

Article

Investigating the Acceptance of a New Bivalve Product in the Greek Shellfish Market: The Non-Indigenous Pearl Oyster *Pinctada imbricata radiata*

Dimitrios K. Moutopoulos ^{*}, Vasileios Minasidis, Athina Ziou, Alexandra S. Douligeri, George Katselis and John A. Theodorou

Department of Animal Production, Fisheries and Aquaculture, University of Patras, 265 04 Mesolongi, Greece; billmhnas@gmail.com (V.M.); athinaziou@gmail.com (A.Z.); alexandra.douligeri@gmail.com (A.S.D.); gkatselis@upatras.gr (G.K.); jtheo@upatras.gr (J.A.T.)

* Correspondence: dmoutopo@upatras.gr

Abstract: Greece exhibits the lowest seafood per capita consumption amongst European Mediterranean countries, and the investigation of consumer attitudes to new seafood products would bridge the gap among producers and consumers by promoting the vertical integration of the supply chain. However, limited information exists about consumer preferences for bivalves in the Mediterranean and for wild bivalves in particular. The present study aims to investigate, for the first time, consumers' attitudes towards the purchase and consumption of bivalves, and more specifically, towards the edible pearl oyster *Pinctada imbricata radiata*, in the Greek shellfish market. Adult participants from the entire country completed a questionnaire covering the basic marketing aspects of bivalve and pearl oyster consumption, such as choice, purchase, reasons for consuming bivalves, confidence in product's hygiene certification, media influence, etc. Data analysis included uni- and multi-variate statistics to examine the possible relations between the consumers' demographics and socio-economic characteristics, and bivalve marketing aspects. Results showed that the majority of Greek consumers chooses traditional shellfish shops for purchasing pearl oysters, prefers a certification of quality, and trusts the confirmation provided by the veterinary authorities. Consumers' attitudes vary considerably according to their demographics and socio-economic characteristics. Multivariate models revealed that the married, highly educated consumers that live in urban places were more reluctant to try new shellfish products and to accept an innovative way of market supply. The results reflect the positive attitude of Greek consumers towards the consumption of pearl oyster, a fact that would be helpful for decision makers in the planning of production, which in turn would promote bivalve consumption in the Greek shellfish market.

Keywords: non-indigenous species; consumer perceptions; seafood market; Mediterranean



Citation: Moutopoulos, D.K.; Minasidis, V.; Ziou, A.; Douligeri, A.S.; Katselis, G.; Theodorou, J.A. Investigating the Acceptance of a New Bivalve Product in the Greek Shellfish Market: The Non-Indigenous Pearl Oyster *Pinctada imbricata radiata*. *J. Mar. Sci. Eng.* **2022**, *10*, 251. <https://doi.org/10.3390/jmse10020251>

Academic Editor: Pedro Reis Costa

Received: 18 December 2021

Accepted: 8 February 2022

Published: 12 February 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The EU Commission has adopted Strategic Guidelines, aimed at enhancing a sustainable and competitive sector and ensuring high standards of consumer protection, animal welfare and environmental sustainability [1]. Such a challenge reflects the global tendency to facilitate the transition of supply chains towards more efficient and sustainable production and consumption [2]. The new reform of the Common Fisheries Policy [3] has several goals, as follows: (a) to improve the organization of seafood markets and to encourage the representative participation of small-scale producers, (b) to inform consumers about the value of seafood consumption and to promote the consumption of existing species that are available, and (c) to raise the consumers' awareness of health and safety issues surrounding seafood products. Shellfish markets consist of different categories of entrepreneurs in the fisheries sector and they have the potential to improve the coordination of marketing

activities within the shellfish supply chain. This would improve the availability of certain products in the shellfish market and ensure a high level of the protection of food hygiene.

Bivalves are more than just a nutritious food product, as they are providers of ecosystem services through water filtration [4–8]. A few studies have also examined bivalves in terms of market reactions to food processing and food safety labeling [9–11], but little is known about consumer demand on new bivalve products in the Mediterranean, and for wild bivalves in specific [12–16]. Despite the presence of a wide range of bivalve species in the Greek seas, public consumption is restricted to specialty seafood restaurants and local “tapas”-like bars [17], as bivalves are not considered a “safe” seafood [18] due to shellfish poisoning incidents that have occurred. The Greek shellfish market is in a state of standstill [17]; most of the Greek shellfish production is exported to European markets, mainly to Italy and France, and products that are not exported are forwarded locally to a small number of restaurants and fishmongers. The demand for shellfish products in Greece has not increased, and the country’s seafood per capita consumption is still limited (almost 5%: [17]), remaining well below the European mean value [19].

The Greek consumers’ attitude to shellfish has been rapidly changing, mainly due to socio-economic changes, such as the improvement in standards of living, the great expansion of the media, the promotion of biological products, the development of the tourism industry, etc. [17] The study of consumer attitudes towards new shellfish products would boost consumption in Greek markets and would be extremely beneficial for a more rational organization of the shellfish market’s distribution roots. This is particularly important in the economy of the fisheries-dependent coastal areas of the European Union. The rayed pearl oyster, *Pinctada imbricata radiata*, a non-indigenous species of Indo-Pacific origin, has been reported in the Aegean since the mid-1960s and has also been reported recently in the Ionian Sea [17]. Although the species was categorized as having minor commercial interest [18], it is harvested for edible purposes, especially in the areas with high natural stock availability, such as the central Aegean Sea [19]. Given the need to control the expansion of invasive species, scientists have proposed the gastronomy of the corresponding edible species as one of the measures to control their spatial expansion into the marine ecosystem [20].

In this context, the present study aims to investigate the consumers’ preferences towards bivalves, and the pearl oyster in particular, in order to estimate their willingness to purchase various types of bivalves, and to delineate their demographic characteristics. This will provide much needed information for the development and expansion of bivalves in the Greek shellfish market.

2. Materials and Methods

2.1. Survey Design

The questionnaire consisted of two sections (Figure A1 in Appendix A). The first section consisted of 28 questions, covering consumers’ preferences and their attitudes towards various shellfish marketing aspects, and included questions focused on the potential purchase of pearl oysters. The second section included the demographic characteristics of the consumers participating in the survey. More specifically, the first section included questions regarding the frequency and quantity of shellfish purchased at a time, the points of purchase, the season of shellfish consumption, the reasons for consuming shellfish, and the frequency of shellfish consumption out of home. Special attention was given to the criteria of participants’ choice (size of the shellfish species, price, freshness, appearance of the shell, hygiene conditions of the fish shop, shellfish packaging and sea of origin) and their importance when buying shellfish. Furthermore, trends concerning shellfish, such as frequency of consumption according to preferred species, certification of shellfish quality, sea of origin and ready-to-eat shellfish, have been recorded. The questions also covered the influence of the media, as well as the consumers’ confidence in the veterinary competent authorities regarding the confirmation of shellfish hygiene and consumer safety, and whether the consumers faced a health problem from eating shellfish. Questions re-

garding the order of preference on specific types of pearl oyster products, the desirable purchase quantity and the material of the package were also included. The second section collected general information about the consumers regarding seven demographic and socio-economic characteristics, namely, gender, householder's age and place of residence, education level, profession, marital status and number of children in the family.

Special care was given to multi-thematic questions, which were those including more than one theme, such as the questions evaluating the different levels of criteria of participants' choice (size of the shellfish species, price, freshness, appearance of the shell, hygiene conditions of the fish shop, shellfish packaging and shellfish sea of origin) using a 3-Likert scale (1 = very important, 2 = important and 3 = insignificant). Other important multi-thematic questions included the frequency of choice of the specific bivalve species that the consumers prefer, based on a 5-Likert scale (1 = almost never, . . . , 5 = very often) and the intensity of press articles or media announcements about shellfish hygiene (e.g., toxins, heavy metals that affect the consumers, etc.) (1 = none, . . . , 5 = very much) when buying shellfish.

Interviews were carried out with consumers who were aged 18 and over and who were primarily responsible for purchasing food for their household. Interviews were carried out during spring and summer 2020, through personal, face-to-face interviews. The interviews were carried out at supermarkets and fish markets, where people were approached randomly.

2.2. Data Analysis

A sample of the population was selected [21] and interviews were carried out in two phases [12,13]. Interviews were conducted based on a stratified sampling method in the first phase, and a three-stage random cluster sampling method in the second phase, comprising one adult per family, namely, the one making the purchasing decisions [12]. Although the last population census in Greece took place a decade ago and the most recent one (in 2021) has yet to be published, it is conceivable that updated data would have the same characteristics. The sample is representative of the population, at least in the proportions of gender, age and place of residence. According to the Hellenic Statistical Authority [21], in the 2011 population census survey, the gender ratio was approximately 1:1 (49.0% male, 51.0% female), the average age of the Resident Population of Greece was 41.9 years, while the proportion of residents living in urban and rural areas was 76.6% and 24.3%, respectively [21].

The percentage contribution of the levels of each demographic feature was estimated. A uni-variate chi-square (χ^2) procedure was performed to examine the possible relationship between a respondent's demographic and socio-economic status, and their preferences and attitudes towards bivalves, and pearl oysters specifically. In case of significant relationships, the Adjusted Standardized Residuals in the crosstabulation tables were carefully examined to detect any differences in the observed and expected values [22].

A reliability analysis on multi-thematic questions was also conducted. This analysis refers to the property of a measurement that causes it to give similar results for similar inputs. Cronbach's alpha coefficient is a measure of reliability, which is defined as the proportion of variability in the responses to the survey, that is the result of differences in the respondents [23].

Multi-variate analyses were also applied to the multi-thematic questions. The categorical regression method with optimal scaling, constitutes an improvement and extension of the classic linear regression method, which quantifies the data of categorical variables, by attributing numerical values to the categories, resulting in an optimal linear regression equation of converted variables. This method also allows for making forecasts of the values of a dependent variable for any combination of a set of independent (classification) variables [24–26]. The effect of each of the classification variables on the dependent variable is described with the corresponding regression coefficient. For testing the collinearity in the model, the Pratt's measures of relative importance and tolerance were used. A variable with

a very low tolerance contributes little information to a model and can cause computational problems. Thus, it would be removed from the categorical regression.

All of the analyses were carried out using the statistical package IBM SPSS Statistics 27.0.1.0 [27].

3. Results

3.1. Demographic Characteristics

A total of 133 questionnaires were answered by consumers with a mean age of 41.1 years (SD = 16.2), with 59.6% of them being female. The survey covered a great part of the country with two thirds of the participants living in urban areas (63.2%) and the rest of them inhabiting Greek coastal cities and the non-coastal areas (30.8% and 6.0%, respectively). The majority of the consumers stated that they had graduated from university (69.2%). A total of 18.9% were private employers, 17.8% were university students and 7.3% were public employers. There were slightly more married consumers ($\chi^2, p = 0.087$) than single ones (50.8% vs. 45.3%), with the majority of the interviewees having two children (68.7%).

3.2. Bivalve Consumption

Almost all of the consumers had tried bivalves at least once (98.4%), and a great percentage of them had tried smooth clams (87.9%), flat oysters (85.7%), Warty Venus Clam (78.9%), scallops (73.6%) and razor shells (51.1%) at least once. Whereas, less than a quarter of the consumers (24%) knew or had tried the rayed pearl oysters at least once. Bivalve species were more commonly eaten by consumers living in coastal areas, than in other areas (Figure 1; $\chi^2, p < 0.05$). Younger consumers and those of a higher education level seemed to know about, or to have consumed, bivalves in higher percentages compared to those of lower education ($\chi^2, p < 0.05$).

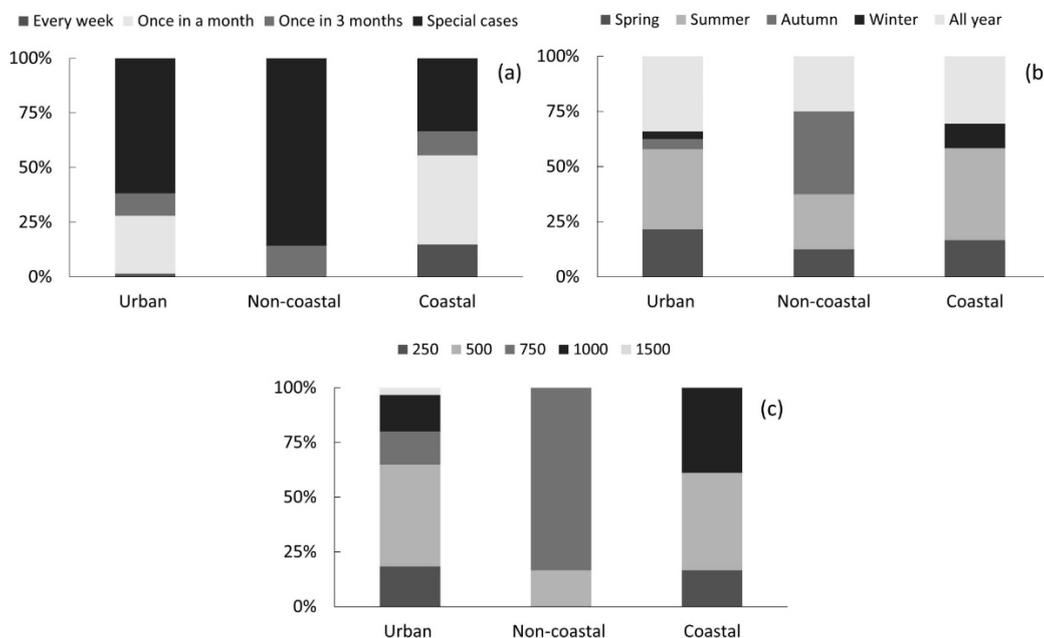


Figure 1. Frequency (%) by place of residence of: (a) consumption of shellfish, (b) shellfish consumption in terms of seasons, and (c) size of package (in g) that the consumers prefer in case of purchasing pearl oysters.

The majority of the responders stated that they usually purchased bivalves from traditional fishmonger shops (59.8%) and from super markets (41.6%), and this behavior did not significantly differ ($\chi^2, p = 0.203$) with place of residence, age and level of education.

More than half of the responders stated that they consumed bivalves only in special cases (53.3%), linked with religious ceremonies. More than a quarter of the consumers reported that their family consumed bivalves once a month (26.3%), and these attitudes did not differ significantly ($\chi^2, p = 0.143$) with age and level of education, whereas it significantly differed ($\chi^2, p < 0.05$) with the place of residence. Consumers from coastal areas purchased bivalves significantly ($\chi^2, p < 0.05$) more often in their family, than the consumers from urban and non-coastal areas. In terms of seasons, more than one third of the consumers stated that they usually consumed bivalves in the summer (39.6%) and spring (20.7%), but 30.8% consumed bivalves all year long. This behavior significantly differed (Figure 1b; $\chi^2, p < 0.05$) only for the place of residence, with consumers from coastal areas purchasing bivalves significantly ($\chi^2, p < 0.05$) more often in their family. More than half of the consumers (58.7%) stated that the amount of bivalves they usually bought and consumed was up to 1 kg, whereas a third (35.8%) purchased between 1.5 and 2 kg, and only 4.5% consumed more than 2.5 kg. This behavior did not significantly differ ($\chi^2, p = 0.508$) with place of residence, age and educational level.

3.3. Quality Criteria

With respect to “Criteria of bivalve freshness” most of the consumers stated that the first criterion they examined was “bivalve odor” (37.1%), second in priority order was “shells (closed or not)” (37.1%), third was “expiration and shell removal date” (32.3%), and fourth was “clarity of packaging water” (48.4%) (Figure 2a). The only shellfish where “very often” was the highest purchase frequency was mussels (47.2%), whereas consumers “seldom” bought warty venus clams, oysters, scallops and smooth clams in higher frequencies. In contrast, the majority of the consumers did not prefer horse mussels, lagoon cockles and pearl-oysters (“never” 66.3%, 65.8% and 62.4%, respectively) (Figure 2b).

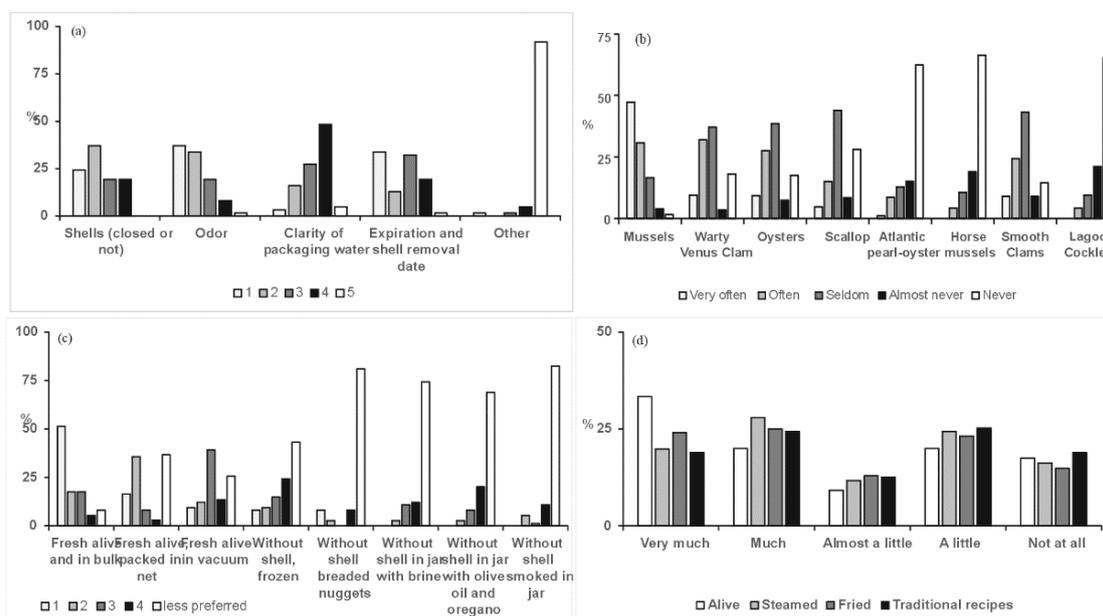


Figure 2. Frequency (%) of: (a) criteria of bivalve freshness that the consumers prefer to examine in shellfish, (b) species preference in terms of frequency of purchase, (c) order of preference (from 1 as most desired to 4, least desired) for which of the following Atlantic pearl-oyster products on the market the consumers would prefer, and (d) how much do press articles or media announcements about shellfish hygiene (toxins, heavy metals, etc.) affect the consumers.

With respect to special preferences regarding pearl oyster packaging, half of the consumers preferred the pearl oyster product to be “fresh alive in bulk” (51.4%), whereas the less preferred product was “deshelled, breaded nuggets” (50%) (Figure 2c). Regarding the

most preferable pearl oyster products, the majority of the consumers chose the following (Table 1): (a) fresh alive, of more than six pieces (57.1%), in a netting bag of 1 kg (56.8%), or in a vacuum (52.4%), independent ($\chi^2, p > 0.310$) of the demographic characteristics, (b) without shell, frozen, of 500 gr (46.8%), dependent on the place of residence (Figure 1c; $\chi^2, p < 0.05$), (c) without shell, breaded nuggets, of more than 250 gr, independent ($\chi^2, p = 0.460$) of the demographic characteristics, (d) deshelled in jar with brine, 250 gr, independent ($\chi^2, p = 0.620$) of the demographic characteristics, (e) without shell in jar, with olive oil and oregano, up to 500 gr, independent ($\chi^2, p = 0.724$) of the demographic characteristics, and (f) deshelled, smoked in jar, in 250 gr, independent ($\chi^2, p = 0.135$) of the demographic characteristics.

Table 1. Preferred product type, packaging material and packaging container in case of purchasing pearl oyster as a food item by consumers (%). Asterisk (*) indicates the highest values.

Product	250 g	500 g	750 g	1000 g	1500 g
Without shell, frozen	15.6	46.8 *	17.4	18.3	1.8
Without shell, breaded nuggets	38.1 *	29.8 *	20.2	10.7	1.2
Without shell in jar with brine	39.5 *	30.7 *	17.5	11.4	0.9
Without shell in jar with olive oil and oregano	33.6 *	43.1 *	14.7	7.8	0.9
Without shell, smoked in jar	41.6 *	34.5	14.2	8.8	0.9
Product	0.5 kg	1 kg	2 kg	3 kg	
Fresh alive in nets	20.0	56.8 *	17.9	5.3	
Product	4	6	8	12	
Fresh alive in vacuum (pieces)	16.8	29.4 *	27.7 *	18.5	
Packaging material	Glass	Plastic	Metal		
	90.4 *	8.8	0.8		
Packaging container	Transparent	Opaque	Dark-Colored	Vase	
	90.4 *	4.4	3.5	1.8	

The vast majority of the consumers stated that they preferred a “transparent container” (90.4%) or “glass material” (90.4%) for the pearl oyster packaging (Table 1), behaviors that did not differ significantly ($\chi^2, p = 0.287$) with the place of residence, age and educational level. The majority of the consumers (81.1%) trusted the announcements of the veterinary services regarding the hygiene condition of bivalves, an attitude that did not differ significantly ($\chi^2, p = 0.492$) with the place of residence, age and education level. A great percentage of the consumers stated that they were influenced “much” and “very much” by press articles or media announcements about shellfish hygiene (e.g., toxins, heavy metals, etc.) (Figure 2d). This did not differ significantly ($\chi^2, p = 0.160$) with the place of residence, age and education level.

3.4. Modeling Approach

The internal reliability, measured by Cronbach’s alpha coefficient, for the multi-thematic question regarding the criteria of participants’ choice on quality when buying shellfish, exhibited that when all criteria were considered in the analysis, Cronbach’s alpha was 0.446, and was increased up to 0.597 when only the criteria of the external appearance, fish shop hygiene conditions, packaging and origin were included in the analysis. The reliability analysis on the frequency of choice regarding specific bivalve species that the consumers prefer, exhibited that when all the species were included in these questions, the Cronbach’s alpha coefficient had the maximum value (0.766). The highest value of the reliability analysis was estimated for the question on the intensity of press articles or media announcements about shellfish hygiene (0.967).

Optimal scaling analysis on the question regarding the intensity of press articles or media announcements about shellfish hygiene (e.g., toxins, heavy metals) that affect the consumers, exhibited a good value for the coefficient of determination (0.265), with a significant ($p < 0.01$) model (Table 2). Marital status and education level were the significant ($p < 0.05$) independent variables left in the final model, with the largest importance for the predictability of the model (Table 2). The tolerance values of the regression model were very high, indicating a lack of multi-collinearity among the corresponding independent variables (Table 2). The quantitative categorical values of the independent variables and the signs of beta values exhibited that engaged and highly educated (at technical institutions or universities) consumers were more sensitive to the intensity of press articles or media announcements about shellfish hygiene (Table 2 and Figure 3).

Table 2. Optimal scaling analysis models on the question regarding the intensity of press articles or media announcements about shellfish hygiene (toxins, heavy metals, etc.) that affect the consumers. Beta indicates the standardized coefficients of the regression, S.E. is the standard error, F is the ANOVA test value, Importance is the % contribution of the independent variable and T is the collinearity tolerance.

Independent Variables	Standardized Coefficients		F Values	Importance	Tolerance
	Beta	S.E.			
Education level	0.238	0.103	5.296	0.177	0.982
Marital status	0.309	0.130	5.643	0.474	0.580

F-value: 3.394, df₁: 10, df₂: 117, R²: 0.265

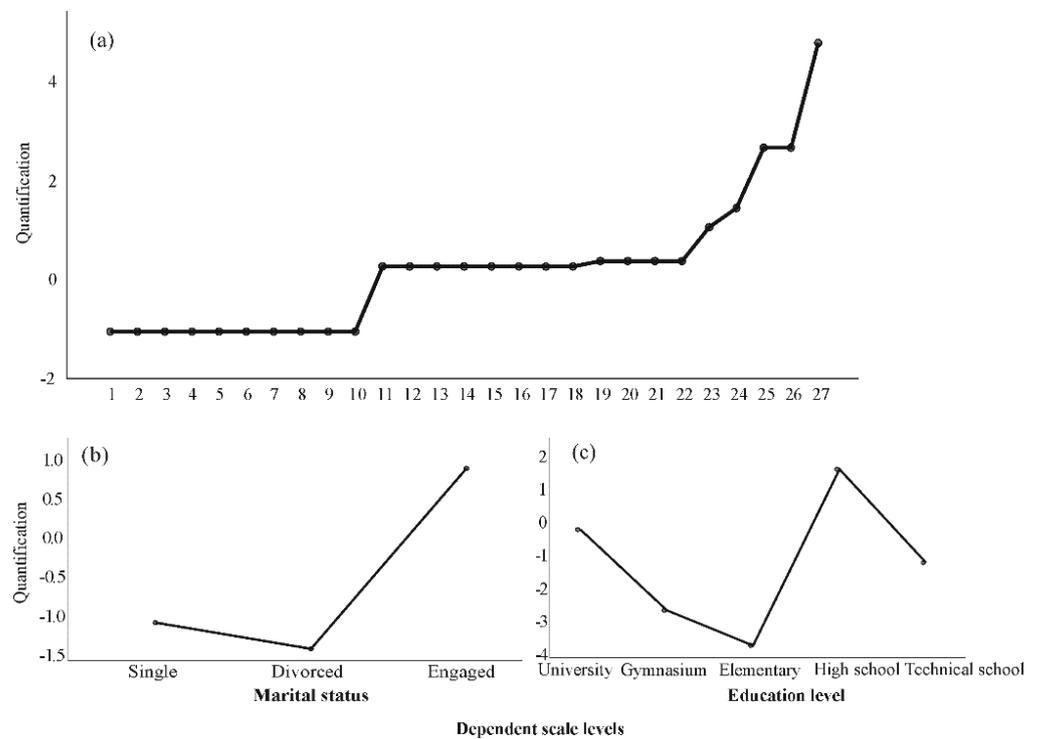


Figure 3. Category quantification plots of the key question on the intensity of press articles or media announcements about shellfish hygiene (e.g., toxins, heavy metals, etc.) that affect the consumers when buying shellfish: (a) dependent variable, (b) marital status and (c) educational level. The scale levels of the dependent variable are derived from the sum of the scores marked to all themes of this question (see Figure A1 in Appendix A).

Optimal scaling analysis on the question regarding the frequency of choice of specific bivalve species that the consumers prefer, exhibited the following pattern with a decreasing order of significance in terms of the value of the coefficient of determination (Table 3): Horse mussels ($R^2 = 0.326$) > Warty Venus Clam (0.257) > Rayed pearl oysters (0.193) > Flat oysters (0.191) > Scallops (0.187) > Smooth clam (0.181) > Mussels (0.167). All models were statistically ($F > 4.222$; $p < 0.05$) significant. The independent variables that positively affected the frequency of shellfish consumption in specific species, and that exhibited the largest importance for the predictability of the models, were the educational level present in six out of seven final models, the marital status and the place of residence in three models, and the age of the consumers in one model (Table 3). The quantitative categorical values of the independent variables and the signs of beta values exhibited that the frequency of consumption per shellfish species increased when the consumers were middle-aged, engaged, highly educated (at technical institutions or universities) and living in urban big cities (Table 3).

Table 3. Categorical regression models of the question on the frequency of choice on specific bivalve species that the consumers prefer. Beta indicates the standardized coefficients of the regression, S.E. is the standard error, F is the ANOVA test value, Importance is the % contribution of the independent variable and T is the collinearity tolerance.

Independent Variables	Standardized Coefficients		F Values	Importance	Tolerance
	Beta	S.E.			
Horse mussels					
Age	0.374	0.151	6.107	0.333	0.960
Educational level	0.192	0.098	3.826	0.088	0.933
Marital status	0.171	0.084	4.122	0.130	0.965
Place of residence	0.299	0.121	6.097	0.333	0.949
F-value: 3.094, df_1 : 10, df_2 : 84, R^2 : 0.326					
Warty Venus Clam					
Marital status	0.304	0.114	7.075	0.542	0.517
F-value: 3.632, df_1 : 10, df_2 : 105, R^2 : 0.257					
Rayed pearl oysters					
Educational level	0.354	0.130	7.419	0.653	0.978
F-value: 1.797, df_1 : 10, df_2 : 82, R^2 : 0.193					
Smooth clam					
Educational level	0.282	0.090	9.786	0.302	0.955
Marital status	0.269	0.131	4.249	0.437	0.539
F-value: 2.138, df_1 : 10, df_2 : 100, R^2 : 0.193					
Flat oysters					
Educational level	0.341	0.102	11.259	0.531	0.906
Place of residence	0.294	0.115	6.557	0.399	0.963
F-value: 2.083, df_1 : 10, df_2 : 98, R^2 : 0.191					
Scallops					
Educational level	0.288	0.108	7.082	0.368	0.924
Place of residence	0.294	0.141	4.352	0.487	0.961
F-value: 1.996, df_1 : 10, df_2 : 96, R^2 : 0.187					
Mussels					
Educational level	0.372	0.182	4.160	0.801	0.979
F-value: 2.123, df_1 : 10, df_2 : 116, R^2 : 0.167					

4. Discussion

Nowadays, the spatial expansion of non-indigenous species triggers consumers to seek increasingly valid measures to ensure the hygiene and quality of the products they

consume. The present study aims to gain insight into the importance of drivers for bivalve consumption amongst Greek consumers and their acceptance of new seafood products. The collected questionnaires were considered efficient for generalizations of percentages from the sample to the corresponding population, with a standard error of 5% and a level of confidence of 95% [22], as well as for the statistical analysis performed [28]. Multi-thematic questions analyzed by multi-variate techniques show a good internal consistency, apart from the criteria of participants' choice on quality criteria when buying shellfish, for which a moderate reliability was found. A few limitations are worthy of being noted. Firstly, our results could not be generalized to a European level due to the nature of our survey, which was conducted on a single, yet national, market. An additional drawback of the present study, refers to the lack of truly spatial coverage in the data collection and the difficulty of generalizing the findings to a Greek adult population. The high educational level of survey respondents is a common bias in studies performed using face-to-face surveys [29]. In fact, respondents are mostly highly educated and at a young age. Despite these weaknesses, this study provides some clear indication about consumer preferences on bivalve consumption and, more importantly, how different factors might affect them.

Exploring new patterns on the acceptance of the pearl oyster in the Greek shellfish market will favor market stability regarding the demand for other seafood products. The clear pattern derived from uni- and multivariate techniques, exhibited that Greek married, highly educated consumers who live in urban places, were more reluctant to try new shellfish products and innovative ways of market supply. However, the frequency of bivalve consumption is still limited, as the majority of the Greek consumers purchase and consume bivalves only in special cases (i.e., certain Orthodox ceremonies). It seems that this pattern remains unchanged across the years, as it is in line with previous studies conducted more than a decade ago [12,30]. Consumers with a long tradition in bivalve consumption, such as the French and Italians, purchase them during autumn and spring, but mainly during winter [31]. This preference is related to the Greek consumers' lack of confidence in seafood, owing to them not having adequate information on health and safety issues, or considering their taste unsatisfactory [12]. Consumers from urban areas, of younger ages, or those of a higher education level were much better informed on bivalve consumption and purchased bivalves significantly more often than the participants in other demographic categories. Young people are considered as regular shellfish consumers at the EU level [32].

Multivariate models applied to the multi-thematic questions portray the consumers' conceptualization that underlies their food choices, especially regarding the acceptance of new seafood products, which was mostly influenced by the educational level, followed by the marital status, and then the place of residence of the consumers. With respect to market pathways, more than two thirds of the participants preferred to purchase bivalves either from the traditional fish shops or the hypermarkets, a trend that is in line with other European countries [32]. Consumers prefer traditional fish shops and hypermarkets that are routinely inspected by veterinarians, who issue a certificate on bivalve sea origin, hygienic condition, freshness and quality [12,13]. In addition, during the COVID-19 pandemic, shellfish consumers are more willing to buy shellfish products from hyper-markets than fishmongers or traditional fish markets, because price is more controlled in the former than in other shellfish markets. The attitudes of people who eat oysters both at home and in restaurants primarily affect the sustainability of their supply chains [1].

Due to the limited acceptance of bivalve consumption in Greece, specialized marketing practices and integrated strategies for promoting and disseminating shellfish products are required. Consumer preferences towards new shellfish products, such as the pearl oyster, can be influenced by including these species on restaurant menus, while cooking show promotion can also help in this direction. Such initiatives highlight the advantages of promoting a non-indigenous species as a food [33,34]. Portraying oysters as a status symbol is a key motivating force of consumption both at home and eating out. Consumers who consider oysters as a "chic" product have a tendency to eat the product at home [1]. Cerveira et al. For instance, [35] provides examples of how media coverage and celebrity

involvement may boost the awareness and acceptability of an otherwise unattractive bivalve species, such as the pearl oyster (62.4% of the participants “never” bought them). Such species were featured on popular shows or were endorsed as premium food items, and have now gained unprecedented attention from consumers. The direct effect that the media have on consumers could furthermore be of use as a tool for informing the consumer about the quality of bivalve products, as well as their quality control criteria and freshness. The information dispersed by the media on shellfish safety, strongly influences the consumers’ purchasing behavior, regardless of their demographic and socio-economic status [16]. However, the media frequently exaggerates veterinary authorities’ restriction advice, prompting consumers to question the hygiene and safety of shellfish. This situation could be changed if consumers were adequately educated on shellfish safety matters. Thus, the media must not only issue interdiction notices, but also educate consumers on issues of shellfish safety and quality.

Food safety, nutrition, taste and price are the most important factors for the purchase and consumption of bivalves [6,36,37]. The lack of information on issues related to the knowledge or purchase of the pearl oyster, especially regarding any possible toxic effects on human health [38], creates feelings of fear, suspicion and caution amongst the potential consumers of bivalves [15]. According to the results of this study, the most important criteria for purchasing bivalves were “bivalve odor”, and the most preferred pearl oyster product was “fresh alive in bulk” (51.4%). Similar results were also observed in a relevant study on offshore fish species [24], in which freshness and the hygienic conditions of the fish shop were the main criteria governing the selection by the consumers. Health is frequently cited as a reason for specific food choices, and its role is a growing trend that has a significant impact on attitudes towards eating seafood [39]. This is a critical issue for the Greek shellfish market, which has a fragmented supply chain with thousands of small producers, traders and retailers, making public provision of control measures difficult. On the other hand, the majority of the consumers trusted the announcements of the veterinary services concerning the enforcement of E.U. legislation on shellfish hygiene [32], regardless of their income level or age. Trust was essential, because it connected with a sense of security and bivalves seemed to be a source not of risk but of pleasure [14].

According to the findings of this study, the inclusion of the pearl oyster as a new shellfish product launched into the Greek market, is based on intrinsic (e.g., appearance, taste, odor, texture) and extrinsic product characteristics (e.g., brand, packaging, nutritional and health claims) [16]. Consumers did not pay attention to the presence/absence of the shell and the shape of the bivalve’s shell, an attitude that is in line with similar surveys conducted in France [40] and in Australia [41]. Providing critical information, such as the origin of the shellfish and the day of capture, can alert consumers that pearl oysters are a healthy food with high nutritional value, that can also be of certified quality, thus increasing their willingness to make a purchase [16]. Initiatives such as flagging food safety, providing a certification of origin, or flagging environmentally friendly products, would also assure consumers about product sustainability [42]. Additional information aids consumers in making decisions, but there is a risk of information overload [1]. When attempting to address structural issues in the production and distribution of shellfish products, these issues appear to be an important indicator as well as a useful marketing tool [43]. These strategies can greatly benefit producers and sellers and facilitate the transition to a more sustainable supply chain.

5. Conclusions

The results of this study point to several avenues for further research to help policymakers to expand and support the development of bivalve market programs across the country, which in turn would promote bivalve consumption. Given the imbalance between the exports and imports of bivalve products [17], the Greek shellfish market needs to include higher value products in order to compete with imports in the local market. The willingness to purchase and consume the non-indigenous pearl oyster *Pinctada imbricata*

radiata would reveal alternative pathways for the control of this species and for mitigating its impact on the ecosystem by taking into account the economic benefits gained as a fishery resource [20]. Another avenue for further research, is the identification of information treatments to convey the environmental benefits of bivalve consumption, and testing whether consumers would pay a price premium for that motive. One successful approach to establishing this goal could be the organization of local festivities for promoting the consumption of new shellfish species, with different ways of cooking it. Future studies could include the price aspect as a driver for consumer purchase intent, because price is considered as a strong driver for a consumer to purchase bivalves [5].

The current study's implications would determine the level of investment in large-scale shellfish market operations, as sales could be increased by teaching Greek customers about pearl oysters and investing in product marketing in the local market. The scarcity of other bivalves owing to overfishing [44], mass mortality events [45,46] and HABs episodes losses [47] as a result of harvesting prohibitions, may prompt the promotion of the pearl oyster as an alternative shellfish product, which also has a high nutritional content and human health advantages [48].

Author Contributions: Conceptualization, D.K.M. and J.A.T., D.K.M.; formal analysis, D.K.M., A.Z., A.S.D., V.M., J.A.T.; data curation, D.K.M., A.Z., A.S.D., V.M.; writing—review and editing, D.K.M., A.Z., A.S.D., V.M., G.K., J.A.T.; supervision, D.K.M.; project administration, J.A.T.; funding acquisition, J.A.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research was a part of the project “Commercial exploitation of the pearl oyster *Pinctada imbricata radiata* by adding value through the development of processed products” (Code MIS: 5010850), funded by the “Innovation in Fisheries” EU-Greece Operational Programme of Fisheries, EPAL 2014-2020.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting the reported results of the study can be provided upon request by the last author.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A. Questionnaire



ΠΑΝΕΠΙΣΤΗΜΙΟ
ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS



Department of Animal production, Fisheries and Aquaculture

Questionnaire for Pearl-Oyster Consumption

The present research is carried out with the aim of investigating the consumption of shellfish and the characteristics of the Rayed pearl-oyster. The questionnaire is ANONYMOUS and does not contain any information that leads to the identification of the respondent. Your answers will be evaluated to serve the purpose mentioned above.

- Date of interview
- Questionnaire number
- Interview area

1. Which of the following shellfish species do you know and which have you tried at least once (Multiple Answers)?

Mussels		1
Warty Venus Clam		2
Flat Oyster		3
Scallop		4
Horse Mussel		5
Callista		6
Donax Shell		7
Noah's Ark		8
Razor Shell		9
Rayed pearl-oyster		10
Lagoon Cockles		11

2. How often do you buy and consume shellfish in your family (One Answer)?

Every day		1
Every week		2
Once in a month		3
Once in 3 months		4
In special cases		5

3. Where do you usually buy shellfish for your home (Multiple Answers)?

Traditional fish shop		1
Public market		2
Central fish market		3
Super market		4
Action market		5
Itinerant fishmongers		6
Other		7

4. In which season do you usually consume bivalves in your family?

Spring		1
Summer		2
Autumn		3
Winter		4

Figure A1. Cont.

All year		5
----------	--	---

5. How many shellfish do you usually buy & consume for a meal of your family?

Quantity	1 kg <input type="checkbox"/>	1,5 – 2 kg <input type="checkbox"/>	more than 2.5 kg <input type="checkbox"/>
----------	-------------------------------	-------------------------------------	---

6. How important each of the following factors is to you when buying shellfish (Note an X for each factor)?

Factor	Very important	Important	Insignificant
Size			
Freshness			
External appearance			
Fish shop hygiene conditions			
Packaging			
Prize			
Origin			

7. When buying shellfish on special holidays, what kind do you usually prefer?

1.	(Special holiday:.....)
2.	(Special holiday:.....)
3.	(Special holiday:.....)

8. Sort by preference (from 1 to the most desirable) what you examine in shellfish in terms of freshness

Shells (closed or not)		1
Odor		2
Clarity of packaging water		3
Expiration and shell removal date		4
Other		5

9. Sort by preference (from 1 to the most desirable) why you choose shellfish as food in your family

Due to tradition		1
Due to low cost		2
Because it is considered a healthy food		3
For their nutritional value		4
Due to taste		5
Other		6

10. How do you usually "cook-eat" shellfish in your family (Note an X for each season)?

	Winter	Spring	Summer	Autumn	All year
Alive					
Steamed					
Fried					
Traditional recipes					

11. Do you eat shellfish when you go out?

Yes		1
No		2

11b. If YES, in which cases?

In vacations		1
Special holidays		2
Family outings		3
Some times		4

Figure A1. Cont.

12. Would you buy ready-to-eat shellfish (pre-cooked)

Yes		1
No		2
Rarely		3

13. If YES, how would you prefer them to be?

Boiled		1
Fried		2
Marinated		3
Smoked		4
Other form		5

14. When you buy shellfish, which of the following species you choose and how often? (Note X for each species);

Species	Very often	Often	Seldom	Never	Almost never
Mussels					
Cockles					
Flat oysters					
Scallops					
Rayed pearl oysters					
Horse mussels					
Calistas					

15. Would you like the shellfish you buy to have a quality control certificate or a quality badge?

YES		1
NO		2
IDON'T CARE		3

16. When you buy shellfish do you ask where they come from (place of origin)?

ALWAYS		1
SOMETIMES		2
NEVER		3

17. How much do press articles or media announcements about shellfish hygiene (toxins, heavy metals,...) affect you?

	Very much	Very	Almost a little	A little	Not at all
Alive					
Steamed					
Fried					
Traditional recipes					

18. Do you trust or not the announcements of the veterinary services regarding the hygiene of shellfish?

YES		1
NO		2

19. Have you ever had a health problem from eating shellfish?

YES		1
NO		2

20. Rank in order of preference (from 1 as most desired to 8 as less desired), which of the following Atlantic pearl-oyster products on the market would you prefer?

Fresh alive and in bulk				
-------------------------	--	--	--	--

Figure A1. Cont.

Fresh alive, packed in net		
Fresh alive in Vacuum		
Without shell, frozen		
Without shell breaded nuggets		
Without shell in jar with brine		
Without shell in jar with olive oil and oregano		
Without shell smoked in jar		

21. In case of choosing fresh alive in nets, what size of package would you like? (kg)

0,5 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	2 kg <input type="checkbox"/>	3 kg <input type="checkbox"/>	5 kg <input type="checkbox"/>
---------------------------------	-------------------------------	-------------------------------	-------------------------------	-------------------------------

22. In case of choosing fresh alive in Vacuum, what quantity of packaging would you like? (Pcs)

4 pieces <input type="checkbox"/>	6 pieces <input type="checkbox"/>	8 pieces <input type="checkbox"/>	12 pieces <input type="checkbox"/>	16 pieces <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	------------------------------------	------------------------------------

23. In case of choosing without shell, frozen, what size of package would you like? (kg)

0.250 kg <input type="checkbox"/>	0.500 kg <input type="checkbox"/>	0.750 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	1.5 kg <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	-------------------------------	---------------------------------

24. In case of choosing without shell breaded nuggets, what size of package would you like? (kg)

0.250 kg <input type="checkbox"/>	0.500 kg <input type="checkbox"/>	0.750 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	1.5 kg <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	-------------------------------	---------------------------------

25. In case of choosing without shell in jar with brine, what size of package would you like? (kg)

0.250 kg <input type="checkbox"/>	0.500 kg <input type="checkbox"/>	0.750 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	1.500 kg <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	-------------------------------	-----------------------------------

26. In case of choosing without shell in jar with olive oil and oregano, what size of package would you like? (kg)

Figure A1. Cont.

0.250 kg <input type="checkbox"/>	0.500 kg <input type="checkbox"/>	0.750 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	1.5 kg <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	-------------------------------	---------------------------------

27. In case of choosing without shell smoked in jar, what size of package would you like? (kg)

0.250 kg <input type="checkbox"/>	0.500 kg <input type="checkbox"/>	0.750 kg <input type="checkbox"/>	1 kg <input type="checkbox"/>	1.5 kg <input type="checkbox"/>
-----------------------------------	-----------------------------------	-----------------------------------	-------------------------------	---------------------------------

28. What packaging material would you like?

Container	Transparent <input type="checkbox"/>	Opaque <input type="checkbox"/>	Dark-Colored <input type="checkbox"/>
Material	Glass <input type="checkbox"/>	Plastic <input type="checkbox"/>	Metal (canned) <input type="checkbox"/>

B. DEMOGRAPHIC CHARACTERISTICS

B1. Sex: Male [1] Female [2]

B2-3. Year and place of residence:

B4. Education:

I have not finished elementary school	[1] <input type="checkbox"/>	High School Diploma	[4] <input type="checkbox"/>
Elementary Diploma	[2] <input type="checkbox"/>	Private Schools	[5] <input type="checkbox"/>
Junior High School Diploma	[3] <input type="checkbox"/>	University	[6] <input type="checkbox"/>

B5. Profession:

B6. Marital status:

Unmarried [1] <input type="checkbox"/>	Married [2] <input type="checkbox"/>	Divorced / Separated / Widowed [3] <input type="checkbox"/>
--	--------------------------------------	---

B7. Number of children:

Up to 1 years old <input type="checkbox"/>	11-18 years old <input type="checkbox"/>	18+ years old <input type="checkbox"/>
--	--	--

Thank you very much for your participation in the survey

Figure A1. Questionnaire for bivalves and Pearl Oyster Consumption.

References

1. Santeramo, F.G.; Carlucci, D.; De Devitiis, B.; Nardone, G.; Viscecchia, R. On consumption patterns in oyster markets: The role of attitudes. *Mar. Policy* **2017**, *79*, 54–61. [[CrossRef](#)]
2. Schmidt, O.; Padel, S.; Levidow, L. The bio-economy concept and knowledge base in a public goods and farmer perspective. *Bio-Based Appl. Econ.* **2012**, *1*, 47–63.
3. *EU Regulation (EU) No 1380/2013*; European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC; EU: Mestreech, The Netherlands, 2013.
4. Liu, Y.; Kow, F.; Grewal, D.; FitzGerald, D. Consumer Purchase Behavior for Oysters: An Empirical Study in Some State Capital Cities of Australia. *Int. J. Consum. Studies* **2006**, *30*, 85–94. [[CrossRef](#)]
5. Loose, S.M.; Peschel, A.; Grebitus, C. Quantifying Effects of Convenience and Product Packaging on Consumer Preferences and Market Share of Seafood Products: The Case of Oysters. *Food Qual. Prefer.* **2013**, *28*, 492–504. [[CrossRef](#)]
6. Rose, J.M.; Bricker, S.B.; Ferreira, J.G. Comparative Analysis of Modeled Nitrogen Removal by Shellfish Farms. *Mar. Pol. Bull.* **2015**, *91*, 185–190. [[CrossRef](#)] [[PubMed](#)]
7. Kecinski, M.; Messer, K.D.; Knapp, L.; Shirazi, Y. Consumer Preferences for Oyster Attributes: Field Experiments on Brand, Locality, and Growing Method. *Agric. Res. Econ. Rev.* **2017**, *46*, 315–337. [[CrossRef](#)]
8. Kecinski, M.; Messer, K.D.; Peo, A.J. Consumer Preferences for the Provision of Water Quality Services by Oysters. APEC working paper (APEC RR16-02) 2016. Available online: <https://cdn.canr.udel.edu/wp-content/uploads/2016/03/22141033/RR16-02.pdf> (accessed on 17 December 2021).
9. Dedah, C.; Keithly, W.R., Jr.; Kazmierczak, R.F., Jr. An Analysis of US Oyster Demand and the Influence of Labeling Requirements. *Mar. Res. Econ.* **2011**, *26*, 17–33. [[CrossRef](#)]
10. Bruner, D.M.; Huth, W.L.; McEvoy, D.M.; Morgan, O.A. Consumer Valuation of Food Safety: The Case of Postharvest Processed Oysters. *Agric. Res. Econ. Rev.* **2014**, *43*, 300–318. [[CrossRef](#)]
11. Li, T.; Kecinski, M.; Messer, K.D. Heterogeneous Preferences for Oysters: Evidence from Field Experiments. *Agric. Res. Econ. Rev.* **2017**, *46*, 296–314. [[CrossRef](#)]
12. Batzios, C.; Angelidis, P.; Moutopoulos, D.K.; Anastasiadou, C.; Chrisopolitou, V. Consumer attitude towards shellfish in the Greek market: A pilot study. *Medit. Mar. Sci.* **2003**, *4*, 155–174. [[CrossRef](#)]
13. Batzios, C.; Angelidis, P.; Papapanagiotou, E.P.; Moutopoulos, D.K.; Anastasiadou, C.; Chrisopolitou, V. Greek Consumer's Image of the Cultured Mussel Market. *Aqua. Int.* **2004**, *12*, 239–257. [[CrossRef](#)]
14. Debucquet, G.; Cornet, J.; Adam, I.; Cardinal, M. Perception of oyster-based products by French consumers. The effects of processing and role of social representations. *Appetite* **2012**, *59*, 844–852. [[CrossRef](#)]
15. Guillou, E.; Raymond, A.; Krien, N.; Buschini, F. Oyster eaters: From consumer practices to the representation of risks. *Appetite* **2019**, *140*, 105–113. [[CrossRef](#)]
16. van Houcke, J.; Altintzoglou, T.; Linsen, J.; Luten, J. Quality perception, purchase intention, and the impact of information on the evaluation of refined Pacific cupped oysters (*Crassostrea gigas*) by Dutch consumers. *J. Sci. Food Agric.* **2017**, *98*, 4778–4785. [[CrossRef](#)] [[PubMed](#)]
17. Theodorou, J.A.; Perdikaris, C.; Spinos, E. On the occurrence of rayed pearl oyster *Pinctada imbricata radiata* (Leach, 1814) in Western Greece (Ionian Sea) and its biofouling potential. *Biharean Biol.* **2019**, *13*, e181204.
18. Katsanevakis, S.; Poursanidis, D.; Issaris, Y.; Panou, A.; Petza, D.; Vassilopoulou, V.; Chaldaiou, I.; Sini, M. Protected marine shelled molluscs: Thriving in Greek seafood restaurants. *Medit. Mar. Sci.* **2011**, *12*, 429–438. [[CrossRef](#)]
19. Moutopoulos, D.K.; Ramfos, A.; Theodorou, J.A.; Katselis, G. Biological aspects, population and fishery dynamics of the non-indigenous pearl oyster *Pinctada imbricata radiata* (Leach, 1814) in the Eastern Mediterranean. *Reg. Studies Mar. Sci.* **2021**, *45*, 101821. [[CrossRef](#)]
20. Kleitou, P.; Crocetta, F.; Giakoumi, S.; Givos, I.; Hall-Spencer, J.M.; Kalogirou, S.; Kletou, D.; Moutopoulos, D.K.; Rees, S. Fishery reforms for the management of non-indigenous species. *J. Environ. Manag.* **2021**, *280*, 111690.
21. HELSTAT (Hellenic Statistical Authority). 2014. Demographic and Social Characteristics of the Resident Population of Greece according to the 2011 Population—Housing Census Revision of 20/3/2014. Athens. Available online: <https://www.statistics.gr/en/statistics/-/publication/SAM03/-> (accessed on 17 December 2021).
22. Zar, J.H. *Biostatistical Analysis*, 5th ed.; Prentice-Hall/Pearson: Upper Saddle River, NJ, USA, 2010; 944p.
23. Cronbach, L.J. Coefficient alpha and the internal structure of tests. *Psychometrika* **1951**, *16*, 297–334. [[CrossRef](#)]
24. Kaimakoudi, E.; Polymeros, K.; Schinaraki, M.-G.; Batzios, C. Consumers' attitudes towards fisheries products. *Procedia Technol.* **2013**, *8*, 90–96. [[CrossRef](#)]
25. Kooij Van Der, A.J.; Meulman, J.J. Murals. In *Multiple Regression and Optimal Scaling Using Alternative Least Squares*; Faulbaun, E., Bandilla, W., Eds.; Sofstat: Stuttgart, Germany, 1997; pp. 99–106.
26. Batzios, C.; Moutopoulos, D.K.; Arampatzis, G.; Siardos, G. Understanding Consumer's Attitude on Fish Quality and Marketing Aspects in the Greek Market. *Agric. Econ. Rev.* **2005**, *6*, 18–30.
27. SPSS. *SPSS BASE 27.0.1.0. Applications Guide*; SPSS Inc.: Chicago, IL, USA, 2020.
28. Lehmann, D.R.; Gupta, S.; Steckel, J.H. *Marketing Research*; Addison-Wesley: Reading, MA, USA, 1998; 780p.

29. Giovos, I.; Barash, A.; Barone, M.; Barría, C.; Borme, D.; Brigaudeau, C.; Charitou, A.; Brito, C.; Currie, J.; Dornhege, M.; et al. Understanding the public attitude towards sharks for improving their conservation. *Mar. Policy* **2021**, *134*, 104811. [[CrossRef](#)]
30. Theodorou, J.A.; Akrivos, V.; Katselis, G.; Moutopoulos, D.K. Use of Local Ecological Knowledge on the Natural Recruitment of Bivalve Species of Commercial Exploitation in a Natura Area. *J. Mar. Sci. Eng.* **2022**, *10*, 125. [[CrossRef](#)]
31. FAO. Consumption of Fish and Shellfish and the Regional Markets. 2020. Available online: <http://www.fao.org/docrep/T5897E/t5897e0.3htm> (accessed on 2 February 2022).
32. EUMOFA. *The EU Fish Market*; Publications Office of the European Union: Luxembourg, 2020.
33. Nuñez, M.A.; Kuebbing, S.; Dimarco, R.D.; Simberloff, D. Invasive Species: To eat or not to eat, that is the question. *Conserv. Lett.* **2012**, *5*, 334–341. [[CrossRef](#)]
34. Varble, S.; Secchi, S. Human consumption as an invasive species management strategy. A preliminary assessment of the marketing potential of invasive Asian carp in the US. *Appetite* **2013**, *65*, 58–67. [[CrossRef](#)]
35. Cerveira, I.; Baptista, V.; Teodósio, M.A.; Morais, P. Forthcoming. What's for dinner? Assessing the value of an edible invasive species and outreach actions to promote its consumption. *Biol. Invasions* **2021**, 1–15. [[CrossRef](#)]
36. Gempshaw, C.M.; Bacon, J.R.; Wessels, C.R.; Manalo, A. Consumer perceptions of aquaculture products. *Am. J. Agric. Econ.* **1995**, *77*, 1306–1312. [[CrossRef](#)]
37. Wessells, C.R.; Anderson, J.G. Consumer willingness to pay for seafood safety assurances. *J. Consum. Aff.* **1995**, *29*, 85–107. [[CrossRef](#)]
38. Galil, B. Poisonous and Venomous: Marine Alien Species in the Mediterranean Sea and Human Health. In *Invasive Species and Human Health*; Mazza, G., Tricarico, E., Eds.; CAB International: Wallingford, UK, 2018; pp. 1–15.
39. Olsen, S.O. Understanding the relationship between age and seafood consumption: The mediating role of attitude, health involvement and convenience. *Food Qual. Prefer.* **2003**, *14*, 199–209. [[CrossRef](#)]
40. Ifremer. *Qualité et Commercialisation des Huitres: Enquête D'opinion Nationale*; Ifremer: Lyon, France, 1997; 80p.
41. Ruello, N. *Report on Coffs Coast Oyster Industry Development Plan*; Ruello & Associates Pty Ltd.: Sydney, Australia, 2002; 81p.
42. Duggan, D.E.; Kochen, M. Small in scale but big in potential: Opportunities and challenges for fisheries certification of Indonesian small-scale tuna fisheries. *Mar. Policy* **2016**, *67*, 30–39. [[CrossRef](#)]
43. Grunert, K.G. Food quality and safety: Consumer perception and demand. *Eur. Rev. Agric. Econ.* **2005**, *32*, 369–391. [[CrossRef](#)]
44. Theodorou, J.A.; Tzovenis, I.; Katselis, G. Empirical approach to risk management strategies of Mediterranean mussel farmers in Greece. *Oceanol. Hydrobiol. Study* **2021**, *50*, 455–472. [[CrossRef](#)]
45. Rodrigues, L.C.; van den Bergh, J.C.J.M.; Massa, F.; Theodorou, J.A.; Ziveri, P.; Gazeau, F. Sensitivity of Mediterranean Bivalve Mollusc Aquaculture to Climate Change and Ocean Acidification: Results from a producers' survey. *J. Shell Res.* **2015**, *34*, 1161–1176. [[CrossRef](#)]
46. Theodorou, J.A.; Leech, B.S.; Perdikaris, C.; Hellio, C.; Katselis, G. Performance of the cultured Mediterranean mussel *Mytilus galloprovincialis* Lamark, 1819 after summer post-harvest re-immersion. *Turk. J. Fish. Aquat. Sci.* **2019**, *19*, 221–229. [[CrossRef](#)]
47. Theodorou, J.A.; Moutopoulos, D.K.; Tzovenis, I. Semi-quantitative risk assessment of Mediterranean mussel (*Mytilus galloprovincialis* L.) harvesting bans due to harmful algal bloom (HAB) incidents in Greece. *Aquac. Econ.* **2020**, *24*, 273–293. [[CrossRef](#)]
48. Theodorou, J.A.; Makri, M.; Douvi, X.; Ramfos, A.; Spinou, E. Seasonal variation in the biochemical composition, condition index, and meat yield of the non-indigenous pearl oyster *Pinctada imbricata radiata* (Leach, 1814) from the West of the Aegean Sea, Greece. *Aquac. Fish.* **2021**, in press. [[CrossRef](#)]