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A Battle of Taste and Environmental Convictions for Ecolabeled Seafood: A Contingent Ranking Experiment

Robert J. Johnston and Cathy A. Roheim

Consumers face pressure from environmental groups to modify their seafood purchase decisions based on concerns about fisheries' production practices. Existing research provides little information indicating whether seafood consumers are willing to change purchasing behavior based on a product's environmental attributes, to the exclusion of other attributes. We describe a contingent ranking experiment addressing preferences for fresh seafood, allowing for choices among different species, some displaying an ecolabel. Results suggest consumers consider overfishing sufficiently important to contemplate changing the species of fish they buy; however, they are unwilling to choose a less-favored species based solely on the presence of an ecolabel.

Key words: conjoint, contingent ranking, ecolabel, seafood, stated preference

Introduction

Seafood consumers are under increasing pressure from environmental groups to modify their seafood purchase decisions based on environmental concerns. For example, the Monterey Bay Aquarium, Audubon Society, Environmental Defense, and others have created lists of species using a "traffic light" system. Under the "red" light is a list of species to avoid, including Atlantic cod, swordfish, and Chilean sea bass—all because of overfishing.[1] Under the "yellow" light are other species which consumers should consider buying with caution, including West Coast salmon and bay scallops. Finally, the "green" light classification identifies species considered to be the "best" choices and include Alaska salmon, tilapia, catfish, and striped bass.

Other public relations efforts include the 1998 "Give Swordfish a Break" campaign, in which chefs nationwide were enlisted to take severely overfished swordfish off restaurant menus until a management recovery plan for the species was put in place by the U.S. government and incorporated into an international management plan. *Time* magazine declared the campaign one of the top 10 environmental stories of the year, and a national organic grocery chain removed North Atlantic swordfish from its seafood counter (SeaWeb, 2002).

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[1]There are many other species on the list, including aquaculture products, and for reasons other than overfishing. Various lists are available on the websites of these organizations.

In some cases, seafood rating systems highlight environmentally-friendly species to be substituted for otherwise comparable products consumers are advised to avoid (e.g., substituting wild Alaska salmon for farmed Atlantic salmon). In other instances, however, consumers are told to avoid certain species almost entirely (e.g., swordfish, red snapper), and to instead purchase alternative species with distinct attributes. One might expect consumers to be less willing to substitute species viewed as widely different (e.g., white fish versus oily finfish), while being more willing to switch between species viewed as similar (e.g., cod versus flounder). Such expectations aside, the literature provides no quantitative information regarding the types of substitution patterns that might be expected, and implications for the potential success of seafood ecolabeling programs. Specifically, existing research provides no information indicating whether seafood consumers would be willing to give up a preferred species in favor of one with improved environmental attributes—such as attributes communicated by a "no-overfishing" ecolabel.

Ecolabeling programs typically evaluate the production processes of market goods with regard to established environmental standards set by independent third parties. If a production process meets these standards, the producer or marketer may purchase a license to use a specific label in its marketing. The label conveys to the consumer otherwise unobservable information concerning a product's environmental impact, and may be used to distinguish products produced using methods that are less deleterious to the environment or natural resources (Johnston et al., 2001; Teisl, Roe, and Hicks, 2002). The use and implications of ecolabels have received substantial attention in the literature in recent years, with published works addressing both theoretical and empirical aspects of labeling (e.g., Sedjo and Swallow, 2000; Moon et al., 2002; Johnston et al., 2001; Loureiro, McCluskey, and Mittelhammer, 2001; Blend and van Ravenswaay, 1999; Nimon and Beghin, 1999).

In the case of seafood markets, ecolabels provide market-based incentives for sustainable fishery management, assuming consumers are willing to pay a premium for labeled products (Johnston et al., 2001). Empirical studies of seafood ecolabels are relatively few, and include Wessells, Johnston, and Donath (1999); Johnston et al. (2001); Teisl, Roe, and Hicks (2002); and Jaffry et al. (2001). Given the paucity of market data regarding ecolabeled seafood (particularly fresh seafood), most studies use data from stated preference survey instruments to estimate consumers' preferences and willingness to pay (WTP) for ecolabeled seafood products in hypothetical markets. In all cases, results of the studies cited above revealed that consumers are willing to pay statistically significant premiums for ecolabeled seafood.

The findings of these studies notwithstanding, the literature provides limited information regarding consumer choices *among* different types (i.e., species) of seafood in the presence of ecolabels. For example, with the exception of the unpublished work of Jaffry et al. (2001), existing stated preference studies of seafood ecolabels assess choices when the consumer is faced solely with two samples of the same species and product form (e.g., labeled versus non-labeled salmon fillets). Results of these studies indicate consumers prefer ecolabeled to the non-ecolabeled seafood products, and are willing to pay a premium to obtain labeled products of the same species. Yet, these studies fail to assess the potential impact of ecolabels under more realistic scenarios in which similar products from multiple species are available. Choices are rarely made among seafood products in a single-species setting. Rather, consumers at supermarket seafood counters or seafood markets are typically faced with a variety of fresh seafood choices. Hence, a more realistic and relevant assessment of consumer preferences would allow for choices among different seafood products, where some of those products may bear ecolabels.

In contrast to the single-species assessments of other work, Jaffry et al. (2001) investigate consumer preferences in the United Kingdom (U.K.) for ecolabeled seafood over a wide range of fresh and processed products. However, although the survey of Jaffry et al. incorporates a wide array of species, it presumes a context in which consumers substitute freely among seafood products regardless of processed state (e.g., smoked haddock is considered an alternative to canned tuna, fish fingers, salmon steaks, and frozen prawns). While consumers in the U.K. may be comfortable substituting between seafood products in various processed states and species, the study described here presumes a more common U.S. context in which choices are made among different species of the same processed form (e.g., fresh seafood), such as one would encounter when choosing among products at a seafood counter in supermarkets or fish markets.

Choice among species is particularly significant in the fresh seafood market, and differs from choices one might expect among non-seafood meat products. First, consumers often express clear preferences for certain types of seafood species. For example, data underlying Johnston et al. (2001) indicate a common pattern in which consumers will frequently purchase one or more species of fresh seafood (e.g., shrimp, cod, salmon), while rarely or infrequently purchasing other types (e.g., mackerel, monkfish). These preferences aside, focus groups and market observations reveal consumers will often make fresh seafood purchase choices "on the spot," based on such considerations as the apparent freshness of products available in the seafood case. For instance, it is not unusual for consumers to purchase a seafood product which appears particularly fresh or of high quality, even if that product is not one the consumer had initially intended to purchase. Product switching behavior is encouraged by seafood counters where all products are displayed in a way that allows them to be easily viewed and compared.

Frequent patterns of species loyalty in the fresh seafood market combined with an observed tendency to switch species under certain conditions (e.g., to obtain a fresher product) begs the question: Will consumers choose a less-favorite species based solely on the presence of an ecolabel? In other words, will consumers sacrifice taste in order to obtain an environmentally friendly product? The willingness of consumers to make such cross-species substitutions may have significant implications for the size of the consumer market for ecolabeled products, and hence for the efficacy of ecolabels as a means to encourage sustainable fisheries management.

This paper describes a contingent ranking experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for a ranking of alternatives among various fresh seafood products. The analysis relies upon data gathered from a mail survey of randomly selected Connecticut households. In contrast to prior work which assesses WTP for ecolabels when faced with only a single seafood species, the primary emphasis here is the potential tradeoff between taste (i.e., a favored seafood species) and the presence of an ecolabel, when multiple fresh seafood products are available.

The Model

To model seafood purchasing behavior, we assume the principal household shopper chooses among various seafood products on a specific shopping occasion. Following Johnston et al. (2001), the quantity of seafood to be purchased is assumed to be 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 confirming that incorporation of quantity purchased in the traditional manner would produce methodological misspecification (Mitchell and Carson, 1989) in the survey instrument.

Given these assumptions, consumer rankings among alternatives of fresh seafood products are modeled using a random utility framework (Hanemann, 1984), similar to that applied by Johnston et al. (2001). For a given consumer, conditional, indirect utility from a seafood product j is assumed to be a function of a vector of product attributes $\mathbf{X}_j$. Here, product attributes include the species of the fresh seafood product (e.g., swordfish, salmon), the presence or absence of a particular ecolabel, and the cost of the product to consumers. The random utility model disaggregates utility into observable and non-observable (stochastic) components, such that

$$U(\mathbf{X}_j) = v(\mathbf{X}_j) + \varepsilon_j, \tag{1}$$

where $U(\mathbf{X}_j)$ represents the consumer's conditional, indirect utility from seafood consumption; $v(\mathbf{X}_j)$ denotes the systematic or potentially observable component of utility; and ε_j represents the stochastic, or unobservable component.

If the consumer compares product $j = A$ to product $j = B$, she will prefer product A to product B if

$$U(\mathbf{X}_A) > U(\mathbf{X}_B), \tag{2}$$

such that

$$v(\mathbf{X}_A) + \varepsilon_A > v(\mathbf{X}_B) + \varepsilon_B. \tag{3}$$

Here, following rank-ordered conjoint methods (Holland and Wessells, 1998; Green and Srinivasan, 1978), survey respondents are presented with four different alternatives, and asked to rank these alternatives in order of their preference [i.e., according to (3)]. This approach was chosen over the referendum or paired-comparison format due to the increased information provided by each response. Within a rank-ordered, random-utility framework (Beggs, Cardell, and Hausman, 1981), a respondent assigns the highest rank to the seafood product that provides the highest level of utility, based on (3) above. Lower ranks are then allocated successively, based on (3) and the anticipated utility from each product. The rationale of the model is that individual respondents compare all the alternatives, select their most preferred (independent of the rankings of the remaining alternatives), and then rank their next alternative out of the remaining subset of choices. This process is iterated until all options are ranked.[2]

[2] As the rank-ordered model does not allow for a "status quo" response in which respondents may choose to purchase none of the presented products (Adamowicz et al., 1998), model findings should be interpreted as revealing factors which influence the choice of seafood products, conditional on the prior choice to purchase one of the available seafood options. Associated welfare results must be interpreted accordingly.

Because ranks are ordinal rather than cardinal, and because the ranks given by each respondent are not independent, neither OLS, ordered probit, nor ordered logit specifications provide consistent parameter estimates. To address this problem, we apply the rank-ordered logit model of Beggs, Cardell, and Hausman (1981), which allows for both the ordinal nature of the data and the lack of independence between observations for each respondent. This approach was also used by Holland and Wessells (1998) in a previous study of demand for seafood safety information.

Following (1)–(3) above, let $U_i(\mathbf{X}_j)$ represent the utility derived by individual i from alternative j with an observable deterministic component $v_i(\mathbf{X}_j)$ and a random component ε_{ij}. The observable $v_i(\mathbf{X}_j)$ is assumed to be a linear function of the vector $\mathbf{X}_j$, such that:

$$(4) \qquad v_i(\mathbf{X}_j) = \mathbf{X}_{ij}\beta,$$

where β is a conforming vector of parameters to be estimated. If individual i's observed ranking of $j = 1, \ldots, J$ alternatives is given by $\mathbf{R}_i = (r_1, r_2, ..., r_J)$, the resulting model allows us to specify the probability of $\mathbf{R}_i$ using the logistic distribution as (Beggs, Cardell, and Hausman, 1981):

$$(5) \qquad \pi(\mathbf{R}_i) = \prod_{h=1}^{J-1} \left[\frac{\exp(\mathbf{X}_{ir_h}\beta)}{\sum_{m=h}^{J} \exp(\mathbf{X}_{ir_m}\beta)} \right].$$

For an independent sample of N individuals, ranking one set of seafood alternatives per individual, the log-likelihood function is given by:

$$(6) \qquad \mathrm{L}(\beta) = \sum_{i=1}^{N} \log \pi(\mathbf{R}_i) = \sum_{i=1}^{N}\sum_{h=1}^{J-1} \mathbf{X}_{ir_h}\beta - \sum_{i=1}^{N}\sum_{h=1}^{J-1} \left[\log \sum_{m=h}^{J} \exp(\mathbf{X}_{ir_m}\beta) \right].$$

The maximum-likelihood estimates of β are those that maximize the predicted probability of the observed sets of ranks. The log-likelihood function is globally concave and provides unique estimates of β which are consistent, asymptotically normal, and asymptotically efficient.[3]

The Data

A limited number of ecolabeled fresh seafood products are currently available in some U.S. markets;[4] however, there are no publicly available market data that allow testing of our hypotheses regarding tradeoffs among fresh seafood species in the presence of ecolabels. Accordingly, this study follows Johnston et al. (2001) and Jaffry et al. (2001), and uses stated preference data to assess hypotheses in question. The data are drawn from a mail survey of Connecticut households completed during 2001. Survey development, including focus groups and pretests, required approximately three months during early 2001.

[3] The standard independence of irrelevant alternatives assumption necessary for the multinomial logit model is assumed to hold at each level of ranking.

[4] For example, one may now purchase Marine Stewardship Council certified salmon in Whole Foods Markets, a natural and organic supermarket chain (Alaska Seafood Marketing Institute, 2001).

As outlined above, seafood choice questions asked respondents to rank four different fresh seafood products in order of preference. The products varied according to three attributes: (*a*) species, (*b*) presence or absence of an ecolabel, and (*c*) price. Species chosen for choice questions were salmon, cod, flounder, and swordfish. These species were selected for several reasons. First, according to the National Fisheries Institute (NFI), in 2001, salmon was the third most popular fish in the United States at 2.02 pounds per capita, cod the sixth most popular at 0.56 pounds per capita, and flatfish (including flounder) eighth most popular at 0.39 pounds per capita.[5] Second, data underlying the analysis of Wessells, Johnston, and Donath (1999) show that cod and flounder consumption are significantly higher in New England than in the rest of the United States, while salmon consumption is equally high. Third, swordfish is a popular species in the Northeast, and was chosen in light of the "Give Swordfish a Break" campaign which was heavily targeted at the East Coast. Fourth, focus groups indicate seafood consumers tend to like some variety within the groups of species they consume, even though within each group there may be one or two favorites. Hence, while respondents could have been offered fish species that are very alike (e.g., cod and haddock), this would have resulted in a relatively uninteresting choice set, both with regard to consumer behavior and the seafood purchase choices proposed by environmental groups.

Price levels for each species within the experimental design were established to reflect a range of values that might be expected in Northeast markets. Focus group evidence and pretests for this survey (and for the survey in Johnston et al., 2001) suggest protest responses and confusion are often generated by surveys providing clearly unrealistic prices for seafood species. For instance, respondents faced with fresh swordfish priced at $4.99 per pound (a very low price) might express disbelief at the realism of the scenario, or wonder whether the product is of low quality. To avoid such problems and associated methodological misspecification, the experimental design specified the mean price of each species to correspond with prevailing market prices at the time of the survey. Three levels of prices were presented. Mean prices were $6.99 for cod and flounder, $5.99 for salmon, and $10.99 for swordfish.

The ecolabel was described as a label which "tells customers that the seafood was caught in a fishery that is managed to stop overfishing. Seafood with this new label has the same quality, color, and freshness as seafood without the label." Specifically, the ecolabel was described simply as a label that guarantees no overfishing, with an emphasis asserting other attributes of the seafood product are unaffected. This specification follows that of Johnston et al. (2001). Other potential definitions of "sustainable" fishing and specifications of the ecolabel were tested in the focus groups (and in those reported by Johnston et al., 2001), but only the guarantee of no overfishing was similarly and consistently understood by respondents. Within the experimental design, species were presented both with or without this no-overfishing ecolabel.

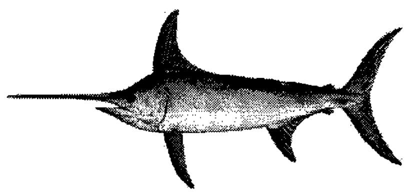
A standard fractional factorial main-effects experimental design was used to construct a range of survey questions with an orthogonal array of attribute levels, resulting in 54 choice questions divided among 27 unique booklets (Addelman and Kempthorne, 1961). An example ranking question is reproduced in figure 1.

[5] Total per capita consumption of seafood in 2001 was 14.8 pounds (shrimp was most popular at 3.4 pounds, and canned tuna second at 2.9 pounds). [Online at National Fisheries Institute website: www.nfi.org/?a=news&b=TopTenSeafoods.]

Suppose that you have a choice between the following four fresh seafood products in your store. Each is equally fresh.

Please rank those four choices of seafood with numbers from 1 to 4.
Write **1** in the card of the fish you are most likely to buy, continue with **2** and **3**, and finally write **4** in the card of the fish you are least likely to buy.

Please do not use the same number twice.

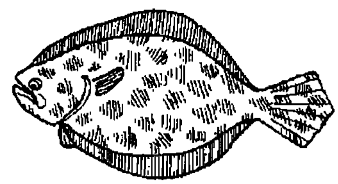


Swordfish Steak

Label: Guaranteed No Overfishing

$12.99 / pound

YOUR RANKING: _____

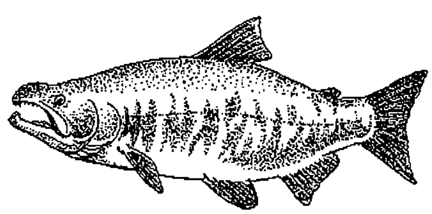


Flounder Fillet

No Label

$5.99 / pound

YOUR RANKING: _____

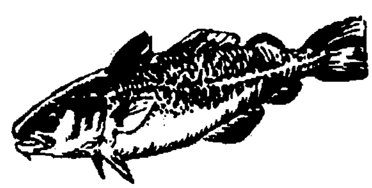


Salmon Fillet

No Label

$7.99 / pound

YOUR RANKING: _____



Cod Fillet

Label: Guaranteed No Overfishing

$8.99 / pound

YOUR RANKING: _____

Figure 1. Sample ranking question

In addition to the choice experiment questions outlined, survey responses provided information concerning preferences and consumption patterns for fresh fish, the role of environmental factors in past purchasing behavior, and demographic characteristics. The survey also incorporated a question designed to identify each respondent's favorite seafood among the four considered in choice questions (cod, salmon, swordfish, flounder), ranked by taste only. Responses to this question allow the choice experiment data to be split systematically according to a respondent's baseline favorite seafood species.

This split-sample analysis allows for assessment of potential tradeoffs between species and ecolabels among consumers with different prior taste preferences. For example, one might assess whether respondents with a *prior* taste preference for salmon (i.e., they rank salmon first by taste) would be willing to purchase another species (cod, swordfish, flounder) in order to obtain a label. Such tradeoffs may be assessed based on responses of this group to choice experiment questions. Similar analyses may be conducted for groups with differing prior taste preferences.

Survey implementation was completed between August and October 2001. In total, 1,500 surveys were mailed to randomly selected Connecticut households, with sampling weighted according to each county's share of the total state population. Survey implementation followed a variant of Dillman's (2000) tailored survey design, incorporating multiple introductory and follow-up mailings. Of 1,414 deliverable surveys, 432 were returned, for a response rate of 31% of deliverable surveys. Of these returned surveys, 64 were dropped from the analysis due to significant item nonresponse. The final data are drawn from the remaining 368 complete and usable surveys. This results in 736 sets of ranking questions for the survey sample, totaling 2,944 observations (four observed rankings per question).

While the survey response rate (31%) does not appear to be particularly high, it is important to view this response in light of the population from which the sample is drawn. Given the topic of the survey, one would expect it would be relevant solely to seafood consumers (97% of respondents were consumers of fresh seafood). Although 1,414 surveys were delivered, it is likely some of these households were not consumers of fresh seafood, and hence would not be a relevant target for the survey. Consequently, the response rate for seafood-consuming households in the sampled population is likely somewhat higher than is indicated by the 31% aggregate response rate. However, given that the percentage of fresh seafood-consuming households among the sampled population is unknown, it is impossible to calculate the effective response rate among this group.[6]

Survey responses validated the popularity of the species included in the choice experiment, and the potential importance of ecolabels. Twenty-five percent of respondents ranked salmon as their favorite species, while 10.1% ranked swordfish as their favorite, 6% ranked cod highest, and 4.4% ranked flounder highest. For their second-favorite species, 13% chose salmon, 9.3% chose swordfish, 5.9% chose cod, and 6.5% chose flounder. Similar percentages ranked these species as their third favorite. Over 50% of respondents were unsure if any of these four species were overfished, while 21% indicated swordfish were severely overfished, 17% responded Atlantic cod were severely

[6] Compared to census data for the sampled counties, survey results indicate a bias toward females, older age groups, and higher income. Given that the survey was specifically targeted at the "primary seafood buyer" of the household, the relatively high female response rate was expected.

overfished, 12% noted Pacific salmon were severely overfished, and 9% indicated Atlantic flounder were severely overfished. Forty-seven percent of respondents felt that a no-overfishing ecolabel would be very important to their seafood purchase decisions, while only 10% felt it would not be important. Sixty-seven percent of respondents stated they would switch species to obtain an ecolabeled product.

Model Results

Definitions and summary statistics for model variables are provided in table 1. Results for the maximum-likelihood, full-sample rank-ordered logit model are reported in table 2. Two specifications are illustrated. The "main effects" model includes only the primary independent variables characterizing species, price, and the presence of an ecolabel. In addition to these main effects, the "main and interactive effects model" includes a set of multiplicative interactions between household attributes (e.g., age, income, household size; see definitions in table 1) and main effects (e.g., price,[7] label, and species). Hence, the main effects model may be viewed as a restricted specification of the main and interactive effects model.

Both the main effects and interactive effects models are statistically significant at $p < 0.0001$, based on likelihood-ratio tests (main model $\chi^2 = 85.16$, df = 5; interactive model $\chi^2 = 141.98$, df = 58). A likelihood-ratio test of restrictions between the main effects and interactive effects model ($\chi^2 = 56.82$, df = 53, $p = 0.33$) fails to reject the null hypothesis of zero joint influence of interactions between household attributes and main effects. Moreover, very few of the included interactions are individually statistically significant (i.e., one out of 53 interactions are statistically significant at $p < 0.05$, and none are significant at $p < 0.01$). Based on these results, we ground subsequent discussion and modeling in the simpler main effects model.

Main Effects Model Results

Main effects model results match prior expectations. All species coefficients are statistically significant at $p < 0.01$, with the exception of *Swordfish*. This finding implies both *Salmon* and *Flounder* are preferred to *Cod* (the default value), but respondents do not prefer *Swordfish* to *Cod*, on average. As expected, increases in price lead to reduced probability of choice. The presence of a label has a positive and statistically significant ($p < 0.01$) effect on preferences.

The expected nature of these results notwithstanding, the primary focus of this analysis is not on either the willingness to pay (WTP) for ecolabels or whether ecolabels have a statistically significant impact on product choice, but rather on the tradeoff between preferred species (i.e., taste) and the presence of an ecolabel. On these grounds, the primary main effects model sends a mixed message. Coefficient estimates in table 2 indicate the relative effect of each variable on the observable component of marginal

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[7] *Price* was specified as a continuous variable, ranging from $3.99 to $14.99 per pound. Recall, the experimental design allows for three different price levels for each species, with price levels varying across species to correspond with well-known differences in mean market prices. This introduces a degree of correlation between price and species. To address this potential correlation, an alternative statistical specification of the price variable was also tested, in which price was specified as the *deviation* of the observed price from the mean price for the species in question. Model results were not significantly altered by this alternative specification of the price variable and are available from the authors upon request.

Table 1. Model Variables and Summary Statistics

Variable	Definition	Mean	Std. Dev.
Product Attributes:			
Price	Specified product price	7.83	2.94
Label	Binary variable indicating the presence of an ecolabel that guarantees no overfishing (1 = present; 0 = absent)	0.64	0.48
Salmon	Binary variable: = 1 if product is salmon; 0 otherwise	0.25	0.43
Swordfish	Binary variable: = 1 if product is swordfish; 0 otherwise	0.25	0.43
Flounder	Binary variable: = 1 if product is flounder; 0 otherwise	0.25	0.43
Cod	Binary variable: = 1 if product is cod; 0 otherwise	0.25	0.43
Respondent Attributes:			
Age 18–35	Binary variable: = 1 if respondent is between the ages of 18 and 35 (inclusive); 0 if respondent is not in this age category [default category is respondents aged 36–55]	0.13	0.34
Age Over 55	Binary variable: = 1 if respondent is over the age of 55; 0 if respondent is not in this age category [default category is respondents aged 36–55]	0.29	0.46
Household Size Less Than 3	Binary variable: = 1 if respondent's household has fewer than 3 members; 0 if household has 3 or more members [default category is households of 3–5 members]	0.55	0.50
Household Size More Than 5	Binary variable: = 1 if respondent's household has greater than 5 members; 0 if household has 5 or fewer members [default category is households of 3–5 members]	0.02	0.13
Income Less Than $55K	Binary variable: = 1 if respondent's household income is less than $55,000 (U.S.); 0 if income is not in this category [default category is income between $55,000 and $100,000]	0.27	0.44
Income Over $100K	Binary variable: = 1 if respondent's household income is more than $100,000 (U.S.); 0 if income is not in this category [default category is income between $55,000 and $100,000]	0.30	0.46
Low Seafood Expenditures	Binary variable: = 1 if household's average seafood expenditures are less than $7.50/week; 0 if expenditures are not in this category [default category is expenditures between $7.50 and $12.50/week]	0.35	0.48
High Seafood Expenditures	Binary variable: = 1 if household's average seafood expenditures are more than $12.50/week; 0 if expenditures are not in this category [default category is expenditures between $7.50 and $12.50/week]	0.31	0.46
Member of Environmental Group	Binary variable: = 1 if respondent self-identifies as a member of an environmental organization; 0 if respondent does not	0.16	0.37
Frequent Seafood Consumer	Binary variable: = 1 if respondent consumes seafood more than once/month, on average; 0 if respondent does not consume seafood with this frequency	0.85	0.36
Feel Salmon Overfished	Binary variable: = 1 if respondent thinks salmon is overfished to at least some degree; 0 if respondent does not consider salmon overfished or is unsure	0.36	0.48
Feel Swordfish Overfished	Binary variable: = 1 if respondent thinks swordfish is overfished to at least some degree; 0 if respondent does not consider swordfish overfished or is unsure	0.44	0.50
Feel Flounder Overfished	Binary variable: = 1 if respondent thinks flounder is overfished to at least some degree; 0 if respondent does not consider flounder overfished or is unsure	0.33	0.47
Feel Cod Overfished	Binary variable: = 1 if respondent thinks cod is overfished to at least some degree; 0 if respondent does not consider cod overfished or is unsure	0.39	0.49

Table 2. Estimation Results of Main Effects and Interactive Effects Models

	Main and Interactive Effects Model (N = 2,160)			Main Effects Model (N = 2,160)		
Variable	Coef-ficient	p-Value	Hazard Ratio	Coef-ficient	p-Value	Hazard Ratio
Main Effects:						
Price	-0.039	0.322	0.962	-0.036	0.0004	0.965
Label	0.128	0.401	1.137	0.200	0.0001	1.222
Salmon	0.079	0.704	1.082	0.299	0.0001	1.348
Swordfish	0.348	0.199	1.416	0.112	0.1262	1.118
Flounder	0.357	0.066	1.429	0.208	0.0007	1.231
Interactive Terms:						
Price × Age 18–35	0.061	0.066	1.063			
Price × Age Over 55	-0.009	0.708	0.991			
Price × Frequent Seafood Consumer	-0.006	0.843	0.994			
Price × Low Seafood Expenditures	-0.059	0.031	0.942			
Price × High Seafood Expenditures	0.006	0.808	1.006			
Price × Household Size Less Than 3	0.036	0.127	1.037			
Price × Household Size Over 5	-0.023	0.770	0.977			
Price × Income Less Than $55K	-0.003	0.916	0.997			
Price × Income Over $100K	0.007	0.767	1.007			
Price × Member of Environmental Group	-0.010	0.728	0.990			
Label × Age 18–35	0.093	0.442	1.097			
Label × Age Over 55	-0.168	0.070	0.845			
Label × Frequent Seafood Consumer	0.082	0.497	1.085			
Label × Low Seafood Expenditures	0.040	0.706	1.041			
Label × High Seafood Expenditures	0.069	0.474	1.071			
Label × Household Size Less Than 3	-0.034	0.698	0.967			
Label × Household Size Over 5	-0.025	0.942	0.976			
Label × Income Less Than $55K	-0.033	0.747	0.968			
Label × Income Over $100K	0.016	0.865	1.016			
Label × Member of Environmental Group	0.196	0.076	1.216			
Salmon × Age 18–35	-0.243	0.137	0.784			
Salmon × Age Over 55	-0.029	0.813	0.971			
Salmon × Frequent Seafood Consumer	0.288	0.066	1.333			
Salmon × Low Seafood Expenditures	-0.010	0.940	0.990			
Salmon × High Seafood Expenditures	-0.124	0.335	0.883			
Salmon × Household Size Less Than 3	0.199	0.089	1.221			
Salmon × Household Size Over 5	-0.026	0.944	0.975			
Salmon × Income Less Than $55K	-0.155	0.237	0.857			
Salmon × Income Over $100K	0.195	0.122	1.216			
Salmon × Member of Environmental Group	-0.205	0.155	0.815			
Salmon × Feel Salmon Overfished	-0.061	0.519	0.941			

(continued . . .)

Table 2. Continued

	Main and Interactive Effects Model (N = 2,160)			Main Effects Model (N = 2,160)		
Variable	Coef-ficient	p-Value	Hazard Ratio	Coef-ficient	p-Value	Hazard Ratio
Interactive Terms (cont'd.):						
Swordfish × Age 18–35	-0.091	0.575	0.913			
Swordfish × Age Over 55	0.163	0.186	1.177			
Swordfish × Frequent Seafood Consumer	-0.269	0.802	0.764			
Swordfish × Low Seafood Expenditures	-0.168	0.208	0.846			
Swordfish × High Seafood Expenditures	-0.008	0.953	0.992			
Swordfish × Household Size Less Than 3	-0.006	0.958	0.994			
Swordfish × Household Size Over 5	-0.294	0.438	0.745			
Swordfish × Income Less Than $55K	0.133	0.322	1.142			
Swordfish × Income Over $100K	-0.002	0.988	0.998			
Swordfish × Member of Environmental Group	-0.089	0.544	0.915			
Swordfish × Feel Swordfish Overfished	0.059	0.526	1.060			
Flounder × Age 18–35	-0.092	0.559	0.912			
Flounder × Age Over 55	0.164	0.173	1.179			
Flounder × Frequent Seafood Consumer	-0.139	0.374	0.870			
Flounder × Low Seafood Expenditures	-0.019	0.889	0.982			
Flounder × High Seafood Expenditures	-0.076	0.538	0.927			
Flounder × Household Size Less Than 3	-0.081	0.479	0.922			
Flounder × Household Size Over 5	0.457	0.227	1.579			
Flounder × Income Less Than $55K	0.134	0.292	1.144			
Flounder × Income Over $100K	-0.151	0.215	0.860			
Flounder × Member of Environmental Group	-0.096	0.483	0.908			
Flounder × Feel Flounder Overfished	0.108	0.261	1.114			
Likelihood Ratio (-2 LnL)	141.9789	0.0001		85.1622	0.0001	

utility, $v(\cdot)$. The coefficient estimate associated with *Label* (0.20), indicating relative influence on marginal utility, is larger than that associated with *Swordfish* (0.11), approximately equal to that associated with *Flounder* (0.21), and smaller than that associated with *Salmon* (0.30). Based on these preliminary results only, it might be concluded that the effect of a label on marginal utility may be sufficient in some cases to cause consumers to alter the rankings provided to different species. For example, based on point estimates of marginal utility only, the model predicts that a representative respondent would rank labeled flounder over unlabeled salmon, ceteris paribus, even though salmon would be preferred were both products to be labeled (or unlabeled).[8]

[8] Relative to unlabeled cod, observable marginal utility associated with unlabeled salmon at its mean price is 0.299. In contrast, observable marginal utility associated with labeled flounder at its mean price is equal to 0.408 = 0.208 + 0.200. Hence, for the average consumer, labeled flounder would be chosen over unlabeled salmon, based on the observable component of utility. However, in the absence of a label, utility associated with salmon (0.299) exceeds that associated with flounder (0.208). One could illustrate the same results using WTP instead of marginal utilities to compare seafood products. However, no additional intuition would be gained by doing so.

Hence, a preferred species, ceteris paribus (salmon), would be sacrificed in order to obtain a less-preferred species (flounder) bearing an ecolabel.[9]

Such simple arguments, however, are based on a broad definition of a representative consumer, and obscure the fact that consumers often enter seafood markets with the goal of purchasing a *specific* type of seafood. To illustrate, a consumer may enter a seafood market with the intention of purchasing salmon (her favorite species by taste)—and then be confronted with a choice of unlabeled salmon versus other species that carry a no-overfishing ecolabel. Here, the policy-relevant question is not whether an *average* consumer would switch, for example, between salmon and flounder in order to obtain an ecolabel—only a small percentage of these consumers would have been in the market for salmon in the first place. Rather, the more relevant and interesting question is whether a consumer who enters the store with the *intention* of purchasing one species (e.g., salmon) will purchase another species instead (e.g., flounder), based solely on the presence or absence of a label. Assessment of the latter question requires an extension of the basic model.

Main Effects Model with Subsamples by Favorite Seafood Species

To allow such issues to be addressed, the survey incorporated a question designed to determine each respondent's favorite seafood among the four considered in choice questions (cod, salmon, swordfish, flounder), ranked solely by taste. Responses to this question allow the data to be split systematically into four independent subsamples, according to a respondent's baseline favorite seafood species. For example, the "Salmon Preferred" subsample includes data for only those respondents who indicated, in the prior question, that salmon was their most preferred species, ranked solely by taste. In contrast, the "Flounder Preferred" subsample includes analogous data for those who reported that flounder was their most preferred species, again by taste. Statistically independent rank-ordered logit results are estimated for each subsample.

The resulting four main effects models—one for each species-specific subsample—allow us to address stated behavior of respondents who are known to prefer a specific species, by taste, ceteris paribus. As a case in point, using the Salmon Preferred model we can assess whether the presence or absence of an ecolabel would be sufficient to cause a priori salmon-preferring respondents to rank more highly another species of fresh seafood. Analogous questions may be addressed in each of the four subsample models—i.e., *assuming* that respondents would be more likely to begin a shopping trip with the intention of purchasing their favorite species (by taste), the models allow us to assess whether the presence of an ecolabel on competing species would be sufficient to cause a change in this intended behavior.

Table 3 presents results for the four subsample models. In three of the four models (Salmon Preferred, Swordfish Preferred, and Flounder Preferred), *Cod* remains the omitted (or default) species dummy variable. In the fourth model (Cod Preferred), *Swordfish* is the default. This distinction in model specifications is made solely for convenience and ease of discussion; it does not affect model results. As above, all models

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[9] Willingness to pay (WTP) results are not illustrated here. Because the choice scenario—as is common in applications of rank-ordered logit models—does not allow for a "no-purchase" option, WTP estimates would be necessarily contingent upon the prior choice to purchase one of the illustrated seafood options. Given the potential for misinterpretation of such conditional WTP estimates, they are suppressed from the discussion of model results.

Table 3. Main Effects Model: Subsamples by Taste-Preferred Species

	A. Cod Preferred (N = 256)			B. Flounder Preferred (N = 416)		
Variable	Coefficient	p-Value	Hazard Ratio	Coefficient	p-Value	Hazard Ratio
Price	-0.003	0.912	0.997	-0.018	0.457	0.982
Label	0.022	0.869	1.022	0.242	0.021	1.274
Cod	1.896	0.0001	6.658	—	—	—
Salmon	0.166	0.493	1.180	-0.044	0.760	0.957
Swordfish	—	—	—	-0.274	0.107	0.760
Flounder	0.706	0.0016	2.026	0.898	0.0001	2.454
Likelihood Ratio χ^2	89.1785	0.0001		72.1294	0.0001	
	C. Salmon Preferred (N = 856)			**D. Swordfish Preferred (N = 632)**		
Variable	Coefficient	p-Value	Hazard Ratio	Coefficient	p-Value	Hazard Ratio
Price	-0.049	0.002	0.952	-0.066	0.000	0.936
Label	0.455	0.0001	1.577	0.152	0.065	1.165
Cod	—	—	—	—	—	—
Salmon	1.507	0.0001	4.514	0.187	0.107	1.205
Swordfish	0.144	0.209	1.155	1.000	0.0001	2.718
Flounder	0.184	0.059	1.201	0.244	0.031	1.276
Likelihood Ratio χ^2	270.7584	0.0001		52.3527	0.0001	

are significant at $p < 0.0001$, based on likelihood-ratio tests. Interestingly, while *Price* is highly significant in the Salmon Preferred and Swordfish Preferred models, it is not statistically significant in the Cod Preferred and Flounder Preferred models. This finding is robust over a wide range of specifications for the price variable and overall model. The reason for this finding most likely relates to particular preference structures among those who prefer the taste of flounder and cod.[10]

Implications for Seafood Ecolabeling: Does Taste Trump Environmental Conviction?

As expected, coefficient estimates suggest respondents provide the highest rankings to those species that are most preferred by taste, ceteris paribus. However, more relevant and interesting are the findings with regard to the effects of the no-overfishing ecolabel. Recall that coefficient estimates in each model indicate the relative effect of each variable on the observable component of marginal utility, $v(\cdot)$. Here, we are primarily interested in the marginal utility provided by the product itself—apart from the potential influence of price.

[10] For example, those who prefer the milder taste of species such as cod or flounder may be unwilling to choose stronger-tasting or more oily fish (e.g., salmon, swordfish), even at extremely unfavorable price differentials. Essentially, these consumers may be unwilling to eat stronger-tasting fish, at nearly any positive price.

Table 4. Relative Marginal Utility of Labeled versus Unlabeled Seafood: Split-Sample Results

Description	Relative Marginal Utility, by Model			
	Salmon-Preferred Model	Swordfish-Preferred Model	Flounder-Preferred Model	Cod-Preferred Model
Unlabeled Salmon	***1.507***	0.187	-0.044	0.166
Labeled Salmon	1.963	**0.339** (0.0001)	**0.198** (0.0001)	**0.187** (0.0001)
Unlabeled Swordfish	0.144	***1.000***	-0.274	0.000
Labeled Swordfish	**0.599** (0.0001)	1.152	**-0.032** (0.0001)	**0.022** (0.0001)
Unlabeled Flounder	0.184	0.244	***0.898***	0.706
Labeled Flounder	**0.639** (0.0001)	**0.396** (0.0002)	1.140	**0.728** (0.0001)
Unlabeled Cod	0.000	0.000	0.000	***1.896***
Labeled Cod	**0.455** (0.0001)	**0.152** (0.0001)	**0.242** (0.0001)	1.918

Notes: Results in **bold** highlight the relative marginal utility of the unlabeled preferred species (by taste), compared to labeled versions of competing species. Values in ***bold italics*** highlight the relative marginal utility of the unlabeled preferred species. For example, in the Salmon-Preferred model (those respondents who rank salmon first, by taste), the key comparison is that of unlabeled salmon to labeled swordfish, flounder, and cod; these results are highlighted in **bold**. Marginal utility is relative to the default (i.e., the excluded dummy variable) of unlabeled cod in the salmon-, swordfish-, and flounder-preferred models, and relative to unlabeled swordfish in the cod-preferred model.

For marginal utilities of competing species (**bold** with no italics), numbers in parentheses indicate the statistical significance (p-value) of the *difference* between the marginal utility in question and the marginal utility associated with the unlabeled preferred species, based on standard Wald tests. For example, in the Salmon-Preferred model, we reject the null hypothesis (at $p < 0.0001$ in all cases) that the marginal utility of unlabeled salmon is equal to that of labeled swordfish, flounder, or cod.

In order to focus the analysis on the relative importance of the label versus species without confounding interference from price, table 4 illustrates the observable (relative) utility associated with different product configurations, for each subsample, assuming a price of zero for each product. For each subsample, the relative utility increment associated with the unlabeled *preferred* species is compared to that associated with labeled variants of the other three species considered. While quantitative results in table 4 assume equal and zero prices for all products, analogous results apply if mean prices are assumed for each seafood species (i.e., the mean price for each species from the experimental design) or equal nonzero prices for each species.[11] That is, results are robust to a wide range of assumptions regarding product price.

For example, for the Salmon Preferred model, table 4 compares the utility increment associated with *unlabeled* salmon (the preferred species, by taste) to that associated with *labeled* swordfish, flounder, and cod (the less-preferred species, by taste). Results indicate whether the utility gain associated with the presence of an ecolabel is sufficient to offset the utility loss associated with the choice of a less-favored species. Numbers in

[11] These results may be easily calculated from parameter estimates in table 3, but are also available from the authors upon request. Mean prices for each species, as specified in the experimental design, are $6.99 for cod, $10.99 for swordfish, $5.99 for salmon, and $6.99 for flounder.

parentheses are Wald test p-values for the null hypothesis of zero difference between the marginal utility of the labeled species in question and the marginal utility of the unlabeled preferred species, at identical prices.

As shown in table 4, there is no instance in which the presence of an ecolabel on a less-favored species (by taste) is sufficient to offset the positive utility associated with the most-favored species (by taste). The difference in relative marginal utility associated with the unlabeled preferred species is positive and statistically significant in all cases, and at $p < 0.0001$ in 11 of the 12 cases assessed. The presence of a price premium (i.e., increase in price) on ecolabeled products would further exacerbate the relative utility loss associated with less-favored species.

For instance, model results reveal that those who rank salmon first by taste (i.e., those in the Salmon Preferred model) will, on average, gain greater utility from the choice of salmon, regardless of the presence of ecolabels on competing seafood species (this difference is statistically significant at $p < 0.0001$ in all cases). Those who rank other species first by taste are similarly predicted to gain greater utility from the favored species, again regardless of the presence of ecolabels on other species. These differences are of particularly large magnitude for those with taste preferences for milder fish (i.e., cod, flounder).

On average, findings suggest respondents with a prior taste preference for one species (i.e., they rank this species first by taste) will continue to choose this species as their primary purchase option, regardless of the availability of ecolabels on competing seafood products. As noted above, these results are robust to a wide range of potential assumptions regarding product price. This result also applies to all species in all subsample models. Hence, while consumers may prefer (and be willing to pay a premium for) ecolabeled products in a single-species choice setting, as shown in previous literature—or when labeled and unlabeled products are available for a favored species—our model results suggest consumers are much less willing to sacrifice a favored species. For these individuals, taste trumps environmental convictions.[12]

These findings are particularly notable given the results of a prior survey question: "Is certification important enough for you to buy a different kind of seafood?" Responses to this yes/no question indicate 67% of respondents consider no-overfishing certification (i.e., the presence of an ecolabel) *sufficient* to cause them to change the type of seafood they buy. This response notwithstanding, choice experiment results suggest that the presence of a label is, on average, *insufficient* to cause consumers to give up a most-favored seafood species.

Conclusions

This paper has described a rank-ordered choice experiment addressing stated preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh seafood products. Results highlight the need for thorough analyses of

[12] As pointed out by a reviewer, in some cases, an unwillingness to switch may not be surprising given product price differentials. For example, a consumer might not be expected to switch from unlabeled salmon to labeled swordfish, given the large price differential (swordfish is typically much more expensive). However, model results show that the observed unwillingness to switch is robust to a wide range of assumptions regarding price. As a case in point, even at *identical* prices, salmon-preferring consumers will still not switch from unlabeled salmon to labeled swordfish. Moreover, results using mean prices do not reveal a willingness to switch from unlabeled swordfish to labeled salmon despite the large price discount.

consumer preferences for ecolabeled seafood, particularly given that ecolabels must compete with other valued attributes of fish to attract consumer purchases.

Here, we assess potential tradeoffs between taste preferences and the presence of ecolabels. Model results point to limitations in the ability of ecolabels to influence behavior in multi-species choice settings—even within a stated preference context. Results indicate consumers are not willing to sacrifice their most-favored (by taste) seafood species in order to obtain a less-favored species bearing a "no-overfishing" ecolabel. Results are, of course, relative to the specific case study, species considered, and sampled population,[13] and are subject to the standard caveats regarding stated preference (i.e., hypothetical) data (e.g., Murphy and Stevens, 2004).

Results must also be viewed within the context of limitations imposed by the survey design—including the interpretation of results as contingent upon the requirement that consumers would be willing to purchase at least one of the four illustrated species.[14] These limitations aside, the respondents' unwillingness to substitute dissimilar seafood species—even in return for an ecolabel—is clear, and represents a potential challenge to the use of labels as a means to promote sustainable fisheries. Where consumers are able to obtain ecolabeled variants of identical or nearly identical seafood species, existing literature (e.g., Johnston et al., 2001) suggests they may be willing to pay a premium for labeled products. The message from the research presented here, however, is that despite numerous campaigns designed to promote environmentally conscious seafood purchases and modify consumers' seafood purchasing habits, consumers do not yet appear willing to sacrifice favored seafood products in exchange for an ecolabel.

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[13] For example, Johnston et al. (2001) found significant differences in reactions to seafood ecolabels between U.S. and Norwegian consumers.

[14] As noted above, the survey does not include a "no-purchase" option.

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