasized both the need to provide respondents with sufficient information to make informed product choices, and a requirement that product descriptions and survey language be kept straightforward and succinct. Hence, the number of attributes of each seafood species considered by respondents was minimized to include only those central to the choice of labeled (certified) versus unlabeled (uncertified) seafood.

Respondents considered the choice of certified versus uncertified seafood for two different

species: cod and shrimp. For each species, certified seafood was described simply as being "caught under strict controls that prevent too much fishing." The survey emphasized the fact that both certified and uncertified seafood were of equal quality, texture and freshness. The order in which the species were considered was randomized, to prevent question order bias (Mitchell and Carson). Prior to the presentation of discrete choice questions, respondents were provided with background information emphasizing the meaning of certified seafood, and reminding respondents of their budget constraint.

For each choice instance, respondents were provided with both the price of the uncertified product and the price of the certified product (per pound in the U.S.; per kilogram in Norway), where the premium is defined as the difference between the two prices. These premiums ranged from –20 Norwegian kroner (NOK) to +50 NOK in Norway and from -$2.00 to +$5.00 in the U.S. In addition to species, price, and premium information, each survey listed a specific "certifying agency" for each set of three questions for any one respondent, maintaining the same agency for each respondent. These agencies included the World Wildlife Fund (WWF) and the Marine Stewardship Council (MSC) in both countries, as well as the National Marine Fisheries Service (NMFS) in the U.S. and the Norwegian Fisheries Directorate (NFD) in Norway (essentially the equivalent national government agency in each country). Following our discussion above that there are several possibilities for certification organizations, these three certification organizations can be regarded as representatives from: i) a national governmental body; ii) a well-known environmental organization; and, iii) a new unknown initiative. Fractional factorial design was used to construct the range of discrete choice question attributes (Addelman and Kempthorne) resulting in 54 unique contingent choice questions, divided among 18 survey versions in each country.

The survey was administered in the U.S. in the summer of 1998 and in Norway during spring 1999. The U.S. sample includes 1,640 completed surveys; the Norwegian sample includes 2,039.

Surveys were completed by the "principal shopper" in seafood consuming households. In addition to the discrete choice questions described above, the survey included questions addressing a number of factors including: 1) respondents' seafood consumption behavior and budget; 2) respondents' trust in potential certification agencies; 3) respondents' demographic characteristics; 4) the extent to which environmental concerns influenced respondents' past purchasing behavior, and; 5) respondents' perceptions regarding the status of particular seafood stocks.

Characterizing Respondents' Ecological Purchase Behavior

Respondents often display heterogeneous preferences for environmental goods or attributes (Swallow *et al.*). In some cases, differences among respondents' preferences may be explained through the inclusion of demographic variables in the utility difference function. However, in other cases, heterogeneity in responses may be due to unobservable, latent factors which influence behavior (Bollen). These factors are often estimated through analysis of Likert-scale responses to multiple questions linked to a set of underlying concepts (Kline; Variyam *et al.*).

In an attempt to better model preference heterogeneity, each survey included a set of ten questions designed to characterize the extent to which environmental concerns influenced respondents' purchasing behavior. These questions were selected from the standardized ECCB (ecologically conscious consumer behavior) scale (Roberts), which asks respondents to rate the veracity of various statements regarding their purchase behavior with respect to environmental product attributes. Responses to these questions are summarized by table 1. Following Variyam *et al.*, factor analysis is conducted to estimate a small number of underlying constructs that together account for a large percentage of the observed variation in responses (Harman). Responses are analyzed using principal component factor analysis of the response correlation matrix, with three factors retained and rotated using the VARIMAX method (Kaiser). Retained factors were chosen based on a threshold eigenvalue of one (Variyam *et al.*). Rotated VARIMAX factor loadings are

illustrated by table 2.

Factor 1 is characterized by high factor loading on questions 4, 7, 8, 9, and 10, where high loadings indicate that respondents considered the statements less true. These statements tend to reflect a consumer's willingness to forgo desired products for abstract environmental reasons—no personal economic gain is involved and no specific purchases are described. High scores on these questions reflect a non-willingness give up products solely for abstract environmental reasons. This factor is accordingly characterized as "*abstract anti-environmentalist*"; it indicates the extent to which respondents reject general environmentalist sentiments governing their purchase behavior.

Factor 2 is characterized by high loading on questions 1, 2, and 3. These are questions regarding the likelihood of purchasing specific types of environmentally-friendly products, often with potential long-term economic benefits to the purchaser. These include products with low energy costs or reduced packaging. Hence, this factor is characterized as representing the degree to which a consumer has made expenditures for specific energy or packaging related environmental benefits. High scores for this factor indicate an unwillingness to undertake this sort of specific behavior—hence we denote this factor "*no specific energy-packaging purchases*".

Factor 3 is characterized by high loading on questions 5 and 6—questions addressing an active change in behavior in response to environmental information. Those with high scores on this factor will not change products in response to ecological information, nor will they convince others to do so. Hence, this factor is characterized as indicating an "*unwillingness to change*" purchase patterns for environmental reasons. The three factors are included in the logit model as standardized factor scores—the original factors transformed so as to have a mean of zero and standard deviation of one (Reyment and Joreskog). This simplifies interpretation of estimated logit parameters, as the scores indicate the extent to which a factor score for a particular respondent differs from that of the sample mean (Kline).

Model Results

The model addresses the choice of certified versus uncertified seafood for cod and shrimp. The price premium is expressed as a percentage of the uncertified price; this convention is adopted as a means to compare premiums across countries. The alternative—standardizing premiums using simple monetary exchange rates—was judged to be unsatisfactory, given rapidly fluctuating exchange rates between the U.S. and Norway, different costs of living across the two nations, and different unit measures ($/lb. versus NOK/kg.). The interpretation of premium in percentage terms was also supported by focus groups and survey pretests, in which the magnitude of the premium was generally assessed relative to the base price of uncertified seafood. Table 3 describes variables included in the final model.

Logit results are provided by table 4. After deletion of observations with missing data for key (often demographic) variables, the final model includes 6,220 observations. A log-likelihood ratio test (*-2LnL*=1248.588; *df*=29) indicates that the model is significant at p=0.0001. Of 29 variables in the model, 18 are significant at p<0.10. The model predicts 76.0% of observations correctly.

Differences Between Norwegian and U.S. Respondents

The final model includes a set of variables hypothesized to influence the likelihood of selecting certified seafood, in addition to interactions between these variables and a dummy variable identifying U.S. responses (as opposed to Norwegian responses). This allows one to assess the influence of each variable in both the U.S. and Norway, and whether the influence of a particular variable is different, from a statistical perspective, in the two different countries. A log-likelihood test of variable interactions with the U.S. dummy (χ^2=340.916, df=15) indicates that the U.S. interaction variables have a statistically significant influence on the model of consumer choice at p<0.0001. Accordingly, we conclude that differences exist between the choices of Norwegian and U.S. respondents.

To illustrate differences in consumer preferences across the two sampled countries, table 5 forecasts the probability that an "average" consumer of fixed characteristics will choose certified seafood, at different premium levels. Consumer characteristics are fixed at sample means (for both countries combined), except that *us_dum* = 1 for the U.S. consumer and *us_dum* = 0 for the Norwegian consumer, where the selected value of *us_dum* also influences the values of all U.S. interaction variables. This method is applied to offset potential effects related to differences in the demographic characteristics of the two samples. That is, table 5 forecasts the preferences of an identical consumer in Norway and the U.S.

Estimated probabilities are calculated directly from estimated model parameters and mean values for associated variables, based on the logistic function

$$Pr(certified) = \frac{1}{1+e^{-dv}} \qquad (7)$$

where *dv* represents the utility-difference function shown in equations (3)-(6). Following Poe *et al.* and Krinsky and Robb, standard errors for the estimated probability (7) are generated using a bootstrap off the estimated variance-covariance matrix. In this case, we randomly draw 10,000 sets of coefficient estimates from the maximum likelihood estimates and accompanying variance-covariance matrix. Probability estimates are calculated for each of the 10,000 draws, resulting in an empirical distribution of probability for each scenario (Poe *et al.*). This distribution is used to calculate standard errors for the probability of choosing certified seafood. These estimated standard errors are used to generate t-statistics for the null hypothesis that the difference between estimated Norwegian and U.S. probabilities is equal to zero.

Table 5 illustrates differences between Norwegian and U.S. consumers' predicted responses to discrete choice questions, for an otherwise identical respondent. In all cases, the estimated probability difference is statistically different from zero at $p<0.05$. For example, at a zero price

premium (*i.e.*, identical prices for certified and uncertified seafood), the estimated probability of a Norwegian consumer choosing certified seafood is approximately 70%. The equivalent estimated probability for a U.S. consumer is 84%. This probability difference is significant at $p<0.05$.

Similar disparities hold for all in-sample premium levels, with Norwegian consumers always less likely to choose certified products. The estimated difference between Norwegian and U.S. respondents increases as the percentage price premium increases, reflecting greater price sensitivity of Norwegian respondents. These results are particularly notable, given that Norwegian respondents indicated a greater importance of ecological attributes in general purchase behavior (cf. table 1). This suggests that a high degree of self-reported environmentalism or general ecological purchase behavior on a national scale will not necessarily lead to a greater acceptance of ecolabeled seafood by consumers.

Price Premium

A log-likelihood test ($\chi^2=662.465$, df=2) clearly indicates the joint significance of variables associated with the price premium (*percent*; *us_percent*) ($p<0.0001$), confirming the results of individual tests of statistical significance (both variables are independently significant at $p<0.0001$). As expected, the price premium (in percentage terms) has a negative impact on consumers' likelihood of choosing certified seafood. Although the effect holds in both countries, it is more pronounced in Norway (*i.e.*, the variable *us_percent* is positive and significant, implying that U.S. respondents are less price sensitive with respect to the choice of certified products). For example, Table 5 illustrates that a change in price premium from 0% to 50% of the uncertified price leads to a 0.36 decrease in the probability of selecting certified seafood for Norwegians, but only a 0.19 decrease for U.S. respondents. This difference in price sensitivity would likely have important implications for the ability of retailers to charge premiums sufficient to cover the increased costs of the product.

Species

To evaluate the relative importance of species on respondents' choices, the model includes a dummy variable (*cod*) identifying observations associated with cod (rather than shrimp). This variable is significant and positive (p=0.0001), indicating that Norwegian consumers are relatively more likely to choose certified cod than certified shrimp, *ceteris paribus*. As the interaction between *d_cod* and *us_dum* cannot be shown to be significant at p=0.10, we conclude that the same choice patterns hold for U.S. respondents. Hence, certification appears to have a stronger influence on purchase behavior for cod, compared to shrimp. The existence of such effects suggests that the success of ecolabeling programs will likely differ across species.

Although one might conclude that this is due to frequent media reports regarding the depletion of cod stocks (*e.g.*, Cramer), in fact only a low percentage of respondents indicated that they believed cod to be "severely overfished." Moreover, preliminary models could establish no significant correlation between a belief that cod stocks were overfished and the likelihood of choosing certified cod; this variable was subsequently deleted from the model. Indeed, the data provide no evidence that the difference between choices involving cod and shrimp are related to beliefs concerning the current status of fish stocks.

Agency Trust

One might expect consumers who express a high level of trust in a particular certification agency to be more likely to choose the certified product, if certification is guaranteed by that agency. Model results support this conclusion; *d_trust* is significant and positive. Prior to discrete choice questions, the survey asked respondents to indicate which of a list of agencies would be most trusted to guarantee certification. U.S. respondents could choose among the World Wildlife Fund (WWF), the Marine Stewardship Council (MSC), and the National Marine Fisheries Service

(NMFS). Norwegian respondents were given a choice among WWF, the MSC, and the Norwegian Fisheries Directorate (NFD). Respondents were not provided additional information regarding these agencies, to mimic an actual buying scenario in which consumers would not be likely to have on-site access to additional information regarding a certifying agency.

Of the agencies considered by U.S. respondents, NMFS garnered the highest trust ratings, with 49% of respondents indicating that they would trust this agency most to provide certification. WWF was chosen by 23% of respondents, and the MSC by 5%. The remaining 23% indicated that they were unsure of their most trusted agency. Approximately 81% of Norwegian respondents indicated that they would trust the government agency most to provide certification. WWF was chosen by 16% of Norwegian respondents, and the MSC by 3%. Private (*e.g.*, seafood industry) certifying organizations were not considered, as prior research regarding seafood safety indicates that seafood consumers place relatively little value on guarantees offered solely by industry groups (Wessells and Anderson).

In cases where the agency, which was identified by the respondent as most trusted, was also the agency specified as guaranteeing seafood certification, Norwegian respondents were more likely to choose the certified product, *ceteris paribus*. Trust in the certification agency had a positive, but smaller impact for U.S. consumers. Hence, trust in the certifying agency increases the likelihood of choosing certified seafood in both countries, but the impact is more pronounced for Norwegian respondents. The lower influence of agency trust for U.S. respondents may reflect a general lack of trust among certain U.S. consumers in government programs (Johnston *et al*. 1999). These results suggest that the choice of certifying agency may be an important element in the success of a certification program. Certifications offered by little known organizations (*e.g.*, the MSC) will likely result in a lower probability that consumers will choose the certified product, compared to certifications offered by better known government agencies.

Environmental Purchase Patterns

An initial log-likelihood test assesses the role of heterogeneity in respondents' "environmental" purchase behavior, as measured by the ten ECCB-scale questions characterizing the extent to which environmental concerns influenced respondents' purchasing behavior (Roberts). Six model variables are drawn from these questions, including the factor scores *factor1*, *factor2*, and *factor3*; and the interactions between these variables and the U.S. dummy (*us_dum*). Hypothesis test results (χ^2=117.381, df=6) indicate the joint significance of these variables at p<0.0001, suggesting that the ten-question ECCB profile successfully captures underlying preferences that influence respondents' hypothetical choices for certified seafood.

The individual latent factors derived from ECCB responses can help identify types of consumers who may be particularly likely or unlikely to respond to seafood certification programs. For example, consumers who score highly on *factor1* (*abstract anti-environmental*) in Norway are less likely to select certified seafood than those with lower scores for this factor. The impact of this variable cannot be shown to be different across the two countries, as the interaction variable *us_factor1* is insignificant at p=0.10. Similarly, the third (*factor3*) is significant (p=0.0001) and negative, indicating that Norwegian respondents who score highly on the "*unwillingness to change*" factor are less likely to choose certified seafood, *ceteris paribus*. Interestingly, *factor 2* (*no specific energy-packaging purchases*) has no apparent influence on the behavior of Norwegian respondents. This may be due to the relatively high profile of energy supply issues in Norway (Kalgraf *et al*.); such issues may be viewed as distinct from other environmental concerns such as overfishing. For U.S. respondents, high scores for *factor2* are associated with a lower probability of selecting certified seafood. This variable (*us_factor2*) is significant at p=0.06.

Summarizing these results, the model suggests that anti-ecological purchasing tendencies identified by high scores on the three latent factors are associated with a significant decrease in the

probability of selecting an ecolabeled seafood product—but that these effects are not always consistent across countries. This suggests that targeting marketing and information toward those with identifiable tendencies towards ecological purchasing behavior may be an important determinant of the success of seafood ecolabeling programs.

One might also seek to explain respondent heterogeneity using variables indicating membership in various environmental organizations (Swallow *et al.*). However, in the present case, such variables do not appear to add to the explanatory power of the model. Holding all else constant, membership in environmental organizations cannot be shown to have a statistically significant impact on a respondent's likelihood of choosing certified seafood. Hence, counter to popular intuition, members of environmental organizations may not be any more likely than the general population to purchase ecolabeled seafood products.

Seafood Consumption Patterns

Model results indicate that Norwegians who most often purchase fresh seafood products (rather than frozen) are no more likely to choose certified seafood. However, U.S. respondents who most often purchase fresh seafood are relatively more likely than their Norwegian counterparts to select certified seafood. Such patterns could be of importance in the development of certification programs, as Unilever (a co-founder of the MSC and a primary private sector proponent of seafood ecolabeling) is a large-volume seller of frozen seafood under the Gorton's® and Bird's Eye® brands (McHale). However, results indicate that at least in the U.S., fresh seafood consumers may be more likely to purchase certified seafood.

Frequency of seafood consumption does not influence consumers' choices of certified seafood in either country, despite substantial differences in the average rate of seafood consumption in the two countries surveyed. Neither *d_often* nor *us_often* can be shown to be statistically

significant at p=0.10. However, model results do support the hypothesis that those with low weekly seafood budgets are less likely to purchase certified products. Norwegian consumers with relatively low seafood budgets (see table 1) are less likely to choose certified product; this effect is significant at p=0.0228. The interaction variable *us_lowb* is negative and significant (p=0.0553), indicating that U.S. consumers with a relatively low seafood budget are less likely to choose certified product than Norwegian consumers. Hence, although the frequency of seafood consumption is not a key indicator of preferences for certified seafood, the average weekly budget for seafood products is a significant factor.

Demographics

Demographic factors also influence respondents' preferences for certified seafood products. However, the impacts of these variables are not consistent across the two countries surveyed. For example, the independent variable *d_hiedu* identifies respondents with at least a four-year college degree. For Norwegian respondents, this variable is associated with a lower probability of selecting certified seafood; for U.S. respondents it is associated with a higher probability of selecting the same products. The effects of gender, age, and income are consistent across both countries. A greater likelihood of selecting ecolabeled seafood is associated with females and respondents over 45 years of age. The influence of gender is greater for Norwegian respondents. Income has no identifiable impact on respondent choice; this is consistent across both countries.

Implications

Despite the insights provided by Norwegian and U.S. survey responses, this research has important limitations that may be addressed by future research. First, the lack of an actual, large scale market for ecolabeled seafood necessitated a stated preference approach, which may result in

upwardly biased estimates of consumers' willingness to pay to obtain ecolabeled products (Arrow *et al.*). Second, restrictions on quantity purchased, although a direct result of consumer behavior in focus groups, limits the welfare information which may be estimated from the random utility model. Finally, the model addresses the choice of ecolabeled seafood contingent on the prior choice to purchase of a particular seafood species. It does not address the impact of labels on consumers' choices among different seafood species, or among seafood and other food products.

These limitations notwithstanding, the presented results provide significant information regarding elements that may affect the success or failure of proposed seafood interntational ecolabeling programs. Model results indicate that a wide range of factors may influence consumers' likelihood of purchasing ecolabeled seafood products. Preferences for ecolabeled fish differ by species, consumer group, certifying agency, and regional demographic factors. For example, greater purchase probabilities for certified products are associated with lower price premiums, trust in the certification agency, greater tendencies towards ecological purchase behavior, higher weekly seafood budgets, and female purchasers. The estimated probability of purchasing certified seafood differs by a statistically significant margin, with the difference between Norwegian and U.S. consumers increasing as the premium increases.

As the market for seafood is global, with large volumes traded among countries, unilateral (single country) labeling may be insufficient to prevent overfishing of valued stocks, particularly for migratory species or products traded in international markets. Model results indicate that preferences for labeled seafood vary across countries, complicating the potential design of international certification programs. As a result, either international or unilateral ecolabeling programs may only lead to a reallocation of trade patterns, without any benefit to fish stocks.

Based on these results, one can assume that consumer reactions to seafood labeling programs will differ across countries. In some cases differences across countries may have minimal impacts

on the ultimate design and success of a labeling program. However, in others, differences between countries may have significant implications for the targeting, marketing, and design of such programs. For example, differences in price sensitivity between the U.S. and Norway may have critical implications for the ability of retailers to charge a price premium sufficient to cover costs commonly associated with labeling programs.

Given that the U.S. and Norway are wealthy countries with the resources to create sustainable fisheries, and to buy products from those fisheries, it is interesting to speculate what the results might be in developing countries where they may have the resources for neither. In that instance, an ecolabeling program may create two separate markets: a non-certified (non-ecolabeled) market in which developing countries participate, and a certified (ecolabeled) market in which developed countries participate.

Results of this analysis suggest that the design of a successful ecolabeling program for seafood products cannot follow a simple "one-size-fits-all" approach, particularly when one considers the design of international programs. Model results highlight the need for thorough empirical analyses of specific seafood labeling proposals, prior to large-scale implementation, particularly given that seafood ecolabels must compete with other valued attributes of fish (safety, quality, price, brand, etc.) to attract consumer purchases. Although the presented data are based on hypothetical responses to survey scenarios, they make the clear case that the characteristics of a seafood certification program can have substantial implications on the ultimate outcome of the program—consumer preferences for ecolabeled seafood, and the effectiveness of this market-based incentive approach on the long-run global sustainability of fish stocks.

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Table 1. Ecologically Conscious Consumer Behavior (ECCB) Questions[a]

Question	Syntax	US Mean[b]	Norway Mean[b]
1	I have purchased a household appliance because it uses less electricity than other brands.	2.92	3.02
2	I have purchased light bulbs that are more expensive but saved energy.	2.88	2.26
3	I will not buy products that have excessive packaging	2.95	2.75
4	If I understand the potential damage to the environment that some products can cause, I do not purchase these products.	2.32	1.76
5	I have switched products for ecological reasons.	2.85	2.79
6	I have convinced members of my family or friends not to buy some products that are harmful to the environment.	3.25	3.44
7	Whenever possible, I buy products packaged in reusable containers.	2.53	1.81
8	When I have a choice between two equal products, I always purchase the one less harmful to other people and the environment.	2.43	1.82
9	I will not buy a product if the company that sells it is ecologically irresponsible.	2.34	1.93
10	I do not buy household products that harm the environment.	2.40	1.86

[a] Scoring: always true=1; mostly true=2; sometimes true=3; rarely true=4; never true=5.
[b] Questions selected from ECCB Scale of Roberts (1996).

Table 2. Rotated VARIMAX Factor Loadings: Responses to ECCB Questions.

Question	Factor 1	Factor 2	Factor 3
1	-0.02435	**0.77782**	0.15438
2	0.23628	**0.70521**	-0.0387
3	0.25356	**0.53508**	0.22601
4	**0.73142**	0.05548	0.07126
5	0.26601	0.11167	**0.75742**
6	0.08083	0.1327	**0.83803**
7	**0.53666**	0.30464	0.21886
8	**0.65413**	0.19599	0.14718
9	**0.75249**	0.0908	0.12315
10	**0.77119**	0.1176	0.10396

Table 3. Model Variables

Variable Name	Definition	Mean Value
d_fresh	Dummy variable with a value of 1 if respondent most often purchases fresh seafood.	0.51
d_often	Dummy variable with a value of 1 if respondent consumes seafood at least once a week.	0.60
d_low	Dummy variable with a value of 1 if respondent's weekly seafood budget is less than U.S. $10 or 80NOK.	0.53
d_trust	Dummy variable with a value of 1 if respondent's most trusted agency is the reported certification agency for purposes of discrete choice questions.	0.24
d_hiedu	Dummy variable with a value of 1 if respondent has at least a 4-year college degree.	0.45
old	Dummy variable with a value of 1 if respondent's age is at least 45.	0.48
female	Dummy variable with a value of 1 if respondent is female.	0.58
d_enviro	Dummy variable with a value of 1 if respondent is a member of an environmental organization.	0.10
d_hincome	Dummy variable with a value of 1 if respondent's income is greater than $75,000 or 200,000 NOK	0.34
d_cod	Dummy variable with a value of 1 if species in observation is cod.	0.50
percent	Certification premium as a percentage of the price for uncertified product.	0.24
us_dum	Dummy variable with a value of 1 for surveys conducted in the United States.	0.50
us_fresh	*us_dum x d_fresh*	0.29
us_often	*us_dum x d_often*	0.17
us_lowb	*us_dum x d_low*	0.33
us_trust	*us_dum x trust*	0.11
us_hiedu	*us_dum x d_hiedu*	0.23
us_old	*us_dum x old*	0.24
us_female	*us_dum x female*	0.32
us_envi	*us_dum x d_enviro*	0.08
us_inc	*us_dum x d_hincome*	0.11
us_cod	*us_dum x d_cod*	0.25
us_percent	*us_dum x percent*	0.13
factor1	factor score indicating latent aspects of ecological purchasing behavior (see main text).	0.02
factor2	factor score indicating latent aspects of ecological purchasing behavior (see main text).	0.005
factor3	factor score indicating latent aspects of ecological purchasing behavior (see main text).	0.02
us_factor1	*us_dum x factor1*	0.19
us_factor2	*us_dum x factor2*	0.05
us_factor3	*us_dum x factor3*	-0.07

Table 4. Logit Model Results

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	Prob > Chi-Square
intercept	0.4742	0.1561	9.2278	0.0024
d_fresh	0.0656	0.0819	0.6426	0.4228
d_often	-0.0206	0.1225	0.0284	0.8662
d_low	-0.1944	0.0854	5.1853	0.0228
d_trust	0.4706	0.0944	24.8735	0.0001
d_hiedu	-0.4446	0.0848	27.5164	0.0001
old	0.1905	0.0846	5.0731	0.0243
female	0.6085	0.0816	55.6673	0.0001
d_enviro	0.1050	0.1806	0.3384	0.5608
d_hincome	0.1989	0.0852	5.4545	0.0195
d_cod	0.3958	0.0824	23.0527	0.0001
percent	-3.5736	0.1908	350.9377	0.0001
us_fresh	0.2665	0.1219	4.7813	0.0288
us_often	-0.1327	0.1571	0.7136	0.3983
us_lowb	-0.2606	0.1360	3.6729	0.0553
us_trust	-0.3875	0.1415	7.5005	0.0062
us_hiedu	0.5359	0.1258	18.133	0.0001
us_old	-0.0868	0.1230	0.4984	0.4802
us_fem	-0.4765	0.1229	15.0347	0.0001
us_envi	0.2190	0.2262	0.9372	0.3330
us_inc	-0.0992	0.1496	0.4401	0.5071
us_percent	1.1224	0.2496	20.223	0.0001
us_dum	1.1981	0.2186	30.0403	0.0001
us_cod	0.0772	0.1289	0.3586	0.5493
factor1	-0.2685	0.0411	42.7547	0.0001
factor2	-0.0123	0.0379	0.1052	0.7457
factor3	-0.1415	0.0356	15.8516	0.0001
us_factor1	-0.0843	0.0676	1.5552	0.2124
us_factor2	-0.1215	0.0647	3.523	0.0605
us_factor3	0.0278	0.0702	0.1566	0.6923
N obs.	6220			
-2 Log L	6784.397			
-2 Log L χ^2	1248.588	(df = 29)		0.0001

Table 5. Estimated Probability of Selecting Certified Seafood: US versus Norway.[a]

Premium (percent)	US Estimated Probability (Std. Error)	Norway Estimated Probability (Std. Error)	Probability Difference (Std. Error)	t-statistic (H_0: Probability Difference = 0)
0%	0.845	0.702	0.142	2.15**
	(0.125)	(0.182)	(0.066)	
24.2%[b]	0.763	0.532	0.231	3.40***
	(0.161)	(0.205)	(0.068)	
50%	0.654	0.346	0.309	4.68***
	(0.192)	(0.192)	(0.066)	
75%[c]	0.533	0.199	0.335	3.68***
	(0.204)	(0.143)	(0.091)	

[a] All variables except *percent*, *us_dum*, and interactions with *us_dum* are held constant at mean values.
[b] 24.2% premium is the sample mean across both countries.
[c] Out-of-sample prediction
** Significant at $p<0.05$
*** Significant at $p<0.01$

Endnotes

[1] Consumers may of course purchase dolphin-safe tuna. However, the purpose of the ecolabeling of tuna is to protect dolphins from mortality or harm as a result of harvesting tuna; it does nothing to prevent overfishing of tuna. In addition, since there are no unlabeled canned tuna products in the U.S. market, consumers have no choice but to buy ecolabeled canned tuna. In other words, we have no data available to measure consumers' preferences for ecolabeled canned tuna. Tiesl *et al*. measures demand changes between the periods pre- and post-labeling of canned tuna.

[2] It is possible, of course, that the presence of a certified seafood product could alter consumers' choices among different seafood species. However, the goal of this study is to address consumers' choices of certified versus non-certified products for a given species, not to address inter-species choices.