Consumers' Perception and Willingness to Pay for Eco-Labeled Seafood: A Case-Study

Sergio Vitale, Federica Biondo, Gioacchino Bono, Cristina Giosuè, Charles Odilichukwu R. Okpala, Ignazio Piazza, Mario Sprovieri and Vito Pipitone

Italian National Research Council (CNR), Institute for Coastal Marine Environment (IAMC)

Abstract: The aim of this paper is to discuss eco-labels on fishery-products, which is useful for improving both seafood markets and strategies for sustainable fishery management. In this study, 560 consumer-surveys were conducted in the north and south of Italy. A probit regression model and linear regression were used to respectively measure consumers' perception and willingness to pay for eco-labeled seafood. The profile of the consumer that would favor eco-labeled products is skewed toward females (~50-year-old) who live in a family and are intrinsically motivated to protect the environment and to promote the sustainable exploitation of marine resources. Willingness to pay for eco-labeled fishery products is related to the initial price of the product, income and family situation; it is also strongly related to the "attention to fish quality" and "environmental features", along with information obtained from "means of mass communication". According to our analysis, a price premium for eco-labeled products could range between 12-13%.

Keywords: Eco-labeled seafood; Consumers' perception; Mediterranean Sea; Price premium; Willingness-to-pay (WTP)

JEL Classification: Q01, Q21, Q22

---

1. Introduction

An environmental-friendly approach to seafood consumption is increasingly critical for ensuring the sustainable use of fishery resources [1].

Seafood eco-labels are relatively new, having been introduced in the early 1990s throughout the United States in the form of the 'Dolphin-Safe' label. These labels have continued to evolve and now include several different international "sustainable" certifications. This approach is based on three key principles, all of which are consistent with the Food and Agriculture Organization of the United Nations' Code of Conduct: (a) fish stocks must be sustainable; (b) environmental impacts must be minimized; and (c) management practices must be effective [2].

The development of eco-friendly seafood has been strongly favored by the European Commission (EC), which has supported sustainable consumption and production as an instrument to maximizing market potential [3]. However, consumer willingness may not be directly translated into consumer behavior given the variety of barriers for sustainable consumption, including availability, affordability, convenience, product performance, conflicting priorities, skepticism and force of habit [4, 5]. Consumer behavior may be primarily influenced by quantifiable perceptions of environmental information on the label, not by intrinsic environmental concerns [1, 3].

Jonell et al. [6] recently highlighted that an emotional component in consumer's decision-making, together with their knowledge of seafood eco-labels, could influence their consumption of sustainable

fish products. The meaning of eco-labels has often been difficult for consumers to understand [4, 7]: in fact, health and food safety concerns are generally their sole reasons for purchasing eco-labeled products [1, 3, 8]. Several studies have shown that consumers likely to choose eco-labeled fishery products were also likely to have a higher consumption of seafood products (especially seafood products that are fresh / wild-caught) [9-12]. Furthermore, consumer preferences vary among species and an eco-label alone may be insufficient to attract consumers to those that are less well-known species [10, 13].

The availability of information about the product could support consumers during the decision-making process and consequently encourage them to pay a price premium. Typically, useful information includes the standardized name of the species, the company name, the source country and the type of fishing gear employed. In particular, there could be great interest in fish species catch, total catch, impact of fishing method, biology, risks of overfishing and the effectiveness of management and research [14].

The objective of this study is to evaluate consumers' responsiveness to a proposed eco-labeled in the Italian hypermarket, as well as to consider several useful strategies for improving the seafood market and the sustainable management of fishery resources.

2. Materials and Methods

2.1. Survey

Few studies have analyzed consumer behavior in relation to eco-label seafood products of the Mediterranean Sea. Consequently, we conducted a survey to assess consumer responsiveness to eco-labels. In order to have a more realistic scenario, we imagined two different eco-labels for "anchovies" (Engraulis encrasicolus). The first label was for fish caught using gear with a low impact on habitats (hereafter: LIH); the second was for fish caught in unpolluted areas, certified 'blue' fishing grounds (hereafter: BFG). We investigated consumers' willingness to pay (WTP) for an eco-labeled anchovy caught with low-impact fishing gear (hereafter: WTP-LIH) and willingness to pay for an eco-labeled anchovy from certified 'blue' fishing grounds (hereafter: WTP-BFG).

The anchovy is one of the most valuable pelagic fishery species in the Mediterranean area [39]. Specifically, anchovies are caught around the central Mediterranean Sea within a geographical sub-area (GSA 16). Although fishing activities have remained somewhat stable in the Mediterranean Sea, the stock appears to have been over-exploited in the past decade.

The survey considered a stratified random sampling of AUCHAN S.p.A. consumers, interviewed face to face by questionnaire. The locations of the survey were fish counters in AUCHAN S.p.A. stores, one in Palermo (Sicily) (central Mediterranean Sea basin), situated in the South of Italy and the other in Milano (Lombardy region), situated in the North of Italy. The location was chosen not only to compare two socioeconomic regions but also to offer a heterogeneous yet representative sampling status to the literature. Milano's population is characterized by relatively high demographic dynamics with the lowest unemployment rate at a national level and with a lacking of a strong culture of seafood consumption. Conversely, Palermo has relatively low demographic dynamics, a high unemployment rate and a rich culinary tradition of seafood consumption. In this context, a stratified random sampling was taken considering a quota sampling for each of the three age groups (18-25 years ~ 10%; 26-65 ~ 70%; > 65 ~ 20%), representing the main socio-demographic determinants of fish consumption among European consumers [15]. A sample size of 550 – 600 interviews was predefined according to cost efficiency and time effectiveness.

The research employed questionnaire design as its research instrument, adapting the survey approach of Brécard et al. [16]. The reference structure was maintained but with fewer questions, consistent with the purposes of this research. To enable enquiry on an eco-labeled anchovy, we added eight new questions formulated to assess consumers' WTP for eco-labled seafood. [e.g. 17-19]. The questionnaire consisted in 35 questions, including the usual sociodemographic variables of gender,

age, family and professional situation, place of residence and monthly-declared income. Respondents expressed their overall fishing knowledge, environmental motivations, intrinsic motivations, qualitative seafood preference and their WTP for eco-labeled anchovy. Table 1 shows a succinct illustration of questionnaire structure by themes, number of items, questions and response types.

Table 1. Succinct illustration of questionnaire design by theme, items, questions and response types.

Themes	No. of questions	Question type	Response type
Overall fishing knowledge	9	7 Questions: Dichotomous 2 Questions: Multiple-choice	All closed
Environmental motivations	3	All dichotomous	All closed
Intrinsic motivations	7	4 Questions: Multiple-choice 2 Questions: Dichotomous	6 closed and 1 open
Qualitative seafood preference	4	1 Question: Multiple-choice	1 closed and 3 open
WTP for Eco-labeled anchovy	5	3 Questions: Dichotomous	3 closed and 2 open

Key: Answer type: Open / closed; Question type: Dichotomous/ Multiple-choice

Prior to this research, the questionnaire was presented to AUCHAN S.p.A. store authorities for approval to ensure that it respected their prescribed Customer relations policy. Although the questionnaire would be anonymous, the participants were informed that the data processing would be conducted in accordance with the European Council (EC) Directive 95/46/CE (24 October, 1995) consistent with the protection, confidentiality and anonymity of personal data.

The interview was conducted face-to-face with AUCHAN S.p.A. shoppers using predefined stratified random sampling. Trained researchers from the Institute for Coastal Marine Environment —National Research Council of Italy conducted the interviews. The consumers were interviewed individually. Each interview lasted for approximately 5 minutes and all were conducted within 4 weeks on the same weekdays. Overall, 560 questionnaires were collected. Following the interview, specific information about the project was presented to the participants to further raise their awareness for and future consumption of eco-labelled seafood products from the Mediterranean region.

2.2 Data analyses

Descriptive analysis of the participants' socioeconomic characteristics (gender, age, family situation, income earners and income) by location (Palermo and Milano) was undertaken and tested by a nonparametric Kolmogorov-Smirnov test (K-S test). Principal component analysis (PCA) was carried out to identify the key variables influencing consumers' awareness of eco-labels. The analysis used a heterogeneous set of variables, from which the 'latent' variables were extracted. These 'latent variables' were not directly observable and they are composed of theoretical factors underlying the initial variables. As a long-used multivariate statistical technique, PCA [20] can reduce a dataset containing several variables into a smaller one. To improve the description of the underlying relation between the initial set of variables and the 'latent' variables, the rotation method of Varimax with Kaiser's normalization was applied.

A binary probit model was used to evaluate the awareness of consumers. The probability model is defined as follows:

$$\boldsymbol{Pr(Y = 1 \mid X = x_i) = (x^T \beta) = \frac{1}{\sqrt{2\pi}} \Phi \int_{-\infty}^{x^T \beta} e^{-z^2}\, dz}$$

where Y is the binary response variable that take values 0 and 1; Φ is the standard normal cumulative density function, β is a vector of the independent variable coefficient estimates, and X is a vector of the independent variables.

One model was deliberately given more variables than the other, with the goal of determining whether this would strengthen the model's power and increase the chances of establishing the statistical significance of the employed variables of interest. Model 1 considered gender, age, income earners, income, family situation, and principal components (means of technical communication [Component 1]; attention to fish quality [Component 2]; attention to environmental features [Component 3]; and means of mass communication [Component 4]), whereas Model 2 considered not only all of Model 1 but also contaminant limits, store and the purchase of other eco-label products.

According to the theory, the consumer makes their choice by taking into account their preferences and budget constraints. For this reason, the "income" variable was introduced as proxy of budget constraint and, in order to represent the consumer preferences, "gender", "age", "income earners" and "family situation" variables were used. The first two variables consider the individual dimensions, while the last two variables add family dimensions to consumer preference.

To test the robustness of the model, the Akaike information criterion (AIC) was applied.

The AIC (Akaike information criterion) is:

$$\boldsymbol{AIC = -2\, log\, L(\widehat{\theta}/y) + 2K}$$

where L($\widehat{\boldsymbol{\theta}}$ / y) is the maximum likelihood estimate of θ and k is the number of estimated parameters. The value of AIC depends on data y, which leads to model selection uncertainty. Next, the AIC value for each model is calculated with the same data set, and the "best" model is the one with minimum AIC value.

Furthermore, a linear model relating the response y to several predictors has been used in the following form:

$$\boldsymbol{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon}$$

where Y is the continuous response variable, β are regression coefficients, X is a vector of the independent variables, and the random variable ε is the error term in the model.

The continuous response variables to this model are WTP-LIH and WTP-BFG. A linear regression model approach was then applied in three different contexts, in function of the explanatory variables considered. Model 1 considered the principal components (1 - 4) in addition to the dichotomy variables LIH and BFG, respectively. Model 2 considered all of Model 1 in addition to gender, age, income earners, income, family situation and contaminant limits. Model 3 considered all independent variables of Model 2, in addition to the store. This three-model approach allowed for the observation of any significant effects arising from the addition of variables. For any regression variable coefficient of the model to be considered statistically significant, the p-value must be <0.10.

3. Results

Table 2 shows the descriptive characteristics of the socioeconomic situations of the studied locations, which were not statistically significant (p>0.05). Although male respondents participated

less frequently in Palermo (46.0%) and more in Milano (50.4%), according to our stratified random sampling the overall age of respondents was spread from 18 to >65 years old, with majority of age classes in the 46-65 range (Palermo =49.4%; Milano = 41.2%). Time and cost constraints allowed us to reach the predefined quota sampling for each strata only roughly, mainly for the age group 18 – 25. Additionally, other dominant demographic information of the studied locations included "other family situation" (Palermo =87.0%; Milano = 91.6%) and "income earners" (Palermo = 77.6%; Milano = 82.0%). Moreover, four income classes were considered, the most represented of which was 00-1999 (Palermo=58.8%; Milano =57.4%). The age and income of the two studied locations were weakly (P=0.055) and strongly (P=0.035) significantly different, respectively.

Table 2. Descriptive characteristics of the socioeconomic situation of Palermo and Milano.

Variables	**Definition**	**Palermo**				**Milano**				
		N	% Dis.	Mean	SD	N	% Dis.	Mean	SD	P-value*
Gender	Male	322	45.96			238	50.42			0.944
	Female		54.04				49.58			
Age (years)	18-25		2.17	21.57	2.57		2.10	21.80	1.92	0.055
	26-45		28.88	35.50	4.95		39.50	35.58	5.85	
	46-65		49.38	55.80	5.82		41.18	55.09	5.82	
	>65		19.57	72.90	4.76		17.23	73.54	4.23	
Family Situation	Living alone	308	12.99			215	8.37			0.945
	Other family situation		87.01				91.63			
Income earners	Yes	311	77.60			217	82.03			0.960
	No		22.40				17.97			
Income (€)/month	<1000		14.47	703.29	141.42		8.80	732.58	156.02	0.035
	1000-1999		58.84	1507.21	279.79		57.41	1541.02	281.62	
	2000-3000		20.90	2364.40	292.13		27.78	1808.93	461.34	
	>3000		5.79	3317.11	279.50		6.02	3532.46	294.00	

* K-S test - nonparametric Kolmogorov-Smirnov test

The overall consumer response on an acceptable price premium collected during the interview process is reported in Figure 1, which shows the acceptable price premiums for seafood catches from LIH and BFG. Ninety-five percent of the respondents were willing to pay a price premium for LIH and BFG, whereas the rest would not be willing to pay more. The two most frequently stated price premiums for LIH and BFG were 1 - 10% and 11 - 20%, with approximately 70% of the overall number of respondents willing to pay these premiums. In particular, for LIH the availability of the respondents was 48% for the price premium range of 1 - 10% and 27% for 11-20%, whereas for BFG it was 35% in both of these price premium ranges.

Figure 1. Overall consumer responses to acceptable price premiums comparing seafood catch from low-impact habitats (*LIH*) and certified 'Blue' fishing grounds (*BFG*).

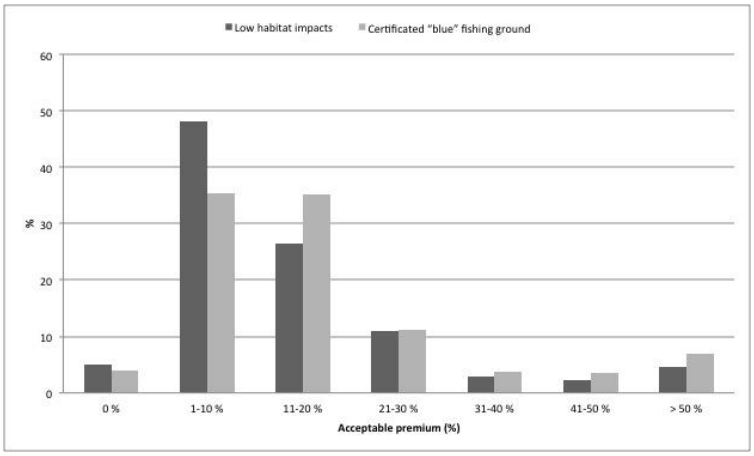

Table 3 shows the rotated component matrix of the factorial weights complementing the consumers' responses. At component one (1), PCA revealed a significant difference ($P<0.05$) for specialized fishing and scientific magazines, professional publications, campaigns and documents for environmental NGOs, and initiatives emanating from ministries and/or local authorities. Conversely, TV, newspapers, and the internet, along with air pollution, climate change, and high catches statistically differed ($P<0.05$) for components two (2) and three (3), respectively. In addition, occupation and belonging to a fisherman's family statistically differed for component four (4) ($P<0.05$). Considering these factorial weights, it was possible to contextualize these 'latent' variables, which enabled the construction of the main components employed in the probit and linear models. The identified components included the following: No. 1= Means of technical communication; No. 2= Attention to fish quality; No. 3= Attention to environmental features; and No. 4= Means of mass communication.

Table 3. Rotated component matrix of weighable factors complementing consumers' responses.

Weighable factors	Component			
	1	2	3	4
Environmental impact	.032	.068	.068	.024
Pollution	.070	-.102	**.731**	.121
Climate change	.010	-.039	**.846**	.006
High catches	.056	.280	**.531**	-.097
Other causes of danger for fish	-.038	.046	-.024	.009
Occupation	-.058	.046	-.010	**.805**
Member of the family of fishermen	.081	-.010	.086	**.720**
Common Fisheries Policy	.090	.497	-.062	.060
Laws and regulations	-.026	-.015	-.057	.142
Fisher meets regulation (Legal requirement)	-.020	-.034	.051	-.226
TV	.007	**.778**	-.018	-.030
Daily/Weekly Newspapers	.096	**.785**	-.052	.011
Specialized fishing magazines	**.428**	.412	.113	.091
Scientific magazines	**.695**	.208	.050	.033

Internet	.406	**.444**	.077	.083
Publications from professionals	**.773**	.106	.040	-.008
Campaigns and documents for environmental NGOs	**.787**	.030	.007	.031
Initiatives emanating from Ministries and/or Local Bodies	**.768**	-.105	.005	-.058
Other source of information	.039	-.143	-.023	.009

Extraction method: Principal component analysis (PCA). Rotation method: Varimax with Kaiser's normalization. Bold digits are statistically significant (P<0.05)

Table 4 shows all variables considered in the analyses as well as their descriptive statistics. Of 16 variables, half were dummy (LIH, BFG, Gender, Income earners, Family situation, Contaminants, Store and Other eco-products), 7 were continuous (WTP-LIH, WTP-BFG, Income, Means of technical communication (C1), Attention to fish quality (C2), Attention to environmental features (C3), Means of mass communication (C4)) and 1 discrete (Age).

Table 4. Variables and their descriptive statistics.

Variable	Description	Mean	SD
LIH	Dummy variable for BFG Label, 1 if present, 0 if not	0.969	-
BFG	Dummy variable for LIH Label, 1 if present, 0 if not	0.945	-
WTP-LIH	Continuous variable to indicate the WTP for product with LIH Label, € /Kg	0.931	1.155
WTP-BFG	Continuous variable to indicate the WTP for product with BFG Label € /Kg	1.190	1.434
Gender	Dummy variable for Male and Female sex: 1 if Female, 0 if Male	0.521	-
Age	Discrete variable, minimum value 18 years	51.40	15.10
Income earners	Dummy variable: 1 if employed, 0 if not	0.794	-
Income	Continuous variable, € /month	1732	657.249
Family situation	Dummy variable: 1 if other family situation, 0 if living alone	0.889	-
Means of technical communication (C1)	Continuous variable to indicate the first principal component	-	-
Attention to fish quality (C2)	Continuous variable to indicate the second principal component	-	-
Attention to environmental features (C3)	Continuous variable to indicate the third principal component	-	-
Means of mass communication (C4)	Continuous variable to indicate the fourth principal component	-	-
Contaminant limits	Dummy variable to indicate if contaminant limits is known: 1 if so, 0 if not	0.659	-
Store	Dummy variable for store city, 1 if Milano, 0 if Palermo.	0.425	-
Other eco-products	Dummy variable to indicate if other eco-products are bought: 1 if so, 0 if not	0.430	-

Notes: Mean and SD not reported for principal component; SD not reported for dummy variables.

Table 5 shows the results of the measurement of consumers' awareness to eco-labels in the models. Models 1 and 2-LIH measured the effect of independent variables on LIH (as dependent variable). Similarly, Models 1 and 2-BFG measured the effect of independent variables on BFG. The full probability models were defined as follows:

$$\begin{aligned}&\boldsymbol{Pr(LIH = 1 \mid X = x_i)}\\&\quad = \boldsymbol{\Phi(\beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Income\ earners + \beta_4 Income}\\&\quad \boldsymbol{+ \beta_5 Family\ situation + \beta_6 C1 + \beta_7 C2 + \beta_8 C3 + \beta_9 C4}\\&\quad \boldsymbol{+ \beta_{10} Contaminant\ limits + \beta_{11} Store + \beta_{12} Other\ eco\ products)}\end{aligned}$$

$$\begin{aligned}&\boldsymbol{Pr(BFG = 1 \mid X = x_i)}\\&\quad = \boldsymbol{\Phi(\beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Income\ earners + \beta_4 Income}\\&\quad \boldsymbol{+ \beta_5 Family\ situation + \beta_6 C1 + \beta_7 C2 + \beta_8 C3 + \beta_9 C4}\\&\quad \boldsymbol{+ \beta_{10} Contaminant\ limits + \beta_{11} Store + \beta_{12} Other\ eco\ products)}\end{aligned}$$

It was found that non-"income earners" were more sensitive to LIH (P<0.01). Conversely, "income" and "other eco-labeled product" purchases influenced BFG (Model 2-BFG) (P<0.01). Adding more variables (prior to running the model) appears to contribute to significantly revealing the respondents' "attention to environmental features" (Component 3) of both LIH and BFG, considering its increasing variable coefficient values between Models 1 and 2. For both LIH and BFG, although adding more variables would improve the statistically significant detectability of the variable coefficient of interest, it would do so to the slight detriment of the robustness of the model given the AIC value reductions from 142.89 (Model 1-LIH) to 140.96 (Model 2-LIH) and 177.48 (Model 1-BFG) to 155.71 (Model 2-BFG). In addition, although it may seem less than ideal that the intercept of Models 1 and 2-BFG were not statistically significant, it did not affect in any way their robustness and validity.

Table 5. Models delineating the variables that affect the decision to buy seafood catch from low-impact habitats (LIH) and certified 'Blue' fishing grounds (BFG)

Variables	LIH		BFG	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Intercept	**2.6306*** **	**2.546*** **	1.0826	0.1225
	(0.7718)	(0.8155)	(0.6834)	(0.7551)
Gender	-0.1407	-0.1636	0.1721	0.2730
	(0.2505)	(0.2648)	(0.2366)	(0.2686)
Age	-0.0091	-0.0115	0.0035	0.0061
	(0.0080)	(0.0085)	(0.0073)	(0.0082)
Income earners	**-0.7774*** **	**-0.7929*** **	0.0595	0.1173
	(0.4450)	(0.4807)	(0.2654)	(0.3016)
Income	0.0001	0.0001	**0.0005*** **	**0.0006*** **
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Family situation	0.2951	0.3986	-0.5351	-0.5039
	(0.3171)	(0.3375)	(0.4783)	(0.5256)
Means of technical communication (C1)	0.1148	0.1063	-0.0331	-0.0307

	(0.1737)	(0.1793)	(0.0454)	(0.0525)
Attention to fish quality (C2)	-0.0597	-0.0576	-0.0409	-0.0729
	(0.0763)	(0.0810)	(0.0670)	(0.0750)
Attention to environmental features (C3)	0.1182	**0.1362*** **	**0.1503*** **	**0.1681*** **
	(0.0762)	(0.0811)	(0.0677)	(0.07959)
Means of mass communication (C4)	0.0625	0.0395	0.0003	-0.0661
	(0.1001)	(0.1025)	(0.0782)	(0.0868)
Contaminant limits		0.0328		0.3880
		(0.2676)		(0.2583)
Store		-0.1549		-0.1186
		(0.2686)		(0.2811)
Other eco-products		0.3054		**0.9843*** **
		(0.2701)		(0.3375)
Null deviance	135.29	129.71	175.30	164.76
Residual deviance	122.89	114.96	157.48	129.71
AIC	142.89	140.96	177.48	155.71

Key: C1-C4: Components 1-4; Levels of statistical significance: <0.01 (***); <0.05 (**); <0.10 (*); bolded digits indicate also statistically significant values

Table 6 shows the results of the estimation of WTP in the models. Models 1, 2 and 3 WTP-LIH measured the effect of independent variables on "WTP-LIH" (as dependent variable). Similarly, Models 1, 2 and 3 WTP-BFG evaluated the effect of independent variables on "WTP-BFG". The full linear models were defined as follows:

$$\boldsymbol{WTP-LIH} = (\boldsymbol{\beta_0} + \boldsymbol{\beta_1} Gender + \boldsymbol{\beta_2} Age + \boldsymbol{\beta_3} Income\ earners + \boldsymbol{\beta_4} Income + \boldsymbol{\beta_5} Family\ situation + \boldsymbol{\beta_6} C1 + \boldsymbol{\beta_7} C2 + \boldsymbol{\beta_8} C3 + \boldsymbol{\beta_9} C4 + \boldsymbol{\beta_{10}} Contaminant\ limits + \boldsymbol{\beta_{11}} Store + \boldsymbol{\beta_{12}} Other\ eco\ products)$$

$$\boldsymbol{WTP-BFG} = (\boldsymbol{\beta_0} + \boldsymbol{\beta_1} Gender + \boldsymbol{\beta_2} Age + \boldsymbol{\beta_3} Income\ earners + \boldsymbol{\beta_4} Income + \boldsymbol{\beta_5} Family\ situation + \boldsymbol{\beta_6} C1 + \boldsymbol{\beta_7} C2 + \boldsymbol{\beta_8} C3 + \boldsymbol{\beta_9} C4 + \boldsymbol{\beta_{10}} Contaminant\ limits + \boldsymbol{\beta_{11}} Store + \boldsymbol{\beta_{12}} Other\ eco\ products)$$

Overall, "attention to fish quality" (Component 2) was consistently of high statistical significance ($P < 0.01$) for WTP-LIH and WTP-BFG, regardless of which model was used. "Attention to environmental features" (Component 3) and "means of mass communication" (Component 4) were statistically significant ($P < 0.10$) for WTP-LIH Models and for WTP-BFG Model 2. Furthermore, WTP-LIH Model 2 and WTP-BFG Models recorded the higher number of significant dependent variables, such as "gender", "income earners", "family situation", "attention to fish quality", "attention to environmental features" and "means of mass communication". It is worth highlighting that for WTP-BFG Model 1, the dependent variable BFG was also statistically significant ($P<0.05$). In addition, the dependent variable "store" in WTP-LIH Model 3 and WTP-BFG Model 3 was significant ($P<0.01$). Moreover, the model of variables resulted in an increase in explained variance (R-sq - adjusted) at either WTP-LIH or WTP-BFG from 0.0995 up to 0.4635 and 0.0777 up to 0.3753, respectively. However, this does not increase the statistically significant detectability of model variable coefficients that might be of interest.

Table 6. Models delineating factors that affect consumers' willingness to pay for eco-labeled anchovy from either "fishing gear with low impact on habitats" (WTP-LIH) or "fish caught in certified 'blue' fishing grounds" (WTP-BFG)

Variables	WTP – LIH			WTP - BFG		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Intercept	**5.8173*** **	**6.4480*** **	**6.9990*** **	**5.0615*** **	**5.0977*** **	**6.4760*** **
	(0.4559)	(6.5820)	(0.5106)	(0.6690)	(0.9003)	(0.7582)
Gender		**0. 3606** **	**0.3297** **		**0.4738** **	**0.4620** **
		(0.1771)	(0.1371)		(0.2295)	(0.1908)
Age		0.0006	-0.0063		0.0055	-0.0028
		(0.0056)	(0.0044)		(0.0072)	(0.0060)
Income earners		**-0.3563***	-0.0034		-0.3308	0.0638
		(0.2630)	(0.1723)		(0.2799)	(0.2353)
Income		0.0000	0.0000		0.0001	0.0000
		(0.0001)	(0.0000)		(0.0001)	(0.0001)
Family situation		**-0.6731*** **	-0.3028		**-0.5164***	-0.2386
		(0.2560)	(0.1995)		(0.3138)	(0.2621)
Means of technical communication (C1)	0.0514	0.0438	0.0081	0.0250	0.0301	0.0013
	(0.0368)	(0.0409)	(0.0317)	(0.0423)	(0.0445)	(0.0371)
Attention to fish quality (C2)	**0.2753*** **	**0.2669*** **	**0.1291*** **	**0.2961*** **	**0.3147*** **	**0.1510*** **
	(0.0460)	(0.0529)	(0.0419)	(0.0606)	(0.0677)	(0.0580)
Attention to environmental features (C3)	**0.1579*** **	**0.1178***	**0.0764***	0.0995	0.0727	0.0948
	(0.0519)	(0.0611)	(0.0474)	(0.0702)	(0.0768)	(0.0639)
Means of mass communication (C4)	**0.1412*** **	**0.1821*** **	**0.1230*** **	0.0990	**0.1651** **	0.0787
	(0.0521)	(0.0583)	(0.0453)	(0.0684)	(0.0755)	(0.0632)
Contaminant limits		-0.1370	-0.0880		-0.0815	-0.0088
		(0.1735)	(0.1343)		(0.2184)	(0.1818)
Store			**-2.1060*** **			**-2.1850*** **
			(0.1371)			(0.1987)
Other eco-products		-0.2582	0.0210		-0.3178	-0.0268
		(0.1639)	(0.1281)		(0.2130)	(0.1789)
LIH	0.2772	0.4499	0.2791			
	(0.4618)	(0.4919)	(0.3809)			
BFG				**1.4781** **	**1.6027** **	0.6757
				(0.6782)	(0.7006)	(0.5881)
R-square (Adjusted)	0.0995	0.1041	0.4635	0.0777	0.0963	0.3753
No of cases	454	364	364	350	307	307

Key: C1-C4: Components 1-4; Levels of statistical significance: <0.01 (***); <0.05 (**); and <0.10 (*); bolded digits indicate also statistically significant values

4. Discussion

The profile of consumers that would favor the eco-labeled anchovy product was skewed toward females of 50 years of age and above, in a family, with high income and a strong intrinsic motivation to protect marine habitats and the sustainable exploitation of marine resources. With respect to gender, our results tend to agree with the literature that female WTP is higher frequent [23, 16]. Across countries, the results of studies on the contribution of income and gender to the decision to purchase eco-labeled products have been mixed. For example, in Norway [3], China [23] and Mexico [7] income and gender play an important role, as well the environmental features. For eco-labeled seafood, females are likely pay more attention to environmental concerns and, accordingly, they could be more willing to pay a higher price [3, 23, 24]. Similar results have been reported in Norway, where female consumers show a greater likelihood to select the eco-labeled seafood; this result appears different from those reported for the United States [21]. Although males show greater concern for the environment in China [17, 22], in France they show more attention to fishing conditions than females [3].

This study has also revealed that consumers' attitudes about purchasing seafood from LIH is not be associated with "income", but could instead be associated with non-"income earners" in part, and more significantly with "environmental features" (Component 3). The contrary appears to be the case when the awareness of BFG is considered. This has statistical significance with "income" and "other eco-label products" purchases, which in turn could also relate to "environmental features" (Component 3). Based on the AIC of both LIH and BFG, the validity of Models 1 and 2 was unaffected since the variable coefficient of interest is statistically detected, even though adding more variables would be to the slight detriment of its robustness.

Most likely, the intrinsic motivation of consumers may be associated with aspects primarily related to LIH rather than to BFG, thus offering relative confirmation for the observations of Brécard et al. [16]. In addition, participants in our study attributed very high significance to "attention to fish quality", which is fundamental in decision-making for WTP. In turn, this appears consistent with results reported by studies conducted in wider contexts such as Europe [16] and worldwide [17, 19]. There is also some evidence that the exploitation level of a given species, the condition of the product (fresh/frozen) and visual aspects, along with the harvesting process (wild vs. farmed), determine how consumers respond to an eco-labeled seafood product [16].

Other empirical studies regarding WTP have also highlighted that consumers perceive seafood with sustainable fishing labels in a different category compared to fish products overall [21, 25]. Moreover, WTP differs based on the type of seafood product, the initial price and consumers' sociodemographic characteristics [16-19, 21, 22, 26]. Indeed, the influence of the initial price of eco-labeled seafood species on WTP has been assessed, for example, in the United States and Norway, where consumers appeared more willing to pay for low-priced eco-labeled cod than for higher priced shrimp [21]. Our results of the eco-label anchovy appear to be in line with those of the above-mentioned studies on low-priced species. Based on this premise, a higher WTP—for instance, up to 95%—was found compared to that which might have been obtained with higher-priced species. Our understanding appears to be in line with the experience shared by Goyert et al. [19] in relation to eco-labeled lobster species in the US market, which revealed lower WTP (36%) compared to those obtained in other studies [17, 18].

In our study, the price premium for eco-labeled anchovies ranged mostly between 1-20% with an average premium for WTP-LIH and WTP-BFG of 11.9% and of 13.2% respectively. These percentages are conservative values compared to the consideration of all consumers' WTP. Indeed, if consumers had been willing to pay, the expected average premium on the initial price could probably be in the range of 20 - 30% for our proposed eco-labeled anchovy. Erwann [19] calculated a price premium of approximately 13% for pollock (*Gadus chalcogrammus*), even though the premium was considered relative to the overall willing to pay of consumers (approximately 81% of

respondents). Similarly, for frozen, processed pollock, using a hedonic analysis of MSC, Roheim et al. [27] revealed a premium of approximately 14%.

As previously mentioned, we selected two AUCHAN S.p.A. store locations not only to differentiate between the two different geo-economic locations (Palermo and Milano) but also to offer a picture of the totality of the studied population from a holistic perspective, so that it could be applied in any typical sampled heterogeneous mix of any other population. Indeed, the stores' statistical significance ($P<0.001$) could be measured as consumers considered WTP-LIH and WTP-BFG (Model 3).

Therefore, the fact that "stores" would easily show high statistical significance in context of WTP (Models 3) demonstrated their importance compared to income and family situation in both eco-labels. The "store" did not affect the respondents' "attention to fish quality" significantly, but did slightly affect "means of mass communication", given its statistical insignificance ($P>0.05$) to the BFG eco-label. "Attention to fish quality" (Component 2) and "environmental features" (Component 3) aside, we argue that the awareness created by mass communication seems to have played a vital role (Component 4). It appears therefore that eco-labels can be less effective if they are not part of a wider shared, well-defined and co-managed system of fishing governance [28].

5. Conclusions

In this article, consumer responsiveness to eco-labeled seafood products was successfully measured through a robust modeling approach drawn from the relevant literature. This study allowed us to emphasize that environmental features and income, together with other eco-label product purchases, significantly influence consumer response to eco-labeled seafood product. In addition, WTP was strongly related to income, family situation, attention to fish quality and environmental features, along with information from mass media. According to our analysis, a possible premium on an initial price would range between 12-13%. Furthermore, the novelty of our investigation consists in finding a higher appreciation of Italian consumers for seafood eco-labels related to health compared to those solely related to ethical issues. The consumers' willingness to pay for these reveals a new aspect of the "ecosystem approach to fishery management" that could improve the development of new measures to manage over-exploited Mediterranean fishing resources. Accordingly, stakeholders should welcome this new rationale for curbing marine resource overexploitation, pushing producers to implement strong environmental preservation measures.

Acknowledgments: This study was conducted under the framework of "Laboratorio 1: sostenibilità e responsabilità sociale" in the project "Centro di certificazione e prova del distretto" - "Linea di intervento: 5.1.1.1 – Art. 36 Reg. (CE) Nr. 800/2008", funded by Sicilian Region. Thanks to AUCHAN S.p.A., particularly Stefano Favari, Paolo Mazzoleni, Libero Di Paola, Francesco D'India, Giuseppe Di Lonardo. We appreciate the support of our CNR colleagues, particularly Maria Bonsignore, Marianna Del Core, Sandro Fiorelli, Nunzio Gallì, Marta Giuga, Marianna Musco, Carlo Patti, Valentina Sclifò, and Anna Traina for conducting the interviews.

References

[1] Nguyen, L.Q.; Du, Q.; Friedrichs, Y.V. Effectiveness of Eco-label? A study of Swedish University Students' Choice on Ecological Food. Master Thesis, Umeå School of Business, Swedish, 2010.

[2] FAO. Available online: http://www.fao.org/docrep/005/v9878e/v9878e00.htm (accessed on 13.06.2018).

[3] Brécard, D.; Lucas, S.; Pichot, N.; Salladarré, F. Consumer Preferences for Eco. Health and Fair Trade Labels. An Application to Seafood Product in France. *J. Agr. Food. Ind. Organ.* **2012**, *10*, 1-27.

[4] WBCSD. Available online: http://www.wbcsd.org/Clusters/Sustainable-Lifestyles/Resources/Sustainable-Consumption-Fact-and-Trends-From-a-Business-Perspective (accessed on 13.06.2018)
[5] Clonan, A.; Holdsworth, M.; Swift, J.A.; Leibovici, D.; Wilson, P. The dilemma of healthy eating and environmental sustainability: the case of fish. *Public Health Nutr.* **2011**, *15*, 277–284.
[6] Jonell, M.; Crona, B.; Brown, K.; Rönnbäck, P.; Troell, M. Eco-Labeled Seafood: Determinants for (Blue) Green Consumption. *Sustainability* **2016**, *8*, 884, doi: 10.3390/su8090884.
[7] Pérez-Ramírez, M.; Almendarez-Hernández, M.; Avilés-Polanco, G.; Beltrán-Morales, L.F. Consumer Acceptance of Eco-Labeled Fish: A Mexican Case Study. *Sustainability* **2015**, *7*, 4625-4642.
[8] Gutierrez, A.; Thornton, T.F. Can Consumers Understand Sustainability through Seafood Eco-Labels? A U.S. and UK Case Study. *Sustainability* **2014**, *6*, 8195-8217.
[9] Jaffry, S.; Pickering, H.; Ghulam, Y.; Whitmarsh, D.; Wattage, P. Consumer choices for quality and sustainability labeled seafood products in the UK. *Food Policy* **2004**, *29*, 215–228.
[10] Johnston, R.J.; Roheim, C.A. A battle of taste and environmental convictions for ecolabeled seafood: a contingent ranking experiment. *J. Agr. Resour. Econ*. **2006**, *31*, 283-300.
[11] Whitmarsh, D.; Wattage, P. Public attitude towards the environmental impact of salmon aquaculture in Scotland. *E. Environ.* **2006**, *16*, 108-121.
[12] Salladarré, F.; Guillotreau, P.; Perraudeau, Y.; Montfort, M.C. The demand for seafood eco-labels in France. *J. Agr. Food. Ind. Organ.* **2010**, *8*, doi:10.2202/1542-0485.1308.
[13] Wessells, C.R.; Johnston, R.J.; Donath, H. Assessing consumer preferences for ecolabeled seafood: the influence of species, certifier and household attributes. *Am. J. Agr. Econ.* **1999**, *81*, 1084-1089.
[14] Ward, T.; Phillips, B. *Seafood Ecolabelling. Principles and Practice,* 1st ed.; John Wiley & Sons Blackwell Publishing: Oxford, United Kingdom, 2008.
[15] Pieniak, Z.; Verbeke, W.; Scholderer, J.; Brunsø, K.; Olsen, S.O. European Consumers' Use of and Trust in Information Sources About Fish. *Food Qual. Prefer.* **2007**, *18*, 1050–1063.
[16] Brécard, D.; Hlaimi, B.; Lucas, S.; Perraudeau, Y.; Salladarré, F. Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecol. Econ.* **2009**, *69*, 115–125.
[17] Xu, P.; Zeng,Y.; Fong, Q.; Lone, T.; Liu, Y. Chinese consumers' willingness to pay for green- and eco-labeled seafood. *Food Control* **2012**, *28*, 74-82.
[18] Erwann, C. Eco-labelling: A new deal for a more durable fishery management? *Ocean Coast. Manage.* **2009**, *52*, 250–257.
[19] Goyert, W.; Sagarin, R.; Annala, J. The promise and pitfalls of Marine Stewardship Council certification: Maine lobster as a case study. *Mar. Policy* **2010,** *34*, 1103–1109.
[20] Hotelling, H. Analysis of a Complex of Statistical Variables Into Principal Components. *J. Educ. Psychol.* **1933**, *24*, 417-441.
[21] Johnston, R.J.; Wessells, C.R.; Donath, H.; Asche, F. Measuring Consumer Preferences for Ecolabeled Seafood: An International Comparison. *J. Agr. Resour. Econ.* **2001**, *26*, 20-39.
[22] Shen, J. Understanding the Determinants of Consumers' Willingness to Pay for Eco-Labeled Products: An Empirical Analysis of the China Environmental Label. *J.S.S.M.* **2012**, *5*, 87-94.
[23] Carlsson, F.; Johansson-Stenman, O. Willingness to pay for improved air quality in Sweden. *Appl. Econ.* **2000**, *32*, 661-669.
[24] Dupont, D.P. Do children matter? An examination of gender differences in environmental valuation. *Ecolog. Econ*. **2004**, *49*, 273-286.
[25] Andrewwstevens. Available online: http://andrewwstevens.com/wp-content/uploads/2015/06/Seafood.pdf (accessed on 13.06.2018).
[26] Zhou, G.; Hu, W.; Huang, W. Are Consumers Willing to Pay More for Sustainable Products? A Study of Eco-Labeled Tuna Steak. *Sustainability* **2016**, *8*, 494, doi: 10.3390/su8050494
[27] Roheim, C.A.; Asche, F.; Santos, J.I. The elusive price premium for ecolabeled products: Evidence from seafood in the UK market. *J. Agr. Econ.* **2011**, *62*, 655–668.
[28] Pipitone, V.; Colloca, F. Recent trends in the productivity of the Italian trawl fishery: the importance of the socio economic context and overexploitation. *Marine Policy*, **2018**, *87*, 135–140; doi:10.1016/j.marpol.2017.10.017.