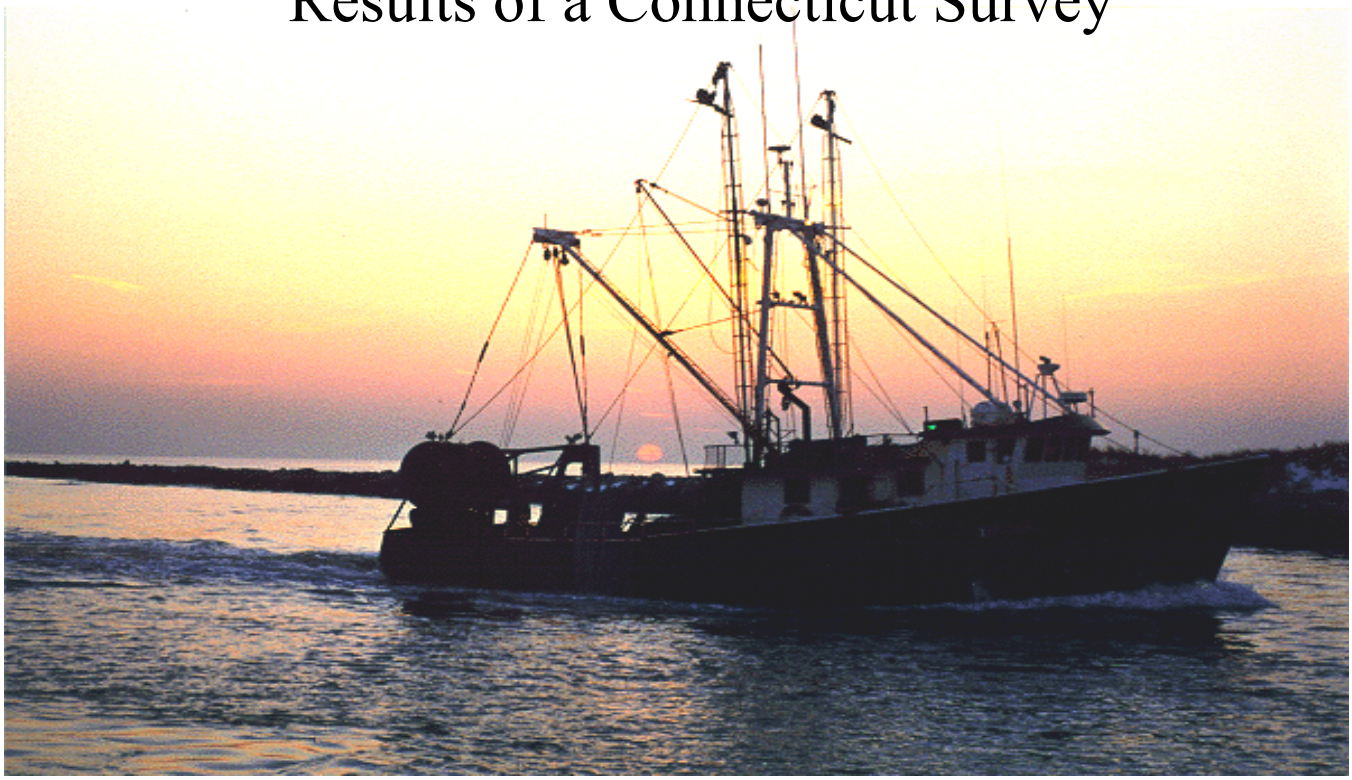
Consumer Preferences for Ecolabeled Seafood: Results of a Connecticut Survey



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1. Introduction

Fish is the major source of protein for over one billion people around the world. Between 1950 and 2000 world catch of wild fish for human consumption increased from 20 to 95 million tons. As demand for seafood has risen, there has been a race to increasingly exploit known fish stocks and to find and develop new stocks (McIlgorm 1999). There is a general consensus that fish stocks worldwide have declined in the past several decades, with over 60% of the world's fisheries either fully utilized or over utilized (FAO 1995).

Many fisheries around the world are managed using limited access mechanisms such as limits on gear type, mesh size, days at sea, and number of boats. A growing number are managed using Individual Transferable Quotas (ITQs), which essentially create a fishery under private ownership by each of the quota owners. However, a large number of fisheries, particularly in the developing nations, remain open access. Open and limited access fisheries typically lead to fishing beyond maximum sustainable yield levels, and in the long run reduce the benefits that society derives from valued fishery resources.

The state of the world's fishery resources has led to increasing consumer awareness of issues related to fisheries exploitation and seafood consumption. A recent *Wall Street Journal* article reported, "Restaurants hook diners with vivid accounts of a fish's final moments." Restaurant menus more and more frequently provide information on the production attributes of the fish (wild versus farmed, country of origin, environmental impact). In 1998, a public relations firm, SeaWeb, which develops projects designed to raise awareness of the world's oceans and the life within it (www.seaweb.org), began a campaign called 'Give Swordfish a Break'. This campaign encouraged chefs to remove swordfish from their menus in support of stronger fish conservation. In addition, environmental groups such as the Blue Ocean Institute, Audubon Society, Environmental Defense, and the Monterrey Bay Aquarium post consumer advice on which seafood products are environmentally benign and which seafood products are not, in an effort to decrease consumer demand for those products whose production process damages the environment.

Concern over the status of fish stocks, combined with the well-known limitations of command-and-control management mechanisms, has recently led to the creation of the Marine Stewardship Council (MSC). The MSC is a non-profit, non-governmental, international organization established to promote sustainable fisheries and responsible fishing practices worldwide. The MSC has developed a logo that indicates to consumers that they are supporting healthier oceans and a healthier environment through the purchase of a labeled product (www.msc.org). Only products from fisheries that are certified by an independent third party as sustainable will bear that logo, or ecolabel.

In general, ecolabeling programs evaluate a 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 its marketing. The label conveys to the consumer otherwise unobservable information concerning a product's environmental impact. In the case of seafood markets, consumers who prefer sustainably harvested seafood products provide a market-based signal to resource managers, creating an incentive to maintain sustainable fisheries resources.

Since the MSC began the process of fishery certification for sustainable fishing in 1999, several researchers have studies issues related to seafood ecolabeling and consumer choice. Studies such as Wessells *et al*. (1999), Johnston, *et al*. (2001) and Jaffrey *et al*. (2001) have assessed consumer preferences for ecolabeled seafood in hypothetical or contingent markets. With the exception of Jaffrey *et al*. (2001), studies of reactions to seafood ecolabels have assessed consumer choices when faced with two samples of the same species, *e.g.*. two samples of salmon with one ecolabeled and the other not. Results have indicated that consumers prefer ecolabeled products, as long as price premiums for the ecolabeled products are not large. Jaffrey *et al*. (2001) investigated consumer preferences for ecolabeling in the U.K and Denmark and varied the products over a wide range of fresh and processed products. Again, consumers generally preferred labeled products to unlabeled products.

This report assesses tradeoffs between species, price, and the presence of ecolabels for popular fresh seafood species. While the unpublished Jaffrey *et al*. study considers a wide array of species, it assumes substitution among a wide variety of processed and non-processed products—a situation which may be poorly reflective of choices facing actual consumers when purchasing fresh seafood. For example, the Jaffrey *et al*. study considers smoked haddock as an alternative to canned tuna, fish fingers, salmon steaks and frozen prawns. In contrast, this study investigates consumer preferences for seafood, allowing variation in price, species and labeling, but focuses on choices among fresh seafood products only. Thus, the decision is similar to that which consumers now face at familiar fresh seafood counters. To investigate these preferences this report relies on a data set collected via a mail survey of randomly selected households in Connecticut. One set of questions presented in this survey asked respondents to rank their preferences for fresh seafood products using a conjoint experiment (Green and Srinivasan 1978), allowing assessments of tradeoffs between species type, price, and the presence of an ecolabel in fresh seafood purchasing decisions.

In addition to answering the conjoint analysis questions, respondents provided information about their preferences and consumption patterns for fresh fish, and individual demographic characteristics. The survey was created by the use of focus groups and pre-testing. Survey implementation was completed between August and October. 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.[1]. Surveying began with a personalized, hand-signed letter sent to each household in conjunction with the survey, stating the importance of responding to the survey, and thanking the household for their cooperation. The accompanying letter asked that the individual chiefly responsible for the retail purchase of seafood complete the survey. Eighty-six surveys were returned as undeliverable. Of 1,414 deliverable surveys, 432 were returned, for a response rate of 31% of deliverable surveys. Of the returned surveys, 64 were dropped from the analysis due to significant item non-response. The final data are drawn from the remaining 368 complete and usable surveys. 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 that 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 that some of these households were not consumers of fresh seafood, and hence would not be a relevant target for the survey. Hence, the response rate for seafood consuming households in the sampled population is likely somewhat

[1] A private list service firm in Rhode Island generated the list.

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. The survey itself contains several sections; the first of which asks about the respondent's general seafood consumption, followed by a section containing information about ecolabeling, The two ranking questions that are the heart of this survey followed with a section on demographics included at the end of the survey.

The survey describes the ecolabel as a program that avoids overfishing. Other potential definitions of 'sustainable fishing' were tested in the focus groups of this project and in Johnston, *et al*, but only 'overfishing' was easily understood. The label is included in the ranking question as one of three attributes and guarantees no overfishing of the specific species described. The survey also emphasizes that seafood with this label has the same color, quality and freshness as seafood without the label.

The purpose of this report is to provide qualitative and quantitative information on the survey results and is structured as follows. Chapter 2 provides a description of respondents' demographic profile. A review of respondents' seafood consumption is provided in chapter 3. Results from questions aimed at determining consumers' environmental opinions are presented in chapter 4. Chapter 5 provides a review of respondents' choices concerning ecolabeled seafood products. Chapter 6 is the manuscript written and submitted for journal publication based on this data set

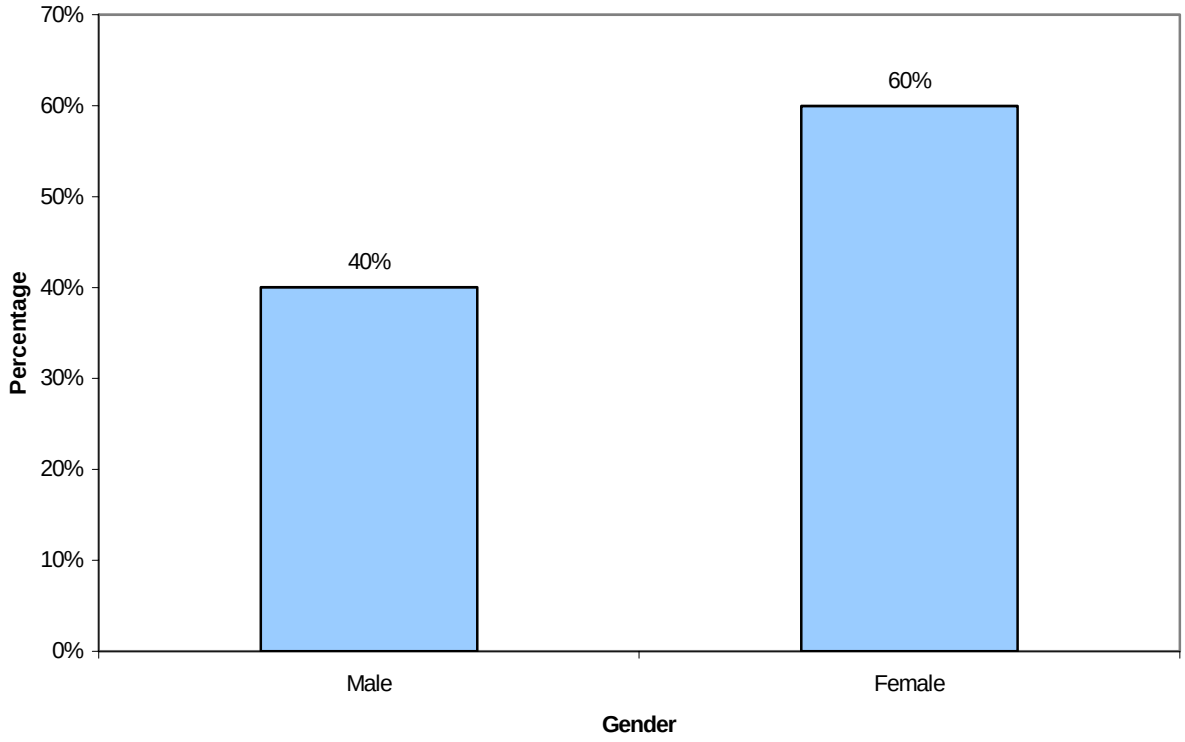
2. Demographic Information

This chapter reviews the demographic profile of the survey respondents. Comparisons to U.S. Census survey data are provided to determine if the sample is reasonably representative of the Connecticut population. Since the survey respondents include only seafood consumers, and are thus representative of that particular market segment, variations from census population data are expected.

Gender

Figure 1 shows the gender of the individual who completed the survey. The survey included screening questions designed to elicit responses the primary fresh seafood shopper. Here, of the 366 respondents who chose to indicate their gender, 60% were female. [2]

Figure 1. Respondent Gender (N =366)

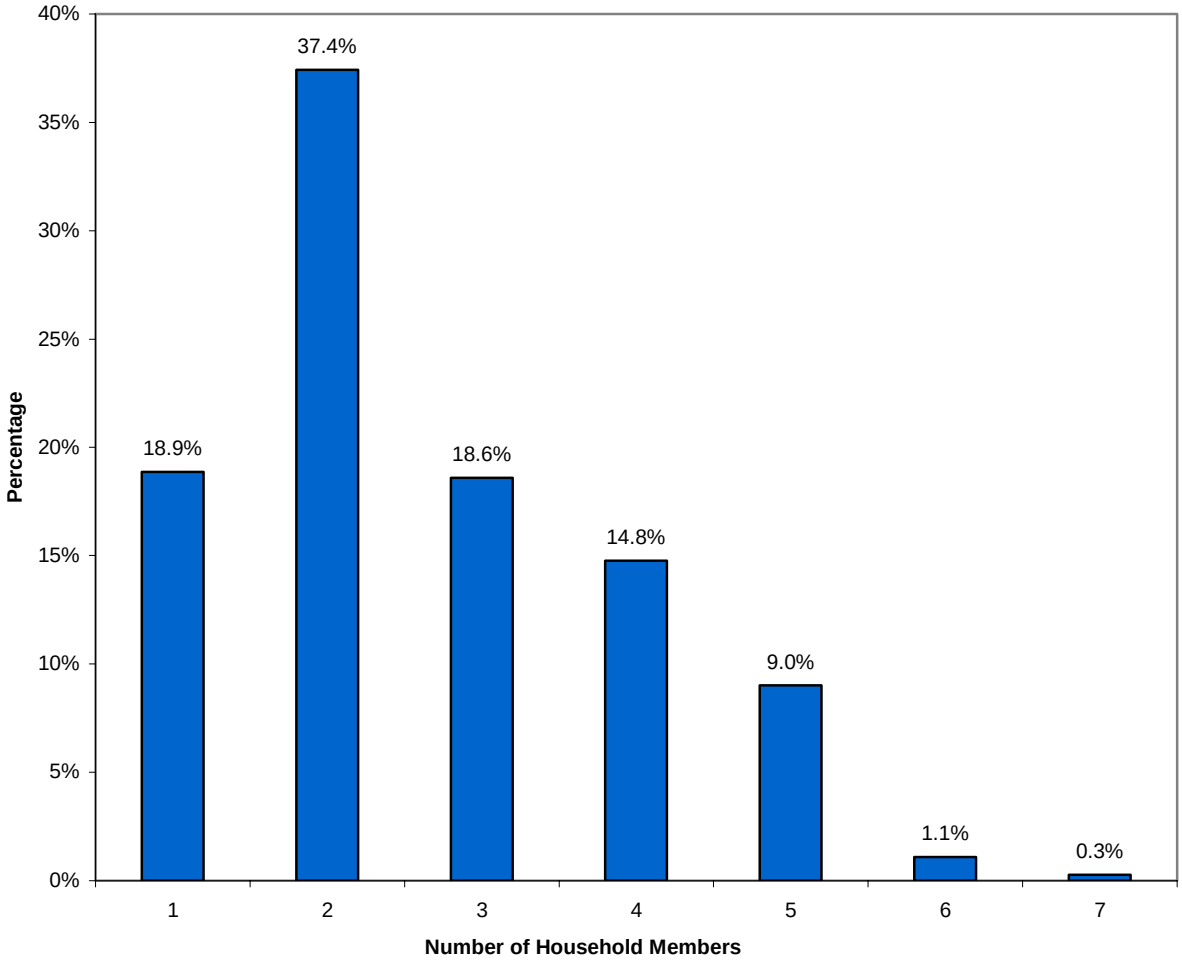


[2] Figures throughout the report may not total 100% due to rounding

Household Size

Household size, as indicated by the respondents who chose to provide that information, is shown in Figure 2. Over 37% of the respondents live in a two-person household, while little over 10% of the households consist of five or more members.

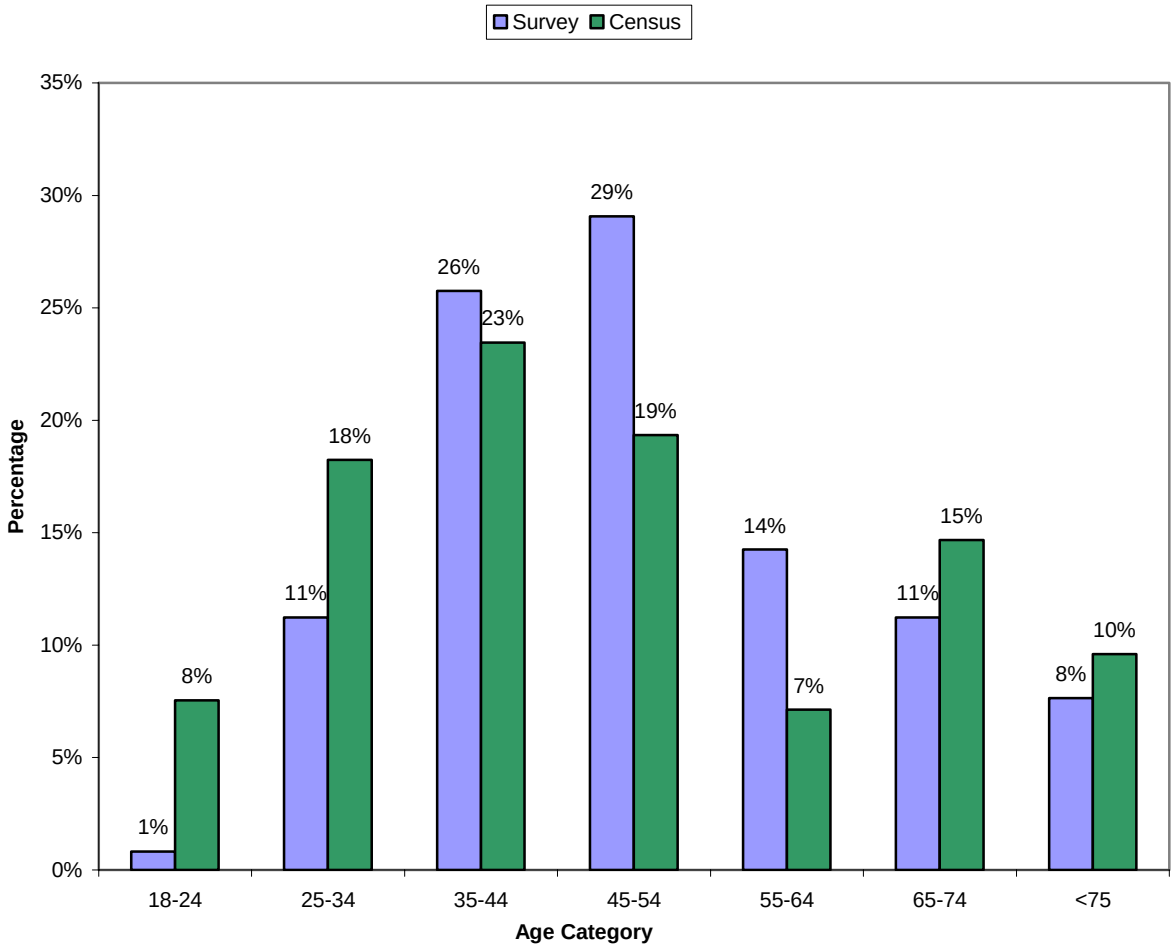
Figure 2. Household Size (N = 365)



Age Distribution

Using data from 2000, Figure 3 compares respondents' age distribution to the census age distribution. The comparison indicates that survey responses over-represent consumers between ages 35 and 64, particularly those between 45 and 64. The survey responses also under-represented consumers over age 65, as well as those between 18 and 34. However, general patterns of representation appear to match census data, with greater proportions of respondents in age brackets between 25 and 54, and smaller numbers of respondents in younger and older age categories.

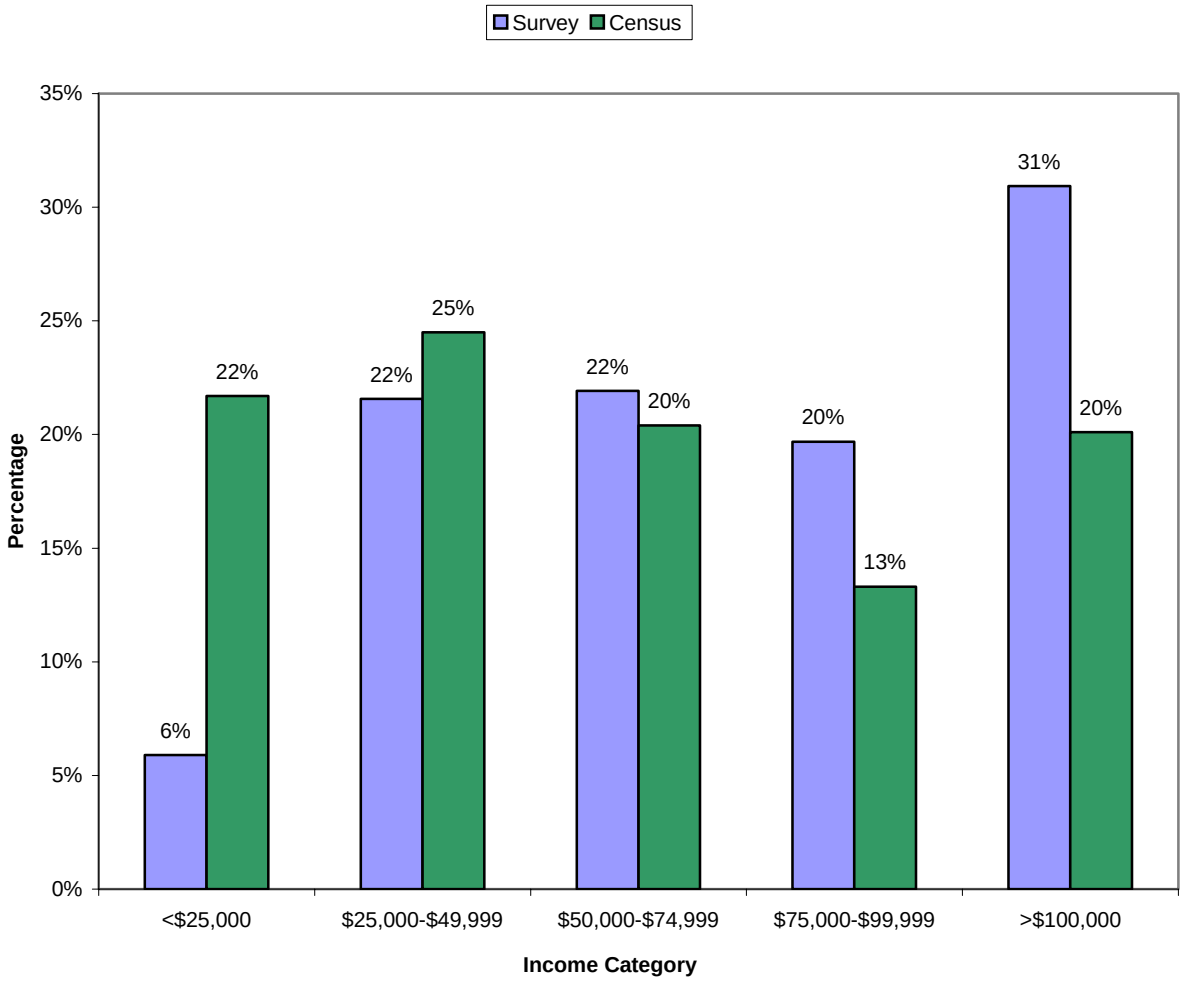
Figure 3. Age Distribution (N =365)



Income

Figure 4 compares respondents' annual household income distribution to the 2000 census data. While survey and census data are comparable in the middle-income ranges (between $25,000 and $75,000), the survey data is skewed at the higher and lower income categories. The survey responses significantly under-represent households making less than $25,000 while over-representing those households with incomes greater than $75,000. Such patterns are typical of surveys of this type.

Figure 4: Household Income (N =319)



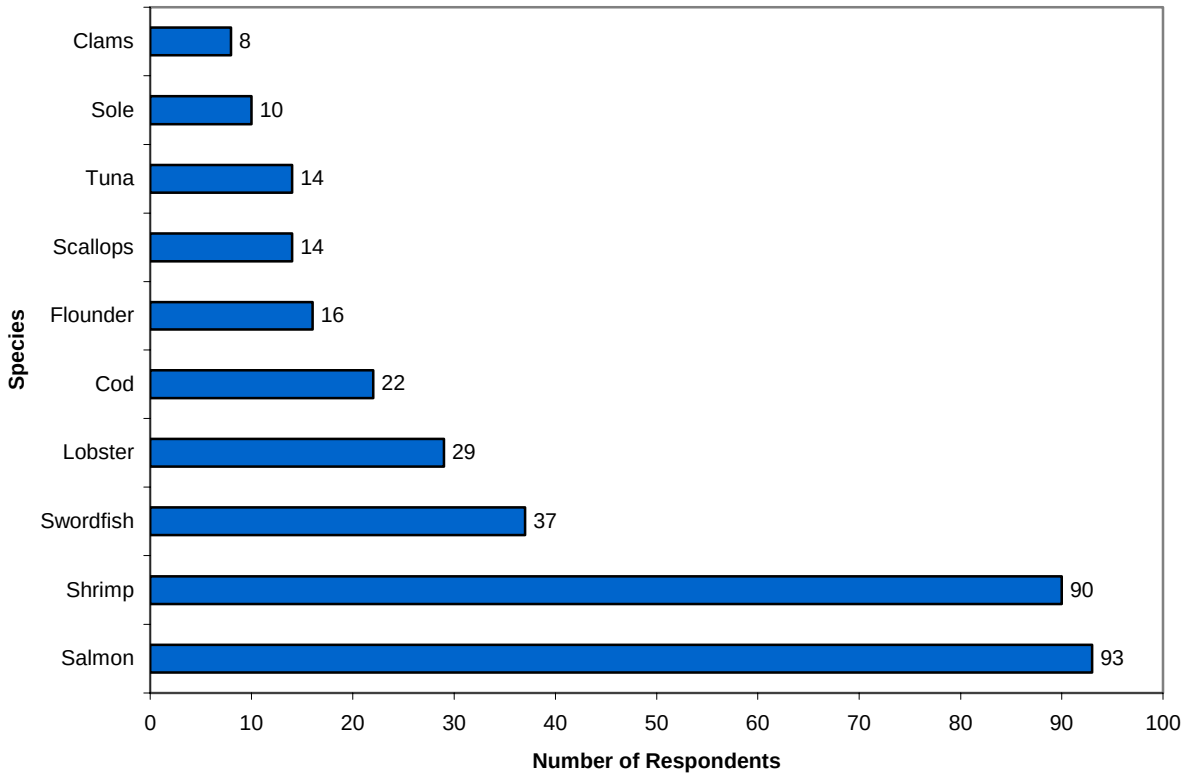
3. Seafood Consumption

This section reviews the respondents' seafood consumption patterns including taste preferences, frequency of consumption, purchasing habits and expenditures.

Favorite Species

Figure 5 shows consumers' ten favorite species as indicated by the respondent in an open-ended question that asked them to write in their three favorite species, in ranked order. Listed with each row is the absolute number of respondents who indicated that species as their favorite. Over half of the respondents listed either salmon or shrimp as their favorite species, indicating a clear preference for these two species.

Figure 5. Favorite Species for Home Consumption (N = 365)



The Top Ten

Although the respondents' three favorite species were elicited in an open-ended question format, the same ten species were consistently chosen and ranked in the top ten spots. Table A lists these species, along with the absolute number and percentage of respondents. Salmon and shrimp are consistently the most favorite, sharing the top two spots. Swordfish, lobster and cod occupy the third, fourth and fifth spots, respectively, across all ranks.

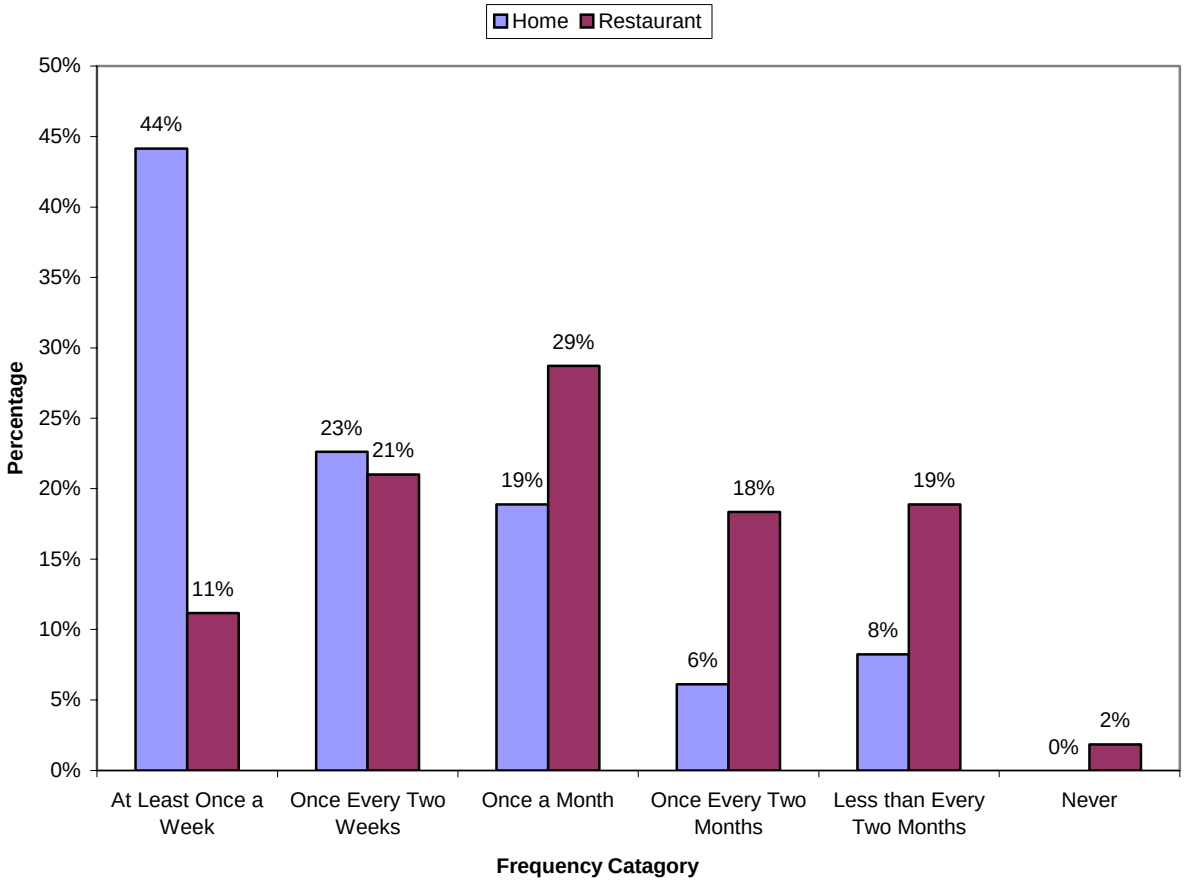
Table A. Consumer Choices for Three Favorite Species

	Percentages			Responses		
	First	**Second**	**Third**	**First**	**Second**	**Third**
Salmon	25.5%	13.3%	13.4%	93	47	43
Shrimp	24.7%	19.8%	18.3%	90	70	59
Swordfish	10.1%	9.3%	7.8%	37	33	25
Lobster	7.9%	7.3%	6.8%	29	26	22
Cod	6.0%	5.9%	4.0%	22	21	13
Flounder	4.4%	6.5%	3.4%	16	23	11
Scallops	3.8%	5.4%	8.1%	14	19	26
Tuna	3.8%	7.3%	8.4%	14	26	27
Sole	2.7%	4.5%	5.3%	10	16	17
Clams	2.2%	5.1%	6.5%	8	18	21
Total	91.2%	84.5%	82.0%	333	299	264

Consumption Frequency

Figure 6 shows the frequency of seafood consumption both at home and at restaurants. Over 85% of respondents indicated that they consume seafood at home at least once a month, with over 66% of respondents indicating a frequency of at least once every two weeks. It is possible that such a high consumption frequency may be due to screening questions eliminating those who do not consume seafood, although it is also possible that those who do consume seafood generally do so frequently. In comparison, seafood consumption at restaurants is generally less frequent, with 37% of respondents indicating a frequency of less than once a month.

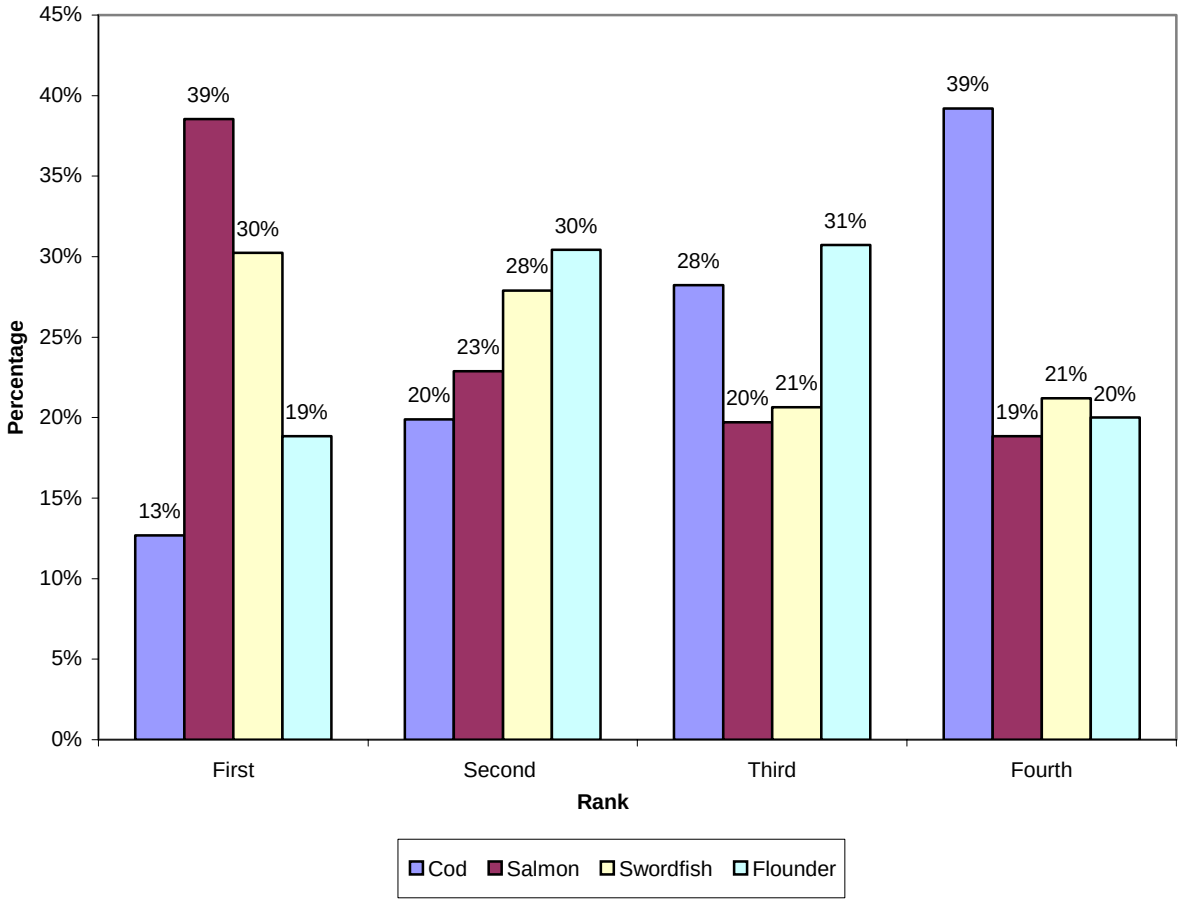
Figure 6. Frequency of Seafood Purchases (N =375)



Consumption of Survey Species

In addition to providing open-ended information about their favorite species, respondents were asked to rank four species, cod, salmon, swordfish and flounder, by taste. These particular species were used in the conjoint analysis questions and as such are the focus of the survey. Figure 7 shows each species and the percentage of respondents to assign a particular rank to that species. Salmon is ranked first by 39% of the respondents and shows a downward trend across the ranks. Cod demonstrates an opposite trend with only 13% of respondents ranking it first and 39% ranking it last.

Figure 7. Survey Species Ranked by Taste (N = 344)



Figures 8 through 11 show the percentage of respondents to assign a particular rank to each species of fish. These results demonstrate a preference among respondents for swordfish and salmon, with flounder ranking third and cod being the least favorite.

Figure 8: Cod Ranked by Taste (N = 344)

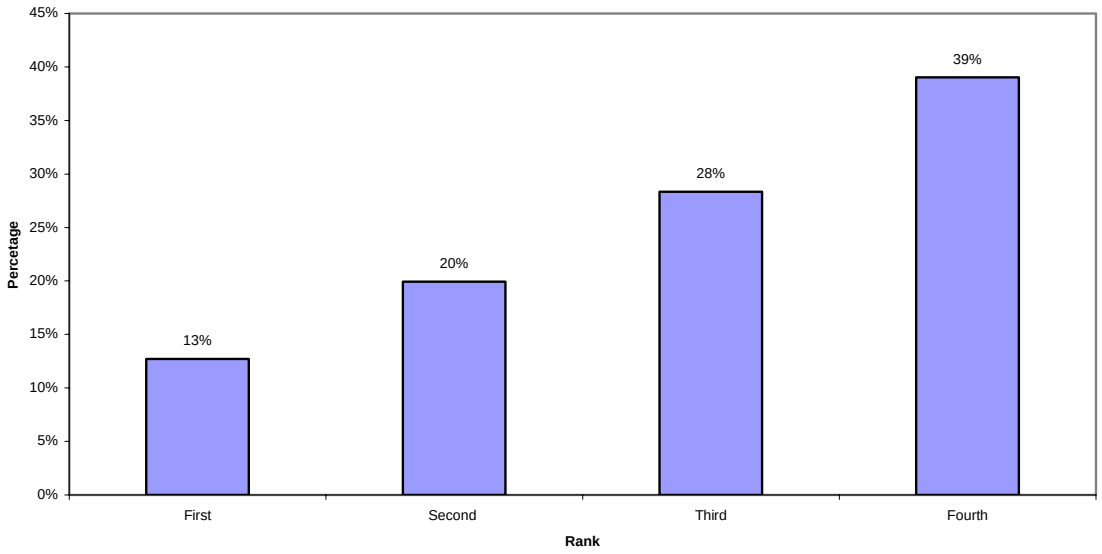


Figure 9: Salmon Ranked by Taste (N = 344)

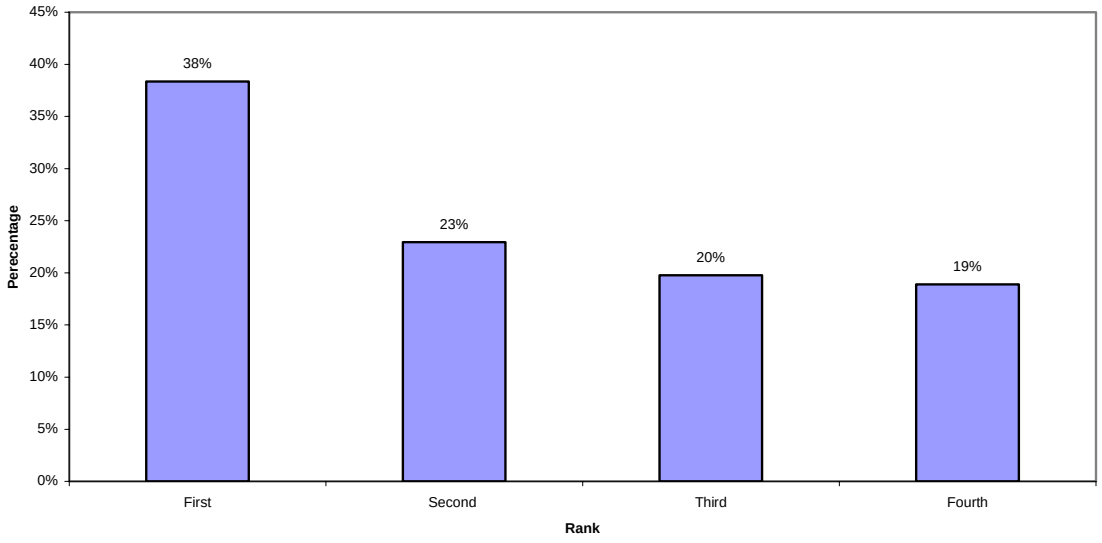


Figure 10: Swordfish Ranked by Taste (N = 344)

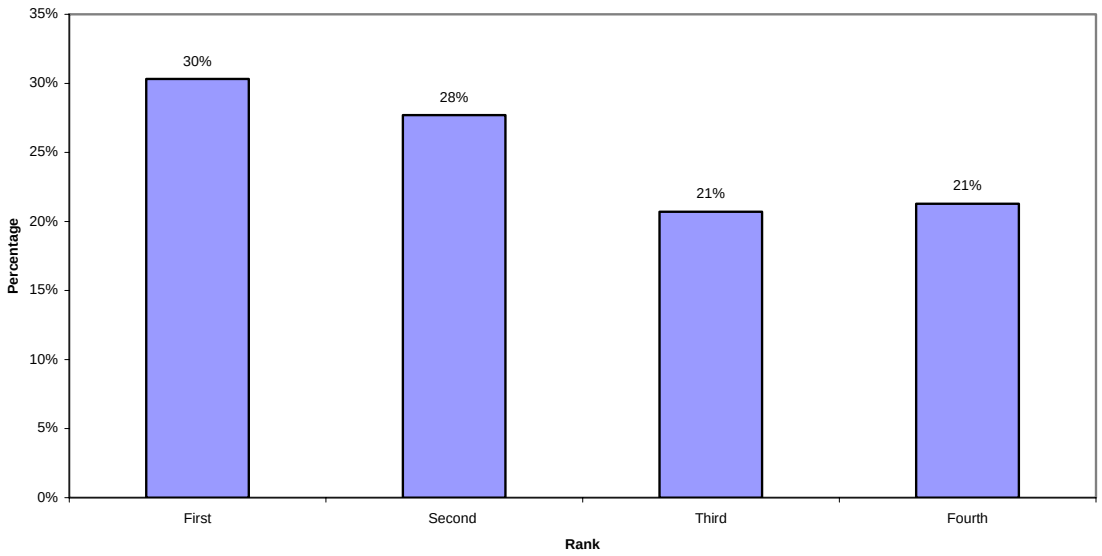


Figure 11: Flounder Ranked by Taste (N = 344)

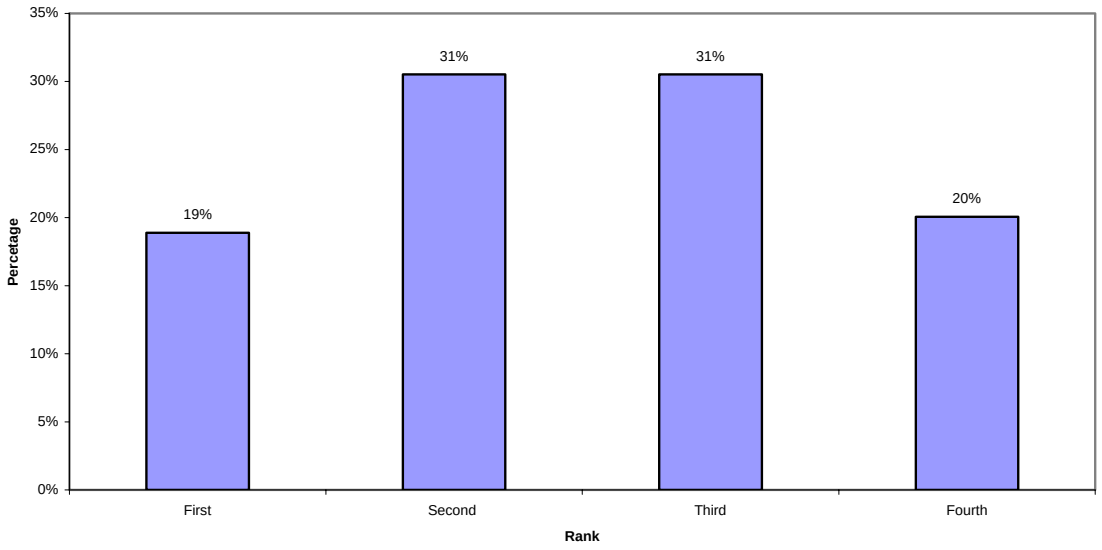


Table B shows the respondents' consumption frequency across the four survey species. In contrast to Figure 6, which demonstrates a high frequency of at-home seafood consumption, Table B demonstrates a much lower frequency, with between 20% and 32% stating that they *never* consume the species in question. The differences in frequency between the two sets of results may be attributed to the limitation to only four species considered by table B. Total seafood consumption (figure 6) is likely higher because it includes all seafood species, in particular shrimp, which is the most popular seafood choice. Among the four species included in the survey, salmon is the most frequently consumed species, and cod is the least frequently consumed, which is consistent with the rankings seen in the previous section.

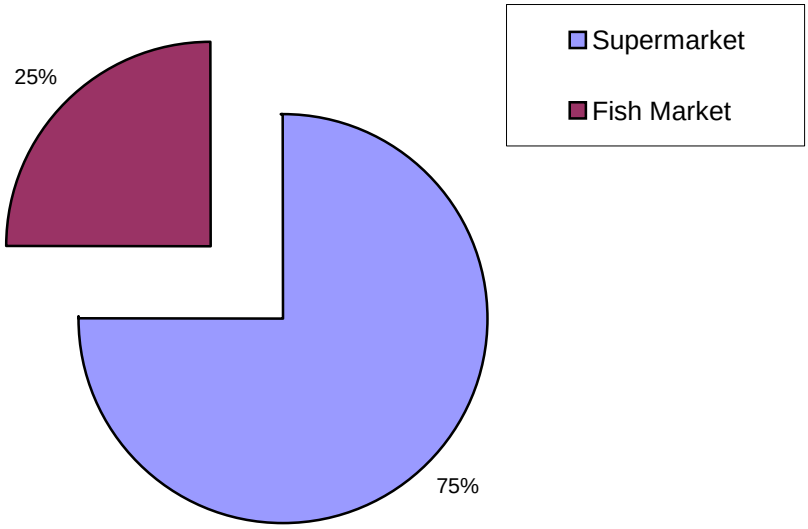
Table B. Consumption Frequency at Home by Species

	Cod	Flounder	Salmon	Swordfish
At Least Once a Week	6%	2%	10%	3%
Once Every Two Weeks	9%	8%	19%	10%
Once a Month	14%	15%	18%	17%
Once Every Two Months	12%	15%	12%	13%
Less than Every Two Months	27%	34%	21%	31%
Never	32%	26%	20%	26%
Total	100%	100%	100%	100%

Product Source

Respondents were asked to indicate where they most frequently purchased their seafood. Figure 12 shows that only 25% of respondents use a seafood market most often while 75% of respondents use a supermarket most often.

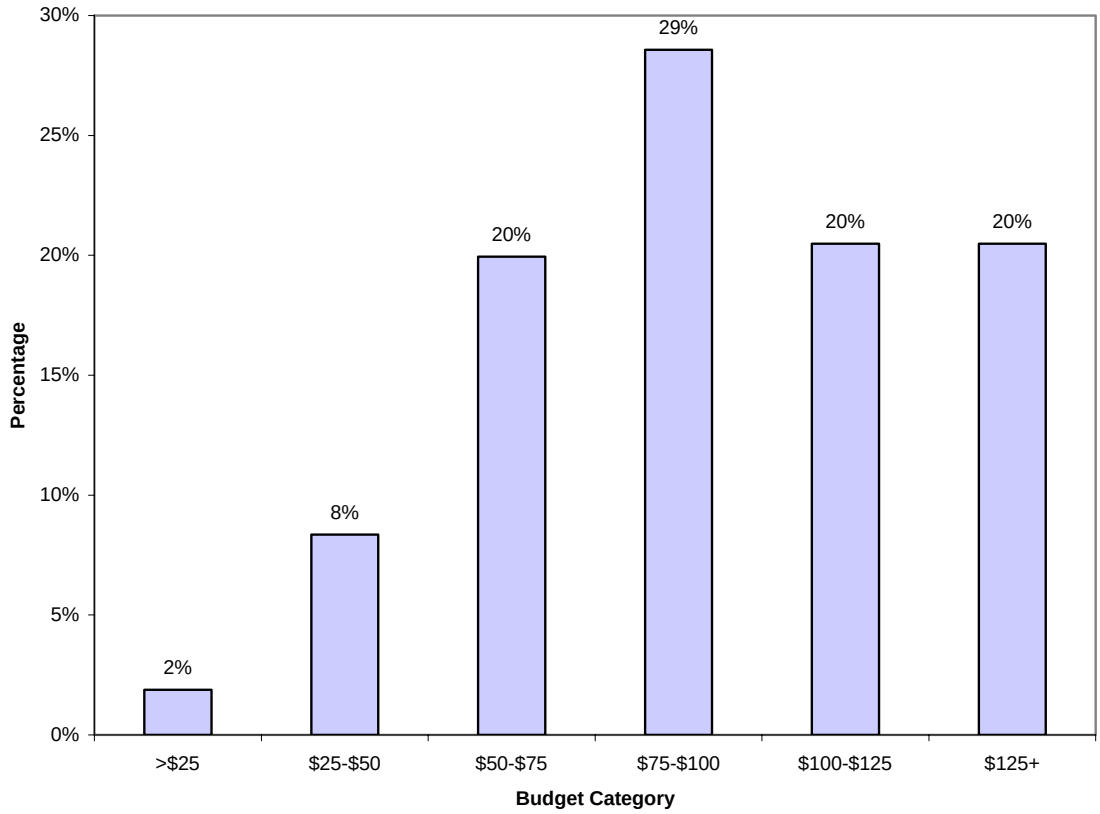
Figure 12. Seafood Purchase Establishments (N = 370)



Expenditures

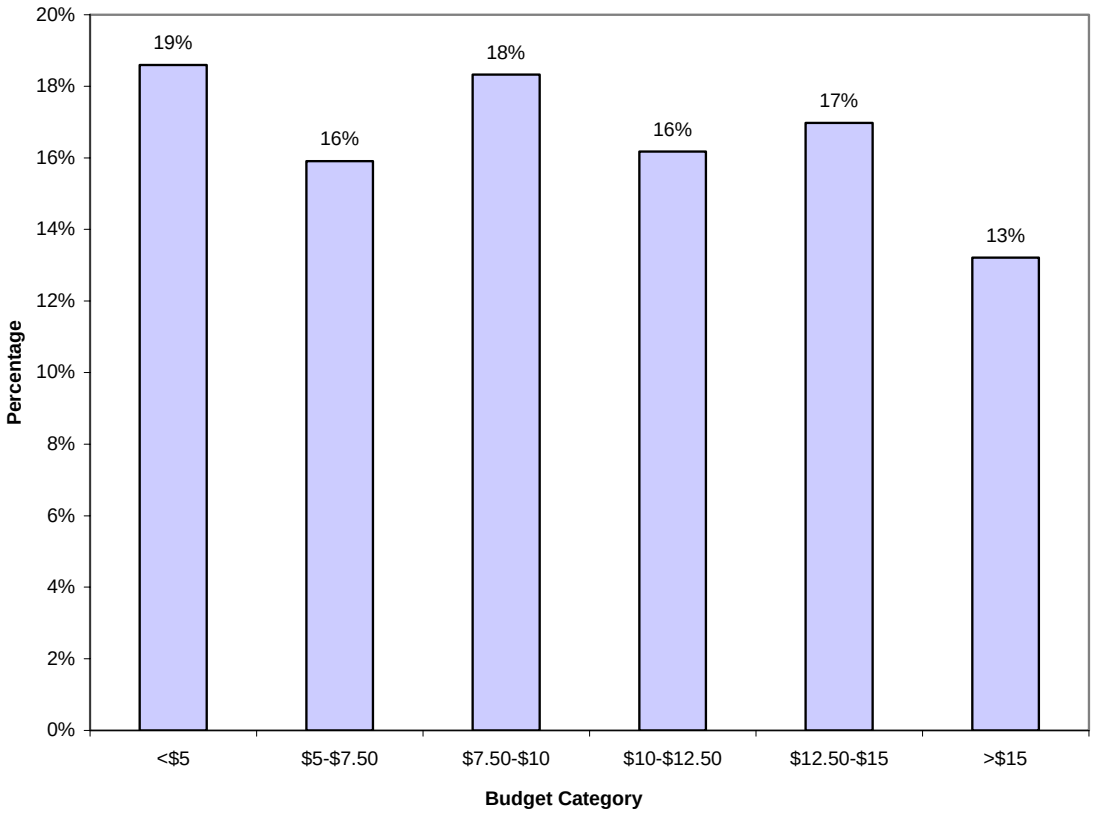
Figure 13 provides respondents' weekly grocery expenditures. In general, respondent expenditures tend to the higher categories, with 69% spending more then $75 a week on groceries. This may be related to the over-representation of higher income respondents in the survey data.

Figure 13. Weekly Grocery Expenditures (N = 370)



Respondents' weekly seafood expenditures are provided in Figure 14. Despite the high grocery budgets shown in Figure 13, there is no clear trend or skew in the respondents' seafood expenditures. There is little difference across the budget categories and no clear consumer tendencies.

Figure 14. Weekly Seafood Expenditures (N = 370)



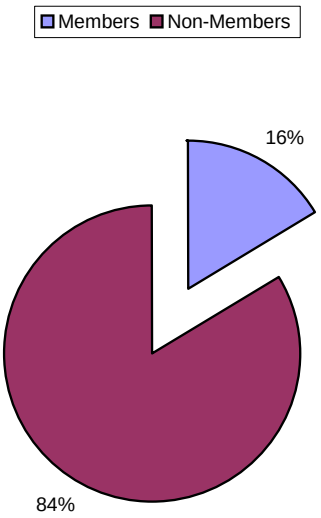
4. Environmental Opinions

Consumer perceptions, actions and attitudes can play a large role in any purchasing behavior and are particularly significant to the purchasing of an eco-labeled product. Thus, the survey incorporated questions to measure consumer perceptions of seafood and the environment. This chapter reviews these responses.

Environmental Membership

Figure 15 shows whether the respondents indicated that they belonged to an environmental organization. It is possible that membership in such an organization displays a level of environmental commitment that could influence choices concerning the purchase of an eco-labeled product. Of the 368 respondents who chose to answer this question, only 16% of respondents indicated that the were members of an environmental organization, while 84% indicated that they were not members of this type of organization.

Figure 15: Membership in Environmental Groups (N = 367)



Fishing Activity

The amount and type of interaction a consumer has with live fish stocks may also affect consumer attitudes about seafood and seafood purchasing behavior. Figures 16 and 17 show that a full one third of respondents indicated that they fish recreationally, while only 1% of respondents indicated that they fish commercially.

Figure 16. Recreational Fishing (N = 370)

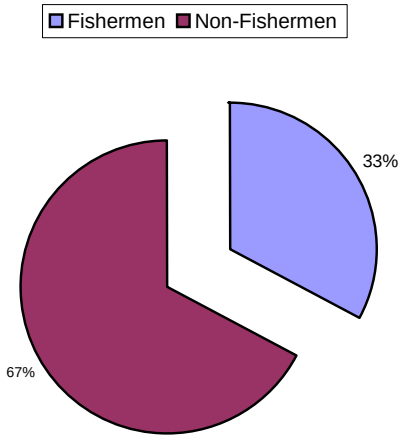
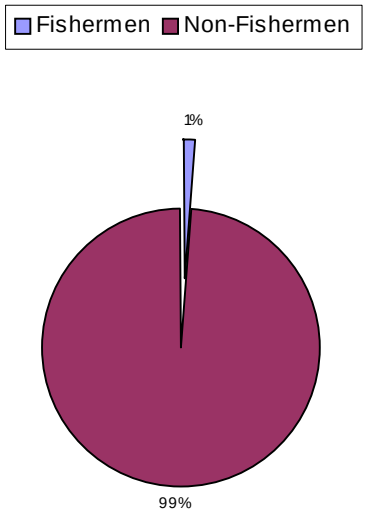


Figure 17: Commercial Fishing (N =370)

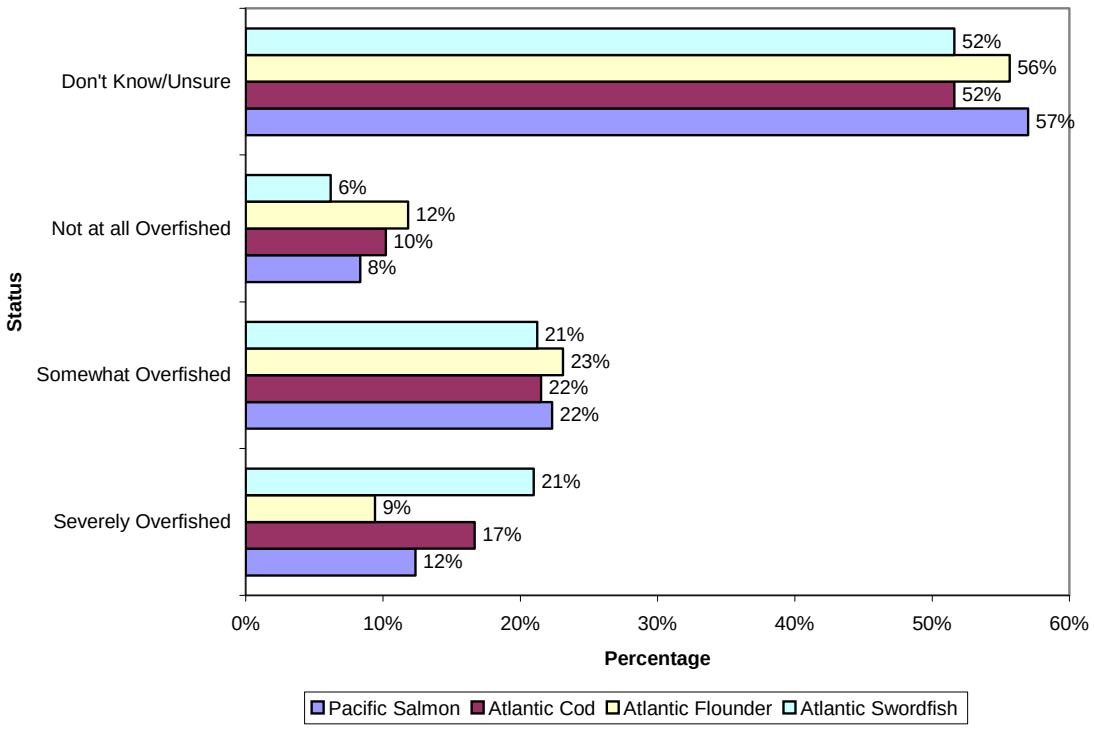


Fish Stock Status

Respondents were also asked to provide opinions on the status of certain fish stocks, given the hypothesis that such opinions may have an impact on choices regarding the purchase of eco-labeled seafood products. Responses are shown by species in Figure 15. For each species of fish, over 50% of respondents answered don't know/unsure, indicating a general lack of consumer knowledge about the current status of fish stocks. Between 21% and 23% answered somewhat over-fished for each species. Considering the absence of variation between species in the responses, particularly in the category of "somewhat overfished," it is possible that these responses do not reflect respondent opinion about the status of a particular species but a general opinion about the issue of overfishing.

It is hypothesized that consumers' perceptions of stock status may be influenced by preferences for particular species. In consideration of this hypothesis, respondents' preference for a species of fish, as indicated by the assigned rank, and opinions about stock status were investigated simultaneously for each species. In each case this analysis produced results that varied very little from those seen in Figure 18. Thus the analysis did not indicate that a respondent's preference for a species influenced their opinion about the stock status

Figure 18: Respondent Opinions on Species Status (N = 371)



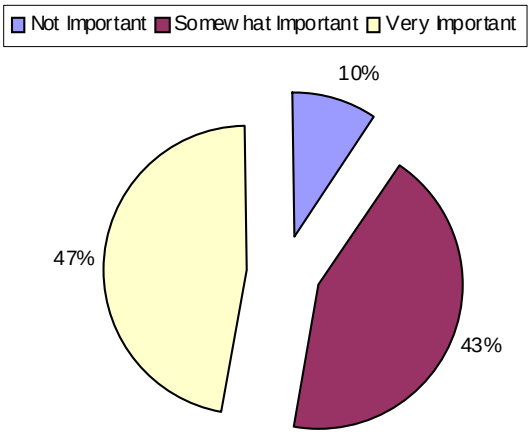
5. Choices and the Ecolabel

In order to obtain general information about respondents' possible choices concerning an ecolabeled product, respondents were asked several questions in addition to the conjoint questions to be discussed in the following chapter. It is important to note that unlike the conjoint questions to be discussed later, the questions reviewed in this chapter are general in nature and do not ask respondents to make any particular choices or tradeoffs. Instead, they represent more general questions regarding the importance of various seafood attributes, and respondents' general expectations regarding whether the presence of an ecolabel might affect their seafood purchase behavior.

The Ecolabel

For purposes of the survey instrument, the ecolabel was described as follows: "This new label 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. *The new label means no overfishing*." After introducing and explaining the ecolabel, the survey asks respondents to determine how important this label would be to them. Figure 19 shows that 47% of respondents felt that this label would be very important and 43% felt it would be somewhat important. Only 10% felt that this label would not be important to them.

Figure 19: Label Importance (N = 366)



Respondents were also asked if they would be willing to buy a different species of fish in order to purchase an ecolabeled product. Figure 20 shows that two-thirds of respondents stated that they would switch species to obtain an ecolabeled product, while one-third would not switch. It is hypothesized that respondents' taste preferences for a species might affect decisions regarding the purchase of ecolabeled products. This hypothesis was considered by examining respondents' stated willingness to switch species (based on the presence of an ecolabel), as related to the prior preference rank assigned to each fish species. In each case respondents' taste preferences had no effect on this stated behavior. Regardless of species ranking, approximately two-thirds of respondents indicated that they would switch species based on the presence of an ecolabel, while about one-third indicated that they would not switch.

Figure 20: Switch Species for Label? (N = 352)

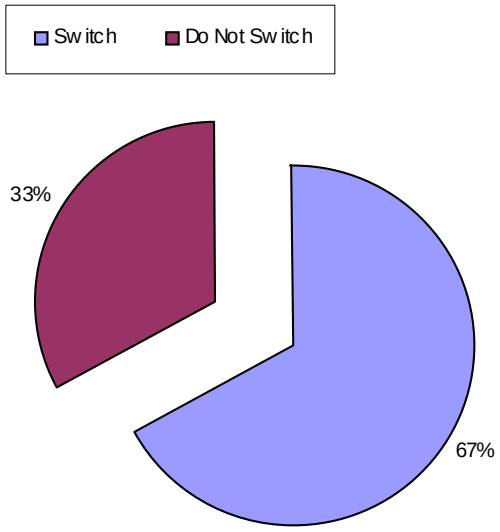
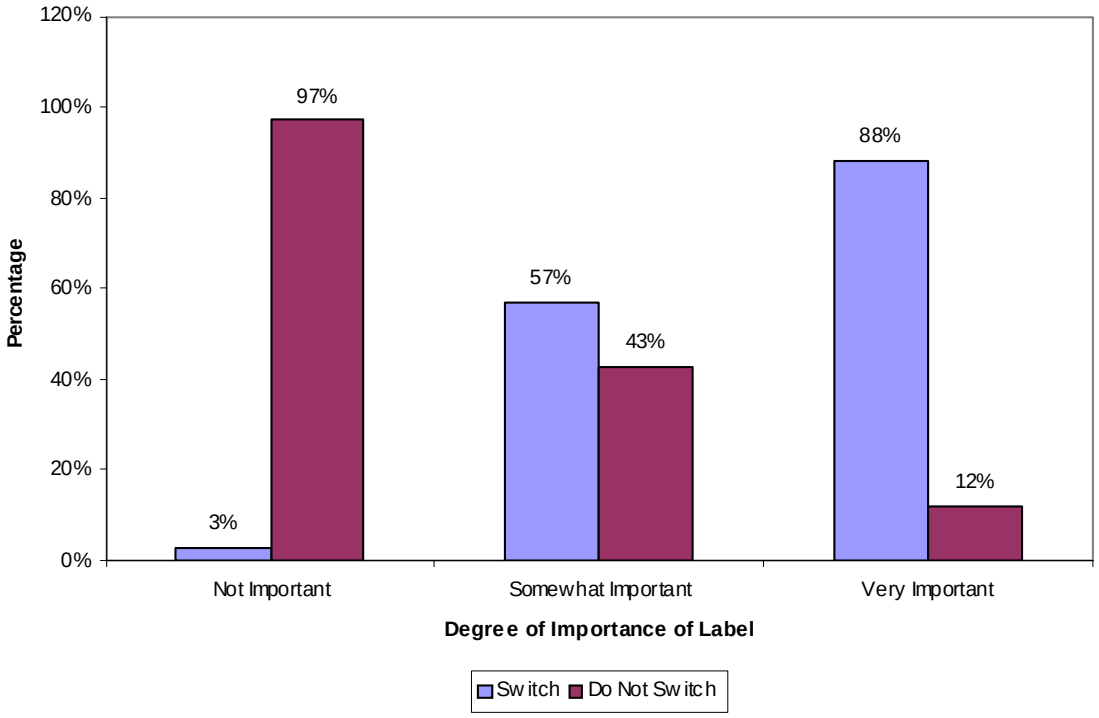


Figure 21 combines the importance the respondents assigned the label with their choice whether to switch species to purchase an ecolabeled product. Of those respondents who indicated that the label was not important, 97% also indicated that they would not switch and of those respondents who indicated that the label would be very important, 88% also indicated that they would switch.

Figure 21: Label Importance and Choice to Switch (N = 351)



Attributes

The ecolabel is not the only attribute that a consumer may consider when choosing a seafood product. Price, quality and the consumer's preference for a particular species are likely to be important factors in the purchasing decision. Therefore, respondents were initially asked to rank price, quality and species taste by importance. The first section of table C shows those responses. With 65% of respondents ranking it first and only 7% ranking it third, quality appears to be the most important attribute. Price appears to be least important, being ranked first by only 14% of respondents and ranked third by 55% of respondents. The respondents were later asked to rank the attributes again with the label included as an attribute. The second part of table C shows the respondents' rankings when the ecolabel is included. Quality is still most important with 48% of respondents ranking it first and only 4% ranking it last. The ecolabel does not appear very important with only 19% ranking it first.

Table C: Attribute Rank

	First	Second	Third
Price	14%	31%	55%
Quality	65%	29%	7%
Species	22%	40%	38%

	First	Second	Third	Fourth
Price	14%	16%	26%	44%
Quality	48%	31%	18%	4%
Species	21%	31%	29%	18%
Ecolabel	19%	22%	27%	33%

Figure 22 compares the percentage of respondents who rank particular attributes first under both circumstances, with and without the label as an attribute choice. The percentage of respondents who rank price and species taste as most important stays the same under both scenarios. However, the percentage of respondents who ranked quality most important is drastically different under the two scenarios. When the ecolabel is not included as an attribute, 64% rank quality most important but when ecolabel is included as an attribute only 47% rank it most important . It appears that almost all of those who ranked the ecolabel as most important were people who had ranked quality as most important when the ecolabel was not a choice. This is an interesting and possibly significant point of interest that has many possible explanations. Some consumers may equate an ecolabel with quality or it may be that those who rank quality highest are more flexible in their choices than those who rank price or species taste highest.

Figure 22: Comparison of Rank Choices

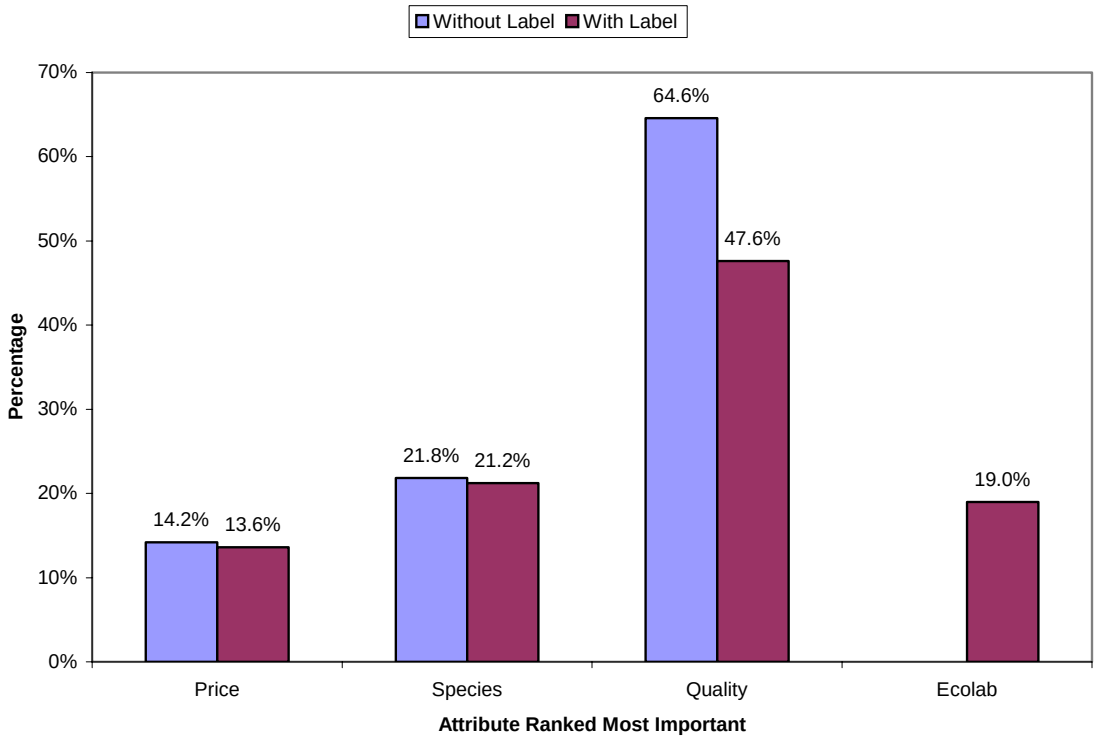
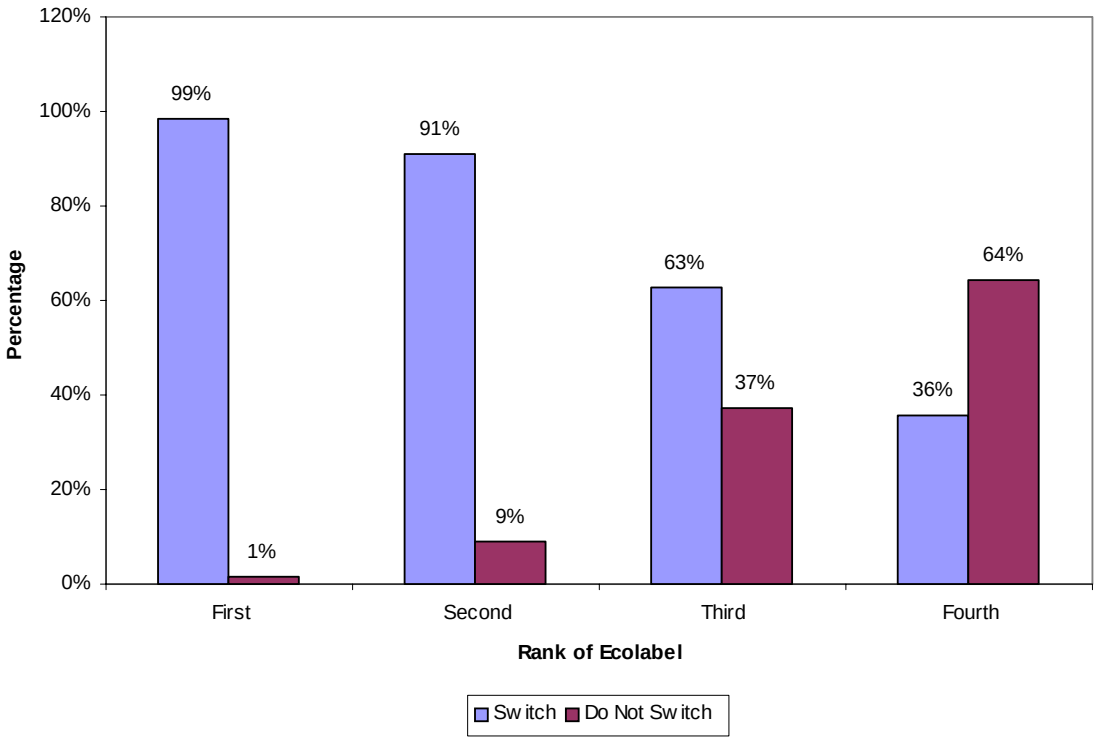


Figure 23 shows the rank respondents assigned to the ecolabel as an attribute simultaneously with whether they indicated that they would or would not switch species to purchase an ecolabeled product. Of those who ranked the ecolabel first among the attributes, 99% also indicated that they would switch and of those who ranked the ecolabel second, 91% also indicated that they would switch. Only 63% of those who ranked the ecolabel third indicated that they would switch and of those respondents who ranked the ecolabel last, 36% indicated that they would switch.

Figure 23: Rank of Ecolabel and Choice to Switch Species (N = 336)



6. A Battle of Taste and Environmental Convictions for Ecolabeled Seafood: A Choice Experiment

This section summarizes the choice experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. As noted above the context was designed to be similar to that which consumers face at fresh seafood counters. The formatting of this chapter matches that required for academic journal submission, as this chapter has been submitted for peer review and possible publication at the *Journal of Agricultural and Resource Economics*.

A BATTLE OF TASTE AND ENVIRONMENTAL CONVICTIONS FOR ECOLABELED SEAFOOD: A CHOICE EXPERIMENT

Abstract

Empirical studies of consumer preferences for seafood ecolabels are relatively few, and typically address choices among labeled and non-labeled products of the same seafood species. Given that consumers often express strong preferences for certain seafood species, however, a more relevant assessment of consumer preferences would allow for choices among different seafood products of similar processed form, where some products bear ecolabels. This paper describes a choice experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. The context is designed to be similar to that which consumers face at fresh seafood counters. Results suggest that consumers are unwilling to choose a less-favored species (i.e., to sacrifice taste) based solely on the presence of an ecolabel.

Keywords: seafood, ecolabel, choice experiment, rank-ordered, conjoint, stated preference.

Introduction

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 et al. 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 et al. 2001; Blend and van Ravenswaay 1999; Nimon and Beghin 1999).

In the case of seafood markets, the use of ecolabels establishes a means to provide market-based incentives for sustainable fishery management, assuming that 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 et al. (1999), Johnston et al. (2001), Teisl et al. (2002) and Jaffrey 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, studies have revealed that consumers are willing to pay statistically significant premiums for ecolabeled seafood products.

The results 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 unpublished work of Jaffrey 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 that consumers prefer ecolabeled to the non-ecolabeled seafood products, and are willing to pay a premium to obtain labeled products of the same species. However, 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, Jaffrey et al. (2001) investigates consumer preferences for ecolabeled seafood over a wide range of fresh and processed products. However, while the survey of Jaffrey et al. (2001) 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)—an assumption that may be of arguable validity. In contrast, the study described here presumes that a more realistic context would incorporate

choices 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 local supermarkets.

Choice among species is particularly significant in the fresh seafood market, given that consumers often express strong 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 species of fresh seafood (e.g., cod), while rarely purchasing other types (e.g., salmon). This apparent tendency towards species-loyalty in fresh seafood purchases begs the question—will consumers choose a less-favored species based solely on the presence of an ecolabel? That is, will consumers sacrifice taste in order to obtain a label? 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 choice experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. The choice context is designed to be similar to that which consumers currently face at fresh seafood counters. The analysis relies upon data gathered from mail survey of randomly selected Connecticut households. In contrast to prior work that assesses WTP for ecolabels when faced with only a single seafood species, the primary emphasis here is the potential trade-off 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 that the principal household shopper chooses among various seafood products on a specific shopping occasion. Following Johnston et al. (2001), 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 (Mitchell and Carson 1989) in the survey instrument.

Given these assumptions, consumer choices among 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, 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

$$U(\mathbf{X_j}) = v(\mathbf{X_j}) + \varepsilon_j \qquad (1)$$

where $U(\mathbf{X_j})$ represents the consumer's utility from seafood consumption, $v(\mathbf{X_j})$ represents 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 (or choose) product A 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 choice options, and asked to rank these options in order of their preference (i.e., according to (3)). This 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 et al. 1981), a respondent provides the highest rank to the seafood product that provides the highest level of utility, based on (3) above. Lower ranks are the allocated successively, based on (3) and the anticipated utility from each product. The rationale of the model is that the individual compares all the choices, selects their most preferred (independent of the rankings of the remaining choices) then makes their next choice out of the remaining subset of choices. This process is iterated until all options are ranked.[3]

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 et al. (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 in a previous study of demand for seafood safety information (Holland and Wessells 1998).

Following (1)-(3) above, let $U_i(\mathbf{X_j})$ represent the random utility that individual i derives 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 $\mathbf{X_{ij}}$ such that:

$$v_i(\mathbf{X_j}) = \mathbf{X_{ij}\beta}, \tag{4}$$

where $\boldsymbol{\beta}$ is a conforming vector of parameters to be estimated. If individual i's observed ranking of $j=1...J$ choices is given by $\mathbf{R_i} = (r_1, r_2, ..., r_J)$, the resulting model allows one to specify the probability of $\mathbf{R_i}$ using the logistic distribution as (Beggs et al. 1981):

$$\pi(\mathbf{R_i}) = \prod_{h=1}^{J-1} [\exp(\mathbf{X_{ir_h}\beta}) / \sum_{m=h}^{J} \exp(\mathbf{X_{ir_m}\beta})] \tag{5}$$

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

[3] 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 that 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.

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

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.[4]

The Data

Although a very limited number of ecolabeled fresh seafood products are currently available in some U.S. markets[5] there are no publicly available data that allow testing of hypotheses regarding tradeoffs among fresh seafood species in the presence of ecolabels. Accordingly, this study follows Johnston et al. (2001) and Jaffrey et al. (2001), and uses choice experiment (i.e., 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.

As outlined above, seafood choice questions asked respondents to rank four different fresh seafood products in order of preference. Species chosen for choice questions were salmon, cod, flounder and swordfish. These species were chosen based on their popularity and familiarity among seafood consumers, and because the represent relatively distinct types of finfish available in fresh seafood markets.[6] Each choice experiment (ranking) question incorporated one choice from each of the four species.

In addition to variation in species, the experimental design allowed for variation in price and the presence/absence of an ecolabel. Price levels for each species were chosen to be consistent with prevailing retail prices at the time of the survey. The ecolabel was described as a label that guaranteed no overfishing, following Johnston et al. (2001).[7] The survey also emphasized that within each species (salmon, cod, swordfish, and flounder) both labeled and non-labeled products shared the same color, quality and freshness. Hence, it was emphasized that the sole differences between the illustrated seafood products were the specified differences in species, prices, and labels.

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

[5] 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).

[6] Swordfish was also chosen as a result of the then-ongoing chef's boycott of Swordfish associated with SeaWeb's "Give Swordfish a Break" campaign (www.seaweb.org), a primarily East Coast reaction to U.S. imports of juvenile swordfish.

[7] Other potential definitions of 'sustainable fishing' and specification 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.

In addition to 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 determine 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 one to assess 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.

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. Survey implementation was completed between August and October. 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 the returned surveys, 64 were dropped from the analysis due to significant item non-response. 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). Model variables and descriptive statistics from these observations are summarized in table 1.

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 that 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 that some of these households were not consumers of fresh seafood, and hence would not be a relevant target for the survey. Hence, 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.[8]

[8] 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.

Table 1. Model Variables and Summary Statistics

Variable	Definition	Mean	Std. Dev.
Product Attributes			
Price	Specified product price minus mean product price over experimental design; see main text.	0.09	2.17
Label	Binary variable indicting 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 if product is not salmon.	0.25	0.43
Swordfish	Binary variable: 1 if product is swordfish; 0 if product is not swordfish.	0.25	0.43
Flounder	Binary variable: 1 if product is flounder; 0 if product is not flounder.	0.25	0.43
Cod	Binary variable: 1 if product is cod; 0 if product is not cod.	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 age 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 age 36-55.	0.29	0.46
household size less than 3	Binary variable: 1 if respondent's household has fewer than 3 members; 0 household has 3 or more members. Default category is households of 3 to 5 members.	0.55	0.50
household size more than 5	Binary variable: 1 if respondent's household has greater than 5 members; 0 household has 5 or fewer members. Default category is households of 3 to 5 members.	0.02	0.13
income less than 55K	Binary variable: 1 if respondent's household income is less than $55,000 (US); 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 (US); 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 per week; 0 if expenditures are not in this category. Default category is expenditures between $7.50 and $12.50 per week.	0.35	0.48
high seafood expenditures	Binary variable: 1 if household's average seafood expenditures are more than $12.50 per week; 0 if expenditures are not in this category. Default category is expenditures between $7.50 and $12.50 per week.	0.31	0.46
member of environmental group	Binary variable: 1 if respondent considers him/herself a member of an environmental organization; 0 if respondent does not consider him/herself a member.	0.16	0.37
frequent seafood consumer	Binary variable: 1 if respondent consumes seafood more than once per 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 that salmon is overfished to at least some degree; 0 if respondent does not	0.36	0.48

	consider salmon overfished or is unsure.		
feel swordfish overfished	Binary variable: 1 if respondent thinks that 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 that 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 that cod is overfished to at least some degree; 0 if respondent does not consider cod overfished or is unsure.	0.39	0.49

Model Results

Results for the full-sample rank ordered logit model are shown in table 2, as estimated using maximum likelihood. 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, label, and species). Hence, the main effects model may be viewed as a restricted specification of the main and interactive effects model.

Most model variables require little additional emphasis, over definitions and summary statistics provided by table 1. However, the specification of price in the two illustrated models is somewhat different than that typically applied in choice experiments, and hence warrants additional explanation. As mentioned above, price levels for each species were chosen to be consistent with prevailing retail prices at the time of the survey. That is, the experimental design allowed for three different price levels for each species, but these price levels differed across species to correspond with well-known differences in mean market prices.[9] This design introduces correlation between price and species, as one would find in actual seafood markets. This was done based on the guidance of focus groups, to avoid the potential for protest responses and methodological misspecification in the final instrument.[10]

Given the presence of this intended correlation, various statistical specifications of the price variable were tested in preliminary model versions, to assess which provided the best model performance. Based on results of these preliminary models, the final specification used for the price variable in table 2 is the *deviation* of the price illustrated in the choice question from the mean price for the species in question, such that

[9] For example, survey scenarios presented flounder at a price of $4.99, $6.99, or $8.99 per pound. Swordfish, in contrast, was priced at either $6.99, $10.99, or $14.99 per pound.

[10] Focus group evidence and pretests for this survey and for the survey in Johnston et al. (2001) indicate that protest responses and confusion are often generated by surveys providing clearly unrealistic prices for seafood species. For example, respondents faced with fresh swordfish priced at $4.99 per pound (a very low price) may express disbelief at the realism of the scenario, or wonder whether the product is of low quality (e.g., previously frozen). 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

$$Price = P_j - P_{j,\ mean} \quad (7)$$

where P_j is the stated price of species j in a particular choice question, and $P_{j,\ mean}$ is the mean price of the same species across the survey design. This price difference may be positive, zero, or negative. Although this price specification provides a somewhat improved model fit, fundamental model results are robust to different specifications of the price variable.

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

	Main and Interactive Effects Model			Main Effects Model		
Variable	Coefficient	P-Value	Hazard Ratio	Coefficient	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	0.117	0.563	1.125	0.334	0.0001	1.397
Swordfish	0.357	0.336	1.214	-0.031	0.6170	0.970
Flounder	0.194	0.066	1.429	0.208	0.0007	1.231
Interactive Terms						
Price x age 18-35	0.061	0.066	1.063			
Price x age over 55	-0.009	0.708	0.991			
Price x frequent seafood consumer	-0.006	0.843	0.994			
Price x low seafood expenditures	-0.059	0.031	0.942			
Price x high seafood expenditures	0.006	0.808	1.006			
Price x household size less than 3	0.036	0.127	1.037			
Price x household size over 5	-0.023	0.770	0.977			
Price x income less than 55K	-0.003	0.916	0.997			
Price x income over 100K	0.007	0.767	1.007			
Price x member of environmental group	-0.010	0.728	0.990			
Label x age 18-35	0.093	0.442	1.097			
Label x age over 55	-0.168	0.070	0.845			
Label x frequent seafood consumer	0.082	0.497	1.085			
Label x low seafood expenditures	0.040	0.706	1.041			
Label x high seafood expenditures	0.069	0.474	1.071			
Label x household size less than 3	-0.034	0.698	0.967			
Label x household size over 5	-0.025	0.942	0.976			
Label x income less than 55K	-0.033	0.747	0.968			
Label x income over 100K	0.016	0.865	1.016			
Label x member of environmental group	0.020	0.076	1.216			

Salmon x age 18-35	-0.243	0.137	0.784		
Salmon x age over 55	-0.029	0.813	0.971		
Salmon x frequent seafood consumer	0.288	0.066	1.333		
Salmon x low seafood expenditures	-0.010	0.940	0.990		
Salmon x high seafood expenditures	-0.124	0.335	0.883		
Salmon x household size less than 3	0.199	0.089	1.221		
Salmon x household size over 5	-0.026	0.944	0.975		
Salmon x income less than 55K	-0.155	0.237	0.857		
Salmon x income over 100K	0.195	0.122	1.216		
Salmon x member of environmental group	-0.205	0.155	0.815		
Salmon x feel salmon overfished	-0.061	0.519	0.941		
Swordfish x age 18-35	-0.091	0.575	0.913		
Swordfish x age over 55	0.163	0.186	1.177		
Swordfish x frequent seafood consumer	-0.269	0.802	0.764		
Swordfish x low seafood expenditures	-0.168	0.208	0.846		
Swordfish x high seafood expenditures	-0.008	0.953	0.992		
Swordfish x household size less than 3	-0.006	0.958	0.994		
Swordfish x household size over 5	-0.294	0.438	0.745		
Swordfish x income less than 55K	0.133	0.322	1.142		
Swordfish x income over 100K	-0.002	0.988	0.998		
Swordfish x member of environmental group	-0.089	0.544	0.915		
Swordfish x feel swordfish overfished	0.059	0.526	1.060		
Flounder x age 18-35	-0.092	0.559	0.912		
Flounder x age over 55	0.164	0.173	1.179		
Flounder x frequent seafood consumer	-0.139	0.374	0.870		
Flounder x low seafood expenditures	-0.019	0.889	0.982		
Flounder x high seafood expenditures	-0.076	0.538	0.927		
Flounder x household size less than 3	-0.081	0.479	0.922		
Flounder x household size over 5	0.457	0.227	1.579		
Flounder x income less than 55K	0.134	0.292	1.144		
Flounder x income over 100K	-0.151	0.215	0.860		
Flounder x member of environmental group	-0.096	0.483	0.908		
Flounder x feel flounder overfished	0.108	0.261	1.114		
N	2160			2160	
Likelihood Ratio (-2 LnL χ^2)	141.9789	0.0001		85.1622	0.0001

Both the main effects and interactive effects model 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). However, 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 statistically significant at $p<0.05$, and none 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

Within the main effects model, results match prior expectations, where such expectations exist. All species coefficients are statistically significant at $p<0.01$, with the exception of *swordfish*. This implies that both *salmon* and *flounder* are preferred to *cod* (the default value), but that 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. Hence, mirroring prior findings of Johnston et al. (2001) and Jaffrey et al. (2001), model results suggest that consumers would be willing to pay a price premium for ecolabeled seafood products, reflecting the positive utility increment associated with these products.

The expected nature of these results notwithstanding, the primary focus of this analysis is not on the willingness to pay (WTP) for ecolabels, 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. Based on the random utility model outlined above, coefficient estimates indicate the relative effect of each variable on the observable component of marginal utility, $v(\cdot)$. The coefficient estimate associated with *label* (0.20), indicating the relative strength of effect on marginal utility, is larger than that on *swordfish* (-0.03), approximately equal to that on *flounder* (0.21), and smaller than that on *salmon* (0.33). Based on these preliminary results only, one might conclude that the effect of a label on marginal utility may be in some cases sufficient to cause consumers to choose a seafood species that would otherwise not be chosen. For example, based on point estimates of marginal utility only, the model predicts that a representative respondent would choose labeled flounder over unlabeled salmon, *ceteris paribus*, even though salmon would be preferred were both products to be labeled (or unlabeled).[11] Hence, the choice of salmon (a preferred species, *ceteris paribus*) would be sacrificed in order to obtain a less-preferred species (flounder) bearing an ecolabel.[12]

[11] Observable marginal utility associated with unlabeled salmon at its mean price is 0.334. 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 (0.334) 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.

[12] 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

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. For example, 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 may bear 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 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 Sub-samples 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 choice data to be split systematically into four independent sub-samples, according to a respondent's baseline favorite seafood species. For example, the "Salmon Preferred" sub-sample includes choice experiment 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" sub-sample includes analogous data for those who indicated that flounder was their most preferred species, again by taste. Statistically independent rank ordered logit results are estimated for each sub-sample.

The resulting four main effects models—one for each species specific sub-sample—allow one to address stated choice behavior of respondents who are known to prefer a specific species, by taste, *ceteris paribus*. For example, the Salmon Preferred model allows one to assess whether the presence or absence of an ecolabel would be sufficient to cause *a priori* salmon-preferring respondents to choose another species of fresh seafood. Analogous questions may be addressed in each of the four sub-sample models. That is, *assuming* that respondents would be more likely to begin a shopping trip with the intention to purchase their favorite species (by taste), the models allow one to assess whether the presence of an ecolabel on competing species would be sufficient to cause a change in this intended behavior.

Results for the four sub-sample models are shown in table 3. 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 specification distinction is made solely for convenience and ease of discussion; it does not affect model results. As above, all models are significant at $p<0.0001$, based on likelihood ratio tests. Interestingly, while the price variable (*price*) is highly significant in the Salmon Preferred and Swordfish Preferred model, 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.[13]

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

	Cod Preferred			**Flounder Preferred**		
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	1.908	0.0001	6.741	-	-	-
Salmon	0.181	0.309	1.199	-0.026	0.851	0.974
Swordfish	-	-	-	-0.345	0.014	0.708
Flounder	0.719	0.0001	2.052	0.898	0.0001	2.454
N	256			416		
Likelihood Ratio χ^2	89.1785	0.0001		72.1294	0.0001	

	Salmon Preferred			**Swordfish Preferred**		
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	1.556	0.0001	4.742	0.253	0.025	1.288
Swordfish	-0.053	0.586	0.948	0.735	0.0001	2.085
Flounder	0.184	0.059	1.201	0.244	0.030	1.276
N	856			632		
Likelihood Ratio χ^2	270.7584	0.0001		52.3527	0.0001	

Implications for Seafood Ecolabeling: Does Taste Trump Environmental Conviction?

As expected, coefficient estimates indicate that respondents are most likely to choose the species that they rank most highly by taste, *ceteris paribus*. However, more relevant and interesting are the findings with regard to the effects of ecolabels. Recall that coefficient estimates in each model indicate the relative effect of each variable on the observable component of marginal utility, $v(\cdot)$. Based on this interpretation, and assuming mean prices for each species, table 4 illustrates the observable (relative) utility associated with different product configurations, for each sub-sample. Specifically, for each sub-sample, the utility increment

[13] For example, those who prefer the milder taste of species such as cod or flounder may be unwilling to choose stronger-tasting 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.

associated with the unlabeled *preferred* species is compared to that associated with labeled variants of the other three species considered.

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

	Model[b]			
Relative Marginal Utility at Mean Price[a]	Salmon Preferred	Swordfish Preferred	Flounder Preferred	Cod Preferred
Unlabeled Salmon	**1.556**	0.253	-0.026	0.181
Labeled Salmon	2.011	**0.405 (0.0162)**	**0.216 (0.0001)**	**0.203 (0.0001)**
Unlabeled Swordfish	-0.053	**0.735**	-0.345	0.000
Labeled Swordfish	**0.402 (0.0001)**	0.887	**-0.103 (0.0001)**	**0.022 (0.0001)**
Unlabeled Flounder	0.184	0.244	**0.898**	0.719
Labeled Flounder	**0.639 (0.0001)**	**0.396 (0.0171)**	1.140	**0.741 (0.0001)**
Unlabeled Cod	0.000	0.000	0.000	**1.908**
Labeled Cod	**0.455 (0.0001)**	**0.152 (0.0001)**	**0.242 (0.0001)**	1.930

a Results in **bold** highlight the relative marginal utility of the unlabeled preferred species (by taste), compared to labeled versions of competing species. The underscore highlights 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**.

b For marginal utilities of competing species (bold with no underscore), 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. 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.

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 (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 (again assuming mean prices). Numbers in parentheses are associated p-values for the null hypothesis of zero difference between the relative marginal utility of the labeled species in question and the marginal utility of the unlabeled preferred species.

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 ($p<0.02$), and at $p<0.0001$ in ten of the twelve 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 the less-favored species.

For example, model results indicate 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 universally statistically significant, and are of particularly large magnitude for those with taste preferences for milder fish (i.e., cod, flounder)

These results indicate that, on average, respondents with a prior taste preference for one species (i.e., they rank that species first by taste) will continue to choose that species as their primary purchase option, regardless of the availability of no-overfishing ecolabels on competing seafood products. This result applies to all species in all sub-sample models. Hence, while consumers may prefer (and by willing to pay a premium for) ecolabeled products in a single-species choice setting—or when labeled and unlabeled products are available for a favored species—model results suggest that they are much less willing to sacrifice a favored species. For the average consumer, taste trumps environmental convictions.

These results 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 indicated that 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.

While the reason for this discrepancy is unknown, it may be related to the difference between a *general* willingness to switch seafood species versus a more *specific* willingness to switch between the particular types of species illustrated in choice questions. As noted above, the four species illustrated in the choice experiment questions were chosen based on their popularity to seafood consumers, and because they represent relatively distinct fresh seafood products that many consumers may not consider to be close substitutes. Approximately 67% of respondents expressed a general willingness to switch species in order to obtain a no-overfishing ecolabel, indicating that these respondents *may* be willing to switch among certain species—perhaps those perceived as very close substitutes (e.g., flounder and sole; cod and haddock). Nonetheless, choice experiment results indicate that respondents are *not* willing to switch among species that are more distinct (e.g., salmon, flounder, cod, swordfish), or more specifically are not willing to give up a favored species in return for an ecolabel.

Conclusions

This paper describes a rank-ordered choice experiment addressing stated preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. Results highlight the need for thorough analyses of 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. While results indicate a statistically significant WTP to obtain labeled seafood of a particular species, they also clearly indicate that 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—even at average prices for both products. The preference for the favored-taste species is even more distinct if the ecolabeled product is sold at a premium price, and for those who favor mild-tasting species such as cod and flounder.

Results are, of course, relative to the specific case study, species considered, and sampled population,[14] 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.[15] Indeed, model results notwithstanding, consumers *may* be willing to substitute highly similar species (e.g., cod and haddock) in order to obtain ecolabels, as indicated by the greater than two-thirds of respondents who indicated a general willingness to switch seafood species in order to obtain a no-overfishing label. 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.

More broadly, results suggest a potential shortcoming in analyses that assess consumer WTP for labeled products, yet do not allow for substitution (or lack of substitution) among different types of products. Most assessments of ecolabels, whether for seafood (Johnston et al. 2001), apples (Louriero et al. 2001), forest products (Sedjo and Swallow 2002), or other consumer goods, assume tradeoffs between labeled and unlabeled products of a single or otherwise unspecified variety. However, in most market settings, consumers choose from products of different varieties—whether different species of seafood, varieties of apples, or types of hardwood—often with a prior preference for the attributes of certain varieties. Assessment in multi-product settings may provide a more appropriate indication of the true size of the market for ecolabeled products, and hence for the potential impact of labels as a tool for environmental management.

[14] For example, Johnston et al. (2001) show significant differences in reactions to seafood ecolabels between US and Norwegian consumers.

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

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Appendix

Experimental Design for Choice Experiment: Fractional Factorial Main Effects Plan

Version	Cod	Cod	Salmon	Salmon	Swordfish	Swordfish	Flounder	Flounder
1	4.99	label	5.99	label	14.99	label	8.99	label
2	6.99	NO Label	3.99	NO Label	6.99	NO Label	6.99	label
3	8.99	label	7.99	label	10.99	label	4.99	NO Label
4	6.99	NO Label	7.99	label	10.99	label	6.99	label
5	8.99	label	5.99	NO Label	14.99	NO Label	4.99	label
6	4.99	label	3.99	label	6.99	label	8.99	NO Label
7	8.99	label	3.99	label	6.99	label	4.99	label
8	4.99	label	7.99	NO Label	10.99	NO Label	8.99	label
9	6.99	NO Label	5.99	label	14.99	label	6.99	NO Label
10	6.99	label	7.99	label	6.99	NO Label	4.99	NO Label
11	8.99	NO Label	5.99	NO Label	10.99	label	8.99	label
12	4.99	label	3.99	label	14.99	label	6.99	label
13	8.99	NO Label	3.99	label	14.99	NO Label	8.99	NO Label
14	4.99	label	7.99	NO Label	6.99	label	6.99	label
15	6.99	label	5.99	label	10.99	label	4.99	label
16	4.99	label	5.99	label	10.99	NO Label	6.99	NO Label
17	6.99	label	3.99	NO Label	14.99	label	4.99	label
18	8.99	NO Label	7.99	label	6.99	label	8.99	label
19	8.99	label	3.99	label	10.99	label	6.99	label
20	4.99	NO Label	7.99	NO Label	14.99	label	4.99	NO Label
21	6.99	label	5.99	label	6.99	NO Label	8.99	label
22	4.99	NO Label	5.99	label	6.99	label	4.99	label
23	6.99	label	3.99	NO Label	10.99	label	8.99	NO Label
24	8.99	label	7.99	label	14.99	NO Label	6.99	label
25	6.99	label	7.99	label	14.99	label	8.99	label
26	8.99	label	5.99	NO Label	6.99	label	6.99	NO Label
27	4.99	NO Label	3.99	label	10.99	NO Label	4.99	label