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Acceptability of insects in animal feed: a survey of French consumers*†

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Abstract

Using insects as an alternative protein source is increasingly becoming part of the future food security equation. Westerners tend to be squeamish or phobic of insects, so before we can operate this kind of change in human diet, we could start by introducing this new protein source into animal diet. This paper investigates French consumer acceptability of farmed trout fed insect meal instead of fish meal.

Here, working up from an online survey of over 300 consumers, we set out to identify the determinants of acceptability and determine how information on the benefits of insect meal for fishery resources can change acceptability.

Our statistical analysis highlights three key factors shaping acceptability of these novel insect-fed products: being 'informed', gender and food neophobia. Clearly, getting information on the negative effects of overfishing and on insect meals as a viable alternative to fishmeal in aquafeed allows to improve the acceptability of insects as fish feed. 76% of 'informed' people would be ready to eat insect-fed fish, against only 64% of 'uninformed' people. Men appeared readier to eat insect-fed fish, as the 'Reluctants' class, which represented 8% of our sample, was composed of 78% women. The 'Fans', 41% of our sample, are more likely to be men and people with a lower than average food neophobia score.

Keywords: consumer acceptability; insect protein; aquafeed; sustainability; survey.

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1 Introduction

It is widely recognized that we need to rethink how we can sustainably source food and feed protein. Fish farming is the fastest-growing animal food and feed protein sector worldwide (Tomberlin et al., 2015), but it is also driving overfishing in wild fisheries. About a quarter of all food fish captured serves to produce feeds (fishmeal and fish oil) mainly for aquaculture (FAO, 2014, Cashion et al., 2017). This makes it urgent to find other protein sources to help the aquaculture sector adopt more sustainable practices (Dicke, 2018).

Insect meal can help preserve fishery resources by offering an alternative to fishmeal (Macombe et al., 2019). The July 2017 amendment to EU regulation EU 2017/893–amendment authorizing the use of insect protein in feed for farmed fish–opens the door to new perspectives for the fish-farming sector. However, central to this opportunity is the issue of consumer acceptability of this process innovation in animals farmed for food (DeFoliart, 1999; Makkar et al., 2014; Moon & Lee, 2015).

In Europe, there is a huge psychological barrier to eating insects, as entomophagy is alien to our foodways. Insects prompt aversion, fear, and disgust, as they are considered as crop pests, vectors of disease, and even dirty and dangerous (Looy et al., 2014). The fact that farmed animals would not be eating feed-insects whole or the fact that the ingestion of insects is not direct for humans in the case of animal feed may still not lift these cultural and psychological barriers. It is important to know whether these negative expectations that surround eating insect-fed food can be easily and quickly overcome.

The present paper deals with consumers' acceptance of using insects in animal feed and of food products obtained from fish fed on insect-based feed. More precisely, the objective of this study is to identify the socio-demographic and psychological factors liable to play a role in consumer acceptance of new insect-based feeds and fish fed on insect-based feed. We also set out to learn whether issuing information on the environmental benefits of insect meal as an alternative to fish meal can positively change consumer acceptability.

More and more studies have been conducted to assess the acceptability of food insects for

humans in Europe (see Hartmann & Siegrist (2017) for a review of the perception and acceptance of insects as alternatives to traditional meat-based proteins). However, few studies to date have looked at the acceptability of insects as a protein source in animal feed (La Barbera et al., 2020). Sagori et al. (2019) inventoried just 6 surveys addressing this focal issue (PROteINSECT, 2016; Verbeke et al., 2015; Mancuso et al., 2016; Laureati et al., 2016; Popoff et al., 2017; Kostecka et al., 2017).

Our study stands apart from these previous studies on several levels. First of all, although the impact of personal determinants on willingness-to-accept the use of insects in animal feed has been studied before (Verbeke et al., 2015; Mancuso et al.; Laureati et al., 2016; Popoff et al., 2017), less attention has been given to information likely to increase consumers' acceptability of food products from animals fed on insect-based feed. Second, in order to prevent certain biases like an over-representation of people with links to farming or the food-farming industry (Verbeke et al., 2015; Laureati et al., 2016), we mobilized a sample that has no particular stakeholdership in the agriculture sector and no particular engagement in food–feed–farming issues in general. Furthermore, an online survey is better geared to testing information impact than a face-to-face in-depth interview (Verbeke et al., 2015; Mancuso et al., 2016; Popoff et al, 2017). Here we randomly split our sample into two groups—one that was pre-informed, and the other not. Cross-comparing these two groups enabled us to determine the extent to which an information campaign can be expected to influence the acceptability of insect-based products. We ultimately managed to collect a large amount of socio-demographic, psychometric and fish-consumption data. Each set of data offered cues and clues to explain the determinants of consumer acceptability for insects in animal feed and to characterize different consumer profiles, which is not something the literature has yet addressed.

Over 300 people were selected to participate in this study based on a five-part questionnaire. The first set of questions collected participant socio-demographic and food preferences data. The next three parts featured questions on opinions and intentions about fish fed on insect-based feed, and thus represent the core of our study. The fifth and final part included a psychometric questionnaire and a food neophobia questionnaire.

The paper is organised as follows. First, the data are described. Next, the empirical methodology is outlined. Then, the obtained results are presented. Finally, the implications and limitations of the present study are considered.

2 Materials

2.1 Data collection

In order to analyse consumer attitudes to farmed trout fed insect meal, we conducted an online survey in December 2016 on 327 people from the Dijon area who were recruited by the quota sampling method. Inclusion criteria for the sample were of being involved in food purchasing (but not necessarily being the primary responsible person for food purchasing), having no known food allergy, having internet access at home, and having already made online purchases. Only the data from 301 participants proved adequately workable.[1]

2.2 Information

In order to evaluate the impact of received information on the environmental benefits of insect meal, before any question, we gave half of the sample some information on the effects of overfishing that also presented insect meals as a viable alternative to fishmeal in aquafeed. In this way, we randomly split our sample into two groups.

The first group, which we call 'informed', gathers the participants who had been given information in the form of a flyer on the screen headed "Did you know?" (See Figure 1).

In detail, the first block of information on overfishing delivered the following message from Greenpeace: "Our oceans are sick from overfishing. 80% of wild fish stocks are overfished or borderline overfished. Marine resources are being heavily depleted." The message went on to add that "according to FAO (Food and Agriculture Organization of the United Nations) figures,

[1] Of a total of 327 participants who went to the survey, two cases were excluded during the analysis owing to missing observations for several socio-demographic variables. Twenty-four of those participants have never chosen fish in an other part of the survey (Bazoche and Poret, 2017).

Figure 1: Message given to 'informed' participants

practically a quarter of all food fish captured serves to produce feeds (fishmeal and fish oil) for aquaculture" (FAO,2014).

The second block of information touched on insect meal, stating that "insect meal offers a viable alternative to fishmeal in feed for farmed fish like trout and salmon, which would help reduce overfishing of species like anchovy and reduce damage to the marine ecosystem".

The second group was not given any particular information.

2.3 Socio-demographic and fish consumption data

Participant sociodemographic data and two questions on their routines in terms of eating fish were collected ahead of the survey itself (see Table 7 in appendix and Table 1). We tested for any statistically significant between-group differences using Wilcoxon and Fisher tests. The two groups were found socio-demographically comparable and had the same food habits.

Compared to national-sample data (INSEE, 2019), our sample stands out as having a slightly over-represented 30–59 age-bracket, which we feel is not problematic given that 30–59 is a typical food-shopping age-bracket. We also find our sample over-represented by people with an upper secondary (*baccalauréat*) or higher diploma compared to the national average. This difference is partly explained by the under-representation of over-60s.

Table 1: Fish consumption

Variables	Questions	Sample (%)		
		Informed N=151	Uninformed N=150	Total N=301
Fish	*How often do you eat fish:*			
	Never or less than once a month	5.30	2.67	3.99
	1 to 3 times a month	25.17	20.67	22.92
	Once a week	38.41	44.67	41.53
	2 to 4 times a week	28.48	27.33	27.91
	More than 5 times a week	2.65	4.67	3.65
Smoked fish	*How often do you eat smoked fish:*			
	Never or less than once a month	41.06	36	38.54
	1 to 3 times a month	47.68	50	48.84
	Once (or more) a week	11.26	14	12.62

Concerning the fish consumption, much like the wider French population (Norwegian Seafood Council, 2018), only a third of our sample eats the food health agency-recommended two portions of fish a week. Even though 73% of participants eat fish at least once a week, the vast majority (87.38%) eat smoked fish less than once a week.

2.4 Questionnaire

As this research is novel and till now there is few literature to rely upon,we constructed our main questionnaireby using the results of a survey realized by a non-profit national consumer advocacy group called CLCV for the ADEME (the French environment and energy management agency) with open-ended questions as a focus group (CLCV, 2015). The aim of this survey was to gain early insight into whether French consumers are ready to eat food from insect-fed animals. Some questions were directly borrowed from the CLCV-led study, some other questions were adapted or added to complete the collected information.

The core of our study questionnaire comprised three sections. First, participants were asked about their opinions on the fish food, in the wild and in farming, and about their concerns on the specific issue of fish farming (7 questions). A second serie of questions surveyed the opinion of participants about eating insect-fed trout. The participants were asked to respond on 5 specific points: normalness, disgust, impact on health, environmental impact, and novelty. In an effort to

more directly assess consumer readiness to eat farmed trout fed on insect meal, a third serie of 7 questions addressed consumers' intentions. More precisely, the objective of these question-items was to pinpoint factors that could shape purchase intentions. The items covered several construct dimensions: sensory (taste), food safety, labelling, economic, and risk factors.

Candidate responses to these three series of question-items were arranged on a five level Likert scale running from 'strongly disagree' to 'strongly agree'. Note too that the order of the questions in each series was random in order to prevent a sequence effect and to iron out any psychosocial bias—chiefly laziness bias—among participants.

2.5 Food neophobia

This study addresses the introduction of a food involving a new production process. This new production process rely on the introduction of insect in animal feed. The acceptability of insect based products is clearly unestablished in occidental siocieties. Even if the introduction of insect use in our study in not at the human food llevel but at the feed level, it seems to us relevant to integrate in our survey a questionnaire on food neophobia. The food neophobia is defined as fear and avoidance of new foods.

Many studies such as Verbeke (2015), Laureati et al. (2016), and La Barbera et al. (2020) show that food neophobia is one of the main personality traits explaining consumer willingness or unwillingness to adopt insects in food and feed. To account for this component here, we included in our questionnaire the psychometric instrument developed by Pliner & Hobden (1992) called the food neophobia scale (FNS). Specifically, six of the FNS items were selected and translated into French following Ritchey et al. (2003): "I don't trust new foods", "I am afraid to eat things I have never had before", "If I don't know what is in a food, I won't try it", "I am constantly sampling new and different foods" (reverse coded), "I like to try new ethnic restaurants" (reverse coded), "I will eat almost anything" (reverse coded).

Answers to these questions on food neophobia are strongly intercorrelated for each participant. Consequently, like Verbeke (2015), working up from just six FNS questions, we constructed a food neophobia score (the *FNSscore* variable) as the mean of the response values between 1 and

5 (5-level Likert scale) and accounting for the 3 (out of 6) reverse-scored items. The higher the *FNSscore*, the greater the participant's food neophobia. The new variable thus created runs from 1 to 4.33 (mean: 2.12 [SD: 0.68])[2]. Here again, there were no significant between-group differences in neophobia index (Mann-Whitney test). Inter-item consistency for *FNSscore* showed good reliability, with a Cronbach's α of 0.81.[3]

3 Statistical analyses

The empirical analysis took place in three steps. We started by performing a descriptive analysis, chiefly discriminating uninformed participants from participants who had been pre-informed on the benefits of insect meals in terms of protecting capture fishery resources. Then, a first set of analyses was performed by running logistic regression models on the responses to the questionnaire part covering intentions to eat insect-fed products. We then performed hierarchical agglomerative clustering (HAC) using results from multiple correspondence analysis (MCA) on our entire dataset (Husson et al., 2016). These two last methods are described in detail below. All these analyses were performed using the open-source RStudio software.[4]

3.1 The logistic regression model

Correlations between participant socio-demographic and acceptance of insects in aquafeeds were analysed by building logistic regression models in which each model's dependent variable is the response to each of the questions in Table 4. In order to properly estimate acceptability in our participant sample, the model chosen has to account for the qualitative nature of the dependent variable (Hosmer & Lemeshow, 2000). We modelled the probability of concurring with the assertions proposed as a function of sociodemographic variables (Table 7 in appendix), being informed

[2]Mean neophobia score was relatively low compared to figures reported in the literature, including figures on studies on Korean, American and Spanish consumers and Lebanese students (Fernández-Ruiz et al., 2013).

[3]The personality dimensions (Openness, Conscientiousness, Altruism, Extraversion, and Neuroticism) were assessed using the Big Five Inventory in a final questionnaire. Since taking into account psychometric data did not fundamentally change our results, we neglected it in our final analyses.

[4]Classification was performed using the R package FactoMineR functions library.

on the environmental benefits of insect meal as an alternative to fish meal (Figure 1), fish intake (Table 1), and food neophobia score.

Let Y_i^*, the latent variable describing the outcome value of Y_i, dichotomous variable, equals 1 if the participant said they 'agree' or 'strongly agree' with the fact they are ready to eat farmed fish fed on insect-based feed (*eat* variable), and 0 otherwise. The model to estimate thus reads as follows:

$$Y_i^* = \alpha + \beta X_i$$

where $i = 1, \ldots, n$ for the participants. X is a vector representing the factors associated with sociodemographic characteristics, membership-group (informed/uninformed), the various scores and the fish-consumption variables, and α and β are the parameters to be estimated. The equivalence between observed dichotomous variable Y_i and latent variable Y_i^* is given by:

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > \mu \\ 0 & \text{otherwise} \end{cases}$$

where μ is a parameter to be estimated. The distribution function used is the logistic distribution. The corresponding specification is a logit model estimated by maximum likelihood method. The predicted probability is thus written

$$\mathbb{P}(Y_i = 1|X_i) = \frac{\exp(\hat{\alpha} + \hat{\beta} X_i)}{1 + \exp(\hat{\alpha} + \hat{\beta} X_i)}.$$

We thus obtain the predicted probability of answering in agreement with the question given the observed variables.

To determine the best model in terms of selecting explanatory variables, we employed the backward stepwise selection technique using the lowest possible Akaike information criterion (AIC) as estimator. To assess the role and significance of each explanatory variable, we used the Wald test based on the asymptotic normality of the maximum-likelihood estimators. The goodness of fit for the model with thee data collected is assessed by the Hosmer–Lemeshow test which assesses the

match between predicted and observed values of event rates subgrouped as deciles. In practice, the models are validated as the p-value is greater than the canonical 5% risk. To assess model performance, we use a ROC curve criterion, i.e. the area under the curve (AUC). Discrimination is deemed acceptable at upwards of 0.7. To round off this analysis, we also give the rate of successful classification using the predicted *vs* effective responses.

3.2 The hierarchical agglomerative clustering

The methodology starts out with multiple correspondence analysis (MCA)—a method to describe qualitative data that is well geared to dealing with survey data—on the responses to the three questionnaires polling on fish farming and the use of insects in feed for farmed fish. MCA allows to analyse the pattern of relationships of several categorical dependent variables and is used to detect and represent underlying structures in a data set. We then applied hierarchical agglomerative clustering (HAC) on the MCA results to determine and then characterize classes of individuals.

The survey data was processed using MCA as a tool for multidimensional analysis on qualitative variables with modalities by measuring the gaps from observed distribution to a distribution that keeps the variables independent based on the χ^2 metric (Husson et al., 2016). The most discriminant axes are defined and the interpretation involves examining the contribution of each original modality to the creation of the axis.

Here we performed the MCA on 19 active variables from the questionnaire presented previously, with three modalities each: -1 = 'Strongly disagree' and 'Disagree', 0 = 'Neither agree nor disagree', 1 = 'Agree' and 'Strongly agree'. The raw data is represented by $19 \times 3 - 19 = 38$ dimensions or factorial axes. The supplementary variables are the participants' sociodemographics, food neophobia scores, fish consumption levels, and whether or not they were informed on the benefits of insect meal as an alternative to fish meal.

The objective of HAC is to partition the different participants into the most homogeneous classes possible based on the MCA factorial coordinates. We selected the first 29 factorial dimensions out of the total 38 dimensions, which meant we were able to keep 93% of the total inertia. Among the many partitions possible, the partition to select has to give the maximum interclass

variance, or in other words the minimum intraclass variance. HAC on the factorial coordinates from our MCA identified two possible partitioning schemes[5]. A first partition into 3 classes, following the 3 active variable modalities, featuring 54.4% of pro-insect people, 33.5% of anti-insect people, and 12% of neutrals, was one possible option. However, to refine our analysis, we opted to study the 5-class partition of our participant sample.

4 Results

4.1 Opinions

Table 2 presents the descriptive statistics and Cronbach alpha coefficients of the first seven questions on participants' opinions surrounding fish feed and diet, for both groups, informed and uninformed. Cronbach's alpha estimates the internal consistency of responses in multi-item bipolar scales. Given the diversity of the questions which loaded on this factor, it is not surprising to find low levels of reliability. The only question that gave a significant difference (in the χ^2 test of homogeneity) between the informed/uninformed groups was the assertion "I find it normal for farmed trout to be fed on insect-based feed". This tends to prove that the information delivered was new to them and was integrated by some of the informed participants.

Insects as animal feed is a practice rejected by a not insignificant number of people: 16% of our sample find it unnatural for fish to feed on insects and abnormal to feed insect feed to farmed trout. But, these figures have to be put in parallel with responses concerning the current aquafeed practice: 30% of participants think that it is not normal to feed plant-crop food to farmed tout.

Interestingly, in the uninformed group, what was thought to be a natural in-the-wild diet did not entirely overlap with what was thought to be a natural aquaculture diet. If we look closely, 60% of uninformed participants found it natural for trout to feed on insects, yet only 52% found it normal to raise farmed trout on insect-based feed. This perception of what is natural in trout diet and in trout farming was less differentiated in the informed group, as 64% of informed participants found

[5]A classification tree does not give the n best classes (general optimum) but the n best classes with the $n+1$ classes from the previous step (local optimum).

Table 2: Opinions on farmed fish diet

Variables	Questions	Sample (%)		
		Informed	Uninformed	Total
	I find it...	N=151	N=150	N=301
nat.ins	*...natural for fish to feed on insects:*			
	Strongly disagree	1.32	6.67	3.99
	Disagree	12.58	13.33	12.96
	Neither agree nor disagree	21.85	20	20.93
	Agree	33.77	32.67	33.22
	Strongly agree	30.46	27.33	28.90
nat.fish	*...natural for fish to feed on other fish:*			
	Strongly disagree	1.99	5.33	3.65
	Disagree	11.92	8.67	10.30
	Neither agree nor disagree	16.56	15.33	15.95
	Agree	39.74	40.67	40.20
	Strongly agree	29.80	30	29.90
nor.ins	*...normal for farmed trout to be fed on insect-based feed:*			
	Strongly disagree	0.66	6	3.32
	Disagree	9.27	16.67	12.96
	Neither agree nor disagree	21.85	25.33	23.59
	Agree	51.66	36.67	44.19
	Strongly agree	16.56	15.33	15.95
nor.fish	*...normal for farmed trout to be fed on fish-based feed:*			
	Strongly disagree	6.62	6	6.31
	Disagree	18.54	17.33	17.94
	Neither agree nor disagree	24.50	20.67	22.59
	Agree	39.07	44	41.53
	Strongly agree	11.26	12	11.63
nor.plant	*...normal for farmed trout to be fed on plant-based feed (grains and pulses):*			
	Strongly disagree	8.61	6.67	7.64
	Disagree	25.83	20	22.92
	Neither agree nor disagree	25.17	20.67	22.92
	Agree	28.48	40	34.22
	Strongly agree	11.92	12.67	12.29
cqces	*Fish farming can have negative knock-on effects on the environment:*			
	Strongly disagree	0.66	2.67	1.66
	Disagree	13.91	14.67	14.29
	Neither agree nor disagree	25.17	23.33	24.25
	Agree	27.15	35.33	31.23
	Strongly agree	33.11	24	28.57
concern	*I am concerned about how farmed fish are fed:*			
	Strongly disagree	1.32	1.33	1.33
	Disagree	5.30	8	6.64
	Neither agree nor disagree	16.56	16.67	16.61
	Agree	37.75	38	37.87
	Strongly agree	39.07	36	37.54
Cronbach's α		0.19	0.13	0.16

it natural for trout to feed on insects and—coherently—68% found it normal for farmed trout to be fed on insect-based feed.

Whereas 70% of participants found it natural for trout to feed on other fish, only 53% of participants surveyed found it normal for farmed trout to be fed on fish-based feed. Over 46% of participants found it normal to feed farmed tout with plant-based feed.

Except for the question concerning fish as a natural feed for fish, all other questions on fish diet or more specifically trout feed were answered 'neither agree nor disagree' by over 20% of participants. This reveals that that a non-negligible subset of people surveyed have neither firm knowledge nor even fuzzy beliefs on the issue.

A broad majority of participants appear to be conscious that aquaculture poses environmental problems, in general. Practically 60% of respondents thought that fish farming can have negative effects on the environment, regardless of whether they had been 'informed'. Three-quarters of our sample harboured concerns over feeding practices in fish farming. Thus, a vast majority of our participants are sensitive to the focal issue surveyed.

Table 3 shows the descriptive statistics and Cronbach alpha coefficients of the five questions surveyed participants' opinions about eating insect-fed trout. The differences in frequency distributions were statistically significant between groups with a margin of error below 5% for the *scheme*, *disgust*, and *env* variables (χ^2 test of homogeneity). The degrees of internal consistency (the variable *disgust* was reverse coded) is relatively liable for the informed participants.

58% of informed participants found that eating trout fed on insect-based feed is reasonable in the scheme of things, against 49% of participants uninformed on insect meal as a more sustainable alternative to fishmeal to help preserve fishery resources. Both these two figures are below the positive-response rates on the question of whether participants found it natural for fish to feed on insects. Moving a step up in the food chain or exposing humans to insects via eating trout led to more neutral responses (more than a 10% item-total difference for answering 'neither agree nor disagree' between the first questions under Tables 3 and 2 across our total sample). Furthermore, the information provided helped bring around better acceptance of feeding insects to farmed fish as something normal and reasonable in the scheme of things, consistently with our *nor.ins* variable.

Table 3: Opinions on eating insect-fed trout

Variables	Questions	Sample (%)		
		Informed	Uninformed	Total
	For me, eating trout fed on insect-based feed ...	N=151	N=150	N=301
scheme	*... is reasonable in the scheme of things:*			
	Strongly disagree	0.66	7.33	3.99
	Disagree	10.60	8	9.30
	Neither agree nor disagree	30.46	35.33	32.89
	Agree	44.37	36.67	40.53
	Strongly agree	13.91	12.67	13.29
disgust (reverse coded)	*... it's just disgusting:*			
	Strongly disagree	27.15	28	27.57
	Disagree	37.09	28	32.56
	Neither agree nor disagree	26.49	24.67	25.58
	Agree	9.27	12.67	10.96
	Strongly agree	0	6.67	3.32
health	*... is good for my health:*			
	Strongly disagree	1.32	6	3.65
	Disagree	5.96	8	6.98
	Neither agree nor disagree	60.93	60	60.47
	Agree	25.83	18.67	22.26
	Strongly agree	5.96	7.33	6.64
env	*... is good for the environment:*			
	Strongly disagree	0.66	5.33	2.99
	Disagree	3.31	4.67	3.99
	Neither agree nor disagree	38.41	46	42.19
	Agree	49.01	32.67	40.86
	Strongly agree	8.61	11.33	9.97
novel	*... is a novel experience:*			
	Strongly disagree	4.64	8	6.31
	Disagree	15.23	13.33	14.29
	Neither agree nor disagree	21.85	30.67	26.25
	Agree	42.38	35.33	38.87
	Strongly agree	15.89	12.67	14.29
Cronbach's α		0.84	0.71	0.80

Looking at the question on disgust, 19% of uninformed people found the idea of eating trout fed on insect-based feed disgusting, against only 9% of informed participants. Positive modelling of environmental messages about insect feed can help overcome the strong feeling of disgust among a fair amount of people. A quarter of the total sample gave a neutral response and 60% of participants were not disgusted by the practice of using insect protein. This and the previous results are perfectly coherent, since this 60% figure also corresponds to the positive response rate for

questions on insects as natural feed or aquafeed (see the *nat.ins* and *nor.ins* variables in Table 2).

An aggregate 60% of participants think that eating trout fed on insect-based feed has no effect on their health. Note however that 14% of uninformed participants thought it would be bad for their health, against just 7% of informed participants. Even though the information delivered talked about environmental risks, it nevertheless helped connect this novel feed practice to less consumer health risk. This may connect back to consumer exposure to food scares over the past two decades (mad cow disease in 1996, dioxin-poisoned poultry in 1999, bird flu in 2005, *E. coli* in cucumbers in 2011), which has cued a movement to get back to more 'natural' foods. Even though 57% of informed participants think that eating insect-fed trout is good for the environment, 38% of informed and 46% of uninformed participants declared they 'neither agree nor disagree' with this assertion. These responses may be tied to the answers to the question on the environmental consequences of fish-farming, as feeding insect meals to trout will still not mitigate all the environmental challenges tied to animal farming. Lastly, 53% of participants think that eating insect-fed trout is a novel experience, thus marking this feed practice as a new and positive development.

4.2 Intentions

Descriptive statistics for the participants' intentions are shown in Table 4. The inter-item consistency for this set of questions is high with a Cronbach's alpha of 0.88 overall. The differences in frequency distributions were statistically significant between informed *vs* uninformed groups with a margin of error of below 1% for the variables *eat*, *safe*, *taste*, *label* and *risk*, and below 10% for the *price* variable. Participants pre-informed on the environmental benefits of insect meals in terms of protecting capture fishery resources would generally be more inclined to eat farmed trout fed insect meal.

More specifically, 76% of informed participants and 64% of uninformed participants said they 'agree' or 'strongly agree' with the question-item "I am ready to eat farmed fish fed on insect-based feed". The figures are much the same on the question that adds the proviso "as long as the foods did not taste like insect", but they increase very significantly (to 89% for informed and 75% for uninformed participants) when the question was claused "as long as the foods were safe and fit

Table 4: Intentions surrounding insect aquafeeds

Variables	Questions	Sample (%)		
		Informed	Uninformed	Total
	I would be ready to eat farmed fish fed on ...	N=151	N=150	N=301
eat	*... insect-based feed:*			
	Strongly disagree	0.66	9.33	4.98
	Disagree	7.28	10	8.64
	Neither agree nor disagree	15.89	16.67	16.28
	Agree	44.37	42	43.19
	Strongly agree	31.79	22	26.91
safe	*... insect-based feed, as long as the foods were safe and fit to eat:*			
	Strongly disagree	0.66	5.33	2.99
	Disagree	3.31	9.33	6.31
	Neither agree nor disagree	6.62	10	8.31
	Agree	34.44	36	35.22
	Strongly agree	54.97	39.33	47.18
taste	*... insect-based feed, as long as the foods did not taste like insect:*			
	Strongly disagree	2.65	12.67	7.64
	Disagree	4.64	8.67	6.64
	Neither agree nor disagree	13.91	14.67	14.29
	Agree	32.45	26	29.24
	Strongly agree	46.36	38	42.19
label	*... insect meal, as long as the food label clearly flags the fact:*			
	Strongly disagree	2.65	11.33	6.98
	Disagree	9.27	12	10.63
	Neither agree nor disagree	15.23	26	20.60
	Agree	41.06	28	34.55
	Strongly agree	31.79	22.67	27.24
risk	*... insect meal, as long as all insect farming-related risks are controlled:*			
	Strongly disagree	3.97	14	8.97
	Disagree	8.61	10.67	9.63
	Neither agree nor disagree	15.89	21.33	18.60
	Agree	43.71	32	37.87
	Strongly agree	27.81	22	24.92
price	*... insect meal, as long as the food is not more expensive than another product in the same category:*			
	Strongly disagree	3.31	11.33	7.31
	Disagree	13.25	14.67	13.95
	Neither agree nor disagree	17.22	18.67	17.94
	Agree	37.75	32	34.88
	Strongly agree	28.48	23.33	25.91
home	*I would see no problem having an insect farm near my home:*			
	Strongly disagree	16.56	19.33	17.94
	Disagree	19.87	16	17.94
	Neither agree nor disagree	22.52	27.33	24.92
	Agree	26.49	21.33	23.92
	Strongly agree	14.57	16	15.28
Cronbach's α		0.90	0.85	0.88

to eat". The health–hygiene credentials of the final product therefore outweigh the taste factor.

Conversely, the clausal conditions concerning product labelling, insect farming-related risks, and purchase prices had less significant endorsement. For example, the proportion of uninformed participants answering positively drops from 64% to 51% when the clause "as long as the food label clearly flags the fact" is added to the question "would you be ready to eat farmed trout fed on insect meal". The difference between these results is largely explained by terminology differences. The questions on the *eat*, *safe* and *taste* variables talked about insect-based animal diet using the expression "insect-based feed" whereas the questions on *label*, *risk* and *price* used the term "insect meal". Participants attached more negative connotations to the term 'insect meal' than the term 'insect-fed'. For questions using the term 'meal', product price on a par with the regular standard product is the least important argument for informed participants and the most important for uninformed participants in order to gain acceptance for using insects as animal feed.

Finally, note that we found a *not in my backyard* effect, as 70% of participants would be ready to eat fish from farms that use insect feeds but only 39% would see no problem having an insect farm near their home. This same effect replicates in informed and uninformed participants. Insect farming-related nuisances, whether real or projected, do exist for a relatively substantial number of participants, since 36% would see a problem having an insect farm near their home.

Results of logistic regressions allow us to pinpoint the variables that play a major role in determining the participants' intentions to eat insect-fed farmed fish. Table 5 reports the results of the various models and tests performed. These results are expressed as odds ratios. An odds ratio, i.e. $\mathbb{P}/(1-\mathbb{P})$, quantifies the strength of effect of a variable on the probability of an 'agree' or 'strongly agree' answer to the question. The direction of the association is measured by comparing the odds ratio against 1. An odds ratio greater than 1 correlates to an increase in acceptability over the reference outcome and an odds ratio less than 1 correlates to a decrease in acceptability under the reference outcome of the explanatory variable.

The most powerful regressions (i.e. scoring highest on the AUC criterion) were those explaining the *eat*, *safe* and *home* variables, and the regressions with the best successful classification rates were *eat*, *safe* and *taste*. These last three variables (*eat*, *safe* and *taste*) represent the responses to

Table 5: Acceptability estimates (odds ratios)

		eat	*safe*	*taste*	*label*	*risk*	*price*	*home*
Constant		6.91***	7.49***	1.38	2.75**	1.41	2.88**	1.86**
Group	Uninformed (Ref.)							
	Informed	1.77**	2.94***	2.10***	2.60***	2.16***	1.61*	
Gender	Female (Ref.)							
	Male	2.53***	1.76*	6.57**	1.58*	2.04***	1.85**	3.46***
Number of children	No children (Ref.)							
	One child	0.97	2.04					1.91*
	Two or more children	0.42***	0.47**					1.00
Education	No diploma/lower-secondary/vocational/secondary vocational (Ref.)							
	Higher secondary or equiv.	1.60				1.23		
	Undergraduate or graduate	2.56**				2.24**		
	Master's level or higher	1.73				1.85		
Age bracket	Under 30 years (Ref.)							
	30-39 years						0.50**	0.51
	40-49 years						0.62	0.36**
	50-59 years						0.72	0.48*
	60 and over						0.38**	0.19***
Smoked fish	Never or less than once a month (Ref.)							
	1 to 3 times a month		1.81*					0.96
	Once (or more) a week		3.06*					2.33*
FNSscore		0.39***	0.52***	1.06	0.57***	0.63**	0.73*	0.55***
FNSscore × Gender	FNSscore × Female (Ref.)							
	FNSscore × Male			0.46*				
AIC		335	256	356	378	385	400	372
Hosmer-Lemeshow test (p-valeur)		0.10	0.88	0.90	0.47	0.37	0.69	0.64
AUC criterion		0.81	0.76	0.64	0.69	0.68	0.65	0.74
Rate of successful classification in the sample		75.75%	83.06%	71.76%	65.12%	68.44%	64.45%	70.10%

Wald test: *** significant at 1%, ** significant at 5%, * significant at 10%.
Ref.: reference modality of the explanatory variable.

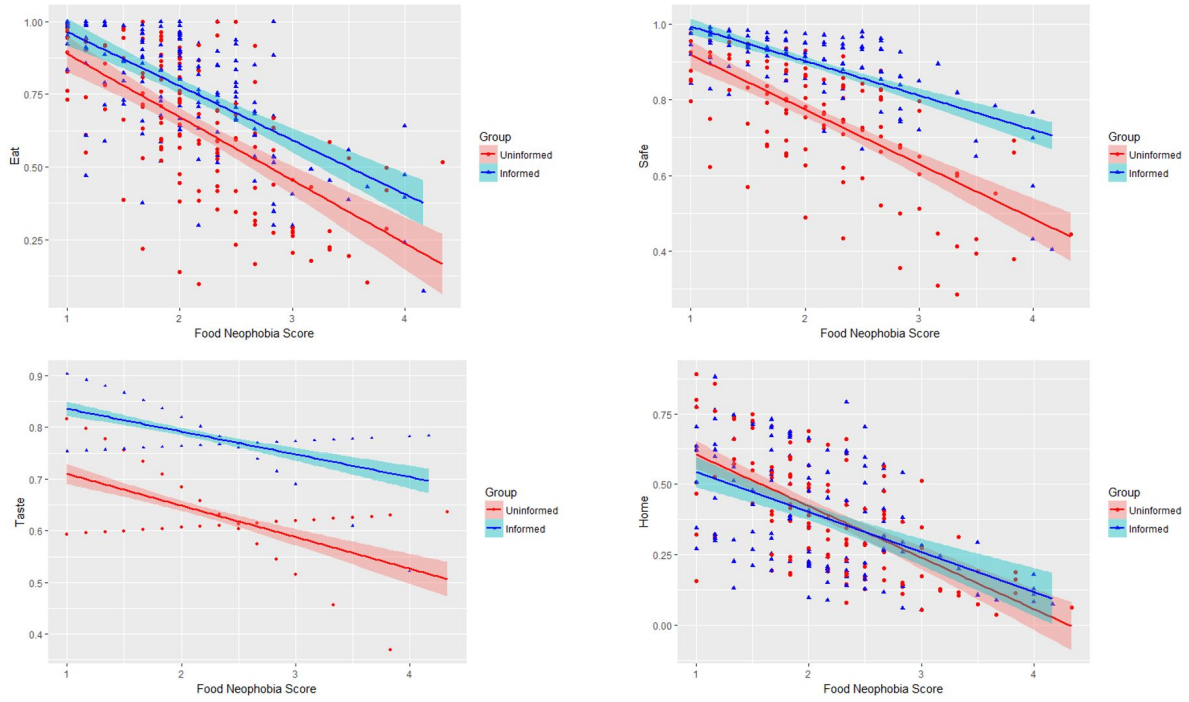
three questions that talked about "insect-based feed" rather than "insect meal". This confirms that the term 'meal' was an obstacle for certain participants.

Food neophobia score is a hugely powerful explanatory factor on all acceptability-related responses. Neophobics, as a rule, will tend to depositivize their responses to questions on their potential consent to eating insect-fed fish. For example, a respondent with one more FNS points will have 2.56-fold less $(1/0.39)$ probability of replying positively to the item "I am ready to eat farmed fish fed on insect-based feed", all other things being equal.

The logistic regressions confirm the earlier descriptive statistics on the role of informing par-

ticipants. Individual predicted probabilities, i.e. $\mathbb{P}$, of answering several questions (variables of the most powerful regressions: *eat*, *safe*, *taste*, *home*) in the affirmative are presented in Figure 2, depending on the food neophobia score for informed and uninformed participants. The straight lines represents the simple linear regressions between the predicted probability and the food neophobia score for informed participants (blue line) and uninformed participants (red line).

Figure 2: Predicted probability depending on the food neophobia for informed and uninformed participants

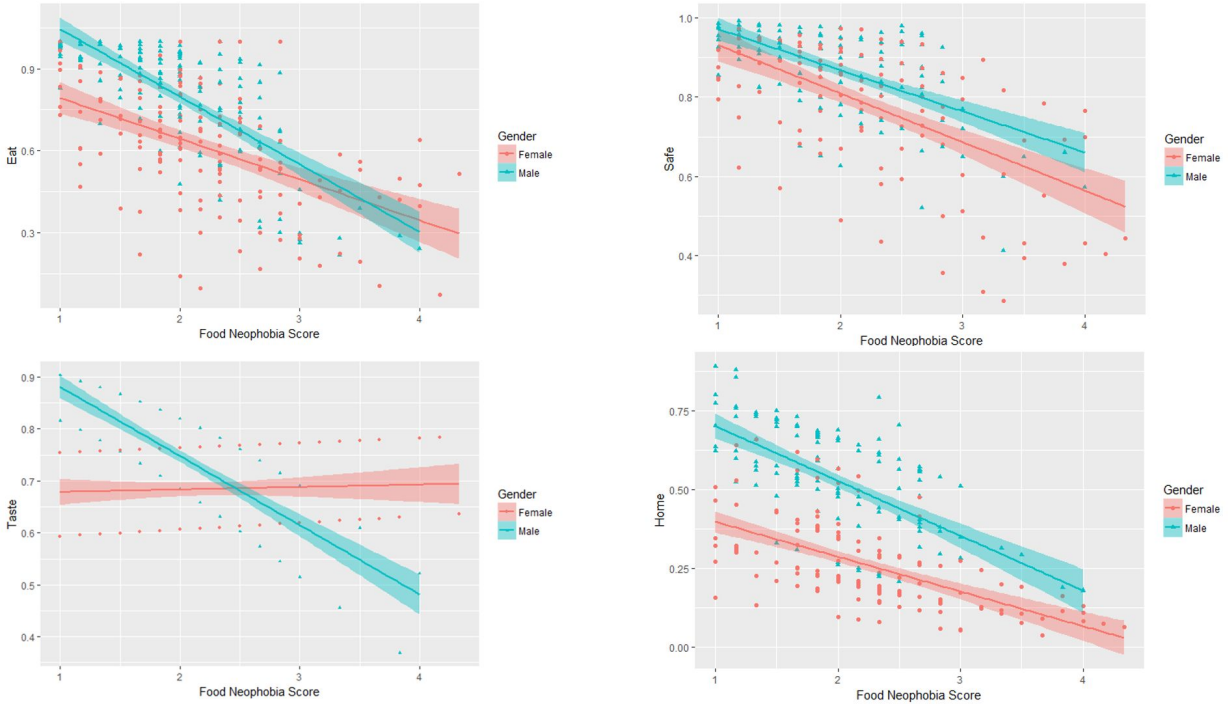


Not surprisingly, the consumers' readiness to adopt insects in fish feed is decreasing in the food neophobia score. Likewise, membership of the informed group effectively ups the probability of being ready to eat insect-fed farmed fish regardless of the conditional clauses attached. The response to not having an insect farm near their home is not governed by whether or not they have been informed on the environmental benefits of using insect meal. These results are perfectly coherent. Being informed that insect meal can help preserve fishery resources increases the acceptability of insect-fed products, except when talking about having insect farms near one's own home. This question is disconnected from the environmental value of insect-fed foods in terms of protecting capture fishery resources.

An individual participant factor very confidently highlighted by the regressions is gender. Men

are far readier than women to accept insect-fed fish. Figure 3 represents individual predicted probabilities ($\mathbb{P}$) of answering several questions (*eat*, *safe*, *taste*, *home*) in the affirmative depending on the food neophobia score for males (green points) and female (orange points). The green (orange) line represents the simple regression line between the predicted probability and the food neophobia score for males (females).

Figure 3: Predicted probability depending on the food neophobia for males and females



A man is 2.5-times more likely to reply positively to "I am ready to eat farmed fish fed on insect-based feed" than a woman, all other things being equal. However, this difference in readiness between males and females gradually diminishes when the food neophobia score increases. The same effect appears with the question concerning an insect farm near home. The predicted probabilities of females increase and meet those of males when the safety of foods is mentioned. Women seem to be more reassured by the guarantee of the food safety than men. Furthermore, a man is 6.5-times more likely to answer "Strongly agree" or "Agree" to the question "I am ready to eat eat farmed fish fed on insect-based feed, as long as the foods did not taste like insect". This figure is attenuated by the cross-variable *FNSscore* $\times$ *Gender*, as for a man, each additional point on the food neophobia score reduces the probability of agreeing with the above statement by 2.17

(1/0.46). This result seems to indicate that the food neophobia is connected to the taste of the product for women.

Having several children in the household decreases the probability of accepting to eat insect-fed trout (*eat* variable), especially when the food safety issue is raised (*safe* variable). Educational attainment emerges as an explanatory factor on *eat* and *risk* variables: participants educated to university undergraduate or graduate level would be more inclined to eat insect-fed fish as long as there are no insect farming-related risks involved.

Age emerges as an explanatory factor in regressions on *price* and *home* variables. Being aged over 60 strongly decreases the probability of accepting to have an insect farm near one's home compared to under-30s: probability is five-fold lower, 2.1-fold lower for fiftysomethings, and 2.8-fold lower for fortysomethings. The *not in my backyard* effect therefore increases with age.

Participants who very frequently eat smoked fish will be three nearly 3 times likelier to eat insect-fed trout as long as the foods were safe and fit to eat. Likewise, they are also more likely to accept having an insect farm near their home. Familiarity with the food increases intention to eat as well as acceptance of an insect farm.

4.3 A typology of consumers

The results of the MCA are presented in Figure 4. The first two axes, i.e. the factorial plane, represent 27.55% of total inertia, which is relatively high given the 38 starting dimensions.[6]

The shape of the cloud of individuals in the first factorial plane resembles a parabola or inverted V-curve—which is known as the Guttman effect (Husson et al, 2016): the principal axis opposes the extremes whereas the second axis opposes the 'mean' individuals at the two extremes. Actives variables that contribute the more to the factorial plan come under both intentions and opinions. in this way, not being ready to eat fish fed on insect-based feed is related to the disgust for this food and the view that it is not natural and normal for fish to feed on insects. The food neophobia score is significantly highly correlated with the first two axes and *gender* and *group* are the best projected supplementary variables on the first axis.

[6]The next two axes each represent less than 5% of total inertia.

Figure 4: Results of the MCA

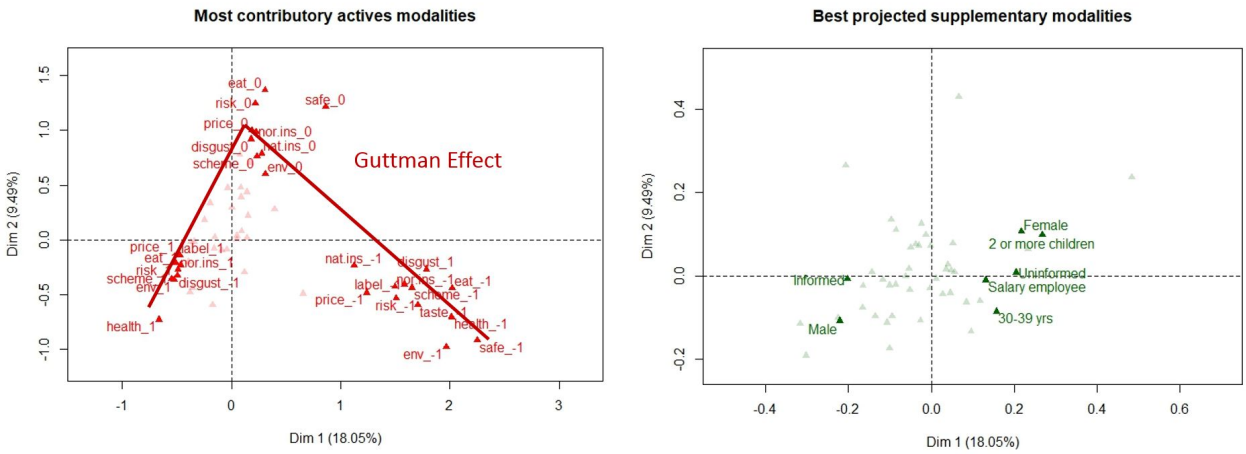


Figure 5 represents the individuals clustered into classes in the factorial plane, where each dot shows an individual's position in the factorial plane. The five classes are relatively homogeneous. Table 6 reports the key characteristics of the 5 classes with the active modalities over-represented with the v.test given in decreasing order, i.e. from biggest to smallest contributors, and likewise for the other variables and modalities. In each class, the over-represented modalities are those that are more frequent in that class than in the other classes. For instance, 91% of the 'Fans' think that eating insect-fed trout is reasonable in the scheme of things, against just 54% for the item-total sample. Conversely, this class does not count a single individual who is not ready to eat insect-fed farmed fish, against 14% for the item-total sample. For the numerical variable, *FNSscore*, figures correspond to in-class means in relation to the all-sample mean. For instance, the mean *FNSscore* of the 'Disgusteds' was 2.47, whereas the average score was 2.12.

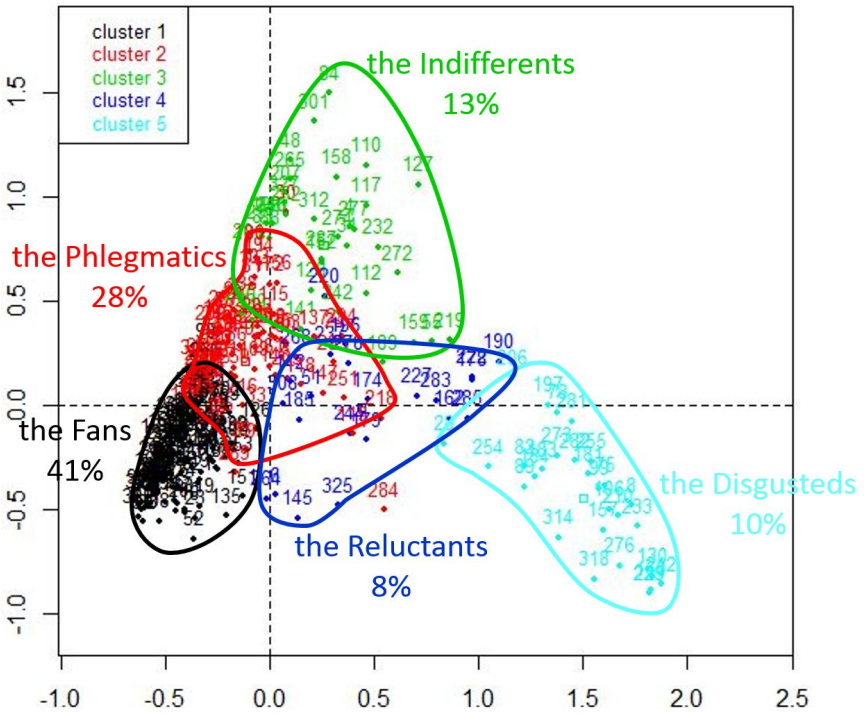
The first class gathers 125 participants qualified as 'Fans', i.e. 41% of our total sample. They replied positively to most of the 14 questions talking about insects as feed/food, and 70% of the Fans would see no problem having an insect farm near their home, against 39% for our total sample. The Fans tend to be men (64%) with a significantly lower-than-average food neophobia score.

The second class gathers the 'Phlegmatics' (28% of our sample), who are ready to eat insect-fed trout fish regardless of the conditional clauses attached, but give neutral replies on questions asking how they feel about this aquafeed practice. Nevertheless, 50% of them do not want an insect

Table 6: Defining characteristics of the 5 classes

	Class 1 **the Fans**	Class 2 **the Phlegmatics**	Class 3 **the Indifferents**	Class 4 **the Reluctants**	Class 5 **the Disgusteds**
Samples	125 (41.53%)	86 (28.57%)	38 (12.62%)	23 (7.64%)	29 (9.63%)
Actives modalities	*scheme*_1: 91/54	*health*_0: 88/60	*risk*_0: 92/19	*risk*_ − 1: 100/17	*safe*_ − 1: 79/31
over-represented	*env*_1: 88/51	*price*_1: 88/61	*price*_0: 79/18	*price*_ − 1: 87/21	*eat*_ − 1: 90/14
	*nor.ins*_1: 94/60	*scheme*_0: 58/33	*eat*_0: 68/16	*label*_ − 1: 78/18	*taste*_ − 1: 86/14
	*disgust*_ − 1: 94/60	*risk*_1: 86/63	*label*_0: 61/21	*safe*_0: 26/8	*risk*_ − 1: 93/19
	*health*_1: 61/29	*label*_1: 85/62	*health*_0: 97/60	*nor.plant*_ − 1: 57/31	*health*_ − 1: 76/11
	*eat*_1: 98/70	*nor.ins*_0: 44/24	*env*_0: 82/42	*taste*_0: 35/14	*scheme*_ − 1: 79/13
	*home*_1: 70/39	*taste*_1: 88/71	*safe*_0: 34/8	*env*_0: 65/42	*label*_ − 1: 86/18
	*nat.ins*_1: 90/62	*env*_0: 62/42	*disgust*_0: 61/26	*cqces*_0: 43/24	*disgust*_1: 79/14
	*risk*_1: 89/63	*safe*_1: 95/82	*nor.ins*_0: 58/24		*nor.ins*_ − 1: 83/16
	*safe*_1: 99/82	*disgust*_0: 41/26	*taste*_0: 42/14		*price*_ − 1: 90/21
	*label*_1: 82/62	*concern*_ − 1: 17/8	*nat.ins*_0: 45/21		*env*_ − 1: 52/7
	*price*_1: 81/61	*home*_ − 1: 50/36	*scheme*_0: 58/33		*nat.ins*_ − 1: 66/17
	*nor.fish*_ − 1: 41/24	*nat.ins*_0: 33/21	*nat.fish*_1: 84/70		*novel*_ − 1: 62/21
	*taste*_1: 64/50	*nor.fish*_0: 34/23			*home*_ − 1: 59/39
		...			...
Actives modalities	*env*_0: 12/42	*health*_1: 6/29	*eat*_1: 13/70	*risk*_1: 0/63	*safe*_1: 10/82
under-represented	*scheme*_0: 8/33	*home*_1: 14/39	*risk*_1: 8/63	*label*_1: 4/62	*eat*_1: 3/70
	*nor.ins*_0: 2/24	*label*_ − 1: 1/18	*price*_1: 11/61	*price*_1: 4/61	*nor.ins*_1: 0/60
	*disgust*_0: 6/26	*price*_ − 1: 3/21	*disgust*_ − 1: 16/60	*taste*_1: 44/71	*taste*_1: 10/71
	*label*_ − 1: 2/18	*risk*_ − 1: 3/19	*label*_1: 21/62	*risk*_0: 0/19	*risk*_1: 3/63
	*eat*_ − 1: 0/14	*scheme*_1: 34/54	*health*_1: 0/29	*home*_1: 17/39	*label*_1: 3/62
	*risk*_ − 1: 2/19	*nor.fish*_ − 1: 9/24	*nor.ins*_1: 26/60	*disgust*_ − 1: 39/60	*price*_1: 3/61
	*health*_0: 38/60	*env*_1: 32/51	*scheme*_1: 21/54	*safe*_1: 65/82	*scheme*_1: 0/54
	*home*_ − 1: 15/36	*eat*_ − 1: 3/14	*env*_1: 18/51	*env*_1: 30/51	*nat.ins*_1: 7/62
	*eat*_0: 2/16	*nat.ins*_0: 47/62	*risk*_ − 1: 0/19		*disgust*_ − 1: 7/60
	*disgust*_1: 1/14	*safe*_ − 1: 1/9	*taste*_1: 45/71		*env*_1: 3/51
	*scheme*_ − 1: 1/13	*disgust*_1: 5/14	*safe*_1: 63/82		*health*_1: 0/29
	*nat.ins*_0: 6/21	*nor.ins*_1: 47/60	*nat.ins*_1: 39/62		*health*_0: 24/60
	*taste*_ − 1: 2/14	*price*_0: 8/18	*nor.fish*_ − 1: 8/24		*novel*_1: 28/53
	...	...	...		...
Supplementary modalities					
over-represented	*Male*: 64/50	*Student*: 9/4		*Female*: 78/50	*Uninformed*: 76/50
		Single: 28/18		*Over 60 yrs*: 26/10	30-39 yrs: 45/28
		Unemployed: 7/3			*2 or more children*: 41/24
		Never eat fish: 8/4			
		Income <€750: 7/3			
		Under 30 yrs: 24/17			
Supplementary modalities					
under-represented	*Female*: 36/50			*Male*: 22/50	*Informed*: 24/50
	Never eat fish: 1/4			*Under 30 yrs*: 0/17	
	2 or more children: 18/24				
Supplementary variables					
	FNSscore: 1.95/2.12		*FNSscore*: 2.48/2.12		*FNSscore*: 2.47/2.12

Figure 5: Projection and partitioning of individuals in the factorial plane of the MCA



farm near their home. They tend to be less concerned than average about how farmed fish are fed. They tend to be young students, not yet in work, and single, scraping by on very little income.

The third class, which counts 38 participants (13% of our total sample), is representative of the intermediate modality *var*_0: they are the real 'Indifferents'. They replied 'neither agree nor disagree' to most of the 14 questions talking about insects as feed/food. Their food neophobia score is, on average, higher than the other participants.

The fourth class counts 23 participants, i.e. 8% of our sample, that we call the 'Reluctants'. They have no intention of eating insect meal-fed fish. The term 'meal' appears to resonate strongly with them, as they categorically reject any idea of eating products when the question uses the word 'meal'. The Reluctants answered 'neither agree nor disagree' more than any other group on two questions phrased using the term 'insect-fed' (*safe*_0 and *taste*_0 modalities). The Reluctants class counts a large majority of women (78%), and the over-60s are over-represented, but it does not count a single under-30 participant.

Our fifth class are the 'Disgusteds'—a class of people who are sickened by insects—which make up a very specific class gathering 29 participants, i.e. 10% of our sample. They replied

negatively to most of the 14 questions talking about insects as feed/food, and 90% of them would not be ready to eat insect-fed fish (against 14% for the item-total sample), 66% think it is not natural for fish to feed on insects (against 17% in the total sample), 83% think that it is not normal to feed insect meals to farmed trout (17% in the total sample), and a massive 79% are actually disgusted by this feed practice, against only 14% in the total sample. Over 50% of people in this class, against just 7% in the total sample, think that feeding insects to trout is not good for the environment. This result is partly explained by the fact that 76% of participants in this class had not been pre-informed on the environmental benefits of insects in terms of protecting capture fishery resources. Thirtysomethings and people with at least two children are over-represented in this class. The food neophobia score of the Disgusteds is, on average, higher than the general all-sample average.

5 Discussion and conclusion

The present study has investigated the French consumers' acceptability of the use of insect meals in aquafeed and the determinants of this. A battery of statistical analyses on the data collected produced insightful and informative results.

Our main result is that providing information on environmental benefits of insect-based feed as fish meal substitute allows to increase the acceptance of the use of insects in feed for fish readiness to eat farmed fish fed on insects. Over 14% of our participants feel disgusted by the idea of eating insect-fed trout. This figure rises to 20% when participants are not informed on the benefits of insect meal for fishery resources, against 9% if they are informed. Conversely, 54% find this feed practice reasonable. The consumer intention data fits with these preliminary results: 70% of our sample would be ready to eat insect-fed farmed fish. This figure splits as 76% in the informed group against 64% in the uninformed group. This first result is largely confirmed by the advanced analyses. Binary logistic regressions clearly show that being informed on the benefits of insect feed as an alternative to fish meal significantly increases the readiness to eat farmed fish fed on insects, whatever the clausal conditions. Furthermore, 76% of the class of the 'Disgusteds'

(10% of our sample), gathering people the least ready to eat fish fed on insect-based feed, were uninformed, against 50% of the total sample. Clearly, getting information on the negative effects of overfishing and on insect meals as a viable alternative to fishmeal in aquafeed allows to improve the acceptability of insects as fish feed.

This study finds food neophobia to be an important individual factor that determines consumers' acceptability of insects as fish feed. A high food neophobia score decreases the probability of assenting to eat insect-fed fish, like in Laureati et al. (2016). However, the 'Indifferents' (13% of the total sample) are more food neophobic than others. This result is consistent with many studies that have reported food neophobia to be a major barrier to the acceptance of and readiness to try insects as food (Hartmann & Siegrist, 2017).

Our results underline the significant role of gender. Like Verbeke et al. (2015) and Laureati et al. (2016), men appear to be readier to eat insect-fed fish. Our findings can suggest that women need more reassurances that the foods are effectively safe and fit to eat and that the food neophobia is linked to the fear that the final food product could have insect taste.

Moreover, the term 'insect meal' is a turn-off for some participants, as the acceptability decreases when questions swap in the term 'insect meal' instead of 'insect-based feed'. The 'Reluctants' (8% of our sample) appear as reluctant because of the use of the red-flag term 'insect meal'. Women are over-represented in this class.

The age also plays a role to a lesser extent. Verbeke et al. (2015) and Popoff et al. (2017) showed that age is not a discriminatory variable, whereas Laureati et al. (2016) and Mancuso et al. (2016) contend that younger buyers are more receptive to this innovation. Interestingly, we find that the older the consumers, the less willing they are to accept an insect farm near home. In addition, the term 'insect meal' seems to be more problematic for the oldest-age-bracket.

Two of the classes gather people ready to eat insect-fed farmed fish and together represent 69% of our total sample, which validates our earlier results. Our findings confirm the dominant role of three key factors in the acceptability of insects as fish feed: gender, food neophobia, and information received. The terminology used and positive environmental messages about insect-fed products help reduce the otherwise-intuitive disgust felt among certain people.

This study does carry limitations. First, the survey used respondent declarations, with all the limitations inherent to this type of survey. However, the participants had been selected to take part in a much wider-ranging study on a different topic, and they received remuneration for their input. Furthermore, before answering the questionnaires on insects as aquafeed, the participants had to make 16 hypothetical choices online between a pack of conventional smoked trout fillet and a pack of smoked trout labelled 'insect-fed', each with different prices (Bazoche & Poret, 2017). The results of that study are consistent with the new results obtained through the questionnaires studied here. Here, our analysis was centred on consumer intentions, not consumer behaviour, and so a further limitation stems from the fact that the product under study, i.e. insect-fed trout, was not yet in shops at the time of our survey. Participants were therefore dealing with what is still only a hypothetical product. However, cross-coupling different sets of questions with different sets of statistical analysis made it possible to assess the consistency and robustness of the findings.

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Table 7: Participant sociodemographics

Variables	Sample (%)		
	Informed N=151	Uninformed N=150	Total N=301
Gender			
Female	48.34	52.67	50.50
Male	51.66	47.33	49.50
Age bracket			
Under 30 yrs	15.89	18.67	17.28
30-39 yrs	25.83	30	27.91
40-49 yrs	20.53	20.67	20.60
50-59 yrs	24.50	24	24.25
60 and over	13.25	6.67	9.97
Marital status			
Single	19.21	17.33	18.27
Married or in domestic partnership	70.20	66	68.11
Divorced or separated	9.93	15.33	12.62
Widowed	0.66	1.33	1.00
Number of adults in the household			
1	26.49	23.33	24.92
2	62.25	68.67	65.45
3 ou 4	11.26	8	9.63
Number of children in the household			
No children	58.28	48.67	53.49
1 child	21.19	23.33	22.26
2 or more children	20.53	28	24.25
Professional status			
Student	5.30	2.67	3.99
Currently unemployed	3.97	9.33	6.64
In part-time work	9.93	12	10.96
In part-time work	64.90	68.67	66.78
Retired	12.58	6	9.30
Not in paid work	3.31	1.33	2.33
Profession			
Farmer	0	0.67	0.33
Self-employed, trader, entrepreneur	5.30	4	4.65
Management, white-collar work	26.49	26	26.25
Middle management	16.56	18	17.28
Salary employee	43.05	48.67	45.85
Blue-collar	3.31	2	2.66
Unemployed	5.30	0.67	2.99
Highest educational credential			
No diploma/lower-secondary/vocational/secondary vocational	21.85	12.67	17.28
Higher secondary, vocational stream or equivalent	19.87	28.67	24.25
Undergraduate or graduate level	30.46	30	30.23
Master's level or higher	27.81	28.67	28.24
Monthly earnings (net)			
Under 750 euros	5.96	0.67	3.32
751–1200 €	5.30	6.67	5.98
1201–1500 €	6.62	9.33	7.97
1501–2300 €	19.87	19.33	19.60
2301–3000 €	21.85	22.67	22.26
3001–3800 €	18.54	20.67	19.60
3801–4500 €	11.26	14.67	12.96
Over 4500 euros	10.60	6	8.31