Deliverable D4.4

Results and interpretations of MCDA

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SUMMARY

The aim of the second stakeholder meeting held in Rotterdam on October 19/20 2015, back to back to the European Aquaculture Conference, was to assess multi-stakeholders knowledge, experience and perception on key issues for the economic development of organic aquaculture.

As in the “real world" situations, solutions to alternatives are reached, as compromise solutions, through negotiations to reach a consensus. These challenging solutions were addressed during a survey among stakeholders based upon a Multi Criteria Decision Analysis (MCDA) technique, meant as a tool to facilitate informed decisions among alternative approaches to specific organic farming issues.

The survey was attended by consumers, retailers, researchers, organic farmers together with experts from the organic certification bodies, the aquaculture associations, the environmental NGOs, the feed industry and the Public Institutions.

Participants were requested to answer anonymously to a questionnaire with a number of closed questions concerning the following eighteen subject areas: 1) Institutional framework; 2) Consumer perception; 3) Environmental interactions; 4) Fish health and welfare; 5) Control provision; 6) Production rules; 7) Legislative framework; 8) Production systems; 9) Product quality; 10) Product ecological quality; 11) Energy use; 12) Recycling; 13) Environmental impact; 14) Quality of water; 15) Quality of feed; 16) Quality of the rearing environment; 17) Physiological condition; 18) Husbandry practices.

The results of the survey were represented, for each question belonging to the eighteen key issues, by box plots, which were set using 0.05, 0.25, 0.5, 0.75 and 0.95 percentiles. In addition, the standardized empirical probability to be ranked first and last, among the different alternatives, was expressed as graphs.

The number of participants to the survey per each category of stakeholders was the following: Aquaculture associations and Organic certification bodies 13; Consumers, Retailers & NGOs 13; Organic farmers 10; Researchers 13; Other 3. The most represented geographical region was the Western Europe (21), followed by the Northern Europe (18) and the Mediterranean Europe (17). The less represented was the Central Europe (7). The gender of the large majority of participants was male (49), only 15 were female. The average age of participants was quite high; almost all were over thirty-five years.

Looking into the Consistency ratio of the answers to the questions delivered by the stakeholders, concerning the eighteen key issues in the survey, the results appear rather positive. The level of coherence of the answers given to a survey by the stakeholders greatly influence the robustness of the results and the interpretation of the views expressed. Indeed, values of the consistency ratio below 0.10 indicate high coherence of the answers delivered, while values above 0.10 indicates a progressive impoverishment of the coherence. In the present survey, the answers concerning thirteen key issues obtained a consistency ratio below 0.10. While, only five of eighteen key issues showed a consistency ratio slightly above 0.10 (but below 0.12).

The survey participation was rather proactive and provided a useful feedback on how to improve the European regulation of organic aquaculture. It is also worth noting that rarely the judgments/preferences expressed by the four stakeholder categories (excluding the "other" category, which includes a negligible number of people) were significantly different each other

and/or from the average of all stakeholders. Furthermore, the results expressed in terms of empirical probability, generally, corroborated those shown in the box plots. They also provided a more accurate assessment of the degree of diversity/similarity of the preferences expressed, especially in cases where the results of the box plots showed higher values of standard deviation.

INTRODUCTION

The overall vision of the OrAqua project is to facilitate economic growth of the organic aquaculture sector in Europe, supported by science-based regulations and in line with organic principles and consumer confidence.

The aim of the second stakeholder meeting held in Rotterdam on October 19/20 2015, back to back to the European Aquaculture Conference, was to assess multi-stakeholders knowledge, experience and perception on key issues for the economic development of organic aquaculture.

To this purpose, a survey on the current EU regulatory framework for the organic aquaculture was carried out.

Conflicting approaches to the wide range of multidisciplinary and complex organic farming issues may challenge stakeholders having different backgrounds and knowledge and maybe conflicting objectives and preferences of specific farming issues (feed, welfare, environment, economic etc.), related to the EU regulation. These challenging issues were addressed using the Multi Criteria Decision Analysis (MCDA) as a tool to facilitate informed decisions of choices among alternatives and hence to balance conflicting approaches to the specific organic farming issues.

MCDA technique facilitates the in depth analysis of important issues/goals (e.g. feed, environment etc.), breaking these into smaller components for evaluating interests/alternatives (e.g. protein source, fat source, amino acid profile, fatty acid profile, feed utilization, growth rate, discharge of nitrogen and phosphorus etc.) and finally integrating each component according to a process of ranking, weighting and calculating a score.

As in the “real world" situations, solutions to alternatives are reached as compromise solutions, resulting from trade-offs between various (sometime) conflicting objectives of the stakeholders and decision makers, through negotiations to reach a consensus. This involves seeking “optimal solutions” to multiple alternatives such as prioritising between fish health/welfare and farm economics/competitiveness, etc. All the above should balance within the framework of the organic principles.

Participants were requested to answer anonymously to a questionnaire with a number of closed questions concerning the following eighteen subject areas: 1) Institutional framework; 2) Consumer perception; 3) Environmental interactions; 4) Fish health and welfare; 5) Control provision; 6) Production rules; 7) Legislative framework; 8) Production systems; 9) Product quality; 10) Product ecological quality; 11) Energy use; 12) Recycling; 13) Environmental impact; 14) Quality of water; 15) Quality of feed; 16) Quality of the rearing environment; 17) Physiological condition; 18) Husbandry practices.

In addition, interested parties had the possibility to submit free contributions by answering to an open question and/or sending an e-mail to a dedicated mailbox.

The survey participation of consumers, retailers, researchers, organic farmers together with experts from the organic certification bodies, the aquaculture associations, the environmental NGOs, the feed industry and the Public Institutions provided a useful feedback on how to improve the European regulation of organic aquaculture.

A glossary of the terms used in the survey was made available in order to ensure a homogeneous interpretation/understanding of the questions among all the participants.
Materials and methods, together with the analysis of the results and the final remarks are reported in the following chapters.

MATERIALS AND METHODS

Whether in our daily lives or in professional settings, there are typically multiple conflicting criteria that need to be evaluated in making decisions. Multi Criteria Decision Analysis (MCDA) is a discipline of operations research that explicitly considers multiple criteria in decision-making environments. There are several techniques belonging to the MCDA, among which the Analytical Hierarchy Process (AHP).

The AHP was developed by Saaty (1990; 2008) and is a popular technique for analysing and supporting decisions in which multiple, competing objectives are involved, and multiple alternatives are available. It is based on three principles: decomposition, comparative judgment and synthesis of priorities.

At the beginning of the procedure, the AHP provides that a complex decision problem is decomposed into simpler decision problems to form a decision hierarchy. The advantage to decompose the decision problem into a hierarchy consists in getting more easily comprehended sub-problems, so that each of them can be analysed independently. When developing a hierarchy, the top level is the ultimate goal of the decision. The hierarchy decreases from the general to the more specific, until a level of attributes is reached. Each level must be linked to the next higher level. Once the decomposition is completed, cardinal rankings for objectives and alternatives are required. This is done by using pairwise comparisons, which reduce the complexity of decision making since two components are considered at a time. The final step is to combine the relative weights of the levels obtained in the previous step to produce composite weights. This is done by means of a sequence of multiplications of the matrices of relative weights at each level of the hierarchy.

As a matter of fact, the different criteria and sub-criteria are usually characterized by different importance levels, which need to be included into the evaluation. These are obtained by assigning a weight to each criterion. Weighting represents a critical stage aimed at including into the analysis the experts' judgment.

AHP converts the human expert judgment into numerical values that can be processed allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way.

The main steps for AHP are 5:

1) Identification of criteria and indicators (identification of the hierarchy).
2) Questionnaire with pairwise comparisons in order to collect preferences of a certain number of experts about the criteria and the indicators.
3) Transformation of pairwise comparison into weights vector for criteria and indicators by means of the principal eigenvector method (Saaty, 2003).
4) Calculation of composite weight for each indicator (Saaty, 2008);
5) Group decision making (synthesis of the prioritization performed for the different experts).

In the survey carried out a set of 176 pairwise comparison matrices was constructed. The problem was modulated in three-step levels, in order to ease the structuring and to facilitate the comprehension of the context by the different stakeholders.

The scale of the semantic operators (scores from 1 to 5) with associated value adopted in the experiment is reported in the table 1.

Table 1 - Scale of semantic operators and relative score adopted in the experiment.

Semantic score for importance	Numerical score
Equally important	1
Little more important	2
More important	3
Much more important	4
Exceptionally more important	5

Given the complexity of the problem, an entire workshop was dedicated to the compilation of the questionnaires. A detailed glossary with *ad hoc* information on the terminology used in the survey was prepared and delivered in advance to the stakeholders.

In the pair-wise comparison, the respondents were asked to evaluate the importance of one element against another; the value "1" represented equal importance and the higher the figure the more important.

The results were elaborated according to the AHP techniques, using a pairwise comparison matrix:

$A = (a_{i,j})_{i,j \in I}$, where $I = \{1,2,..., N\}$ is the indexes set, N is the number of alternatives and $a_{i,j}$ is the number of our scale assigned by the stakeholder in the pairwise comparison between the i-th and j-th alternatives. A is a positive reciprocal square N×N matrix, where a square matrix is reciprocal if $a_{i,j} = \frac{1}{a_{j,i}}$.

As in the survey we had three decision levels, we computed the weight vector on each level and then calculated the composite weight for each final alternative. Thus we used the eigenvalue/eigenvector averaging technique, according to Saaty (2003; 2008), who demonstrated that a good approximation of the priority vector is represented by the principal eigenvector of A. The principal eigenvalue (or a multiple of them) λmax is associated to the principal eigenvector and it is used to estimate the consistency of the answers.

Hence, after recording the pairwise comparison matrix for the three levels of alternatives (criteria and associated indicators), we have computed principal eigenvalue λmax and the associated eigenvector. Finally, we have normalized the eigenvector to obtain a priorities vector for each of pairwise comparison matrix.

It was possible to calculate a measure of inconsistency (Consistency Ratio) for each matrix of preferences, using the following formula: $C.R. = \frac{C.I.}{R.I.} = \frac{\frac{\lambda_{max} - N}{N-1}}{R.I.}$; where C.I. is the consistency index, computed using the principal eigenvalue λmax and the number of alternatives N; the

random index R.I. is a randomly generated value, computed assuming that the numbers in pairwise comparison matrix A was completely random.
In the AHP the pairwise comparisons, in a judgment matrix, are considered to be adequately consistent if the corresponding consistency ratio (CR) is less than or equal to 0,1 (Saaty, 1980). Otherwise, the answers could lead to inconsistent results in the AHP.

MCDA assessments, and AHP is not an exception, can be affected by a range of uncertainties, due to the imperfect knowledge of the specific system under study and to the subjectivity of expert judgements (e.g. Banuelas and Antony, 2004; Rossetto et al., 2015). Incorporating uncertainty in the AHP has been achieved, in the literature, using probabilistic judgements (e.g. Levary and Wan 1998), fuzzy sets (Lee et al. 2001) and ranking intervals (Arbel and Vargas 1993). Such methods have produced a means to test statistical significance of the final score and facilitate consensus when there are a large number of stakeholders.
In our survey, a sensitivity analysis has been carried out to evaluate the robustness of the results, with respect to the uncertainty associated to the weights expressing the relative importance of the elements considered in the AHP. To this end, we introduced uncertainty in the process, using a Monte Carlo approach, according to the following steps:

1. We applied the uncertainty to the local weights at all hierarchical levels: we multiplied the deterministic local weights by the factor $(1 + \varepsilon)$, where ε is a normally distributed error with mean 0 and standard deviation 0.15. Standard deviation is set so that 90% confidence bounds encompass the original value of the weight ±20%; in order to get robust results 1000 extractions were made.
2. The local perturbed weights were normalized to add up at 1;
3. The composite weights for each element were derived as the product of local weights along the hierarchical tree;
4. The composite perturbed weights were normalized to add up at 1;
5. On the 1000 vectors of weights for each hierarchical level and for each element the following metrics were calculated:
    a. Percentiles: 0.05, 0.25, median, 0.75, 0.95;
    b. Individual statistics: min, max and mean value, standard deviation and CV;
    c. Frequency as an empirical probability ranking.
6. For each statistic, the global vector of mins, maxs, means, standard deviations and CVs was derived as weighted (by numerousness of the group) mean of all stakeholders, or mean of a given stakeholder group; this was carried out for each level of the hierarchical tree (level 1, 2 and 3);
7. For each percentile, the global vector of weights was derived as weighted mean among stakeholders (the higher is the numerousness the lower is the weight) or mean in a given stakeholder group; this was carried out for each level of the hierarchical tree (level 1, 2 and 3);
8. For each frequency, an empirical probability ranking has been computed for all stakeholders (or stakeholder group) on the occurrences weighted by a weight calculated on the numerousness of the group to which the stakeholders belong (the higher is the numerousness, the lower is the weight) and expressed as percentage to be first, second, third etc..; this was carried out for each level of the hierarchical tree (level 1, 2 and 3);

9. The frequencies computed in the above step have been finally standardised in the dicothomic alternatives to be first and to be last.

Results were represented, for each key issue of each level, by box plots, which were set using 0.05, 0.25, 0.5, 0.75 and 0.95 percentiles. In addition, the standardized empirical probability to be ranked first and last, among the different alternatives, was expressed as graphs.

The indicator termed here empirical probability is a sum of the frequency of the ranking for a given criterion/objective, based on its weight, and taking into account the judgement of each stakeholder with his/her associated weight (both in the specific stakeholder groups or as a whole). Thus, the empirical probability just considers the frequency at which a given element has been preferred by the stakeholder/group. This step takes also into account the uncertainty introduced in the process.

The mean and other associated statistics represented in the box-plot are, instead, based on averaging the value of the weight associated to each element, as result of the transformation of pairwise comparisons into weights vector, even in this case taking into account the uncertainty that has been introduced in the process.

Consequently, the results of the different metrics might corroborate each other or might give a sign for further insight.

All the algorithms and computations were performed using an *ad hoc* routine designed and implemented in the R environment. This routine also produced numerical and graphical outputs.

RESULTS

Exploratory analysis

The number of participants to the survey was the same (13) per each stakeholder category, with the exception of the Organic farmers that were 10.

The most represented geographical region was the Western Europe (21), followed by the Northern Europe (18) and the Mediterranean Europe (17). The less represented was the Central Europe (7). The gender of the large majority of participants was male (49), only 15 were female. The average age of participants was quite high; almost all were over thirty-five years.

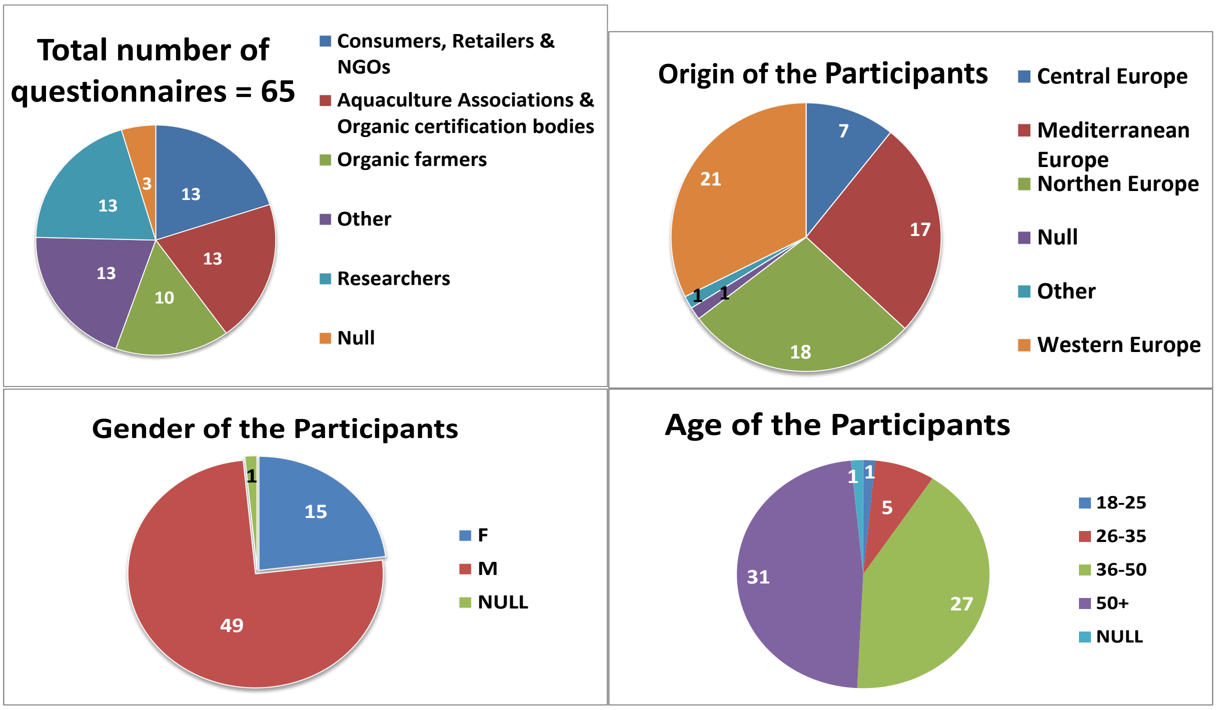


Fig. 1 – Number, geographical origin, gender and age of the participant to the survey.

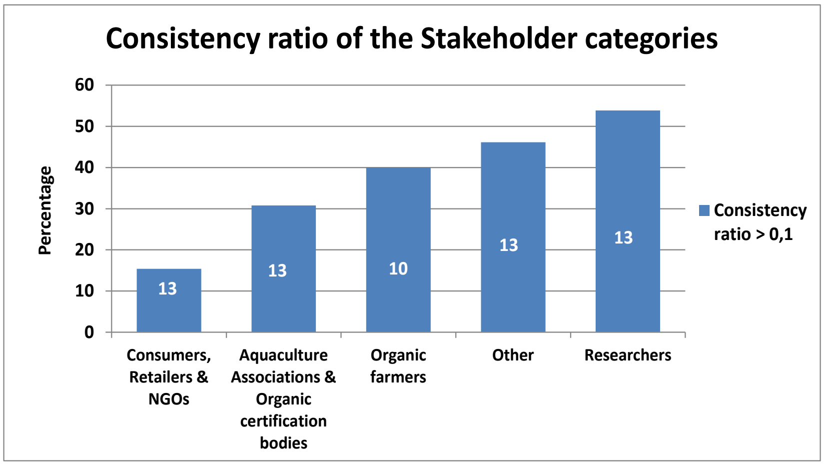
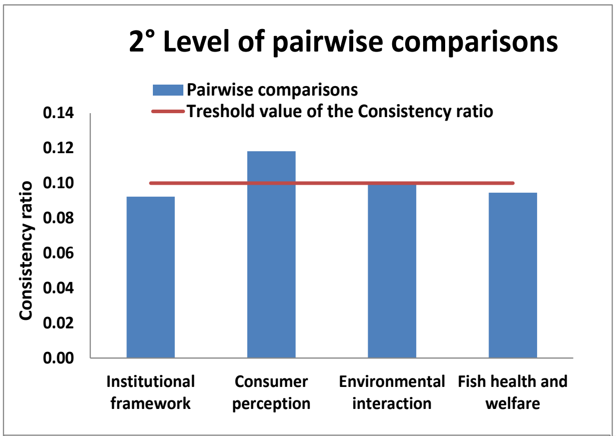


Fig. 2 – Consistency ratio of each stakeholder category. Numbers in the bars indicate the participants to the survey.

Consistency ratio values above 0.1 indicate a progressive impoverishment of the coherence of the answers to the questions in the survey.

The category of stakeholders with the better performance was *Consumers, Retailers & NGOs* with less than 15% of consistency ratio above 0.1.

The category that showed the worst performance was that of Researchers with a bit more than the 50% of consistency ratio above 0.1. This result is not surprising, considering that when facing rather complex questionnaires, sometime there is a risk of overestimating the own evaluation capability and underestimating the complexity of the questions.



Looking into the Consistency ratio of the eighteen key issues addressed by the participants to the survey, the performances becomes significantly better.
Only five out eighteen of the key issues covered by the survey showed a consistency ratio above 0.1 but below 0.12.
Namely, they were *Consumer perception*, *Control Provision*, *Production rules*, *Legislative framework* and *Environmental impact*.

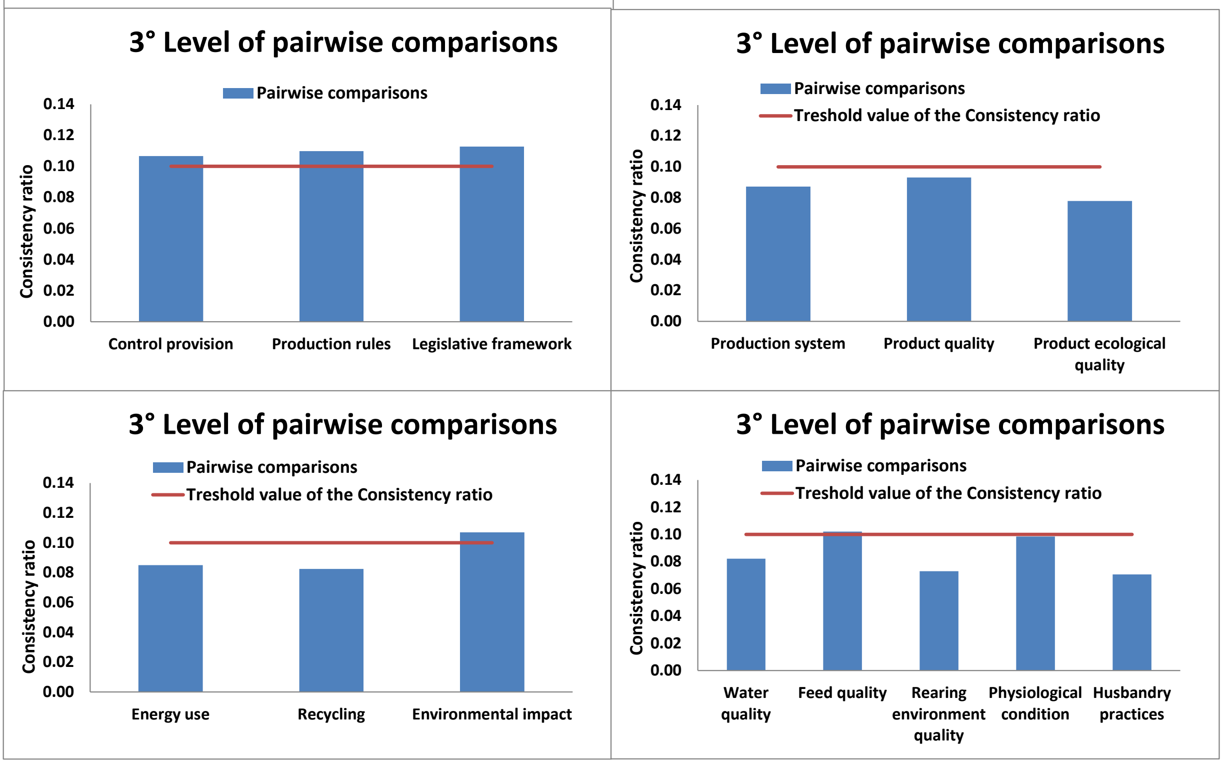


Fig. 3 – Consistency ratio of each key issue addressed by the participants to the survey.

The level of coherence of the answers given by the participants to the survey questions greatly influence the robustness of the results and the interpretation of the views expressed by stakeholders.
In our case, more than the consistency ratio obtained from the different categories of stakeholders, the relative consistency ratio obtained by each key issue in the survey will affect the robustness of the results and the interpretation of the views expressed by stakeholders. In light of the above consideration, the quality of the survey results can be judged significantly faithful to the views expressed by stakeholders.

First level results

How important do you consider the subjects in the figure below (Y-axis) to promote the development of the *Organic Aquaculture*?

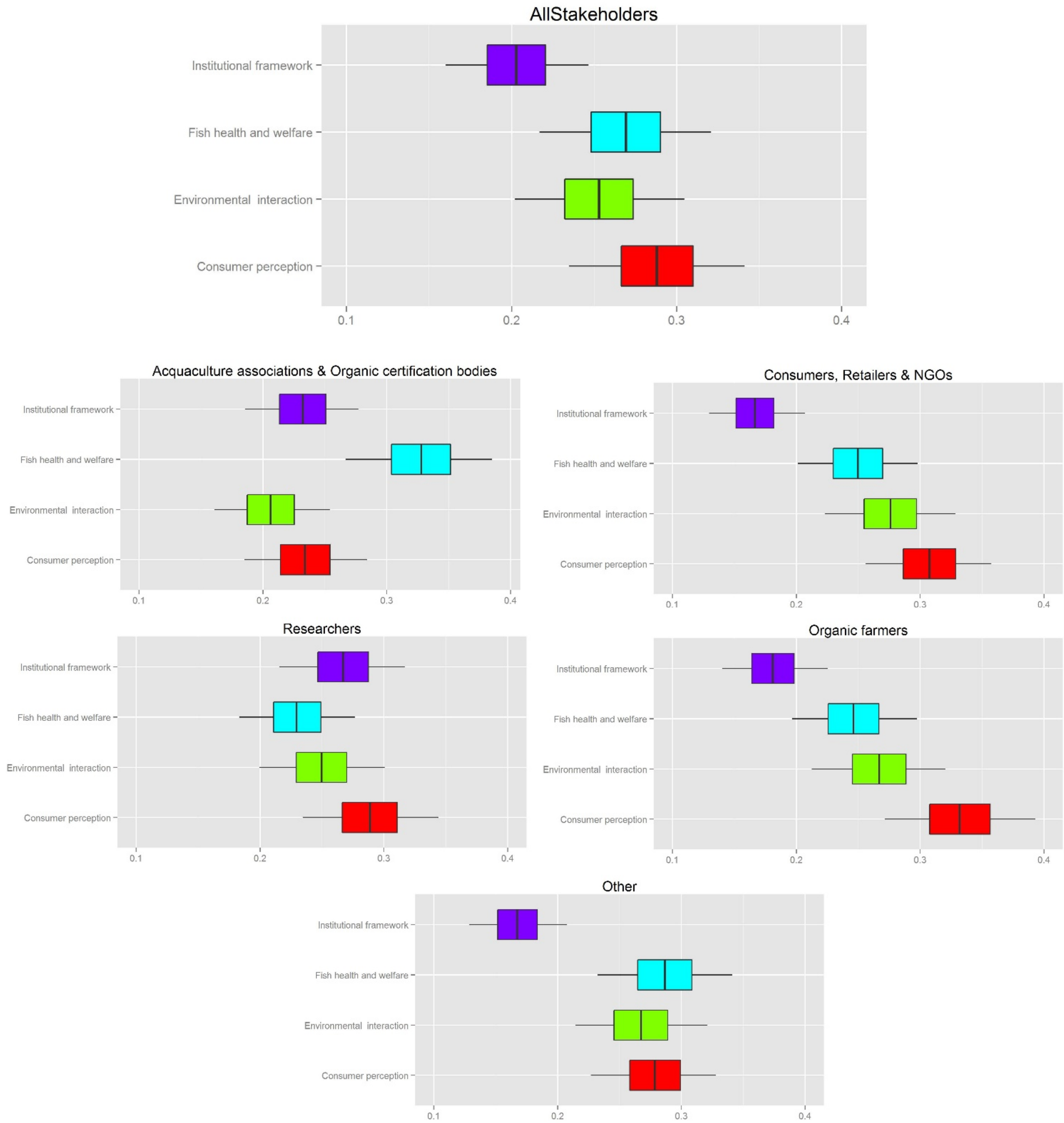


Fig. 4 – More important subjects to promote the development of the *Organic Aquaculture (level 2)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the most important issue to be taken into consideration in order to promote the development of the *Organic Aquaculture* is the *Consumer perception* (consumer's opinion regarding the principles and regulations of the organic production).

The *Institutional framework* (the social, economic and legislative background/basis, along with the framework for production of standards and controls) instead is considered less important than both the *Fish health and Welfare* (a condition which mitigates stress caused by farming conditions and ensures that the physiological needs of the fish are met) and the *Environmental interactions* (the relationships - e.g. impacts - between organic farms and the environment, as well as the attitude to an environmental friendly behaviour).

The same picture appears if we consider the preferences expressed by Consumers, Retailers, NGOs and Organic farmers. Only the judgment of the Aquaculture associations & Organic certification bodies, that gave first place to the *Fish health and welfare*, differs from this picture.

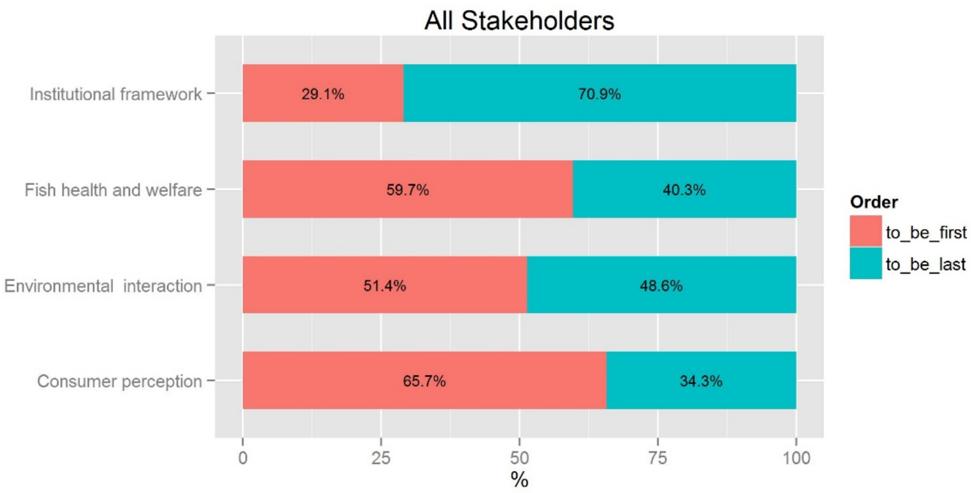


Fig. 5 – Empirical probability to be the most or the less important subject to promote the development of the *Organic Aquaculture* (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. *Consumer perception* is the most important subject).

In addition, it can be noted that, in terms of probability, there is not much difference in respect to the second subject (i.e. *Fish health and welfare*), which resulted at the first place according to the opinion of the Aquaculture associations & Organic certification bodies, as it is shown in the box-plot (fig.4).

Second level results

How important do you consider the subjects in the figure below (Y-axis) in order to characterise the *Institutional Framework*?

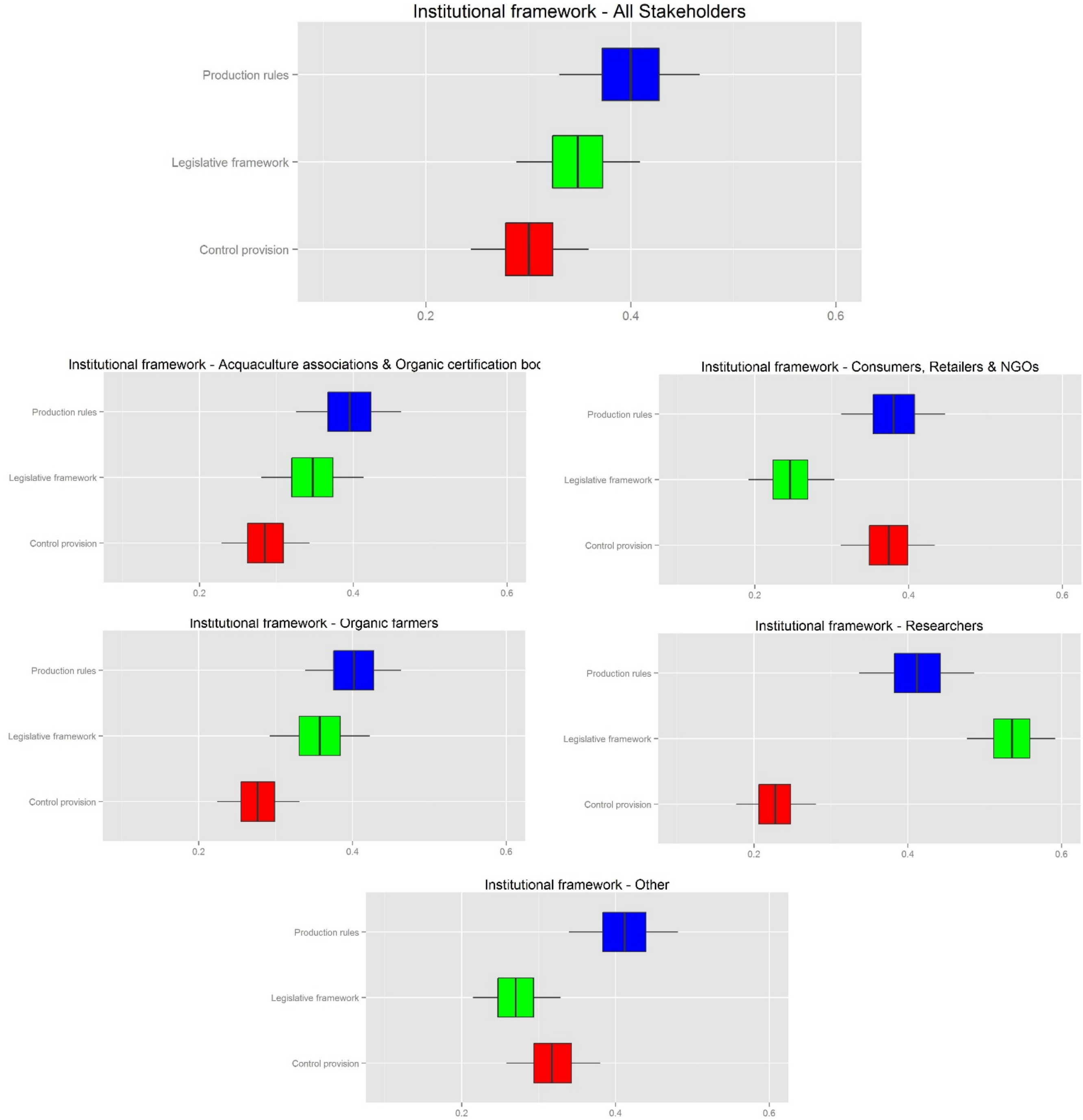


Fig. 6 – More important subjects in order to characterise the *Institutional Framework (level 2)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the element that is more appropriate to characterise the *Institutional framework* (the social, economic and legislative background/basis along with the framework of production standards and controls) is the *Production rules* (the whole set of production rules that may distinguish the organic aquaculture from the conventional one), followed by the *Legislative framework* (the EU organic regulations along with the actions to support the implementation and development of organic aquaculture, undertaken by Member States and EU) and by the *Control provision* (the qualitative/quantitative checks/controls carried out on organic farms, raw materials and organic products).
Only the judgment of the Researchers, who gave first place to the *Legislative framework*, differs from this picture.

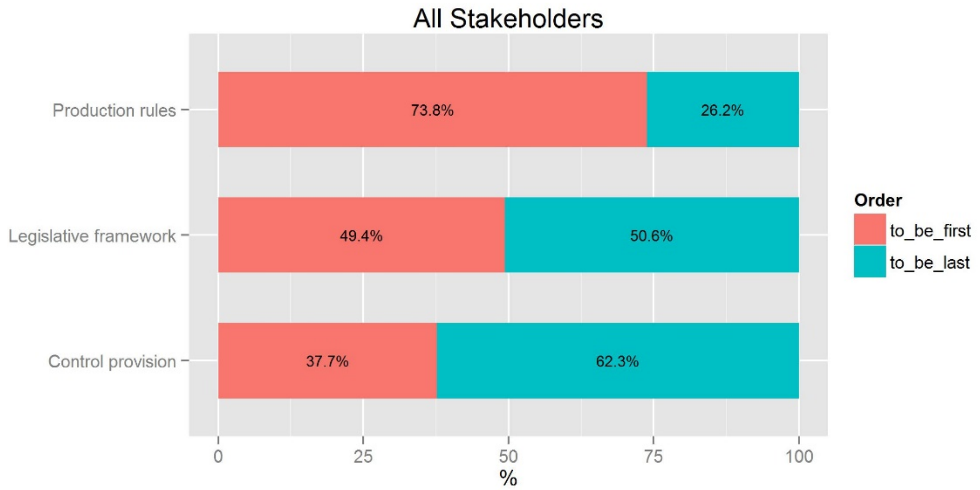


Fig. 7 – Empirical probability to be the most or the less appropriate element to characterise the Institutional framework (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Production rules* are the more appropriate to characterise the *Institutional framework*).

How important do you consider the subjects in the figure below (Y-axis) in order to characterise the *Consumer perception*?

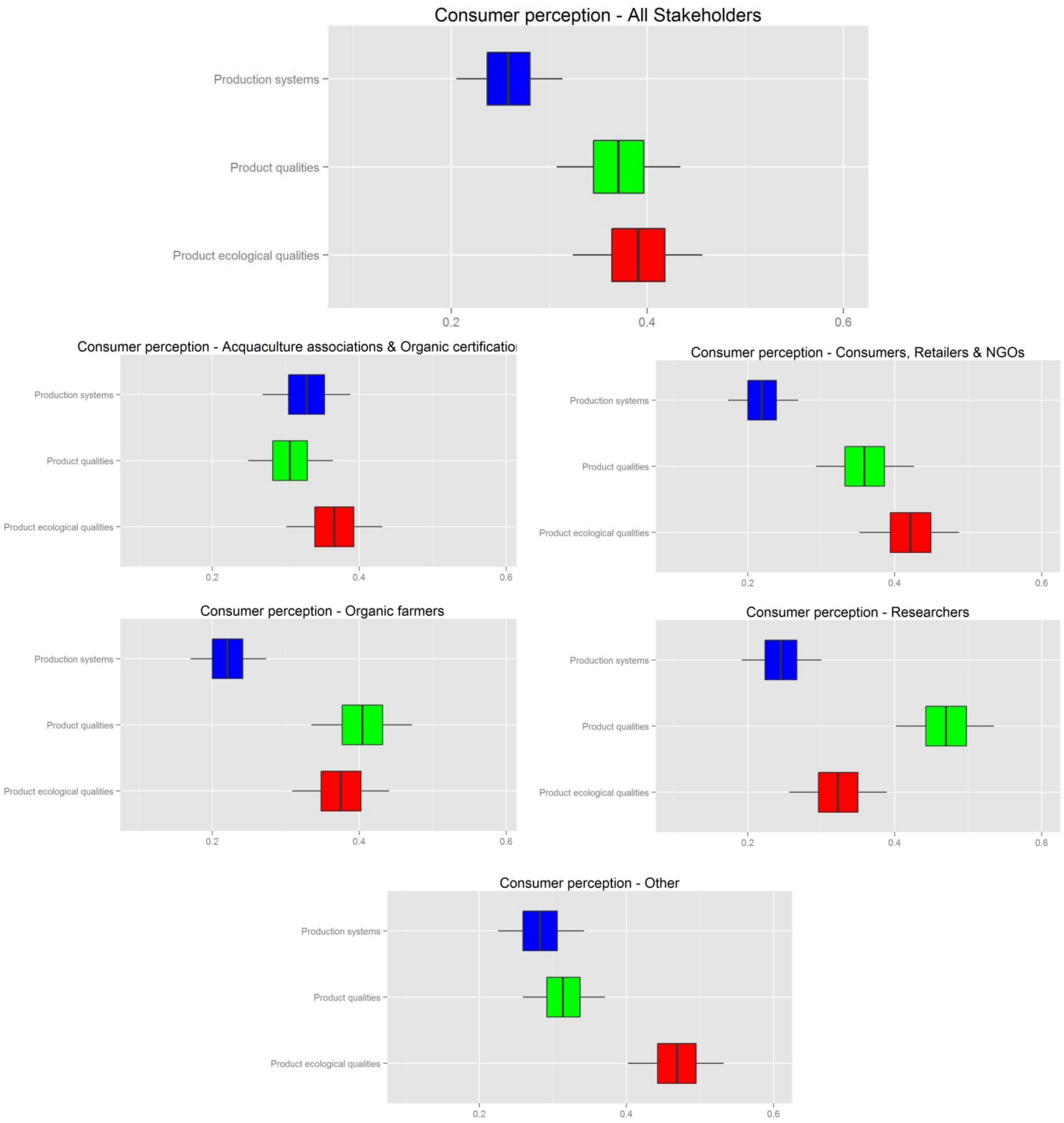


Fig. 8 – More important subjects in order to characterise the *Consumer perception (level 2)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the element that is more appropriate to characterise the *Consumer perception* (consumer's opinion regarding the principles and regulations of the organic production) is the *Product ecological qualities* (e.g. environmental friendly; animal friendly; sustainable; local/domestic production), closely followed by the *Product qualities* (e.g. no chemicals, additives, hormones used; good appearance; good smell; good taste; good texture).
The stakeholder categories Organic farmers and Researchers expressed similar opinion, but with the ranking of *Product ecological qualities* and *Product qualities* in opposite position.

Fig. 9 – Empirical probability to be the most or the less appropriate element to characterise the Consumer perception (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability, while confirming those showed in the box-plot (i.e. the *Product ecological qualities* are the more appropriate to characterise the *Consumer perception*), also highlight that actually there is not much different ranking between the *Product ecological qualities* and the *Product qualities.*

How important do you consider the subjects in the figure below (Y-axis) in order to characterise the *Environmental interaction*?

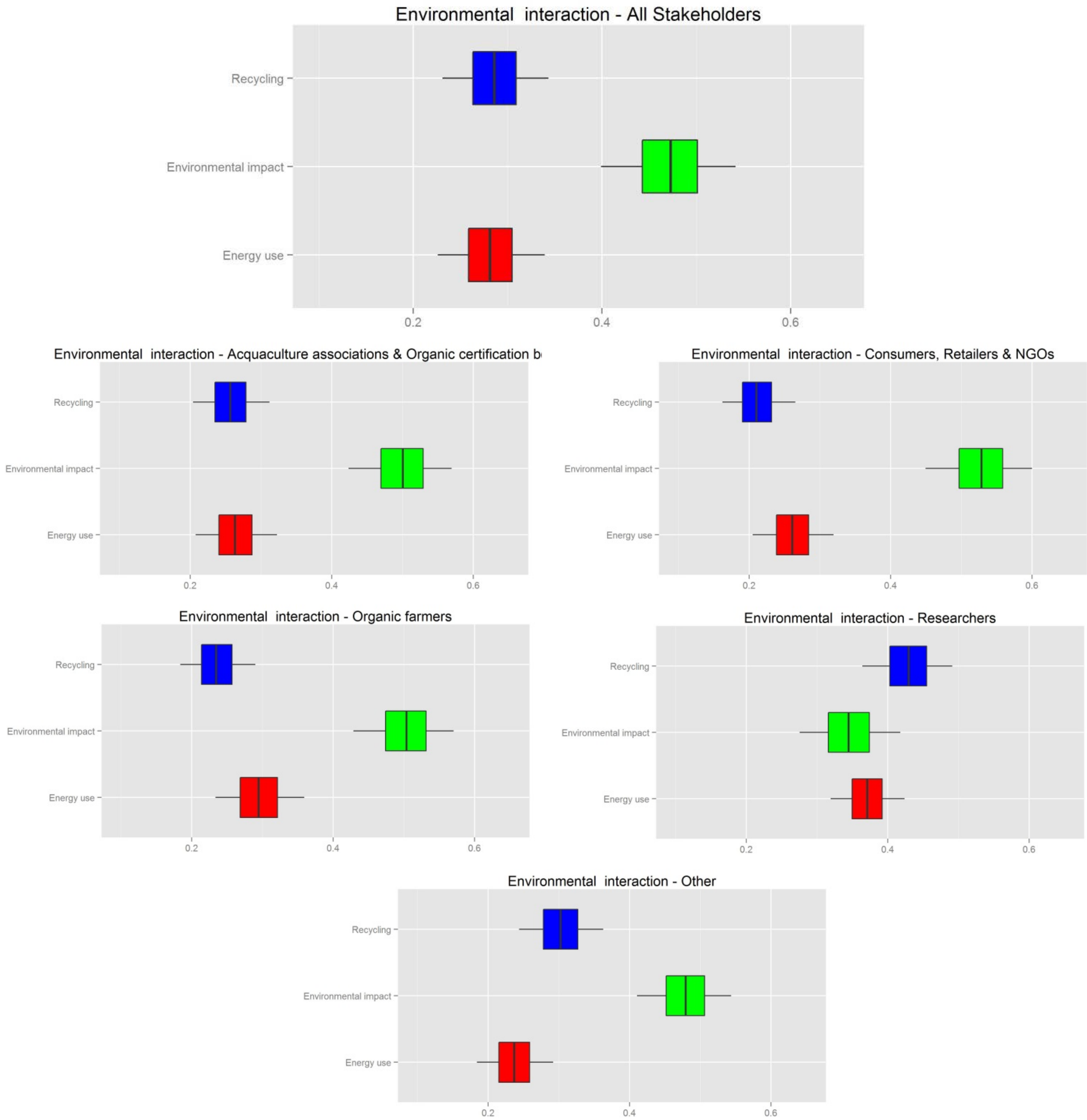


Fig. 10 – More important subjects in order to characterise the *Environmental interaction (level 2)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the element that is more appropriate to characterise the *Environmental interaction* (the relationships - e.g. impacts - between organic farms and the environment, as well as the attitude to environmentally friendly behaviour) is the *Environmental impact* (the impact of the organic farms on the surrounding environment), followed by far by *Recycling* (the attitude to use recycled or recyclable products and reduce waste) and by *Energy use* (the practice and/or attitude of organic farms towards renewable energy and the environmental performance assessment), which had assigned a comparable importance.
All the groups converged to this judgement, except Researchers that gave a slightly higher weight to *Recycling* while *Environmental impact* and *Energy use* were given a less but comparable weight.

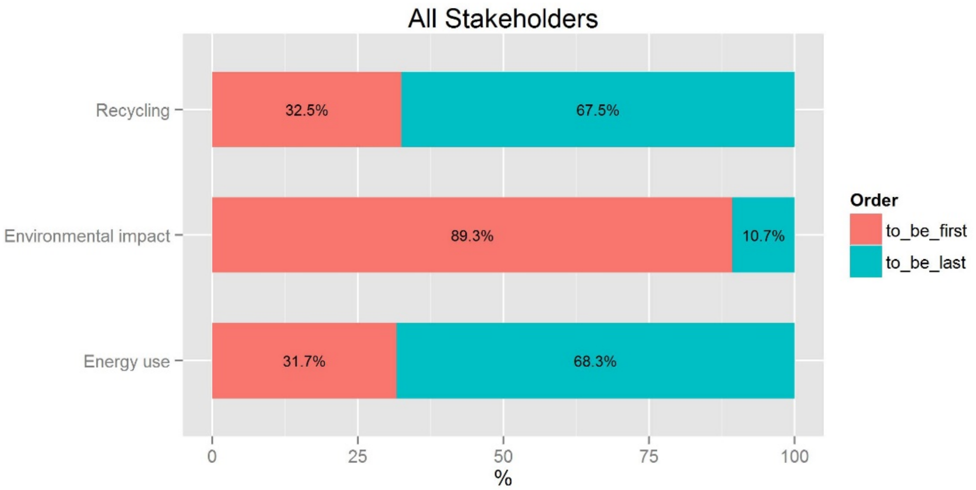


Fig. 11 – Empirical probability to be the most or the less appropriate element to characterise the Environmental interaction (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Environmental impact* is by far the more appropriate to characterise the *Environmental interaction*).

How important do you consider the subjects in the figure below (Y-axis) in order to characterise the *Fish Health and welfare*?

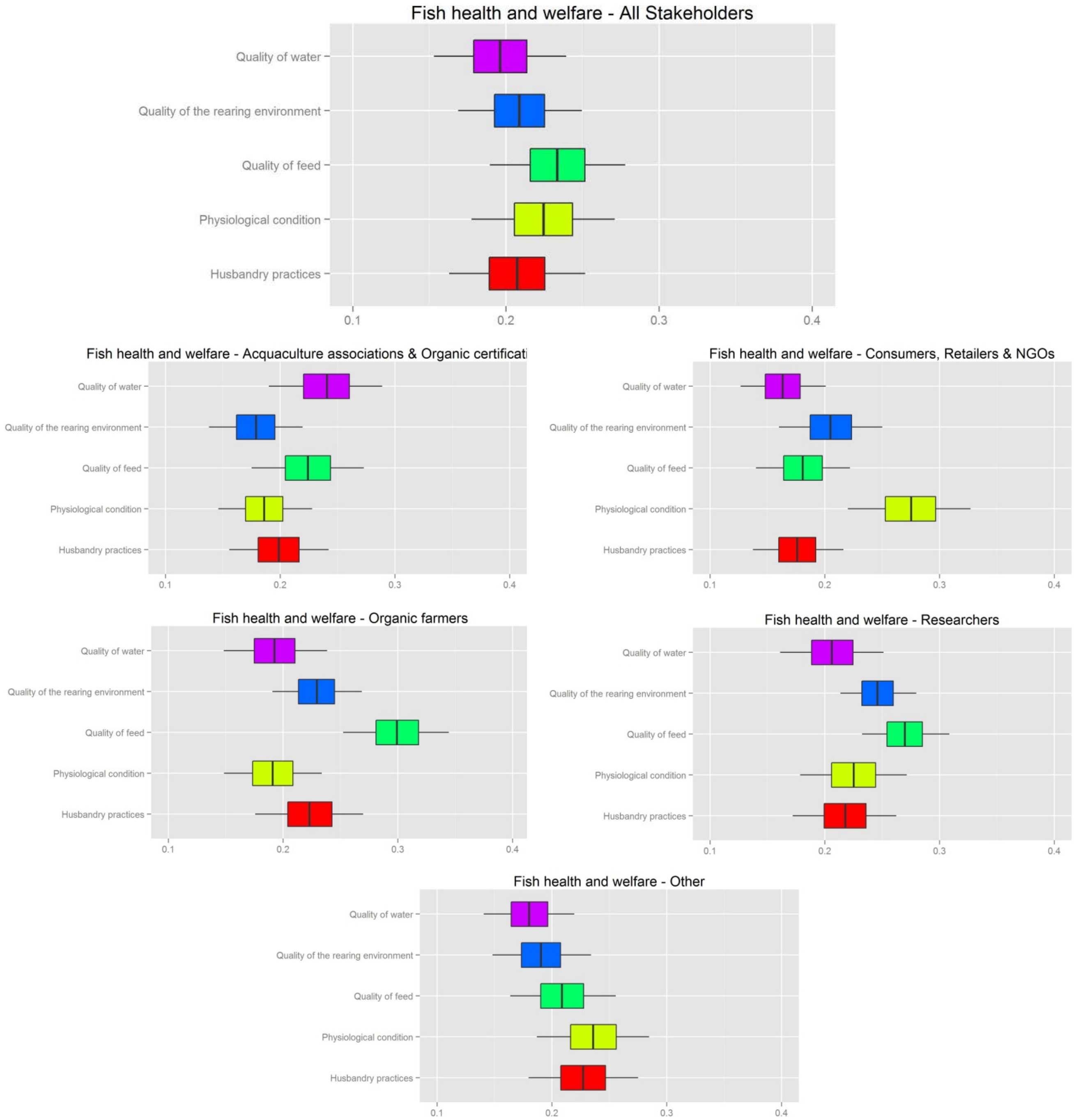


Fig. 12 – More important subjects in order to characterise the *Fish health and welfare (level 2)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the element that is more appropriate to characterise the *Fish health and welfare* (a condition which mitigates stress caused by farming conditions and ensures that the physiological needs of the fish are met) is the *Quality of feed* (the nutritional characteristics and palatability of the feed), closely followed by *Physiological condition* (the physiological health conditions of the farmed animals).
However, all the other elements were classified to levels of rather equivalent importance to the first and second, respectively *Quality of feed* and *Physiological condition*.
Consumers, Retailers and NGOs gave a higher importance to the element *Physiological condition,* keeping all the other elements to a lower but comparable weight among them. The group Aquaculture Associations and Organic Certification body gave, instead, a slight higher weight to the element *Quality of water*.

Fig. 13 – Empirical probability to be the most or the less appropriate element to characterise the Fish health and welfare (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability show a quite different picture from that of the box-plot. Indeed, *Physiological condition*, closely followed by *Husbandry practices*, appears as the more appropriate element to characterise the *Fish health and welfare*.
The reason why the results showed by the metrics in the box-plot are different from those expressed in terms of empirical probability is that some stakeholders (in this case two) gave very high weight to *Quality of feed*, in the pairwise comparisons, and very low weight to the other elements.
Indeed, when the various metrics do not converge is a sign of very skew positions expressed by some stakeholders. Conversely, more the weight assigned to the different elements, by the stakeholders, are smooth/balanced, more converging are the various metrics.

Third level results

Which actions in the figure below (Y-axis) do you consider most appropriate/relevant in order to make the *Control provisions* more effective?

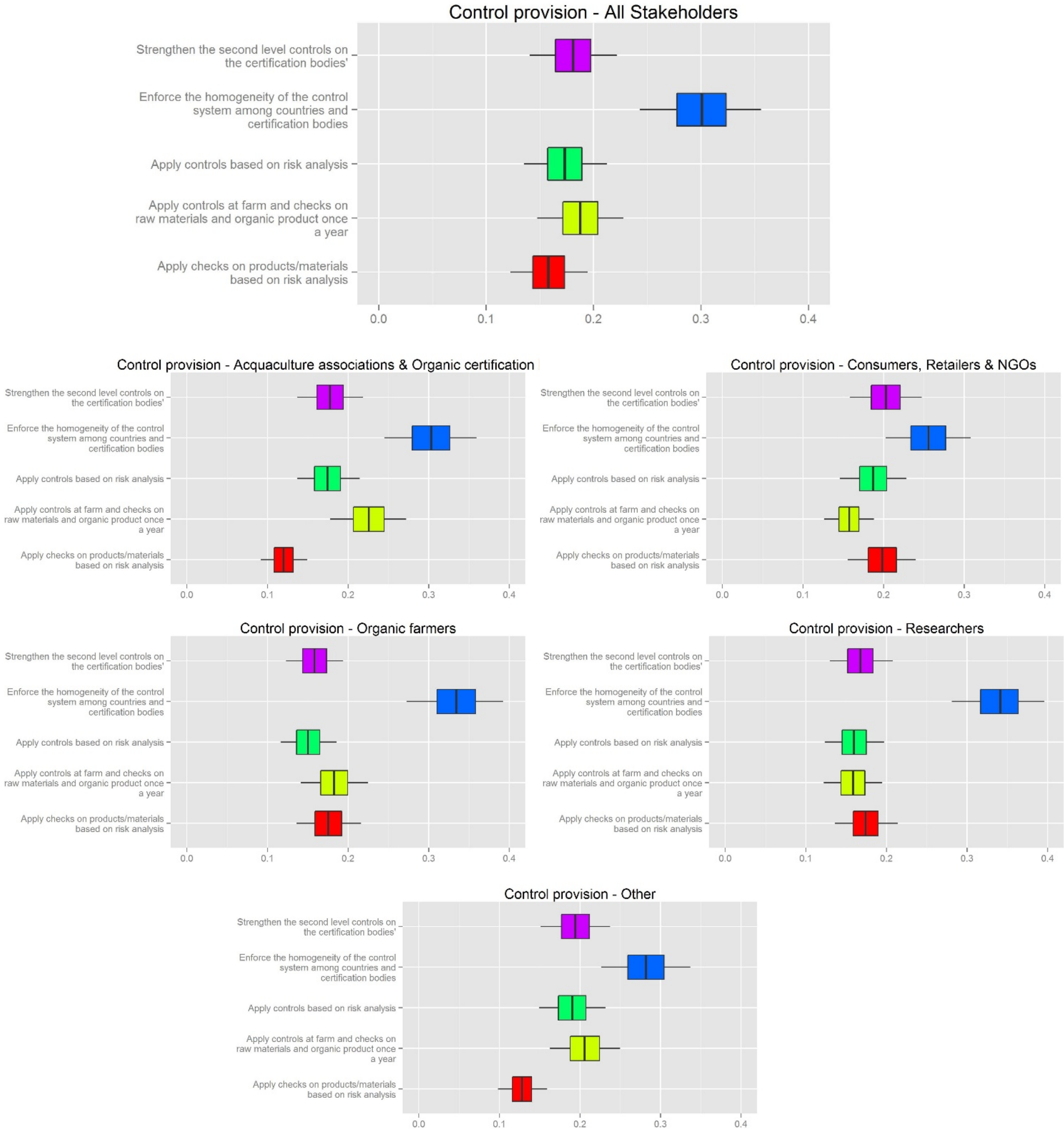


Fig. 14 – More appropriate actions in order to make more effective the *Control provision (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the more relevant action to make the *Control provisions* (the qualitative/quantitative checks/controls carried out on organic farms, raw materials and organic products) more effective is by far *Enforce the homogeneity of the control system among countries and Certification bodies*. The other alternatives were considered almost equivalent.
A similar judgement seems mirrored also in the different stakeholder groups.

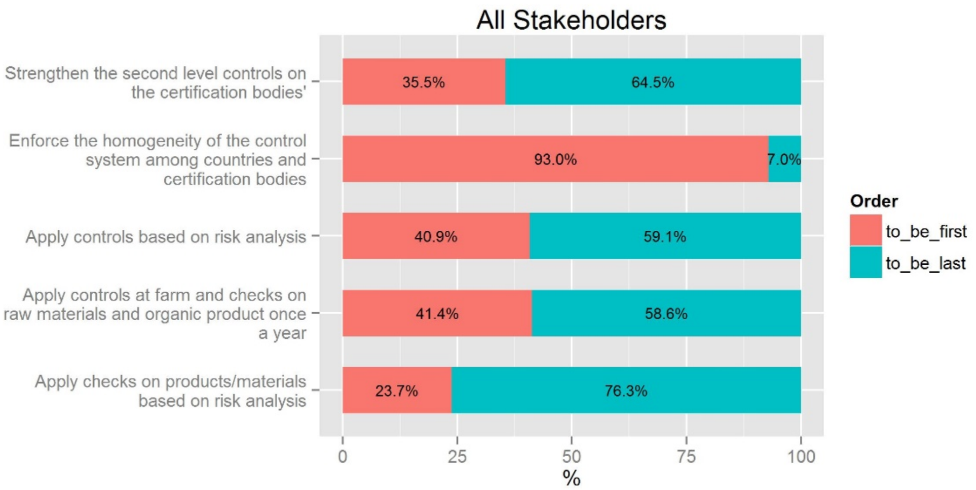


Fig. 15 – Empirical probability to be the most or the less appropriate action to make the Control provisions effective (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Enforce the homogeneity of the control system among countries and Certification bodies* is by far the more appropriate action to make the *Control provisions* effective).

Which actions in the figure below (Y-axis) do you consider most appropriate/relevant in order to make the *Production rules* more effective?

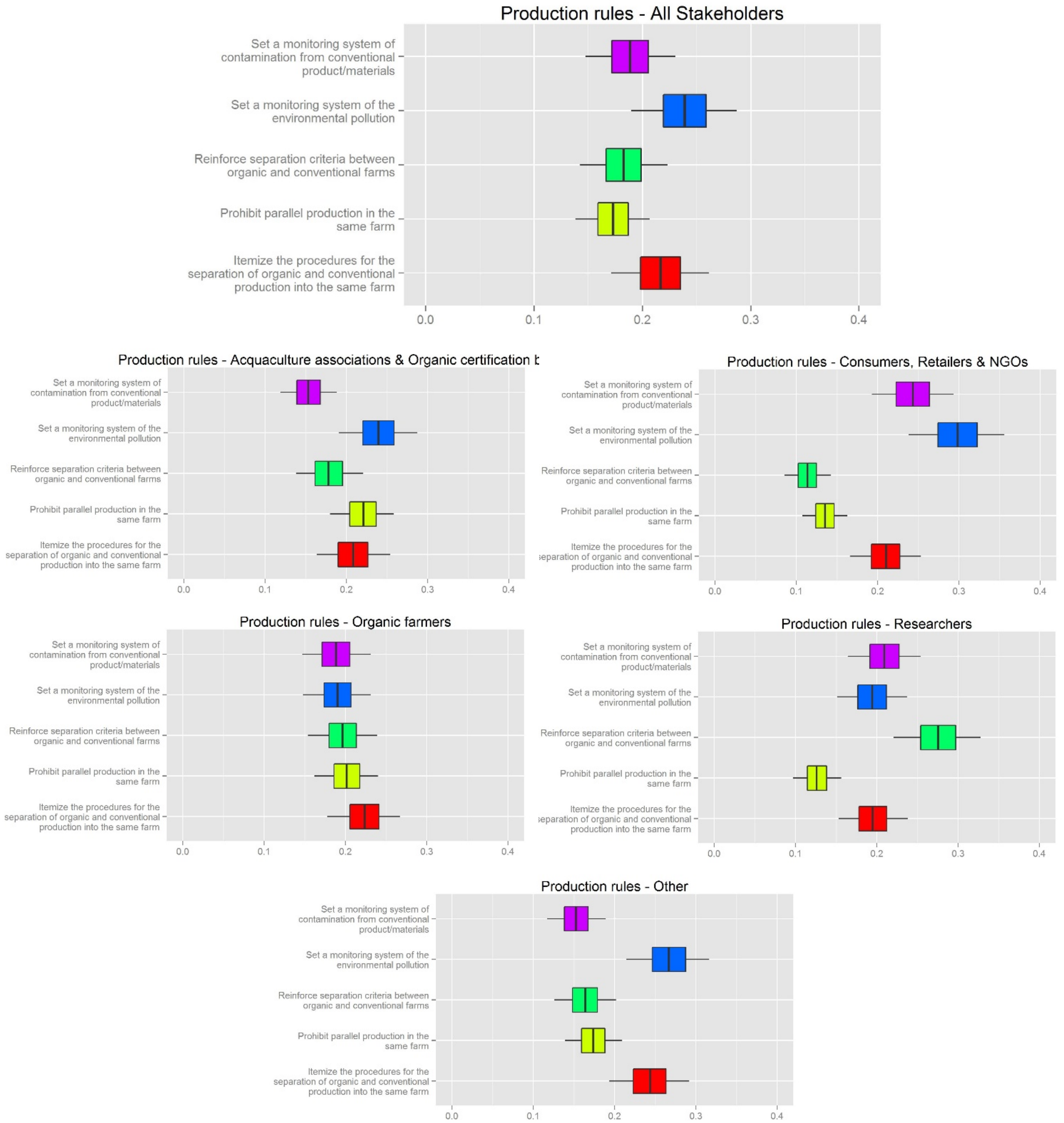


Fig. 16 – More appropriate actions in order to make more effective the *Production rules (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the whole group of stakeholders, who participated to the survey, there were not marked preferences among the alternative actions to make more effective the *Production rules* (the whole set of production rules that may distinguish the organic aquaculture from the conventional one). *Set a monitoring system of the environmental pollution* just obtained a slightly higher preference.
A similar position was expressed by the groups Aquaculture Association & Organic certification bodies and Consumers, Retailers and NGOs. Researchers, instead, expressed a preference for the alternative: *Reinforce separation criteria between organic and conventional farms*.

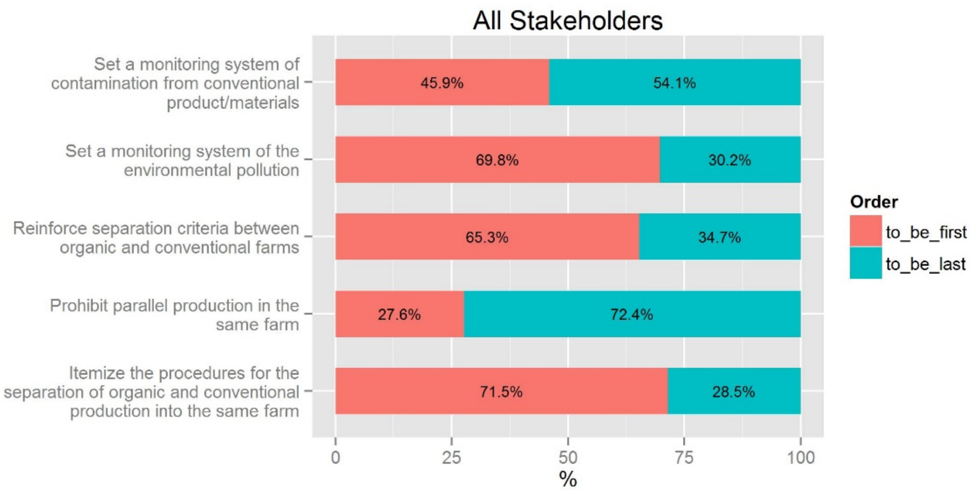


Fig. 17 – Empirical probability to be the most or the less appropriate action to make the Control provisions effective (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. no marked preferences among the alternative actions to make more effective the *Production rules*). However, in addition, it appears more pronounced the aversion for the alternative *Prohibit parallel production in the same farm* (the rearing of organic and non-organic fish of the same species in the same production units).

Which of the actions in the figure below (Y-axis) do you consider most relevant in order to establish a more appropriate *Legislative framework*?

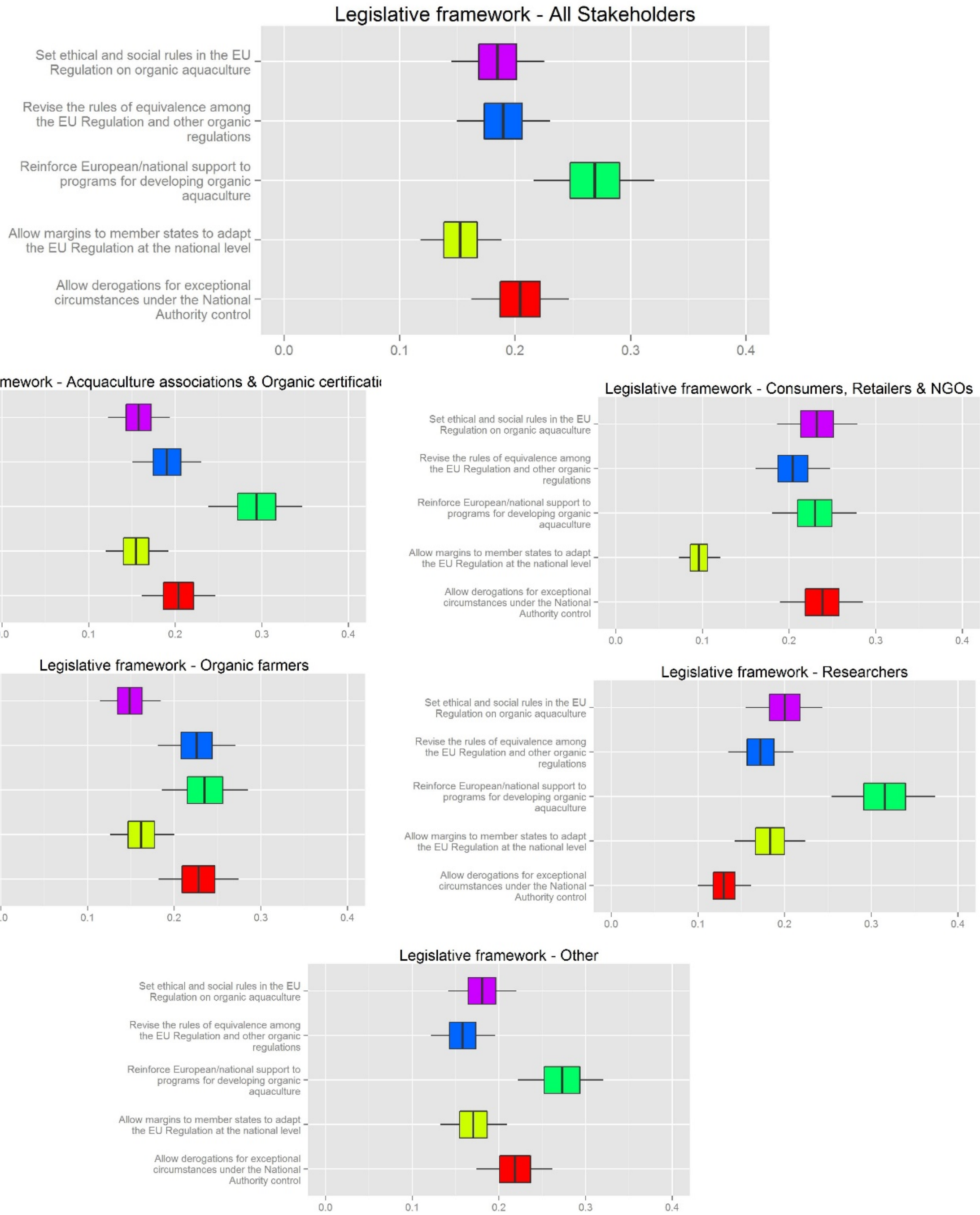


Fig. 18 – More important actions in order to establish a more appropriate *Legislative framework (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the more relevant action in order to establish a more appropriate *Legislative framework* was represented by the alternative: *Reinforce European/national support to programs for developing organic aquaculture.*

This pattern of preferences is quite similarly mirrored in most of the different groups and especially for Aquaculture associations & Organic Certification Bodies and Researchers.

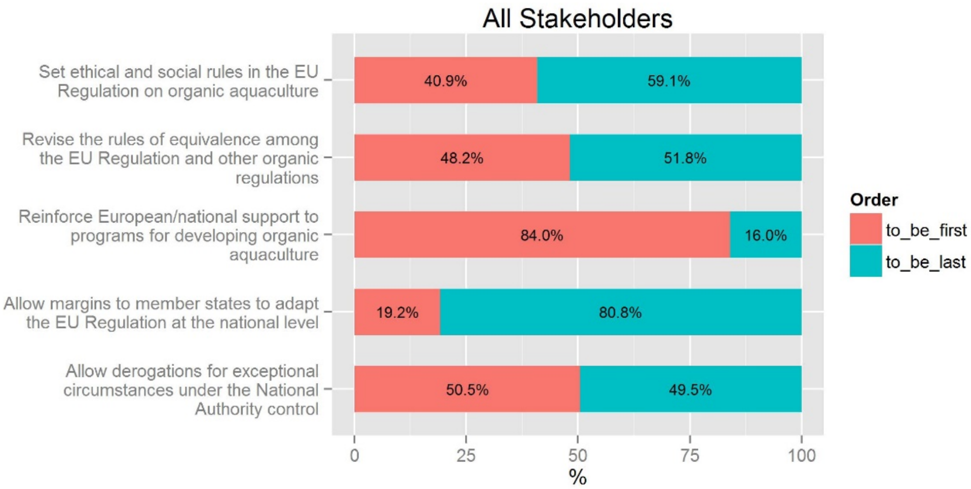


Fig. 19 – Empirical probability to be the most or the less appropriate action to establish a more appropriate Legislative framework (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the more relevant action in order to establish a more appropriate *Legislative framework* was represented by the alternative: *Reinforce European/national support to programs for developing organic aquaculture*).

Which of the *Production systems* in the figure below (Y-axis) do you consider more in line with the organic principles?

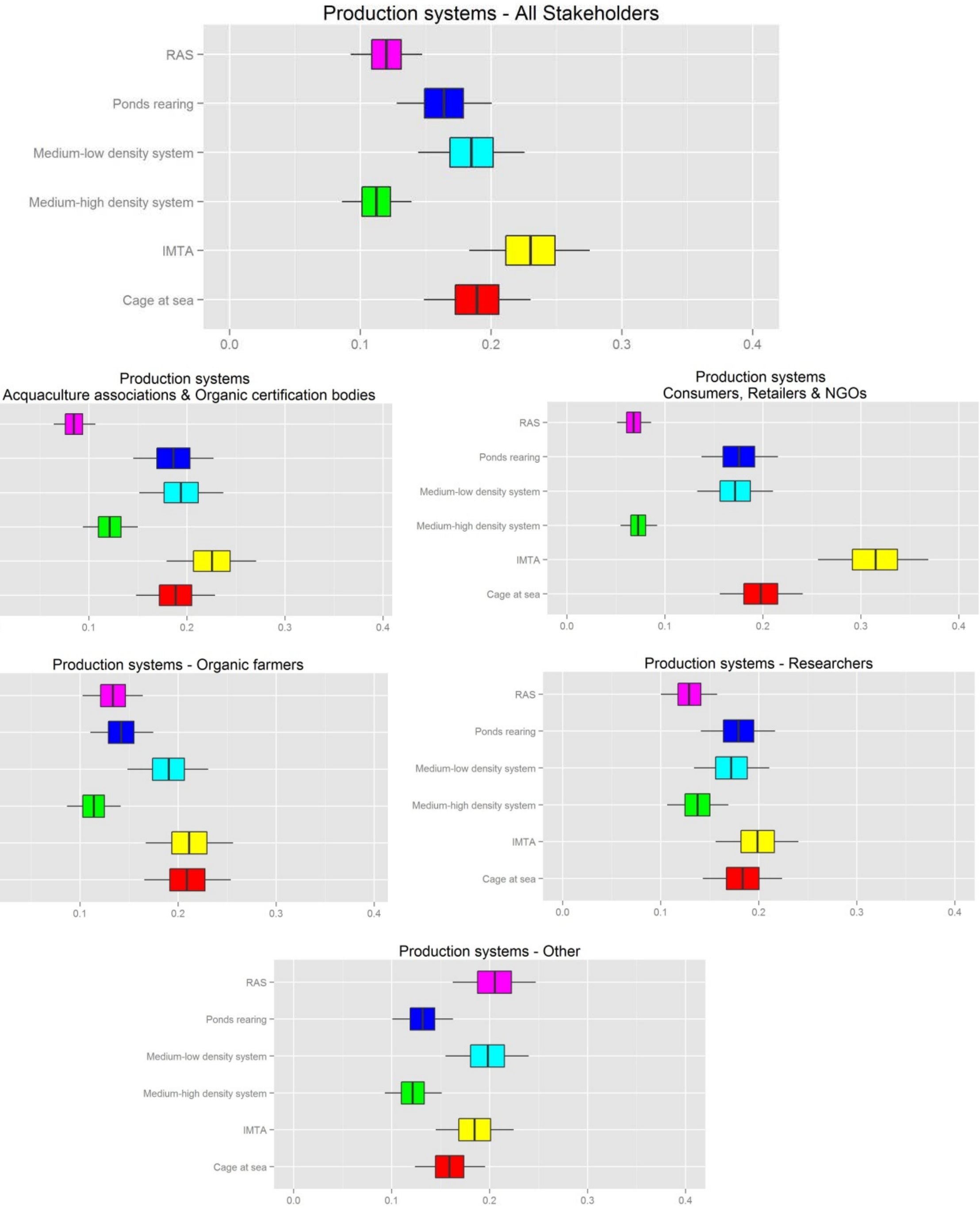


Fig. 20 –*Production systems* more in line with the organic principles (level 3). Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the *Production system* (the different physical aquaculture production systems with regard to the use of technology, the relations with the environment and the intensity) more in line with the organic principles was considered *IMTA* (Integrated multi-trophic aquaculture is an intensive and synergistic cultivation, which uses water-born nutrients and energy transfer. Multi-trophic means here that the various species occupy different trophic levels), followed by *Cage at sea* and *Medium-low density systems*, while the lower preference was assigned to the alternatives represented by *RAS* (closed recirculation aquaculture system – RAS - means a facility where aquaculture takes place within an enclosed environment on land or on a vessel involving the recirculation of water, and depending on permanent external energy input to stabilize the environment for the aquaculture animals) and *Medium-high density system*.

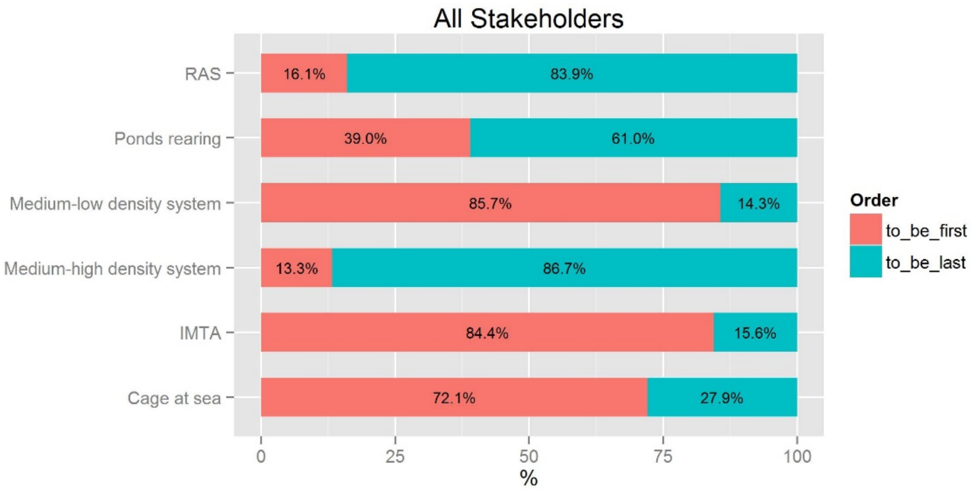


Fig. 21 – Empirical probability to be the Production system more (or less) in line with the organic principles (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Production systems* more in line with the organic principles were considered *Medium-low density systems* and *IMTA*, followed by *Cage at sea*, while the lower preference was assigned to *Medium-high density system* and *RAS*).

Which of the *Product qualities* in the figure below (Y axis) do you feel are more desirable in the organic products?

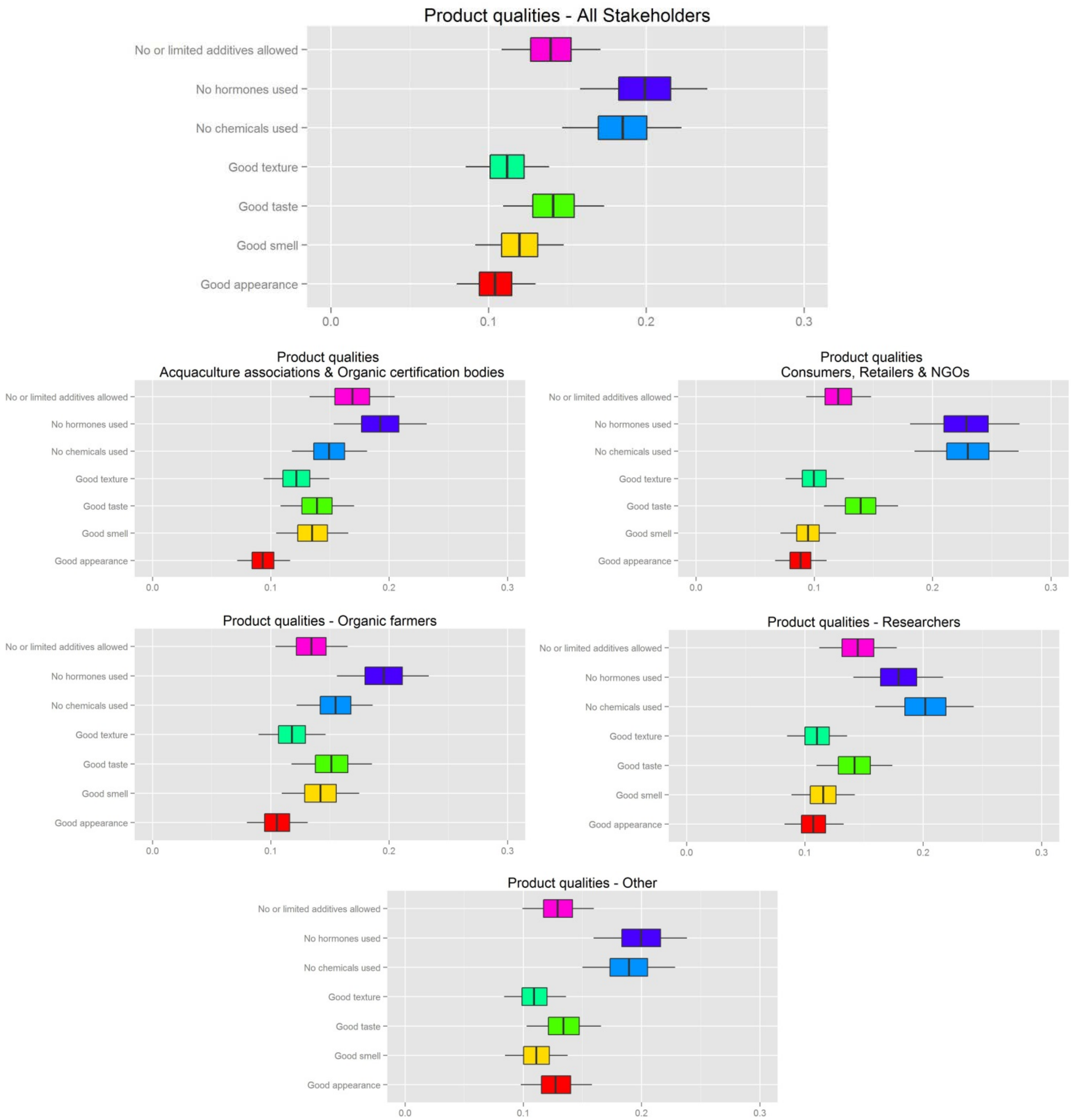


Fig. 22 – More desirable *Product qualities* in the organic products (level 3*)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the *Product qualities* (not exhaustive examples are: no chemicals, additives, hormones used; good appearance; good smell; good taste; good texture) more desirable for the organic products were: *No hormone used* and *No chemicals used*, while the less important quality was considered the *Good appearance*.
This pattern of preference was more pronounced (higher distance between the higher and lower preference) by the group of Consumers, Retailers, NGOs.

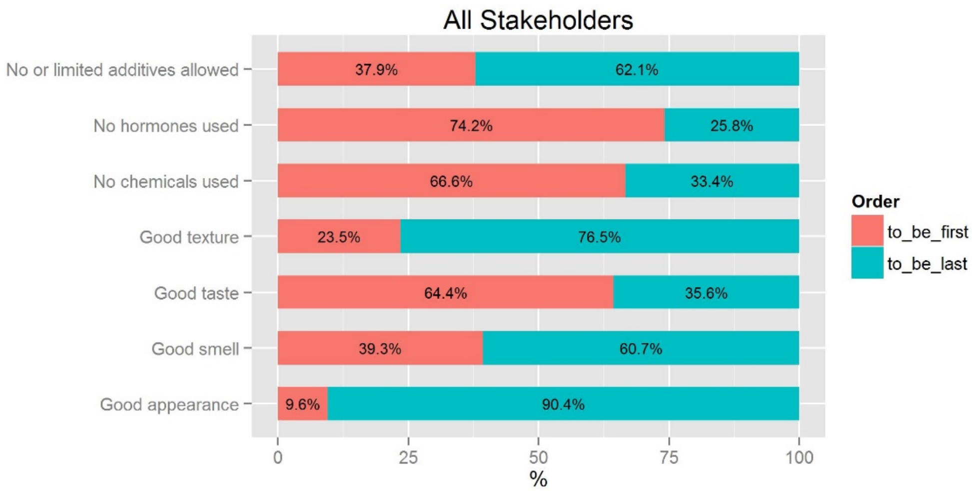


Fig. 23 – Empirical probability to be the more (or less) desirable *Product quality* for the organic products (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Product qualities* more desirable for the organic products were: *No hormone used* and *No chemicals used*, while the less important quality was considered the *Good appearance*).

Which of the *Product ecological qualities* in the figure below (Y axis) do you feel are more desirable in the organic products?

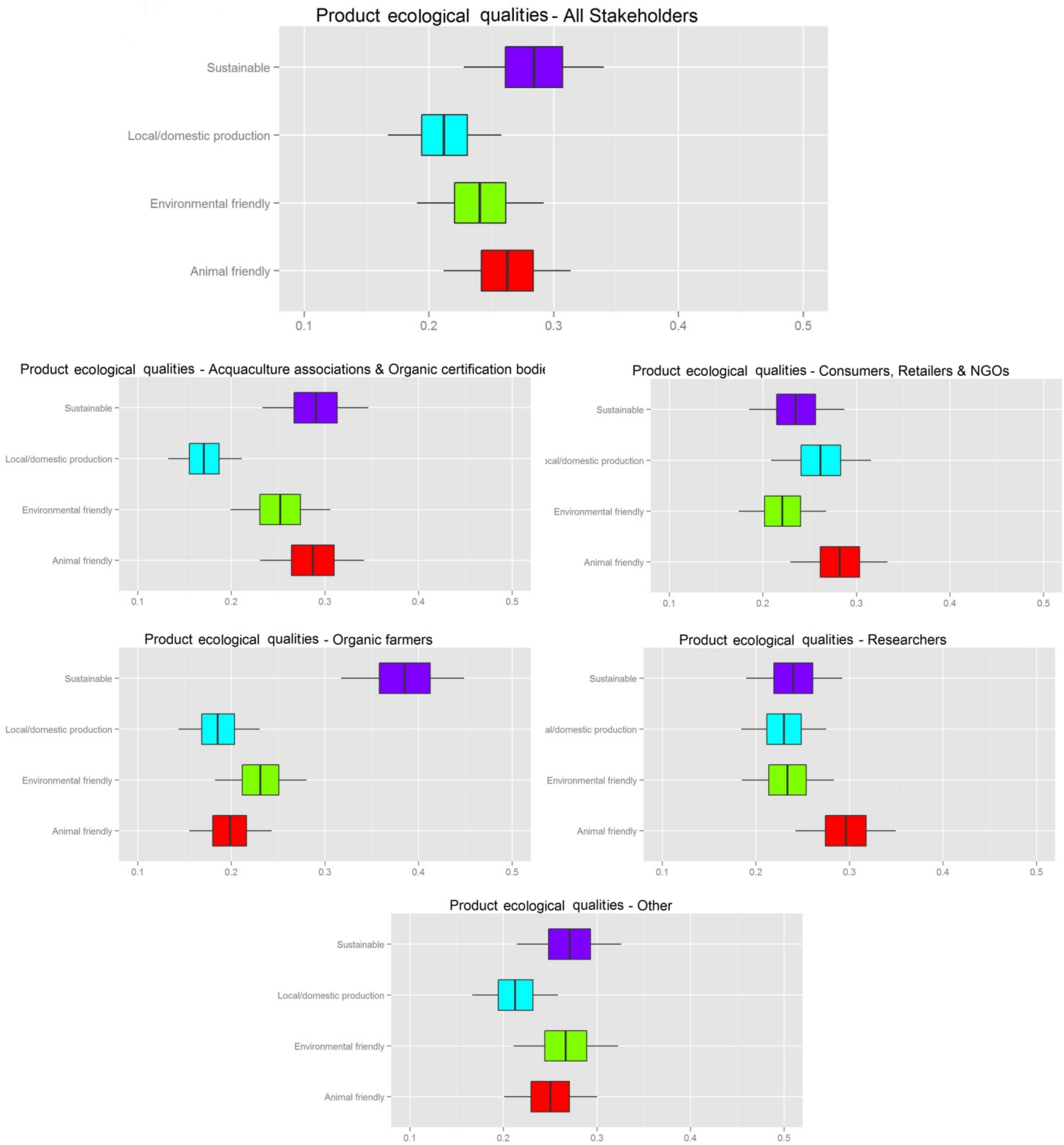


Fig. 24 – More desirable *Product ecological qualities* in the organic products *(level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the *Product ecological quality* (not exhaustive examples are: environmental friendly; animal friendly; sustainable; local/domestic production) more desirable in the organic products was: *Sustainable*, followed by *Animal friendly*, though the preference pattern was not very marked.
Inverse pattern showed Researchers and Consumers, Retailers and NGOs with the firs preference for *Animal friendly*.

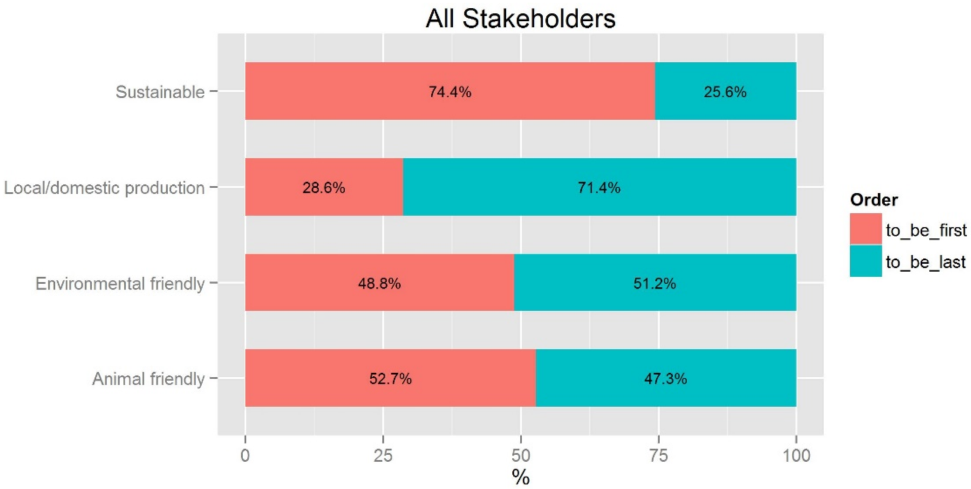


Fig. 25 – Empirical probability to be the more (or less) desirable *Product ecological quality* for the organic products (i.e. to be first and to be last), according to the stakeholder.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Product ecological quality* more desirable for the organic products was *Sustainable*, followed by *Animal friendly*).

Which actions in the figures below (Y axis) do you consider most important in order to establish a more appropriate *Energy use*?

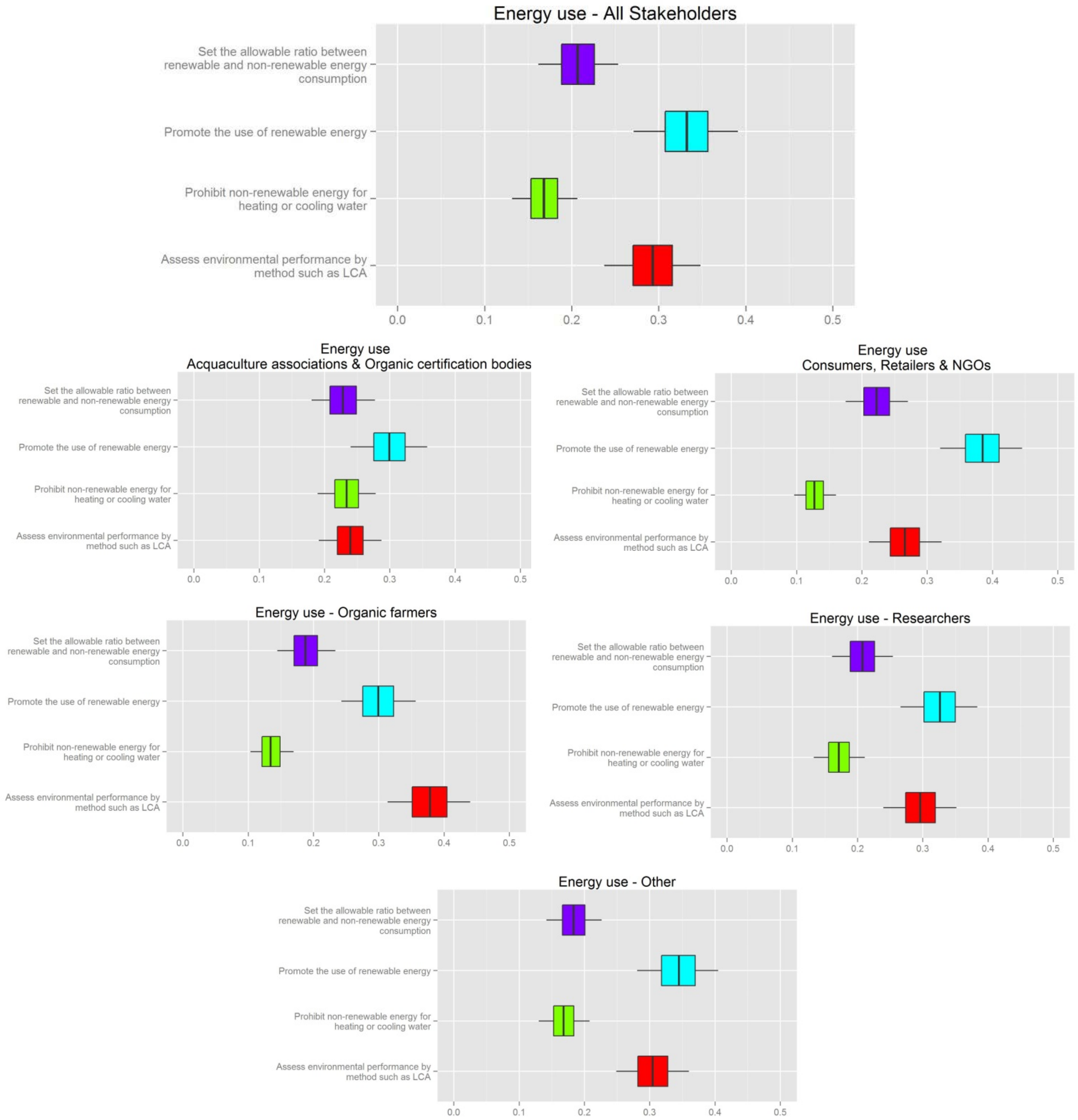


Fig. 26 – More important actions in order to establish a more appropriate *Energy use (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

Regarding the actions considered most important in order to establish a more appropriate *Energy use* (the practice and/or attitude of organic farms towards renewable energy and the environmental performance assessment) the preferences expressed by the whole stakeholder group was clearly: *Promote the use of renewable energy.*
Looking at the preference expressed by the Organic farmer, *Assess environmental performance by method such as LCA* (Life-cycle assessment – LCA -, also known as life-cycle analysis, is a technique to assess environmental impacts associated with all the stages of a product's life) got by far the higher score. Somewhat unexpectedly, the organic farmers did not consider the LCA an additional bureaucratic burden!
By almost all the groups a lower score was assigned to *Prohibit non-renewable energy for heating or cooling water*.

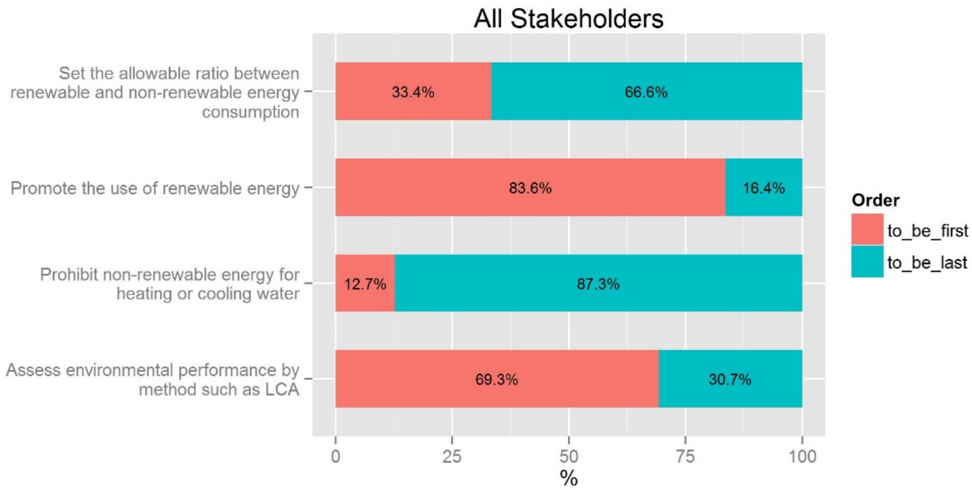


Fig. 27 – Empirical probability to be the more (or less) important action in order to establish a more appropriate Energy use (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the actions considered most important in order to establish a more appropriate *Energy use* was *Promote the use of renewable energy*, followed by *Assess environmental performance by method such as LCA*).

Which *Recycling* activities in the figures below (Y axis) do you consider more effective to reduce waste?

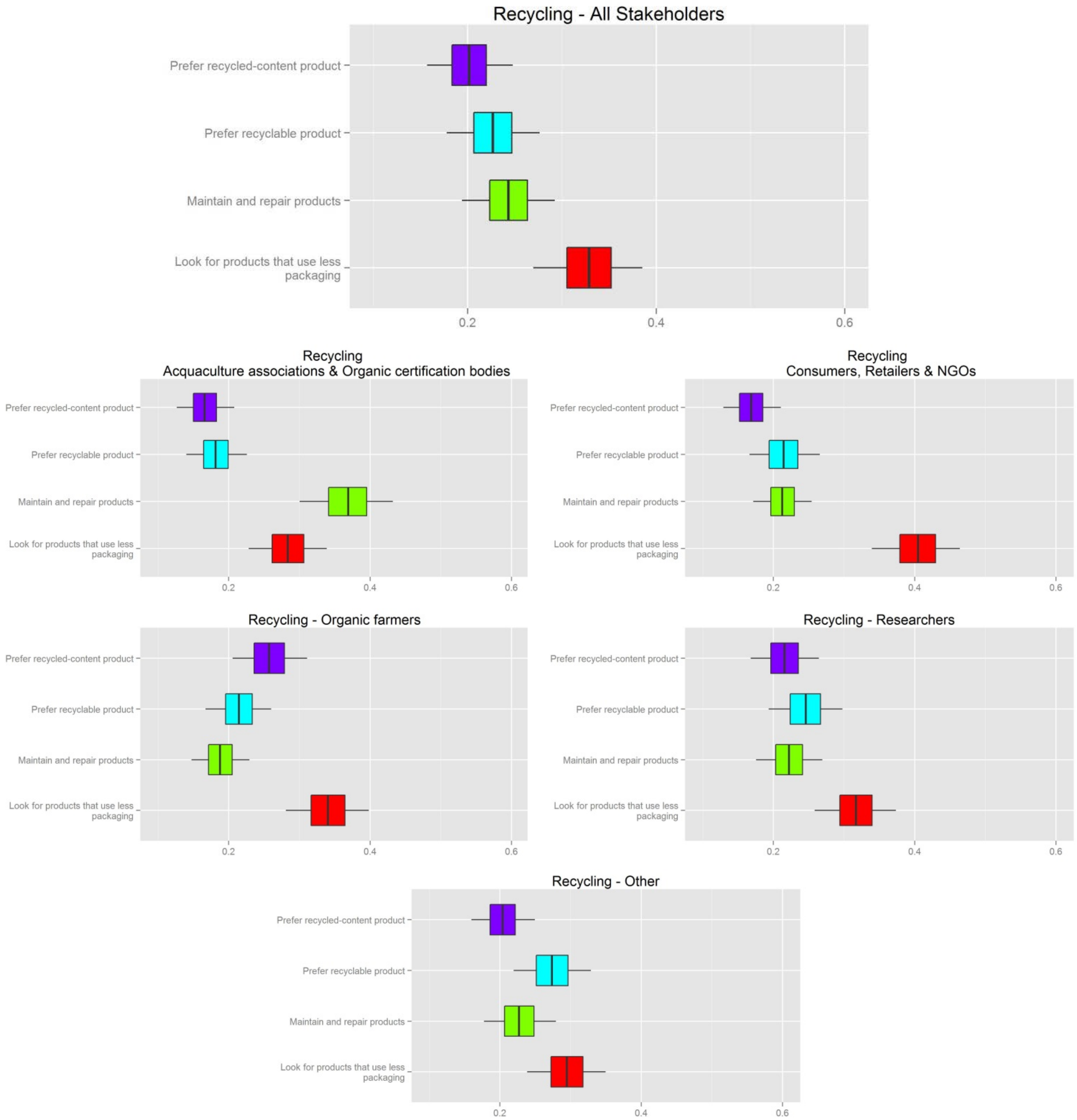


Fig. 28 – More important *Recycling* activity in order to reduce the waste *(level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

Regarding the *Recycling* activity (the attitude to use recycled or recyclable products and reduce waste) considered more effective to reduce waste, the whole group of stakeholders expressed a preference for *Look for products that use less packaging*. This was actually the first choice of all the different stakeholder groups, except Aquaculture associations and Certification bodies that ranked as first preference *Maintain and repair products*.

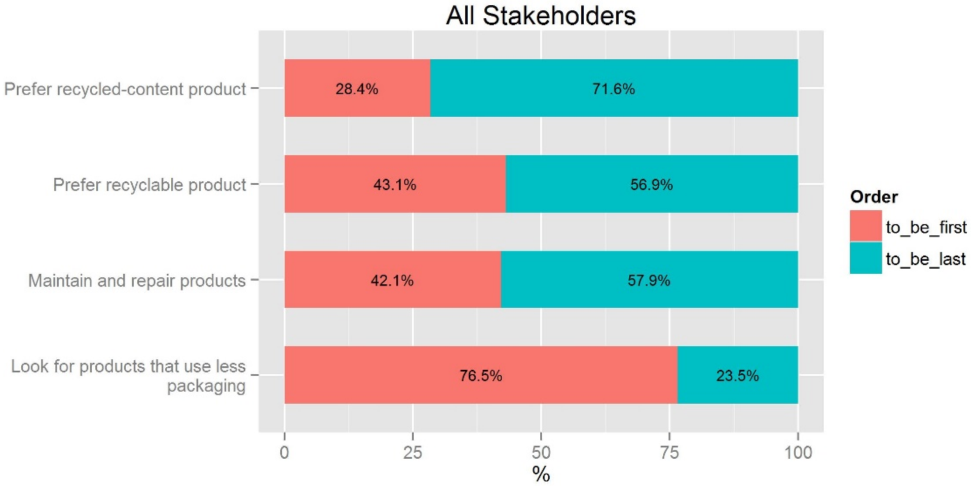


Fig. 29 – Empirical probability to be the *Recycling* activity more (or less) effective to reduce waste (i.e. to be first and to be last), according to the stakeholder experience.

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the *Recycling* activity considered more effective to reduce waste was *Look for products that use less packaging*).

Which of the practices in the figure below (Y-axis) do you consider more appropriate in order to limit the *Environmental impact* in the organic aquaculture?

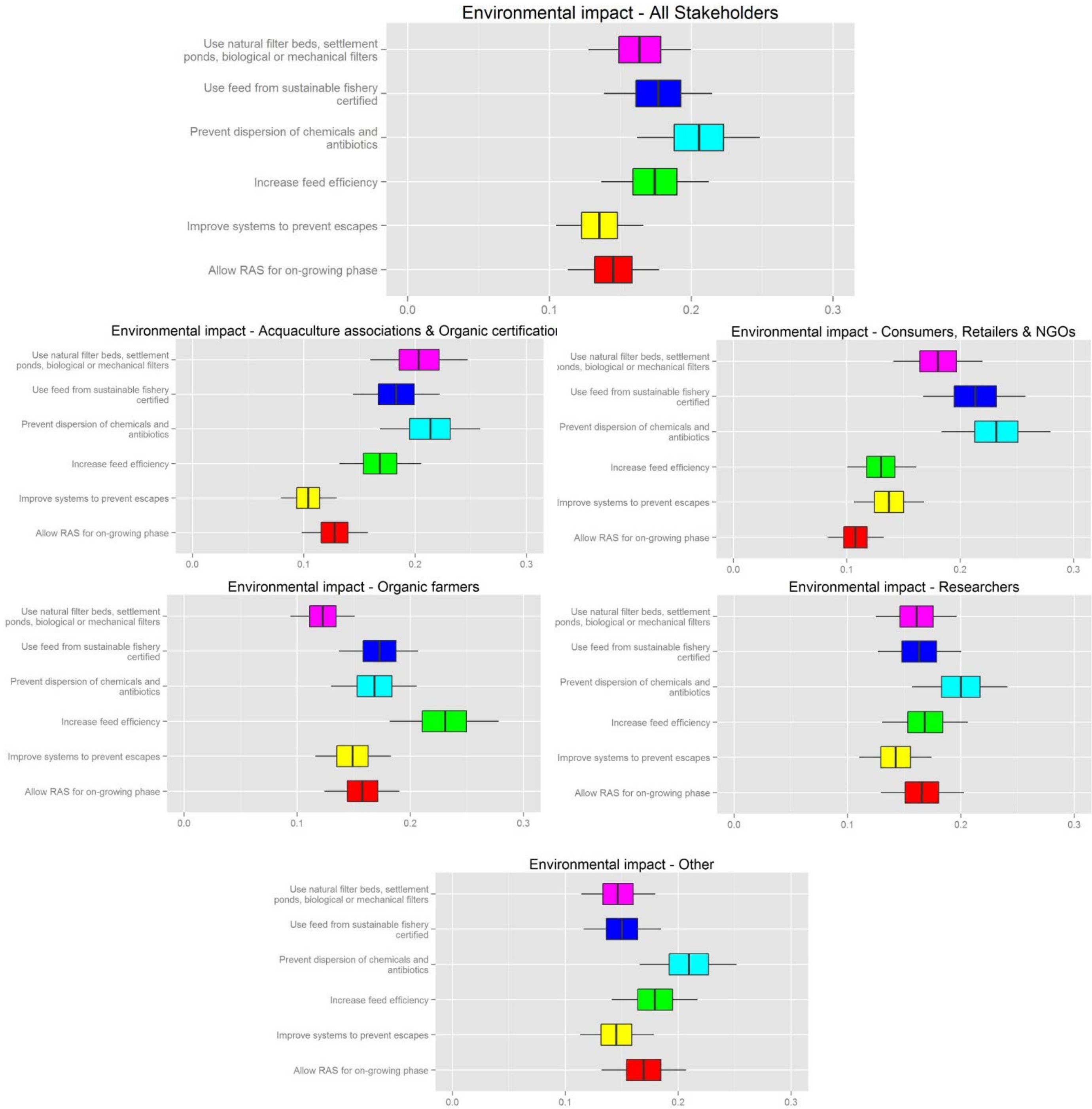


Fig. 30 – More appropriate practices in order to limit the *Environmental impact (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated in the survey, the more appropriate practice to limit the *Environmental impact* in the organic aquaculture is *Prevent dispersion of chemicals and antibiotics*.
While the less appropriate are *Improve systems to prevent escapes* and/or *Allow RAS for on-growing phase*.
Similar picture appears if we consider the preferences expressed by the Consumers, Retailers, NGOs, Aquaculture associations & Certification bodies and Researchers.
Only the preferences expressed by the Organic farmers were firstly to *Increase feed efficiency*.

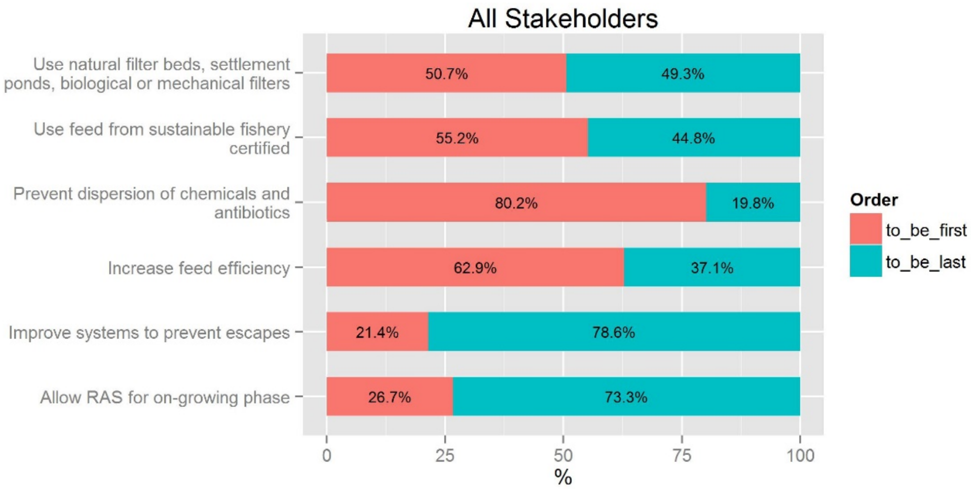


Fig. 31 – Empirical probability to be the more (or less) appropriate practice to limit the *Environmental impact* (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the more appropriate practice to limit the *Environmental impact* in the organic aquaculture is *Prevent dispersion of chemicals and antibiotics.* While the less appropriate are *Improve systems to prevent escapes* and/or *Allow RAS for on-growing phase*).

Which of the measures in the figure below (Y-axis) do you consider more appropriate in order to keep the *Quality of water* under control in the organic aquaculture farms?

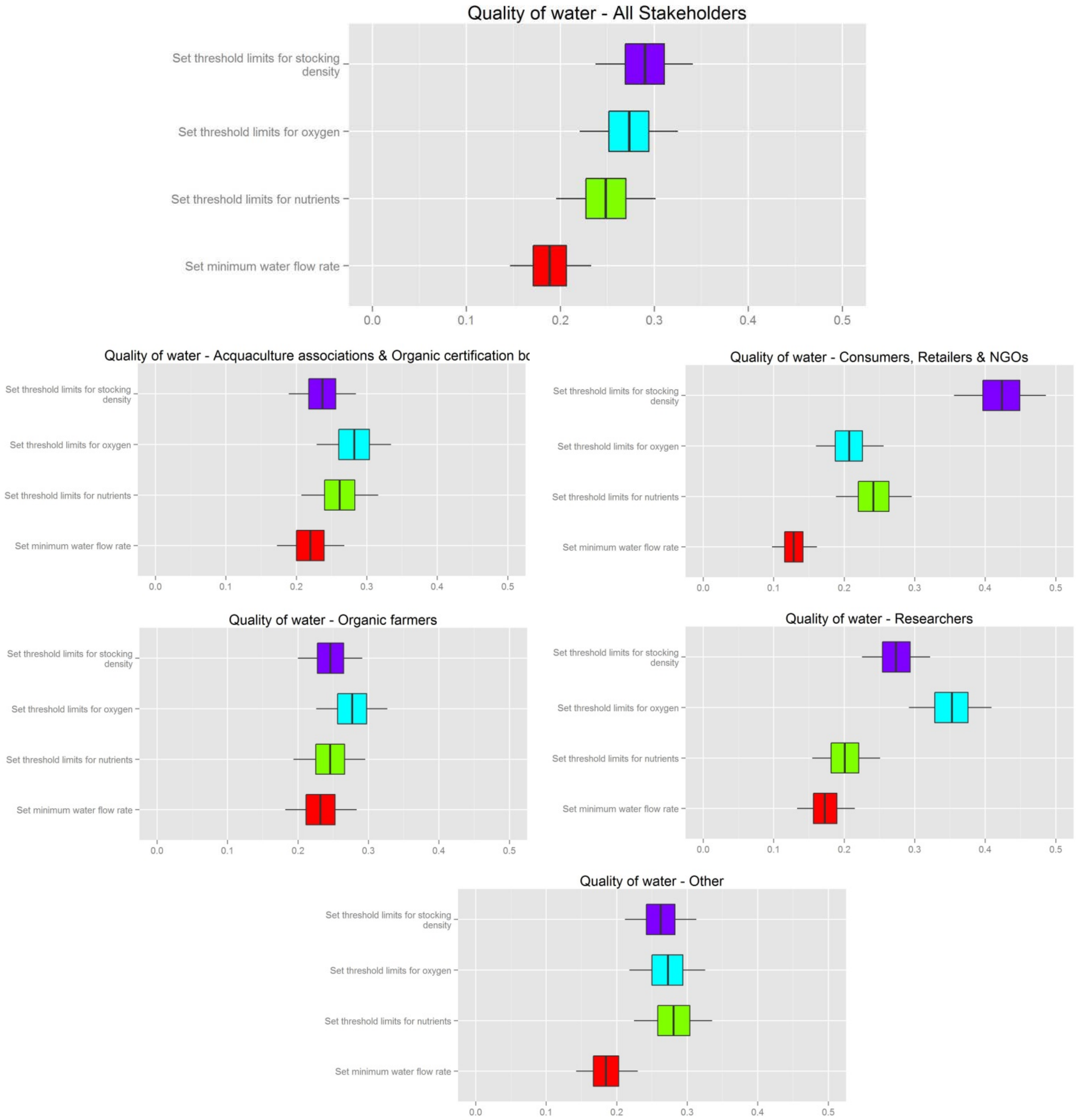


Fig. 32 – More appropriate measure in order to keep the *Quality of water* under control *(level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

Regarding the measures considered more appropriate in order to keep the *Quality of water* (the qualitative and quantitative characteristics of the water in the aquaculture farms) under control in the organic aquaculture farms, the whole group of stakeholders expressed a preference for *Set threshold limits for stocking density*. However, such preference was only slightly higher than that for *Set threshold limit for oxygen* and *Set threshold limit for nutrient*. The less ranked option was *Set minimum water flow rate*.
Looking at the preferences expressed by three of the single groups of stakeholders, a slightly higher preference for *Set threshold limit for oxygen* was instead expressed.

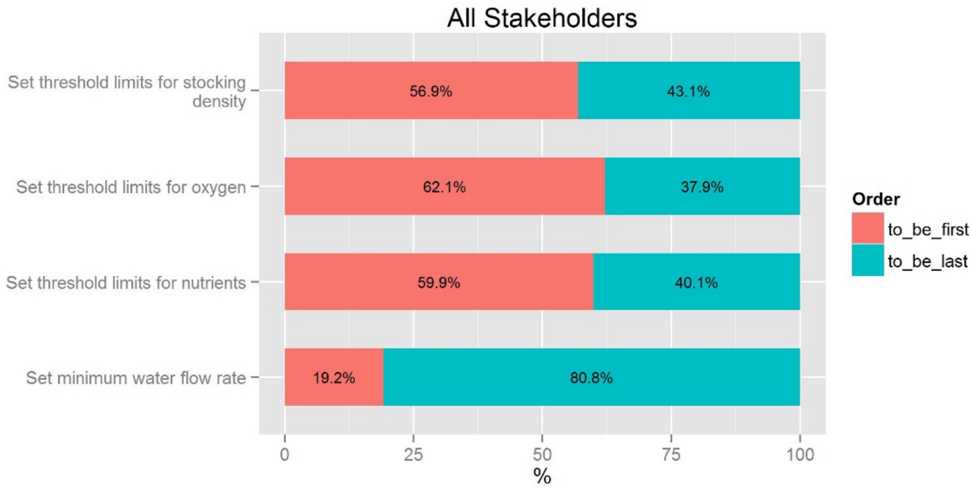


Fig. 33 – Empirical probability to be the more (or less) appropriate measure in order to keep the *Quality of water* under control (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the measures considered more appropriate in order to keep the *Quality of water* under control are *Set threshold limit for oxygen, Set threshold limit for nutrient* and *Set threshold limits for stocking density*).

Which of the measures in the figures below (Y axis) do you consider more appropriate in order to ensure the *Quality of feed* in the organic aquaculture farms?

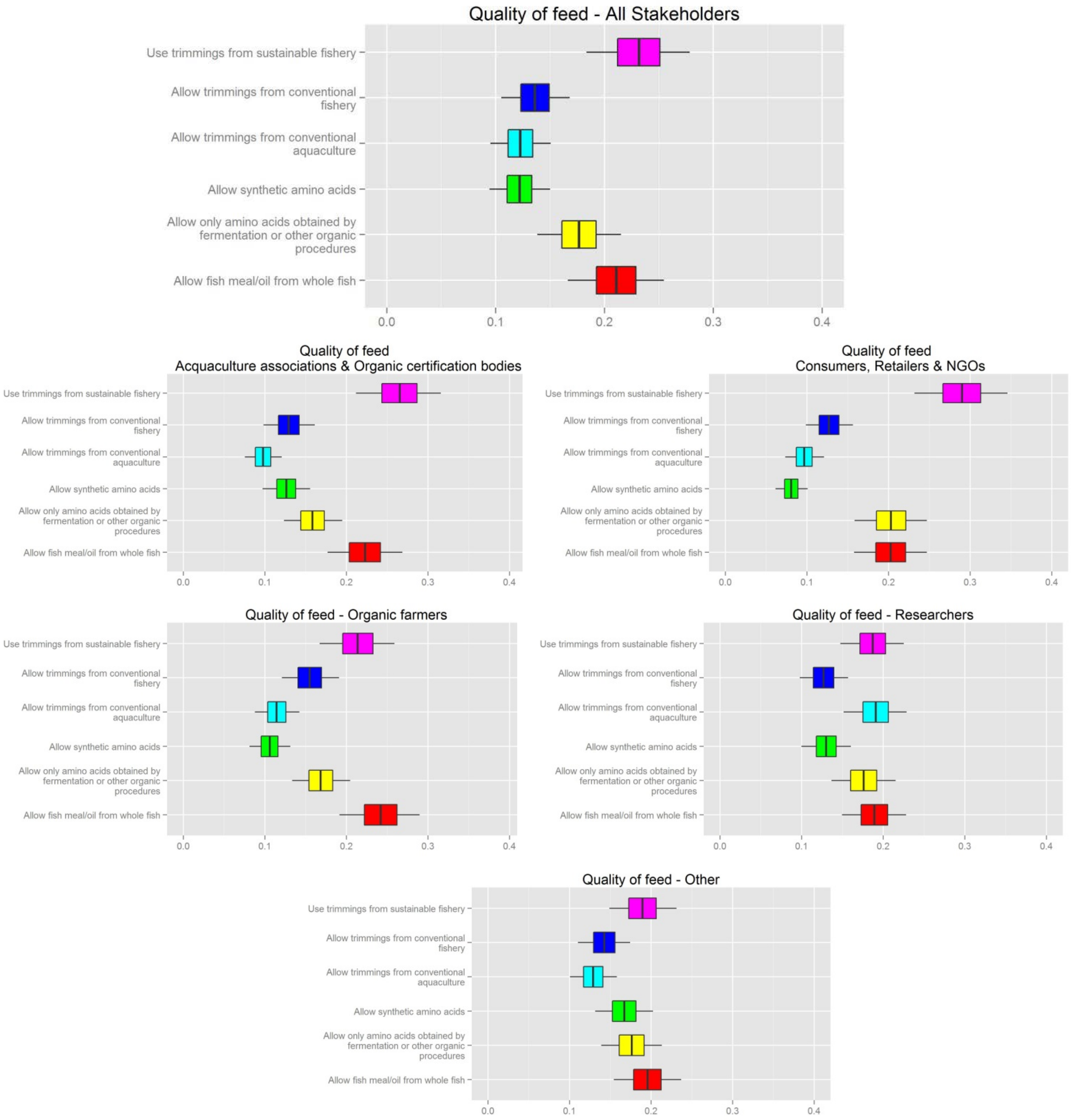


Fig. 34 – More important measure in order to ensure the *Quality of feed (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the more appropriate measures in order to ensure the *Quality of feed* (the nutritional characteristics and palatability of the feed) in the organic aquaculture farms were firstly *Use trimmings from sustainable fishery* (trimmings are the waste product of fish processing, which are used for the production of fishmeal and oil. The content of essential amino acids is generally lower in the trimmings, while the high phosphorus content might be in conflict with national environmental legislations) and secondly *Allow fishmeal/oil from whole fish*. The other alternatives had lower score.

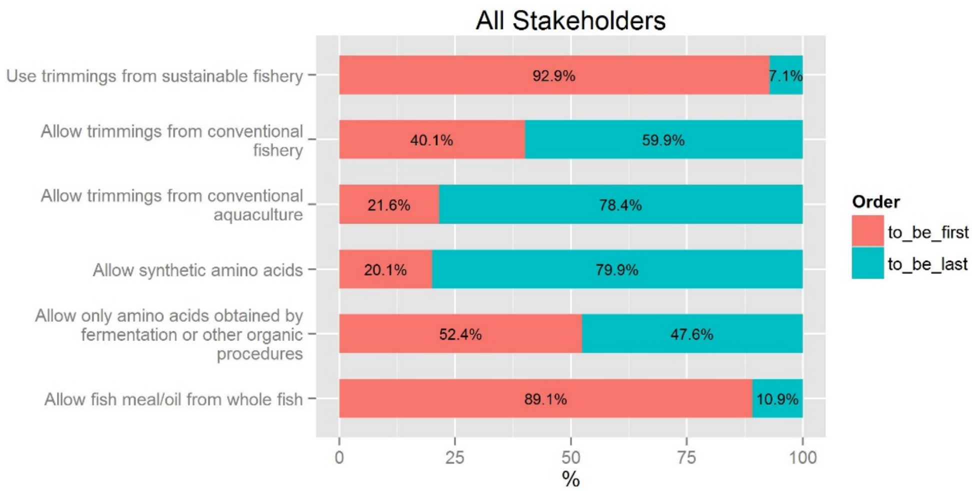


Fig. 35 – Empirical probability to be the more (or less) appropriate measure in order to ensure the *Quality of feed* (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the measures considered more appropriate in order to ensure the *Quality of feed* were firstly *Use trimmings from sustainable fishery* and secondly *Allow fishmeal/oil from whole fish*).

Which of the measures in the figure below (Y-axis) do you consider more appropriate in order to ensure the *Quality of the rearing environment* in the organic aquaculture farms?

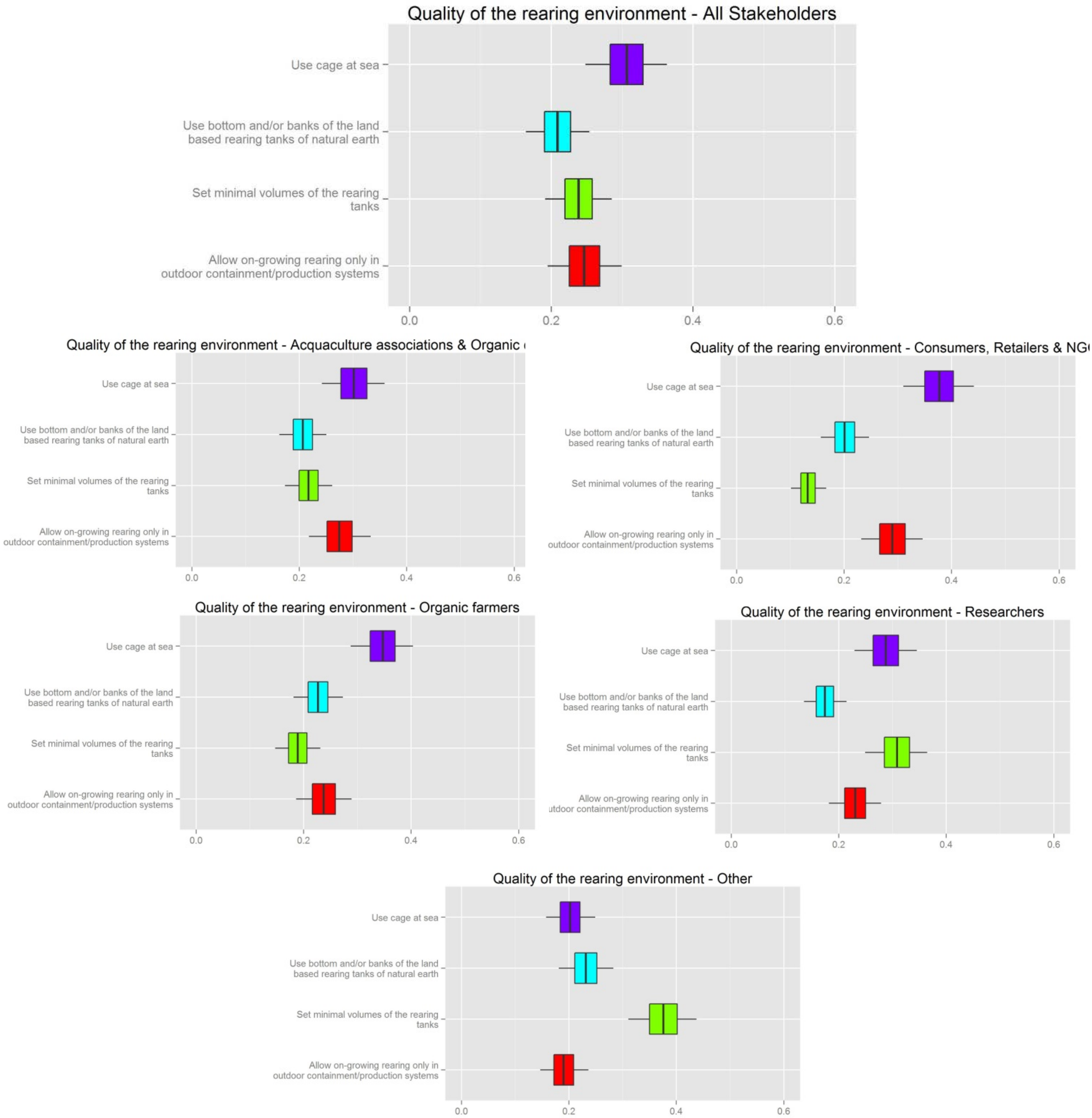


Fig. 36 – More appropriate measures in order to ensure the *Quality of the rearing environment (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated in the survey, the most appropriate measure in order to ensure the *Quality of the rearing environment* in the organic aquaculture farms (the dimension and the physical characteristics of the different production systems, as well as their relationships with the environment -e.g. outdoor production systems, natural vegetation on land-water interface, etc.) was *Use cage at sea*, the other alternatives getting lower scores.
Analogous picture appears if we consider the preferences expressed by the single groups of stakeholders.

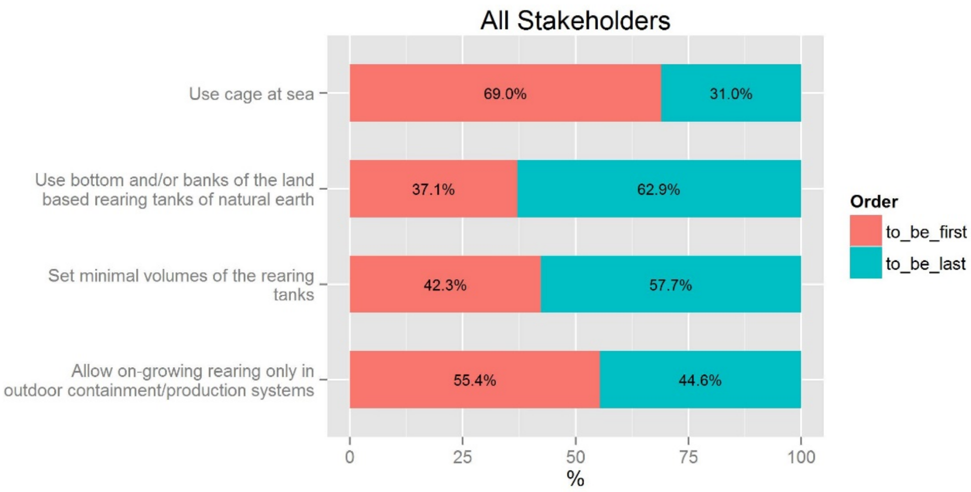


Fig. 37 – Empirical probability to be the more (or less) appropriate measure in order to ensure the *Quality of feed* (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot (i.e. the most appropriate measure in order to ensure the *Quality of the rearing environment* in the organic aquaculture farms was *Use cage at sea*).

Which of the measures in the figure below (Y-axis) do you consider more appropriate in order to ensure good *Physiological condition* to the fish in the organic aquaculture farms?

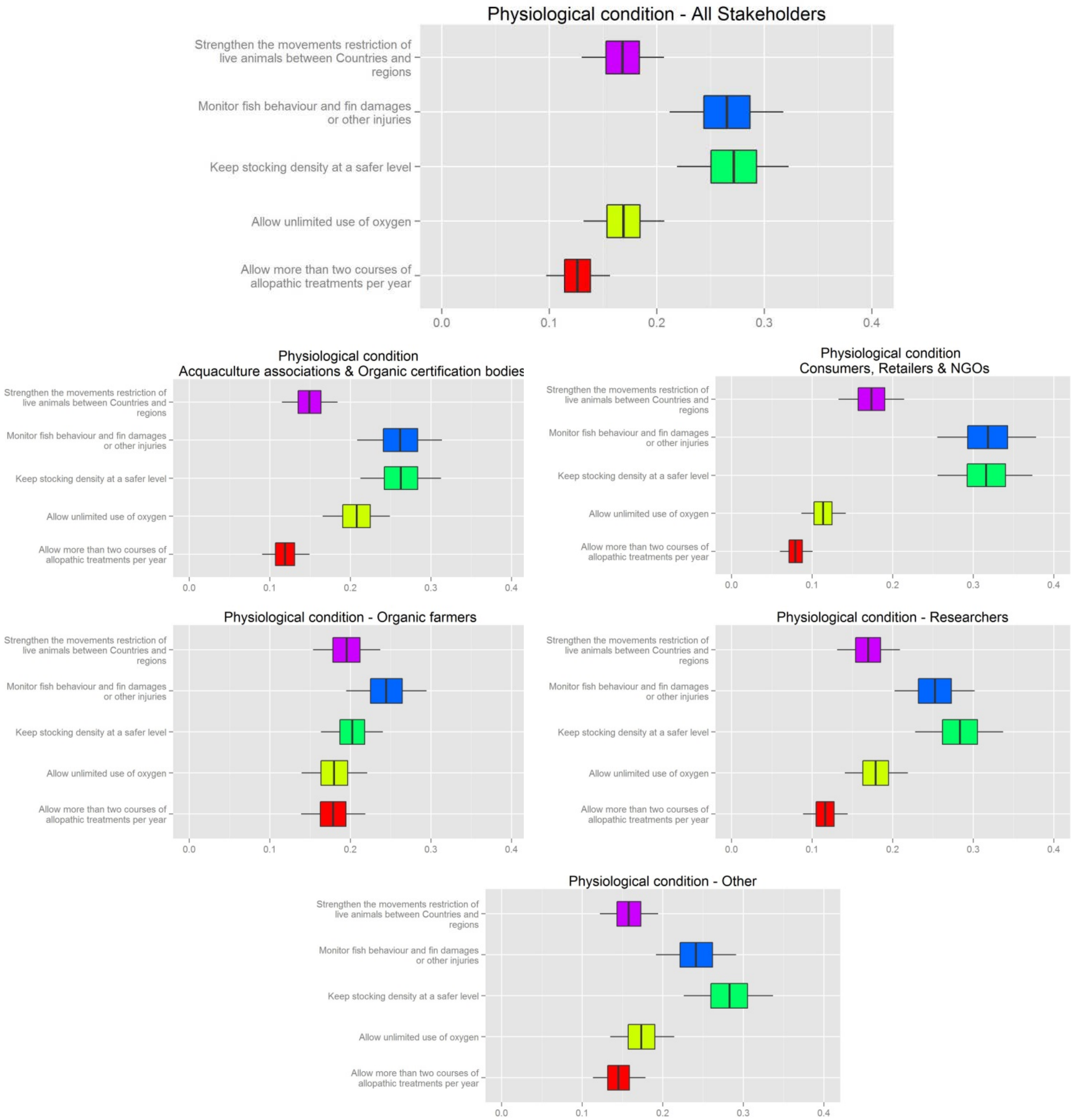


Fig. 38 – More appropriate measures in order to ensure good *Physiological condition (level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the more appropriate measures to ensure good *Physiological condition* (the physiological health conditions of the farmed animals) to the fish in the organic aquaculture farms were represented by *Keep stocking density at a safer level* and *Monitor fish behaviour and fin damages or other injuries*. Considering the different stakeholders groups there was almost an unanimous consensus on this judgement.
In almost all the groups the less ranked option was *Allow more than two courses of allopathic treatments per year* (drugs for the treatment of disease -e.g. antibiotics-).

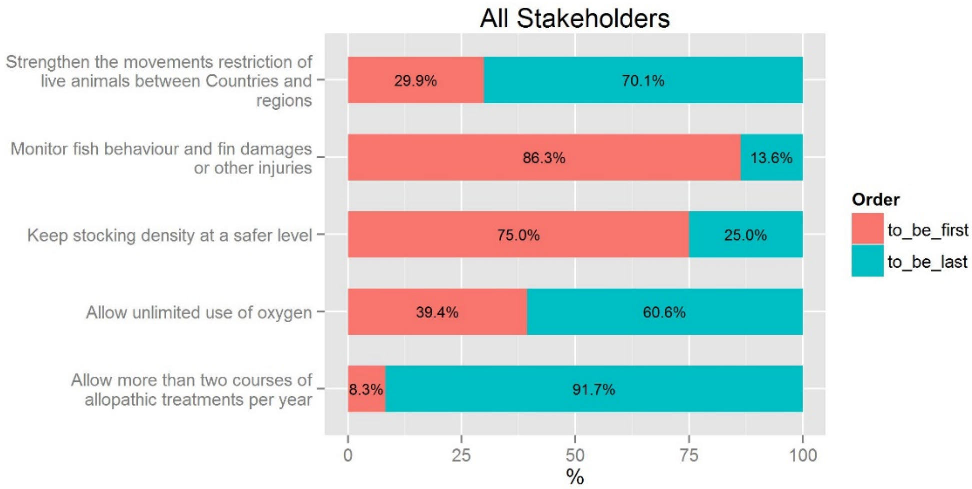


Fig. 39 – Empirical probability to be the more (or less) appropriate measure in order to ensure good *Physiological condition* (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot, just giving a slightly higher preference to *Monitor fish behaviour and fin damages or other injuries* in respect to *Keep stocking density at a safer level*.

Which of the actions in the figure below (Y-axis) do you consider most appropriate/relevant in order to make the *Husbandry practices* more in line with the organic principles?

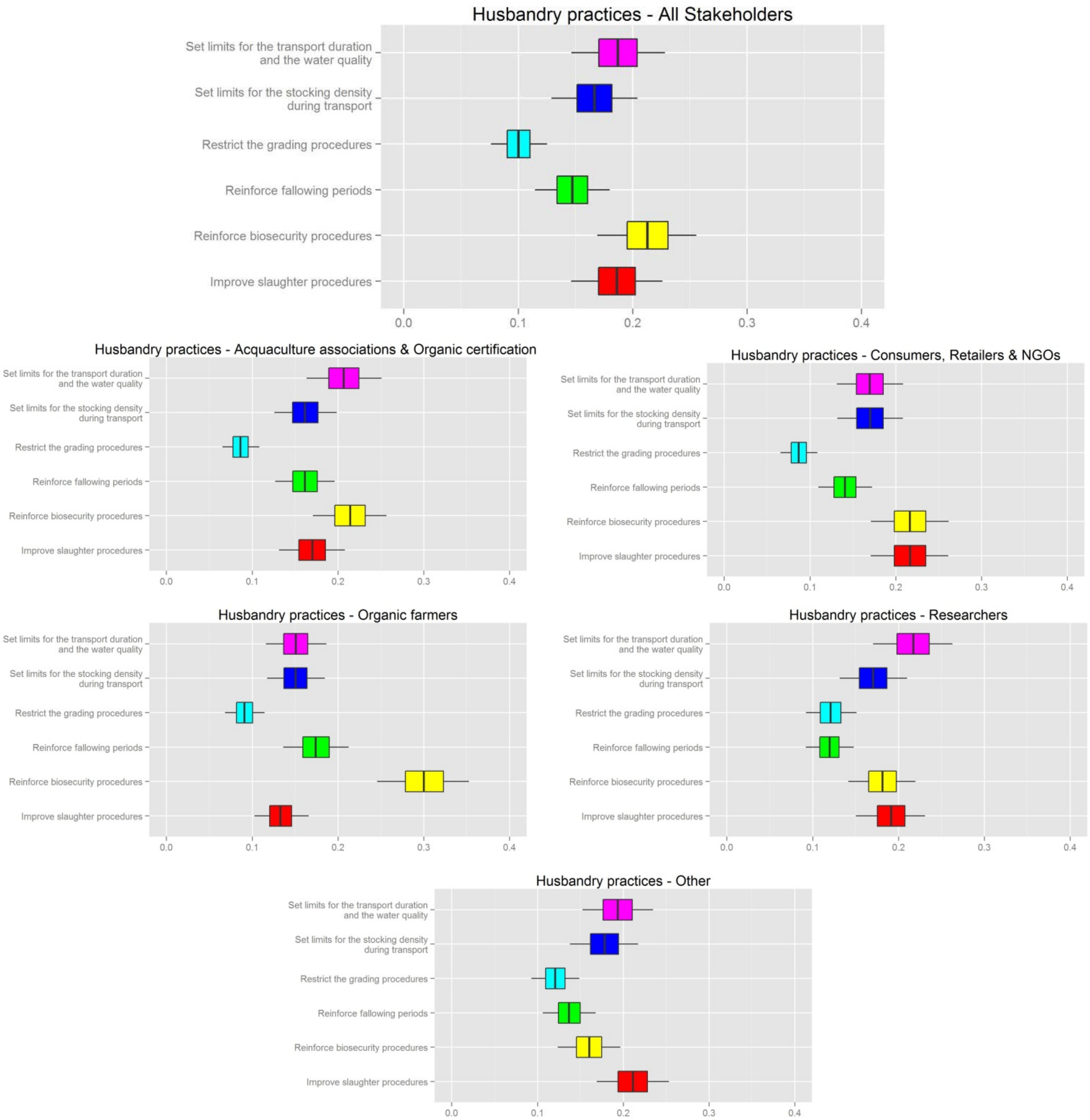


Fig. 40 – More appropriate actions in order to make the *Husbandry practices* in line with the organic principles *(level 3)*. Box Plot (percentile 0.05, 0.25, 0.5, 0.75 and 0.95) with the ranking of the preferences expressed by each stakeholder category and all categories combined (upper graph).

According to the majority of the stakeholders, who participated to the survey, the more appropriate action in order to make the *Husbandry practices* more in line with the organic principles was represented by *Reinforce biosecurity procedures* (biosecurity in aquaculture consists of practices that minimize the risk of introducing an infectious disease and spreading it to the animals at a facility and the risk that diseased animals or infectious agents will leave a facility and spread to other sites and to other susceptible species), being the other alternatives less ranked. The last resort was *Restrict the grading procedures*. This judgement was shared among all the stakeholder groups, with more or less gaps among the alternatives.

Fig. 41 – Empirical probability to be the more (or less) appropriate measure in order to ensure good *Physiological condition* (i.e. to be first and to be last), according to the stakeholder experience

The results expressed in terms of empirical probability corroborate those showed in the box-plot, just giving a higher ranking level to *Set limits for the transport duration and the water quality* right after *Reinforce biosecurity procedures.*

FINAL REMARKS

Looking into the Consistency ratio of the answers to the questions delivered by the stakeholders, concerning the eighteen key issues in the survey, the results appear rather positive. The level of coherence of the answers given to a survey by the stakeholders greatly influence the robustness of the results and the interpretation of the views expressed. Indeed, values of the consistency ratio below 0.10 indicate high coherence of the answers delivered, while values above 0.10 indicates a progressive impoverishment of the coherence. In the present survey, the answers concerning thirteen key issues obtained a consistency ratio below 0.10. While, only five of eighteen key issues showed a consistency ratio slightly above 0.10 (but below 0.12).

According to the majority of the stakeholders, who participated to the survey, the most important issue to be taken into consideration in order to promote the development of the *Organic Aquaculture* is the *Consumer perception.*

The *Product ecological qualities* (e.g. environmental friendly; animal friendly; sustainable; local/domestic production) are the more appropriate qualities to characterise the *Consumer perception.*

The more relevant action in order to establish a more appropriate *Legislative framework* for the organic aquaculture is to *Reinforce European/national support to programs for developing organic aquaculture.*

The more relevant action to make more effective the *Control provisions* (meant as the qualitative/quantitative checks/controls carried out on organic farms, raw materials and organic products) is by far to *Enforce the homogeneity of the control system among countries and Certification bodies*.

The more desirable *Product qualities* (not exhaustive examples are: no chemicals, additives, hormones used; good appearance; good smell; good taste; good texture) for the organic products are: *No hormone used* and *No chemicals used*, while the *Good appearance* is considered the less important quality.

The more desirable *Product ecological quality* (not exhaustive examples are: environmental friendly; animal friendly; sustainable; local/domestic production) in the organic products is: the *Sustainability*, followed by the *Animal friendly* quality.

The *Environmental impact* is the more appropriate element to describe the *Environmental interactions* (meant as the relationships between the organic farms and the environment, as well as the attitude to environmentally friendly behaviour).

To *Promote the use of renewable energy* actions is clearly considered the most important attitude in order to establish a more appropriate *Energy use* (the practice and/or attitude of organic farms towards renewable energy and the environmental performance assessment).

Look for products that use less packaging is considered the *Recycling* activity more effective to reduce waste.

The more appropriate practice to limit the *Environmental impact* in the organic aquaculture is considered to *Prevent dispersion of chemicals and antibiotics*. While the less appropriate is considered *Improve systems to prevent escapes* and/or *Allow RAS for on-growing phase*.

The *Production systems* more in line with the organic principles are considered, firstly the Integrated multi-trophic aquaculture (*IMTA),* which is an intensive and synergistic cultivation that uses water-born nutrients and energy transfer. Multi-trophic means here that the various species occupy different trophic levels. Secondly *Cage at sea* and *Medium-low density systems*. While, *Closed recirculation aquaculture system* (*RAS*) and the *Medium-high density system* have obtained the lowest preference.

The measure considered more appropriate in order to keep the *Quality of water* under control, in the organic aquaculture farms, is to *Set threshold limits for stocking density*. However, such preference is only slightly higher than that obtained by *Set threshold limit for oxygen* and *Set threshold limit for nutrient.*

The more appropriate measures to ensure good *Physiological condition* (the physiological health conditions of the farmed animals) to the fish, in the organic aquaculture farms, are to *Keep stocking density at a safer level* and *Monitoring fish behaviour and fin damages or other injuries*.

The more appropriate measures in order to ensure the *Quality of feed* were firstly *Use trimmings from sustainable fishery* (trimmings are the waste product of fish processing, which are used for the production of fishmeal and oil). Secondly *Allow fishmeal/oil from whole fish*.

The latest considerations that it is worth noting are:

a) Rarely judgments/preferences expressed by the four stakeholder categories (excluding the "other" category, which includes a negligible number of people) are significantly different each other and/or from the average of all stakeholders.
b) The results expressed in terms of empirical probability, generally, corroborate those shown in the box plots. They also provide a more accurate assessment of the degree of diversity/similarity of the preferences expressed, especially in cases where the results of the box plots show higher values of standard deviation.

GLOSSARY

1	Additives	Here are intended in the general meaning of processing aids and other substances/ingredients used for processing food, approved by Regulation (EC) N° 889/2008.
2	Allopathic treatments	Drugs for the treatment of disease (e.g. antibiotics).
3	Amino acids	Amino acids are the building blocks of proteins. A carefully balanced profile and an adequate amount of amino acids in the diets are critical for the welfare and growth of the fish.
4	Biosecurity procedures	Biosecurity in aquaculture consists of practices that minimize the risk of introducing an infectious disease and spreading it to the animals at a facility and the risk that diseased animals or infectious agents will leave a facility and spread to other sites and to other susceptible species.
5	Certification body	Body accredited by the authorities of each Country to carry out inspections at the aquaculture farms on compliance with the EU organic regulations.
6	Chemicals	Here are intended, in a general sense, as chemically synthesised products, which the EU regulation only allows to a very limited extend.
7	Consumer perception	Consumer’s opinion regarding the principles and regulations of the organic production.
8	Control provisions	The qualitative/quantitative checks/controls carried out on organic farms, raw materials and organic products.
9	Derogation	The suspension of the application of a specific part of the organic regulation, under documented exceptional circumstances and given by a National authority.
10	Energy use	The practice and/or attitude of organic farms towards renewable energy and the environmental performance assessment.
11	Environmental impact	The impact of the organic farms on the surrounding environment.

12	Environmental interactions	The relationships (e.g. impacts) between organic farms and the environment, as well as the attitude to environmentally friendly behaviour.
13	Equivalence	The Commission may recognise third countries whose system of organic production complies with principles and production rules *equivalent* to those of the EU organic regulations and whose control measures are of *equivalent* effectiveness to those of the EU organic regulations.
14	Escapes	The fish escaped from the farm cages at sea or from land-based tanks and ponds, which could generate genetic drift, i.e mix of genes in the wild populations.
15	Fallowing periods	Fallowing is a routine disease management measure for resting or restoring the local environment/production area, at the end of a production cycle, carried out prior to the introduction a new population.
16	Feed efficiency	The most efficient utilization of the feed (i.e. high performance in terms of growth and minimum waste)
17	Fish health and welfare	A condition which mitigates stress caused by farming conditions and ensures that the physiological needs of the fish are met.
18	Grading procedures	Sorting or grading live fish are practices that optimizes production by reducing cannibalism, decreasing size variability among harvested fish, and improving feed conversion efficiency.
19	Physiological conditions	The physiological health conditions of the farmed animals.
20	Hormones	Substances to promote growth or to control reproduction (e.g. induction or synchronisation of ovulation) or to produce mono-sex populations.
21	Husbandry practices	The practical farming management activities.

22	IMTA	Integrated multi-trophic aquaculture (IMTA) is an intensive and synergistic cultivation, which uses water-born nutrients and energy transfer. Multi-trophic means here that the various species occupy different trophic levels.
23	Institutional framework	The social, economic and legislative background/basis along with the framework of production standards and controls.
24	LCA	Life-cycle assessment (LCA), also known as life-cycle analysis, is a technique to assess environmental impacts associated with all the stages of a product's life.
25	Legislative framework	The EU organic regulations along with the actions to support the implementation and development of organic aquaculture, undertaken by Member States and EU.
26	Movements restriction of live animals	Restrictions on the movement of live animals between countries and regions are based on the “Directive 2006/88/EC on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals”.
27	Nutrients	Nitrogen and phosphorus are nutrients that are natural parts of aquatic ecosystems, but when too much nitrogen and phosphorus enter the environment (i.e. rivers, lakes, coastal waters) it may have detrimental impact on the ecological systems and can lead to illnesses and death of large numbers of fish.
28	Parallel production	Parallel production is the rearing of organic and non-organic fish of the same species in the same production units (in the current EU Regulation it is allowed for fish and bees but not for livestock).
29	Product qualities	Non exhaustive examples are: no chemicals, additives, hormones used; good appearance; good smell; good taste; good texture.
30	Product ecological qualities	Non exhaustive examples are: environmental friendly; animal friendly; sustainable; local/domestic production.

31	Production rules	The whole set of production rules that may distinguish the organic aquaculture from the conventional one.
32	Production systems	The different physical aquaculture production systems with regard to the use of technology, the relations with the environment and the intensity.
33	Quality of feed	The nutritional characteristics and palatability of the feed.
34	Quality of the rearing environment	The dimension and the physical characteristics of the different production systems, as well as their relationships with the environment (e.g. outdoor production systems, natural vegetation on land-water interface, etc.).
35	Quality of water	The qualitative and quantitative characteristics of the water in the aquaculture farms.
36	RAS	Closed recirculation aquaculture system (RAS) means a facility where aquaculture takes place within an enclosed environment on land or on a vessel involving the recirculation of water, and depending on permanent external energy input to stabilize the environment for the aquaculture animals.
37	Recycled-content product	A product containing or made by recycled components or ingredients.
38	Recycling	The attitude to use recycled or recyclable products and reduce waste.
39	Risk analysis	The assessment of the risk of occurrence of non-compliance with the EU organic regulation, on the basis of which the nature and frequency of the controls shall be determined.
40	Second level control	As a duty of the national authorities to organize audits or inspections of control bodies accredited if necessary. If these control bodies fail to execute properly the tasks delegated to them, the competent authority may withdraw the delegation.

41	Slaughter procedures	Slaughter techniques/procedures should be able to render fish immediately unconscious and insensible to pain.
42	Trimmings	Trimmings are the waste product of fish processing, which are used for the production of fishmeal and oil. The content of essential amino acids is generally lower in the trimmings, while the high phosphorus content might be in conflict with national environmental legislations.
43	Whole fish	Fish meal and oil, in addition from trimmings, can be made from wild-caught, small marine fish usually deemed not suitable for direct human consumption. The use of the *whole fish*, in general elevates the content in essential amino acids and reduces the environmental impact of the feed.

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