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Lead beneficiary: AWI
Authors: Krause, Gesche, Hörterer, Christina, Petereit, Jessica

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GLOSSARY OF ACRONYMS

Acronym	Definition
SDGs	Sustainable Development Goals
ICYMARE	International Conference for Young Marine Researchers
EAS	European Aquaculture Society
UN	United Nations
HIGHSEA	A unique classroom instruction project in Germany at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research
RAS	Recirculating Aquaculture System
IMTA	Integrated Multi Trophic Aquaculture
IIM	Instituto de Investigaciones Marinas, Spain
IASS	Institute for Advanced Sustainability Studies, Potsdam, Germany
NOK	Norwegian Kroner
SZ	Süddeutsche Zeitung, one of Germans larges Newspapers

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Executive summary

This report addresses the question of how consumers and stakeholders will accept eco-intensification of marine food production systems and how improved information availability effect narratives of this change. GAIN identified several species that host the potential to eco-intensification measures that may alter food availability but also food preferences, all of which are driven by different understandings and contexts of sustainability. Hence, the exercise introduces a fundamental dilemma in that way that motivations for and processes of social change at different spatial scales and multiple governance levels have not been adequately addressed. Societies of today have developed into multi-faceted highly fragmented and diverse entities with a broad array of different interests, views, knowledge structures, perspectives, norms and values. This makes addressing the social dimensions of consumer and stakeholder acceptance a subject so difficult to tackle, especially in the light of transforming societies towards more sustainable food consumption patterns by eco-intensification measures. This is however a timely demand, as ongoing rapid changes in demographic, social, economic, ecologic and consumption-production patterns call for new research lines of how information and awareness can be turned into action.

The results presented in this report show that despite in parts a very high level of awareness of aquaculture and sustainability, consumers are often hesitant to change their behaviour as these are often driven by other aspects outside the direct realm of food. This has also repercussions to efforts of eco-intensification measures, as lack of knowledge on aquaculture in the first place leads to limited acceptance (and opinion) on its improvements. However, as shown by the interviews. Understanding and acceptance of the importance of sustainability within marine food is increasing, which implies a general increase of public approval for eco-intensification efforts of the industry. Thus, next to the role of price, national cultural preferences, peer group contexts and accessibility of alternative seafood products as well as an understanding of the plurality of sustainability dimensions in aquaculture production are all welded together and provide a highly contextual picture on the potential of improved information on eco-intensification measures. For instance, the emerging trend of vegetarianism and vegan diets especially among younger age generations is a case in point, since this may require very different production lines in the future, as demand potentially shifts away from contemporary fish consumption patterns.

Central thematic arenas can be outlined that must be understood as potential avenues of further research and stakeholder engagement:

Contextual Levels: The different levels from individual to national when analysing and discussing potential change processes must be considered. Context matters whether people are moved by intellectual, emotional, spiritual, economic, or other reasons. This needs to be acknowledged within the lines of sales and successive information schemes. Building room for

transparent processes for participation and decision-making facilitate a sense of ownership for new lines of production that root in establishing close linkages from the onset with i.e. retailers.

Regionality: Regionality and clear framing of the origin of the product matters. On the individual level, it was found that current certification schemes, more often than not, appeared to be confusing to the consumer. Rather, transparency about place, location and how they match with customers own world-views needs to be improved.

Actors: Noticeably, the young generation is very aware about food choices and highly receptive to vegetarian and vegan diets. This may limit acceptance and consumption rates of eco-intensification of seafood. Thus, the groups who are currently leading the transformation may focus on different commodities that may be of interest to future consumers. Compelling links to values, emotions and meanings or past experiences are essential to engage people, especially the "customers of tomorrow".

Impact: The analysis of the term sustainability by word clouds, identified major elements of ongoing discourses of bridging ecological and economic concerns. Eco-intensification policy measures can be developed to turn awareness about the need to transform current marine food systems to transit into action and to develop compromise solutions, which address narratives of various discourses. Identifying or creating inspiring narratives to motivate and link different actors in the change process is hereby central.

1 Point-of-Departure

Living the Age of the Anthropocene (Crutzen 2002), a defined narrative of a new geological era that emerged for rethinking humans' relationship with nature, many calls have been voiced in the past decade to address the urgent and critical challenges of global change. These are collated by the UN Sustainable Development Goals (SGDs) and mirrored in the ongoing planetary boundaries discourse (Rockström, Steffen et al. 2009, Steffen, Richardson et al. 2015, UN 2016), among others. In its wake, there is a need to find new ways to feed the fast-growing global population. This growth, combined with the expectations of citizens from an increasingly prosperous world, will intensify the global demand for food and biomass.

On this note, this report examines the question of how consumers and stakeholders will accept eco-intensification of marine food production systems and how improved information availability effect narratives of this change. The exercise introduces a fundamental dilemma in that way that motivations for and processes of social change at different spatial scales and multiple governance levels have not been adequately addressed which would shed light to the ongoing rapid changes in demographic, social, economic, and consumption-production patterns. Indeed, it could be found that despite a very high level of awareness of i.e. climate change and its impacts, people are often hesitant to take action to change their behaviour Komendantova and Neumueller (2020).
While managing demand for food will be increasingly important (Ingram 2017), there is no doubt that there will be an increased demand for aquatic food sources, as agriculture already accounts for 40% of the earth's land surface and 70% of the world's use of freshwater (SAPEA 2017). There is an increased realisation of the extensive environmental footprint and costs associated with today's food production methods (Godfray, Beddington et al. 2010, Crist, Mora et al. 2017) and other food system activities (UNEP 2016). Food production and other food system activities are therefore already a substantial contribution to crossing planetary boundaries (Rockström, Steffen et al. 2009, Steffen, Richardson et al. 2015, Campbell, Beare et al. 2017, Crist, Mora et al. 2017). Consequently, attention to increased utilisation of marine food commodities as a human food provider seems inevitable (EASAC 2016). However, increased food from the ocean may release some of the pressure that has been put on agriculture to achieve UN sustainable development goal SDG2, 'End hunger, achieve food security and improved nutrition and promote sustainable agriculture', but this needs to be achieved without compromising SDG14 'Conserve and sustainably use the oceans, seas and marine resources', and SDG12 "Responsible consumption and production".

Hence, in the EU-GAIN project, a central focus is placed on eco-intensification of European aquaculture. This is a transdisciplinary challenge that requires the integration of scientific and technical innovations, new policies and economic instruments, as well as the mitigation of social constraints. Successful eco-intensification of aquaculture is believed to provide more and better aquatic products, more jobs, and improve trade balance by reducing imports.

However, to achieve these, this requires support from the public for policy changes, which includes not only acceptance of food supply transitions, but also willingness to use and to pay for alternative eco-intensification measures, as well as to actively engage in such transformative pathways. Furthermore, it also requires individual behaviour changes in personal consumption of aquatic foodstuff across the EU.

This report is therefore structured as follows: We describe the central methods and materials used before providing an overview of contemporary consumption patterns in the EU and trends across different age groups and degree of information available, hereby focussing on three EU-member States that are part of the GAIN consortium. We identify the knowledge availability according to the social structure, as well how the specific social positioning within a given age structure affects the acceptance and awareness of aquaculture. Next, the understanding of sustainability in a society is captured, as findings revealed a high degree of uncertainty and lack of understanding of aquaculture and the role sustainability (via eco-intensification measures) plays therein. By identifying consumers understanding of what sustainability implies for them, we are able to address this gap. We close with central recommendations on how to increase stakeholder acceptance of eco-intensification in European aquaculture.

2 Material and Methods

Drawing from the multidisciplinary background from the GAIN Consortium, the following methods resemble a set of potential quantitative and qualitative approaches from a social science stance. By this, the report must be viewed from a position of critical realism. As such: a) reality is independent and exists outside of our observations; b) the world as we know and understand it is constructed from our perspectives and experiences, through only what is 'observable'; and c) unobservable structures can cause observable events and the social world can be understood only if people understand the structures that generate events (Danermark, Ekström et al. 2019). For this reason, this report is situated in the qualitative research paradigm. These were used to identify context-specific variables of various social categories, such as age structure, degree of education, degree of exposure to knowledge on aquaculture and social positioning.

All methods were pre-tested and outcomes of first surveys were further refined within the GAIN team. In the following, we provide details on each of the central methods employed.

2.1. Stakeholder Analysis

A stakeholder analysis is an essential method in any research, especially for identifying potential pathways of improved information-led uptake of scientific findings. This requires good knowledge of the stakeholder landscape and their social positioning that influences decision-making processes that are related to issues of sustainable consumption of marine foodstuff. Without the knowledge of the stakeholders and their mind-sets, priorities and level of consumption in the first place, increased information on eco-intensification of marine seafood renders the initiative already from the onset negative. Thus, a stakeholder analysis is fundamental for the research process within GAIN.

A stakeholder analysis can be understood as a process that “i) defines aspects of a social and natural phenomenon affected by a decision or action; ii) identifies individuals, groups and organizations who are affected by or can affect those parts of the phenomenon; and iii) prioritizes these individuals and groups for involvement in the decision-making process” (Reed, Graves et al. 2009). There are central criteria for any kind of stakeholder analysis that should be considered in the context of marine food provision. As shaping consumer awareness and acceptance is a knowledge-intensive process, with many competing interests and normative views from different social groups, a stakeholder analysis is instrumental for understanding the competing interests and how the different stakeholders are involved in shaping the process and the views thereon. However, careful consideration must be placed on the willingness and capacity to engage the stakeholders as well as ways to communicate with them (Durham, Baker et al. 2014). Typically, methods, such as knowledge mapping, snowball sampling, social network analysis, etc. form the mainstay for stakeholder analysis. A more detailed overview is provided in Reed, Graves et al. (2009).

2.2. Systematic Literature Review

A systematic literature review is fundamental to any research project, as it provides an overview of the topic, it identifies and collects important documents within a particular field, and it describes the state "of existing evidence" (Dicks, Haddaway et al. 2017) in a more or less standardized, systematic manner. According to Haddaway, Woodcock et al. (2015), central criteria need to be established, such as to clearly define the research question. The search string must be comprehensive and all documents need to be screened with common criteria that have been established prior to the search. Despite its pitfall of being time consuming and difficulties in accessing specific data sets (i.e. grey literature), it is a suitable preparatory method to capture the central issues related to the research subject (Bowen 2009).

In the GAIN project, the focus was on systematically reviewing and capturing existing data and knowledge of previous national and EU-assessments that addressed social acceptance and consumer preferences of marine seafood. In this regard, literature reviews are a useful complement to findings stated in the poster surveys, thus supporting the identification of specific national issues and potential recommendation options on how to improve social acceptance of eco-intensification measures in marine food production systems in a tailored fashion. In GAIN, two posters were developed which related to each other. Central hereby were questions related to food preferences and purchasing behaviour in first approximation. Special focus was placed on fish species that are produced and common throughout the EU and are focus species in GAIN.

2.3. Poster Survey

In order to clarify the specific national context of consumers, we conducted a series of poster surveys within different consumer groups in order to validate findings from the secondary data sources. This method is highly suitable if unbiased data is needed on a specific topic. Mandatory for its application is however, that sufficient scope for answers is provided and not too many details are presented. Furthermore, the format must be clear from the onset and must include the thematic focus of interest, in our case to gain understanding about consumption preferences and view-points on eco-intensification measures. Thus, in a somewhat randomised fashion it is possible to assess, i.e. how much knowledge, expectations and assumptions the participants hold in regard to aquaculture on the individual level in first approximation (Price, Jhangiani et al. 2015). In this way, it follows Esterberg's call for knowledge sharing as a relationship between two individuals that come together "to try to create meaning about a particular topic" (Esterberg, 2002:85), thereby drawing on a range of different social conventions and cultural knowledge. A poster survey in this regard is more open and conversational than a structured interview or questionnaire.

The first outline of the poster survey was pre-tested in an Institution (IASS Potsdam, Germany) that was based away from the coast (landlocked) in order to get a better idea of common people's perceptions that had no professional relationship with aquaculture. Such pre-testing is an important step to identify the weaknesses of a survey and to improve the next edition. Pre-test gives a hint if the survey is clear for the participants understanding and helps identify what we want to affect with the survey (Pratt, McGuigan et al. 2000). In our case, it surfaced

that it is important to add in addition to the central species that are under investigation in GAIN the option “not eating seafood at all” and to provide room to enquire about different species as only the three GAIN species (see Annex I). This was especially important for the international surveys and showed the diversity of products that are preferred in the different countries. An example set of the final poster survey can be found in Annex II of this report. In total, over 400 participants took part in the 2-paged poster survey and indicated their species preference; of these 383 completed the more detailed questions regarding seafood-purchasing criteria.

2.4. Questionnaires

Questionnaires are one of the most common methods in empirical social research, and commonly used to produce quantitative data for statistical analysis, as they provide pre-structured answers and allow to test a large sample size (Matthews and Ross 2010, Porst 2013). In GAIN this method was used to gain qualitative data in a standardized format (Thronicker, Wu et al. 2019) on the knowledge of different stakeholder groups with respect to aquaculture and their implications for sustainability. In GAIN, questionnaires were used as an explorative survey method to collect self-reported qualitative and quantitative data within different social groups in a national context, as well as among participants of specific knowledge transfer events (i.e. European Aquaculture Society Conference). For all types of questionnaires, it is necessary that they are partially standardized in terms of the type of questions, the structure and context but topic-specific (Price, Jhangiani et al. 2015, Thronicker, Wu et al. 2019). However, there are some advantages and disadvantages, which have to be weighed before applying questionnaires with respect to anonymity, the response rate, the development costs and the sensitivity of questions (Scholl 2015). The questionnaire design should consider 1) identification of the problem, 2) the research questions or assumptions on the phenomenon, 3) identification of variables, 4) decision on suitable research design, 5) sample and planned analysis, 6) operationalization of variables and 7) a final choice of methods that identifies the questionnaire as a suitable instrument (Krause and Schupp 2019). Pre-test with representatives of the target group is preferable to foster clear wording of the terminology of the questions, a low complexity and a balanced ordering of questions.

Online and paper surveys were used to ask different stakeholder groups with different focus on generation and education (n = 442). The Online and paper surveys had the same design and questions (Annex III and IV). The first part was similar for all questionnaires and consisted of five questions about frequency and preference in seafood consumption (see Annex V

Table 11), knowledge on aquaculture production, attitude towards aquaculture and the sustainability of fish farming. In the second part, socio-demographic characteristics (Annex V Table 10) were evaluated through six additional questions about distance to sea, education, gender, age and country of origin.

In order to achieve high relevance of the questionnaires, focus was placed at targeting younger age groups, as these are those members of society that are not yet too consolidated in their views on aquaculture, eco-intensification and sustainability, thus would be the central target group to advance information sharing. In order to foster capacity-building vis á vis data collection in young-age groups “consumers of tomorrow”, we employed a group of young students, who are part of the HIGHSEA cooperation project. HIGHSEA is a unique classroom instruction project in Germany. The 22 pupils it admits to the programme every year learn, experiment and prepare for the “Abitur” (final examination and university entrance qualification) at the Alfred Wegener Institute (AWI) two days a week in the course of their last three years of school. The special feature: the boundaries between biology, chemistry, mathematics and English are largely done away with during these classes, as the youngsters work together with scientists on an interdisciplinary basis. A group of three HIGHSEA students translated the existing questionnaire and added three additional questions regarding perceptions on sustainability, the sustainable development goals (SGDs) and the preferred path of information about aquaculture. The question about the country of origin was excluded because of the focus on German respondents. An example set of an online questionnaire that targets especially the younger generations can be found in Annex V of this report.

2.5. Knowledge Transfer Events

Face-to-face knowledge exchange during workshops is the key element of a participatory process in knowledge transfer. It is facilitated by stakeholder dialogue and enables the combining of expertise as well as public values and preferences. As a form of stakeholder dialogue this method helps to clarify and improve the knowledge base for decision making (transfer from stakeholders to science) and support implementation of knowledge by stakeholders (Oels 2006). By combining face-to-face knowledge, it is possible to discuss a specific topic that is of interest to a varying group of stakeholders and experts and to assess their different perspectives on a given issue. To this end, it is mandatory to assemble a group of stakeholders of different sectors (see stakeholder analysis) with a specific and shared topic of interest. As a spin off, the participatory character of these events may enhance the uptake of new information on aquaculture and eco-intensification options, improving them vis à vis potentially reducing objections in the public (Eben 2006). In GAIN, several knowledge transfer events took place, in which we addressed participants directly to conduct balanced face-to-face discussions and offer personal contacts and networking opportunities. In addition, we used these events to conduct poster surveys and questionnaires to capture and validate central positioning of experts in regard to aquaculture, consumption, preferences and sustainability concepts. In addition, to shed more light into the role of improved information availability, we conducted ex-ante and ex-post surveys at these knowledge transfer events.

For instance, additionally to the general survey at the ICYMARE (International Conference for Young Marine Researchers), a separate part was added to the standard questionnaire which was handed out in the "Aquaculture" Session in order to see if the perception of young marine scientists changed as a result of gaining knowledge about aquaculture. Hereby the participants of this session on aquaculture where asked to complete an ex-ante questionnaire prior the session and the second part as ex-post questionnaire after the session, with two additional questions focusing on individual change of perception and learning of something new. By and large, based on the experiences in the GAIN project such stakeholder dialogues, despite their high level of preparation time, are much more effective if conducted as face-to-face events because they enable networking between participants and exchange of knowledge in a comparatively short time.

2.6. Qualitative Content Analysis

A qualitative content analysis is a "searching-out of underlying themes in the materials being analysed" (Bryman 2004:392), which can be documents, digitized survey data, protocols, and interview transcripts that are the output of the literature review, semi-structured interviews, focus groups, workshops and questionnaires. This analytical approach is defined as "*a method for systematically describing the meaning of qualitative material. It is done by classifying material as instances of the categories of a coding frame*."(Schreier 2012:1). The goal is to analyse the written data about their qualitative aspects, such as the descriptions of phenomena and their context, elicitation of mental concepts, social or personal meaning, perceptions and values (Schreier 2012). To employ the method, the analysed documents and the search procedure must be documented (Bowen 2009). In a circular process, a coding frame is developed, which consists in parts of predefined codes that are of interest to the researcher, and which then become more refined once the material is analysed and interpreted, and new categories evolve from the material. In that sense, a qualitative content analysis uses coding of semiotic correlations as a means to extract themes and meanings from the material at hand (Bryman 2004).

In GAIN, the qualitative content analysis aimed at identifying central consumption preferences at the national scale, and at an identification of potential different social position categories that share the same viewpoints. A thorough analysis of the stakeholders' perception of sustainability in marine food production, the perceived opportunities as well as established barriers of consumption were of crucial importance. This knowledge was, in turn, instrumental for finding potential recommendations for mainstreaming eco-intensification measures into the national context.

3 Consumption and Stakeholder Acceptance

The following sections are divided into two central pillars of analysis in order to provide more details on the question of how contemporary consumption and acceptance can be addressed by improved information availability. To this end, the report provides a first a short review on current EU consumption patterns before focussing in more detail on aquaculture consumption and match these with the findings of the GAIN survey results. The second pillar focus on the role of acceptance and how these potentially differ across different stakeholder groups. We look in detail on the role and effects of media as central means of improved information availability and on consumers understanding of sustainability, as this influences the narrative of eco-intensification measures in aquaculture and how these are perceived in the public sphere.

3.1. Consumption of Seafood

On average, seafood consumption, measured here in kg/capita, is high across Europe. With 24.3 kilograms per capita and around 12.8 million tonne total consumption in 2017 Europe is an important market for fish and seafood (EUMOFA 2019). That said, to obtain a more detailed perspective on consumption in Europe, it is very important not to see Europe as one country, but as several individual ones, with very different consumption levels and practices (see GAIN Deliverable 3.2). This is due to the fact that food consumption is highly linked to regional social practices and culture, as well as being part of regional identities. Recognizing this social role of food, the GAIN project aimed to identify the consumers' preferences per individual countries, thus revealing the differences that can be identified between different age groups, as well as different degrees of information availability. In the following, we provide a summative description of the current Pan-European situation before focusing more specifically on the GAIN partner countries.

3.1.1 Trends of European Consumption of Fish and Seafood

The 10-year trend from the FAO (2018) showed a global increase of 8% in fish and seafood consumption per capita, shifting consumption on average from 18.8 to 20.2 kg. Similarly, European seafood and fish consumption rose in the last years but due to the declining wild stock around Europe and comparatively low growth in EU aquaculture, the dependency of the EU on external food supplies has increased (Halpern, Longo et al. 2012). Even though aquaculture grew over several decades worldwide the internal EU aquaculture production has seen only a very marginal increase in recent years (Lopes, Ferreira et al. 2017) (see Figure 1).

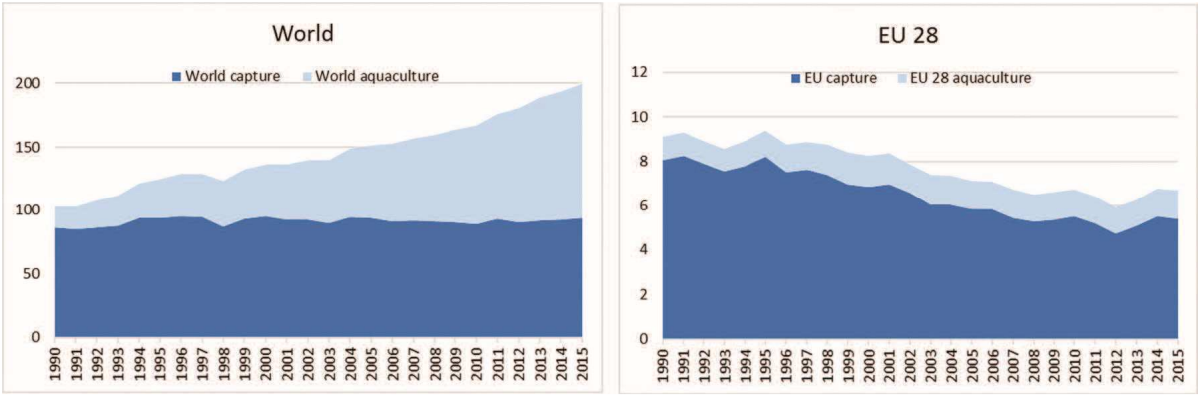

Figure 1 Development of Aquaculture production (in million tonnes) in the world (left) and European Union (right) indicating that the EU does not follow the high growth rates as displayed in other parts of the world (data from FishStatJ 2017, Bardocz, Jansen et al. (2018)).

This decline is mostly explainable by the high prices and the EU regulations, which complicate the farming of seafood and thus limit the commercial competitiveness potential.

Table 1 EU Production in tonnes live weight between 2013 – 2017 (EUMOFA (2019); based on Eurostat; online data codes: fish_aq2a, and fish_ca_main)

		2013	2014	2015	2016	2017
Food use	Catches	4,037,046	4,422,100	4,088,121	4,156,816	4,025,943
	Aquaculture	1,168,283	1,236	1,247,453	1,304,840	1,372,012
Total production destined to food used		**5,205,329**	**5,658,908**	**5,335,574**	**5,461,656**	**5,397,955**
Non-food use	Catches	791,944	959,567	1,056,098	857,663	1,227,070

Table 1 details the live weights in tonnes the EU produced in recent years. Even though aquaculture is using plants for non-food purposes, the numbers are too low to be presented (FAO 2018). It can be shown that wild-capture fish experienced a decrease from 2016-2017, while the non-food use increased by 43% compared in the same years. The self-sufficiency rates of the EU remained the same level between 2008 and 2017, but show rather low overall ranges between 40-45% (EUMOFA 2019). Noteworthy is, that for example in the year 2017, from the average European consumption per person of 24.35 kg of fish and seafood, 18 kg originated from wild-capture and only around 6 kg were derived from aquaculture products. Due to these two trends, low self-sufficiency level and low aquaculture production, imports of seafood are highly relevant for the EU. Indeed, the value of seafood was 22.1 billion $ in 2018, which makes Europe the second largest seafood and fish importer in the world (EUMOFA 2019). 64% of Europe's fish fillets are imported from developing countries, like Mexico, Vietnam or Brazil, mostly to north western Europe. The most important import species are Hake, Cod, Alaska Pollock and Salmon. The latter species is somewhat an exception as it is predominately produced in Norway, an EEA country, and processed to a large degree in EU. Some of the other species mentioned are exported to Europe in considerable quantities, e.g. Pangasius fillets (*Pangasius hypophthalmus)* alone valued at $221 million in trade in 2018. The main markets for Pangasius are in the Netherlands, Germany and the UK (CBI 2018).

The latter already indicates that there are high variations between the countries in Europe in terms of the amount of seafood and fish consumed. For instance, while Hungarian communities only eat up to 5.2 kg per person/year of seafood, Portuguese eat on average 57 kg per person/year. Comparing the six largest countries in Europe by population, the variations in consumption patterns between countries is high (Figure 2).

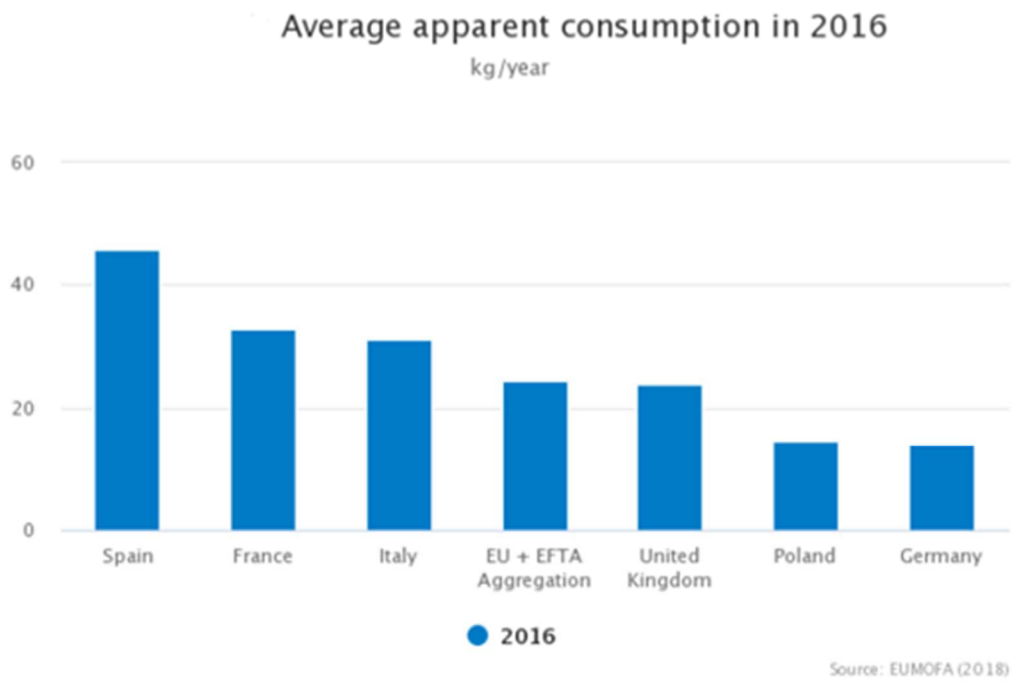

Figure 2 Average apparent consumption in the six largest countries (by population) in Europe in kg/year (Source: EUMOFA (2018).

Figure 2 shows that the annual consumption per capita in Spain is 47.7 kg while Germany reaches only 13.9 kg. In 2017, money Europeans spend on seafood showed a 15-year record and was 2.9 % higher than in 2016, at 67.3 billion $. However, this increase in spending is still negligible compared to the 260 billion $ Europeans spend on meat products during the same period (EUMOFA 2018). One central reason for this gap in spending is that prices of seafood and fish are on average much higher compared to meat prices. EUMOFA (2018)reported that the price for fish increased by 10% between 2013 and 2017 and the tendency is continuing. The Eurobarometer (2018) identified that 70% of the respondents, regardless of age, who already consumed fish and seafood products would buy more if prices were not so high. That said the price factor is one of the few categories in seafood consumption, where no differences between age groups can be detected. The Eurobarometer (2018) surveyed different socio economic categories as for example managers, manual workers, house persons, unemployed or retired persons to compare the educational background of the participants with each other. While 65% of the surveyed students at the Eurobarometer (2018) would buy more if the price was less, 63% of all managers with a high knowledge and age stated to be willing to purchase more seafood if prices were lower. The category with the highest correlation to price were the unemployed, who agreed with 78% that they would eat more fish if it would be cheaper (Eurobarometer 2018).

On the species level, Salmon is by far the most consumed fish in the EU, with almost 35% share in 2017 (EUMOFA 2018). Norway is the main exporter for salmon and the overall imports and exports of all aquaculture and fisheries products. In 2018, the imports and exports of salmon in Norway reached 32.3 billion making it the highest rate in the world. However, wild-capture still makes up three-quarters of total apparent seafood and fish consumption in the EU (EUMOFA 2018). This is in accordance with the findings of the Eurobarometer (2018), in which it was revealed that 35 % of consumers prefer wild products over farmed products (9%), but 43% responded that they have either no preference (32%) or don't know what kind of products they are buying (11%). One reason for the high values in wild-capture fisheries can be partly explained by prices. However, Figure 3 shows a general trend on expenditure increase across EU households between 2017 and 2018, Sweden being the exception (Eurobarometer 2019). Another reason for buying wild products was noted by the Eurobarometer (2019) that the respondents believe that wild-capture products taste better (63% vs. 54% for farmed products) and that they are healthier than farmed products (79% vs. 71%). However, these data on consumption indicate twofold: the importance of aquaculture for European food security in the future, as well as the lack of knowledge on aquaculture among the general consumers. The latter is of particular importance, as there is an observable trend to consume more seafood and fish and therefore aquaculture is likely to gain more and more importance for sustainable food supply and food security in the EU in the future.

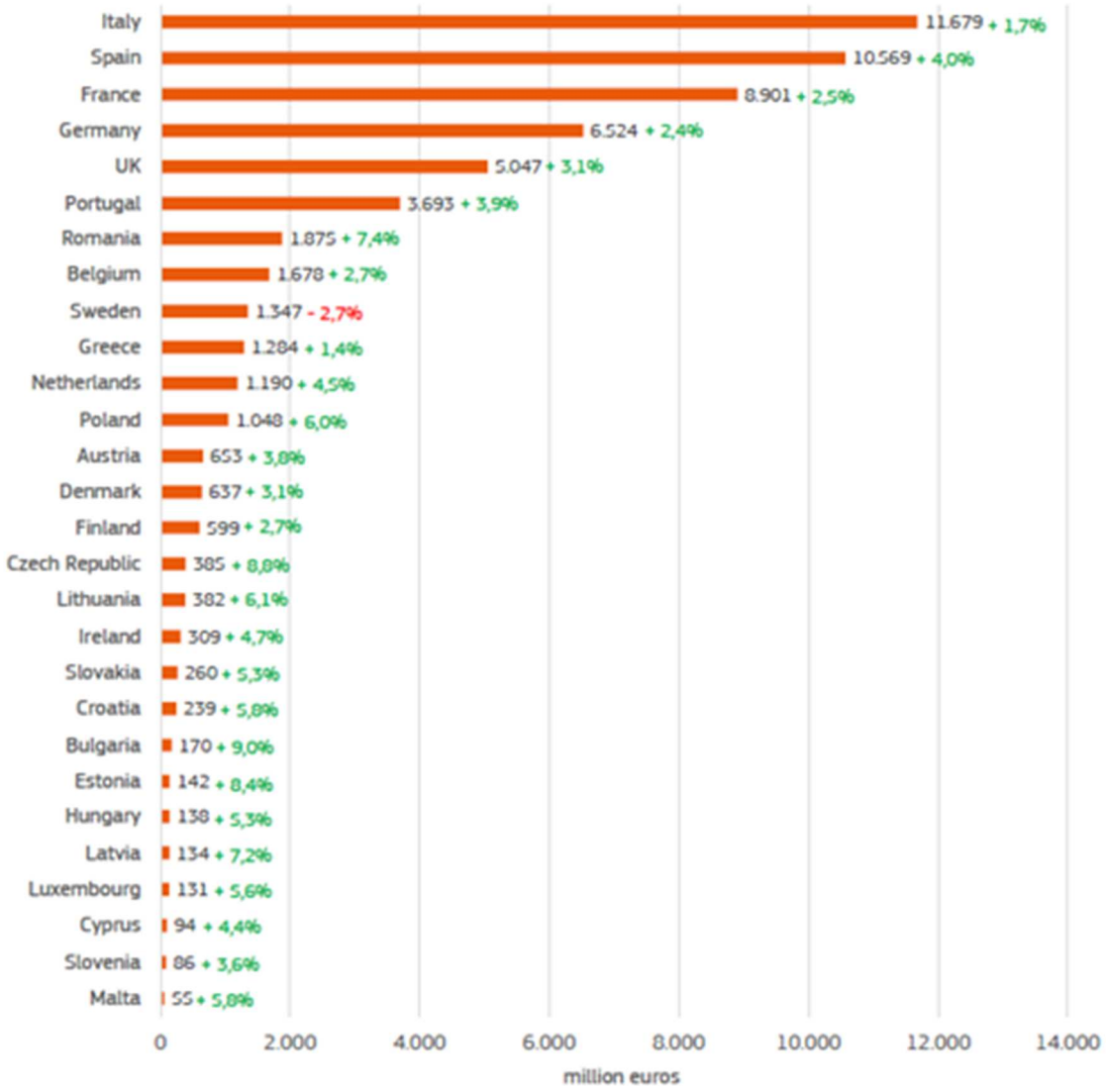

Figure 3 Household expenditure on fish and seafood in 2018 and % variation 2018/2017 (Source: EUMOFA (2019))

3.1.2 Contextualizing National Consumption Patterns

As demonstrated in the summary of existing seafood consumption surveys within the EU, there are notable differences between the European countries. In the following, we provide an overview on current seafood consumption patterns in Germany, focussing on aquaculture. This is done in order to firstly contextualise the EU findings on a national setting and secondly, to frame aquaculture consumption in more detail. Thirdly, most of the detailed survey approaches described in the material and methods section were primarily conducted in Germany. These were linking with the findings from our research with Poland and Spain (two of the GAIN partner countries) to contextualise the implications of the results further for the recommendations section. Special attention was hereby placed on to identify how different consumer groups choose their seafood products and what role prior knowledge plays therein. Therefore, the surveys were conducted in different countries (Germany, Poland and Spain) and at different occasions to compare the aquaculture knowledge between groups.

3.1.2.1 Seafood Consumption in Germany

Following Russia, Germany is the second most densely populated country in Europe, with hosting a population of around 82 million inhabitants, of which 20% have a migration background (NSC 2019). This explains why Germany displays a wide range of different consumer categories. The overall socio-economic situation is good and the average high household income fosters one of the highest expense rates for consumption in the world.

In 2019, the supply and offer of different varieties of seafood products was the highest ever recorded. Despite this high and diverse supply, the consumption of seafood per person slightly decreased to 13.7 kg. The NSC (2019) reported that 57% of the German population state to eat at least once a week seafood products. Interestingly however is that the per capita consumption in countries with similar eating ratios is a lot higher, as for e.g. in Sweden with 30kg per capita/year. The reason for this divergence is quite straightforward. In many other European countries seafood is served as the main course for dinner, whereas in Germany most of the consumption takes place in smaller proportions, for example salmon slices on a slice of bread or a few pieces of herring as a snack. The Eurobarometer (2018) showed that in contrast Spanish people (48%) eat more often (at least once a month) seafood products out of home, meaning in restaurants, than German people (21%). The average for the European Union for seafood consumption in restaurants at least once a month is at 32%, in contrast to around 50% in Lithuania, Hungary and Latvia respond that they never eat wild-capture fish or aquaculture products in restaurants (Eurobarometer 2018).

The NSC (2019) identified salmon as the most popular fish of Germany, showcasing a duplication rate in consumption within the last five years. A reason for this significant increase of salmon in the total share of seafood in Germany relates again to the specific situation of the German retailer industry, by which since a few years also discounters provide cheap and fresh salmon products off the shelf. That said, it is noteworthy to point out that the four biggest supermarket chains in Germany are holding around 80% of the overall share in the food retail industry (NSC 2019). This has led to an observable oversaturation of the points of sale and a strong influence on the price-consciousness of consumers that is influenced by the dominance of discounters. Furthermore, the private ownership of most retailers makes it difficult to streamline State regulations.

Another reason is the increased popularity of Sushi consumption, especially within the younger generation. The latter will be discussed in more detail below. In view of these consumption patterns, it is not surprising that Norway is the most important exporter of seafood to Germany, with salmon as the main export product. Overall Norway exports seafood worth 3.6 billion NOK (336 €) into Germany and 81 % of the money is for salmon products, meaning Germany spent 2.95 billion NOK (277 million €) in 2018 on importing salmon from Norway, making Germany the biggest consumer of Norwegian salmon (NSC 2019). The overall demand for fish and seafood products is 1.2 million tonnes and the favourite fish species in Germany are, next to salmon, Alaska Pollack (*Gadus chalcogrammus*), Pollack (*Pollachius pollachius*), Tuna (*Thunnus albacares***)** and Herring (*Clupea harengus) (FIZ 2019)*. Even though German consumers enjoy eating fish, the relatively low consumption rates

can be explained by the strong price consciousness of the average consumer. Indeed, the price for fish rose in the last four years almost 9.5% where meat products had less than 2% price increase (NSC 2019). Counterbalancing the increasing price of seafood is the observable increase in popularity of Sushi. Around 1/3 of the young-aged consumers (20-34 years) stated that they eat more salmon in comparison to the years before. They stated that they eat fish twice a week, which is in relation to an increasing sushi consumption. Sushi is additionally interesting in terms of understanding consumption patterns as there are notable age differences (see Figure 4 and Figure 5). The latter has some relevance for the GAIN innovations, as they provide a window-of-opportunity to improve value addition to by-products that occur by preparation of sushi products. To harness this opportunity, new governance schemes are called for that spur the collection and further use of these by-products as side-streams towards valuable secondary materials, thus increasing profits and minimizing the environmental footprint.

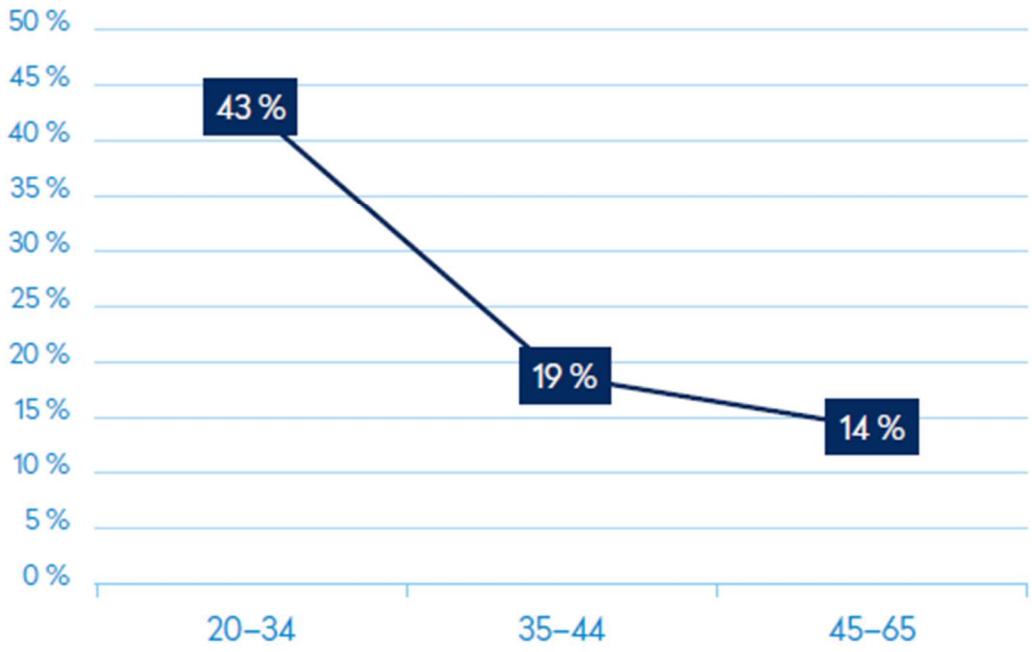

Figure 4 Percentage of consumers who eat more salmon than last year in relation to age (Source: NSC (2019).

People who are younger (25-39) show a general higher proportion in eating fisheries and aquaculture products at restaurants than older people (40-54), 36% vs. 27% (Eurobarometer 2018). In contrast, the same study reveals that fish and seafood products were purchased more by older people (64%) at least once a month than younger people in the age between 15-24 (43%).

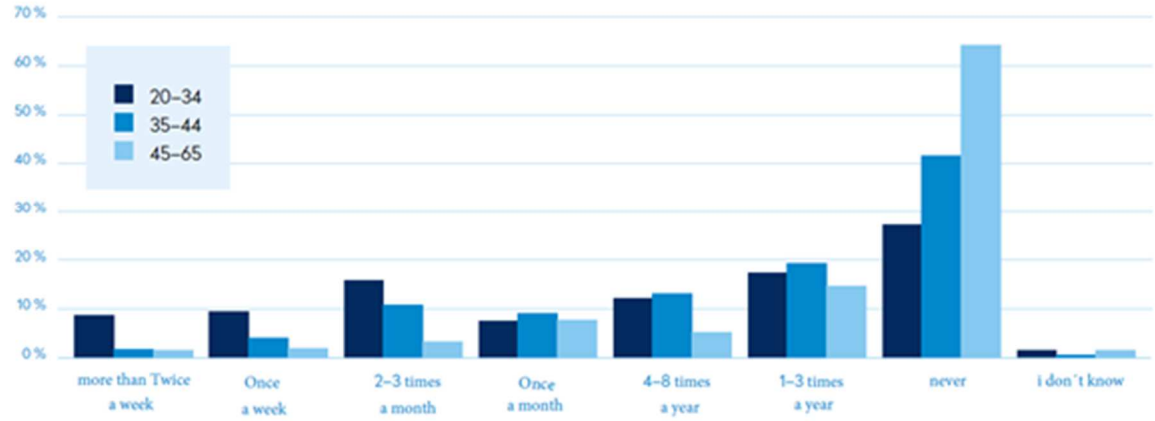

Figure 5 Sushi consumption per age categories. (Source: NSC (2019).

Another upcoming observable trend in Germany are poke bowls, which have their origin in Hawaii. Poke means "to slice or cut" in Hawaiian and refers to chunks of raw, marinated fish — usually tuna — which is then tossed over rice and topped with vegetables and umami-packed sauces. In this manner, they can be viewed as the next generation of sushi. More and more younger people are eating this dish. Indeed, the recent NSC (2019) illuminated that while half of the younger generation has never eaten poke bowls, over 70% of the older generations have never eaten this dish (Figure 6). This is an indication that food trends are picked up by younger ages especially due to the information availability within social media. In addition, the younger generations are far more susceptible to try new seafood/aquaculture products than older people are. Only 56% of the older people (55+) stated to try new seafood products at home while 73% of younger people were open to new production lines of seafood (Eurobarometer 2018). Furthermore, the study of the NSC- Report, 2019 reveals another interesting trend that is that younger age categories are mostly buying their seafood in restaurants (including take away restaurants) and prefer pre-processed and packed products in supermarkets. This can be attributed to the fact that the younger generations are cooking less (either due to time limitations or inability of cooking). In this regard it is noteworthy that over half of the younger generation states to be cooking in less than 30 minutes and less than 50% of the cooking time is spent on seafood and fish dishes (NSC 2019). With advanced ages, this trend cooking time reverses to more prolonged times, as well as an increase in competency level. Additionally, a positive correlation could be found between higher degree of cooking knowledge and competence and the willingness to pay good quality fish and seafood. Despite this correlation however, the quality of fish products ranks second after the price when it comes to purchasing behaviour. In general, gender seems not to impose a big influence on the amount of seafood that was purchased (Men: 63% vs. Women: 67%, (Eurobarometer 2018).

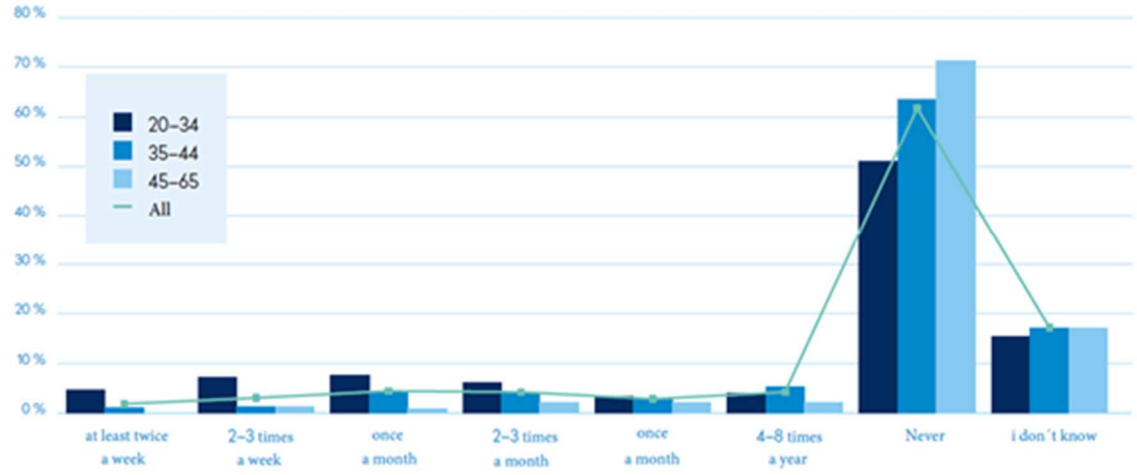

Figure 6 Preferences for buying poke bowls according to age categories (Source: NSC (2019).

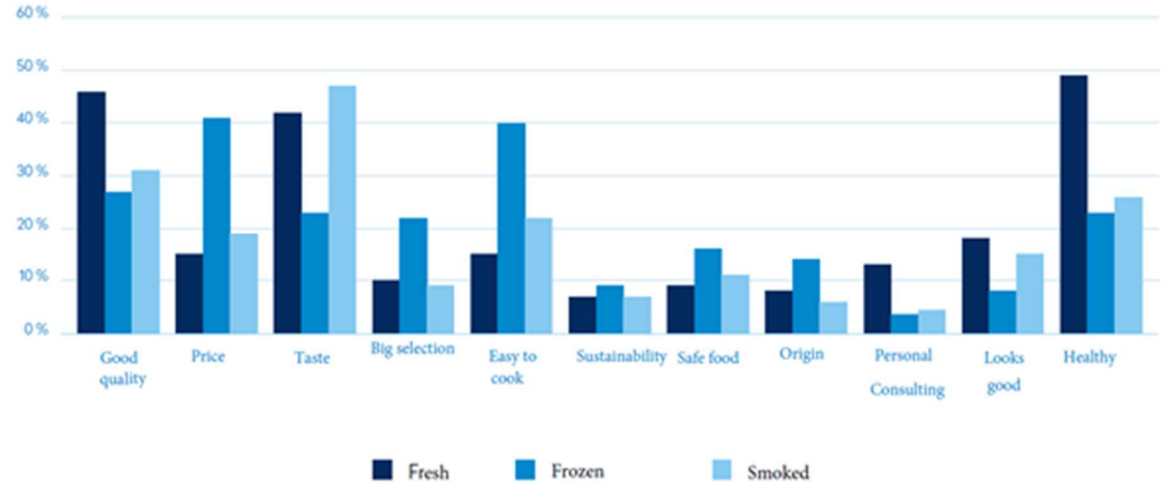

Figure 7 Choice criteria of German consumers when buying different types of seafood (Source: NSC (2019)).

The NSC (2019) found out that the average German consumer does mostly not plan their meal when going shopping for groceries, rather being influenced by advertising and spontaneous decisions. Furthermore, Germans are mostly not affected by specific trademarks or brands, but rather compare products directly in the stores. In the case of seafood, the most important factor for selection of a specific product is the colour of the fish and the price (Figure 7). This is the reason why many consumers prefer farmed salmon over wild-capture salmon, the latter displaying less red meat than the farmed one. However, in contrast, wild above farmed products are preferred due to the dominance of consumer perceptions that wild-capture fish are healthier and taste better (Eurobarometer 2019). Interestingly, blind consumption tasting in diverse TV-shows has shown that most people do not taste a difference between farmed and wild fish.

Another central reason for buying a specific seafood product relates to the perceived positive role of certification schemes. The more certificates a product displays, the more positive it is viewed by the consumers; even despite that, more often than not, consumers do not really know what they entail (NSC 2019). Another interesting finding is that older people (45-65 age) would buy more fresh fish if there would be more fresh counters available and if the price

performance ratio would increase (Eurobarometer 2018). In contrast, younger people appear to be less interested in the price but more in the way of cooking. They would buy more fresh fish if the fish would be already readily prepared for cooking and if there would be more preparation tips in how to cook the fish (NSC 2019).

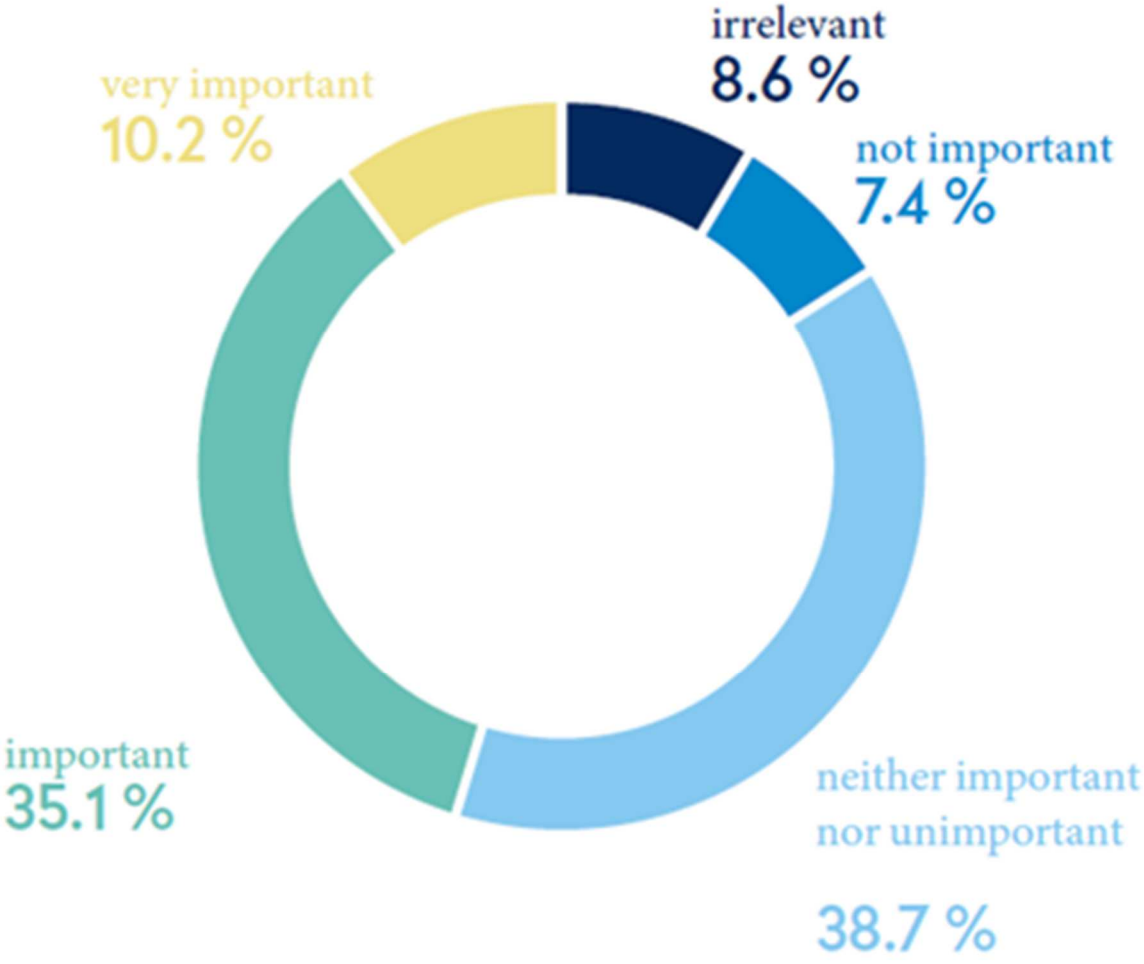

Figure 8 Stated degree of importance of the origin for the consumer (Source: NSC (2019).

Figure 8 shows how important the origins of the fish are for the consumers. Interestingly, Norway as a country is again the most prominent factor. The people associate Norwegian fish with “cold climate” and “lots of water” which would be good for the fish and “Norwegian people have a fishing tradition”. All those aspects are very superficial but show how important the perception of the country of origin of the seafood product is to the consumer (NSC 2019). Indeed, over 53 % of the Germans prefer products that are from their country or even their region while 27% prefer the EU. In contrast, in Spain only 11% state to prefer if the seafood comes from the EU, but over 82% would prefer if the fish comes from their region or at least their country (Eurobarometer 2018).

However, one important trend which often is overlooked in the current discourse on seafood consumption trends is the rise of vegetarian and vegan lifestyles. Indeed, around 19% of all women and 12% of all men in the EU are preferring vegetarian or vegan diets and refrain from eating seafood at all (Eurobarometer 2018). Noteworthy is that especially the younger

generations, the "seafood consumers of tomorrow" follow this trend. Currently 36% of the younger people (15-39) are vegetarians compared to only 9% of people above 55 years.

3.1.3 Social Positioning and Degree of Knowledge Effects on Consumption Patterns

The above-collated data on national consumption patterns shows a strong indication that socio-economic positioning; age and degree of knowledge are correlated. To investigate whether there are not only differences between countries but also between different socio-economic statuses, a series of poster surveys were conducted (see example in Annex II)

These targeted to identify consumer preferences of diverse age and knowledge groups. The posters were exhibited at different knowledge transfer events and Table 2 lists a rough overview on the overall attendees at the different knowledge transfer events as well as an estimate on number of participants per poster survey, the age and the level of aquaculture know-how in first approximation. It is important to acknowledge here the difficulties and limitations of qualitative data collection in social science related fields. Thus, an overall estimation of response rate in these surveys is shown in Figure 9.

Table 2 Properties of occasions where the poster was presented. (low- only consumers, who never thought deeper about aquaculture; medium- people who at least sometimes read about aquaculture and their products and/or are interested in sustainable products in general; high- people who are interested in AQ and show a high knowledge in AQ and their products (source: own data)

	EAS	ICYMARE	EU	Focus Fish	Helgoland Conf.	Thünen Institute	IIM-CSIC	Carp Conf.
Total participants	2700	250	0	50	50	50	200	250
Poster participants	52	113	15	35	26	27	63	52
Age	20-70	20-30		30-60	30-50	30-50	30-50	30-50
Country	Germany	Germany	Belgium	Germany	Germany	Germany	Spain	Poland
Background	high	low	low	high	medium	high	medium	high

As indicated in Table 2, most of our data collected targeted especially younger generations. This was done out of the premise that these groups are most susceptible to new information and display a higher degree of flexibility to change their consumption behaviour and preferences as these are not fully consolidated yet. One third of the data collected therefore captured the views of younger persons (between 20-30 years) attending the ICYMARE (29%), which is a conference for young marine scientist. Of these most stated having a rather limited exposure to knowledge of aquaculture products

Other national knowledge transfer events where data was obtained were, ranked in degree of completion rate (total numbers of attendees vs. number of participants of the survey): 16% from Spain with a medium knowledge on aquaculture and their products. Poland (14% completion rate) in which most participants held a high degree of knowledge on aquaculture and another 23% of the participation from various events within Germany (Thünen Institute 7%, Helgoland 7% and the Focus Fish Meeting with 9% completion rate). In addition, data was

collected by international participants at two international conferences one with a high knowledge on aquaculture and their products (EAS) and another with a low degree of knowledge (EU- Meeting) (18% completion rate).

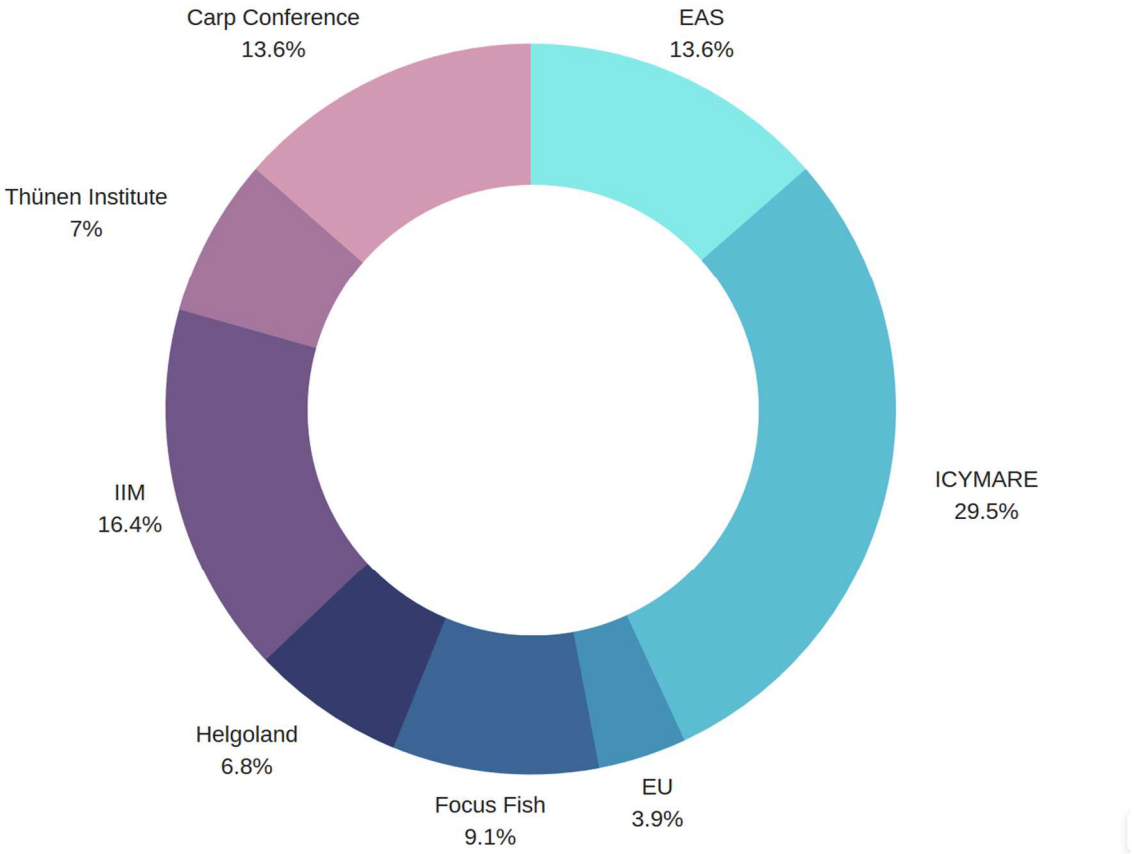

Figure 9 Participation rate of surveys at the different knowledge transfer events. EAS: European Aquaculture Society Conference, IIM: Instituto de Investigaciones Marinas, ICYMARE: Conference for young marine researchers, EU: European Union meeting in Belgium, Focus Fish: Conference about aquaculture and their products in Germany, Carp Conference: Polish Conference about the carp aquaculture industry (Source: own data).

Overall, 44 % of the participants revealed a relatively high level of prior knowledge on aquaculture related information (i.e. attendees of the EAS (European aquaculture conference), Thünen Institute (for sea fisheries), Focus Fish conference (fish industry, aquaculture and research) and the carp conference). A noticeable very limited prior knowledge was identified by 33% of the survey participants, here mainly the ICYMARE (young researchers conference) and at the EU Commission (administrative personnel). Of these, 23% stated to have rather medium knowledge on aquaculture related production, meaning that they are aware of some of the issues related to aquaculture but lack detailed knowledge about it (here mainly attendees of the Helgoland event (researchers in different disciplines) and the staff of the IIM CSIC (Instituto de investigaciones marinas, research institute in marine sciences).

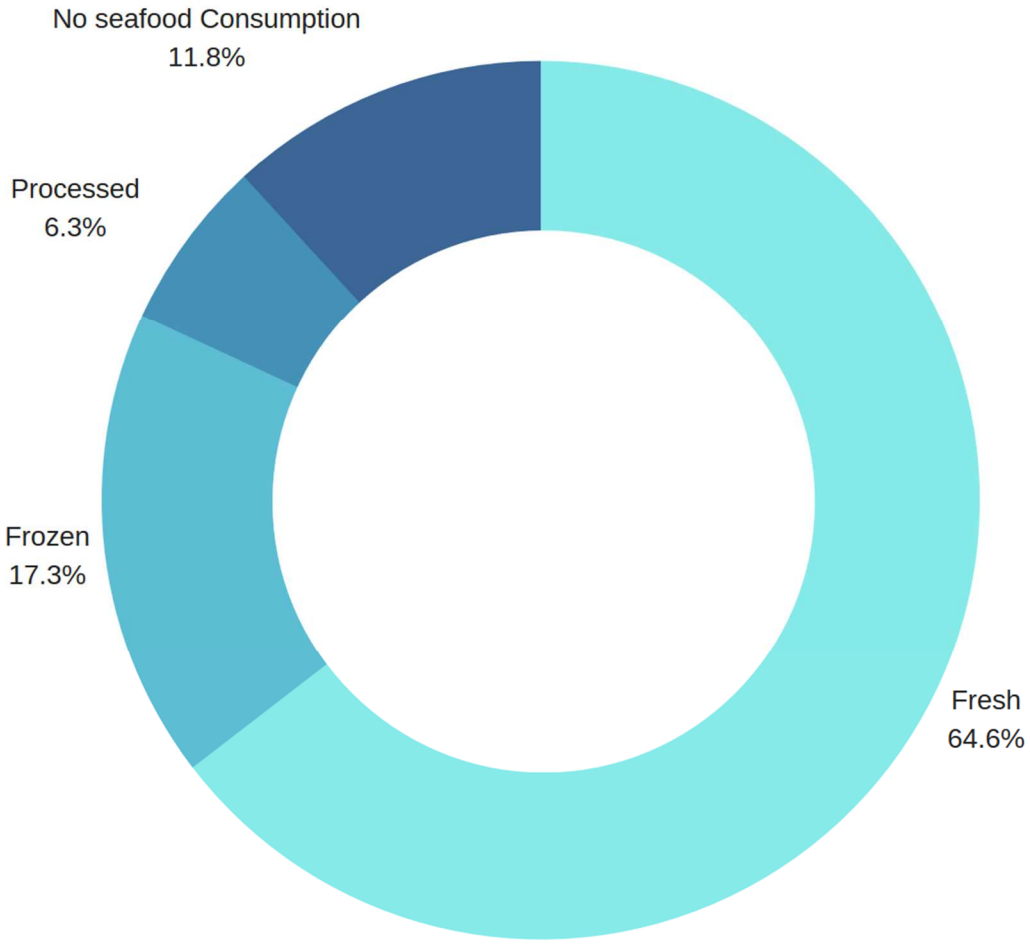

Figure 10 Total percentage of preferred type of fish/seafood (Source: own data).

Figure 10 highlights the results on which type of seafood is preferred by consumers. Fresh fish and seafood is preferred by most of the survey participants overall with 65%. However, 12% of all respondents mentioned not eating seafood at all, which somewhat mirrors the trend towards vegetarian and vegan diets mentioned earlier.

However, it is very interesting to note the cultural differences in the results. For instance, in Spain none of the participants stated not eat seafood at all, but 76% mentioned to prefer fresh fish to frozen (22%) or processed (2%) fish. In contrast, 31% of the younger people (from the ICYMARE) between 20- 30 years stated not eating fish at all. The preferred type of fish is also fresh but only with 58% and frozen and processed products have the least percentage ranges between 8% and 3%. This is somewhat reflected in the findings of the Eurobarometer (2018), in which it was shown that younger people (15-25) are more likely to buy ready meals (51%) than older age groups (36%).

The most evenly distributed results were recorded in Poland. Here, 56% prefer fresh fish over frozen (21%) and processed products (12%) and 12 % mentioned never eating seafood or fish. These survey results can be matched with the Eurobarometer (2018), who identified similar trends across the EU, in which fresh products (37%) are preferred over frozen products (25%).

In regard of consumption of frozen products, all survey participants from Germany, Poland and Spain respond that they are buying such items at least from time to time (70-71%). A larger proportion in Germany (60%) and Poland (44%) responded never or rarely to buy fresh products, including live fish. In contrast, only 9% of participants in Spain mentioned never to buy this type of fish. This is mirrored in the Eurobarometer (2018) data, in which Spain is, following Greece, the nation who buys at least from time to time fresh products, while Germany is the country with the lowest proportion. On EU-average, however 33% never buy fresh products.

3.1.4 Socio-Economic Positioning Effects

A central important issue within consumption is, next to the accessibility to food, the affordability dimensions (Ingram 2017, SAPEA 2017). The latter is tightly related to the socio-economic positioning of the respective consumer that affects how much attention to the price of a seafood product is placed. As shown by our surveys, the majority (73%) stated to be influenced in their consumption behaviour by the price and only 29% stated that they were not concerned with it (Figure 11). In more detail, it surfaced in the survey that younger people as well as Spanish people appear to be more attentive to the price of seafood (86%).

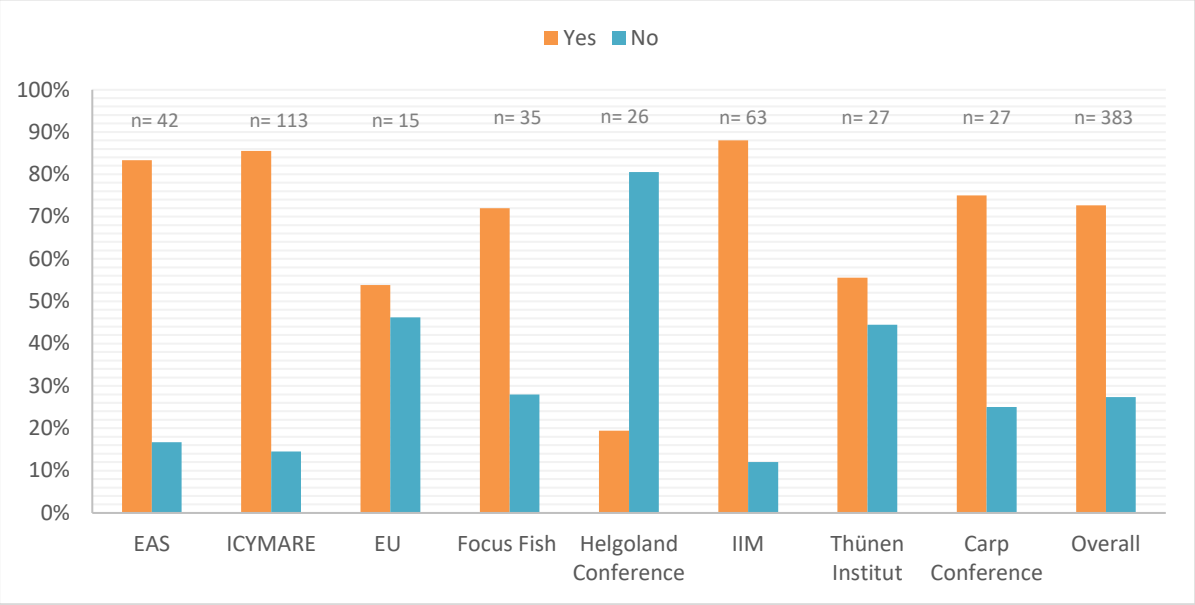

Figure 11 The stated role of price in seafood product choice (Source: own data).

The only knowledge transfer event where participants mentioned to be less price-concerned was at the conference in Helgoland. However, as this event was somewhat a secluded meeting of rather socio-economic well positioned academics with an average knowledge on aquaculture products, these findings must be viewed with caution. Indeed, at this occasion only 19% revealed to pay attention to the price and 81% stated to pay more attention to other attributes of the product apart of the price. These rather exceptional results can be interpreted in two ways. One explanation could be that all the attendees are well informed about sustainability in general and are trying to invest more money in more sustainable

products. A second interpretation is that attendees did not want to be exposed to their peers as being perceived as avaricious. Being dishonest especially when it comes to money issues is a common phenomenon and are a central problematic issue of “willingness-to-pay” studies. Indeed, more often than not it could be shown in surveys that people stated that they are not looking at the price if it is a high-quality product. However, these statements do not match with the actual purchasing numbers from supermarket (in Germany and elsewhere) that reveal that consumers tend to buy to a very large extend the cheapest product on the shelf, disregarding their origin or quality.

3.1.5 Consumption Preferences in National Context

Figure 12 displays the overall distribution of the species that consumers state to buy regularly. The surveys paid hereby special attention on the consumer preferences of those species that were identified within the GAIN project as hosting the highest potential for eco-intensification measures. The poster survey addressed the issue which of those potential eco-intensification candidates was deemed to be preferred by different consumer groups (see Annex II for details). In was found that salmon is preferred most with 30%, followed by sea bream with 19%, trout 12% and seabass with 7% indicated of total preferences. Interestingly however, 10% of all participants indicated that they do not eat seafood and 23% stated to prefer other species than the ones suggested by the poster, which were the three most common fish species in Europe, salmon, trout and sea bream. In the southern European survey however, trout was exchanged with sea bass since they are more commonly consumed in these regions.

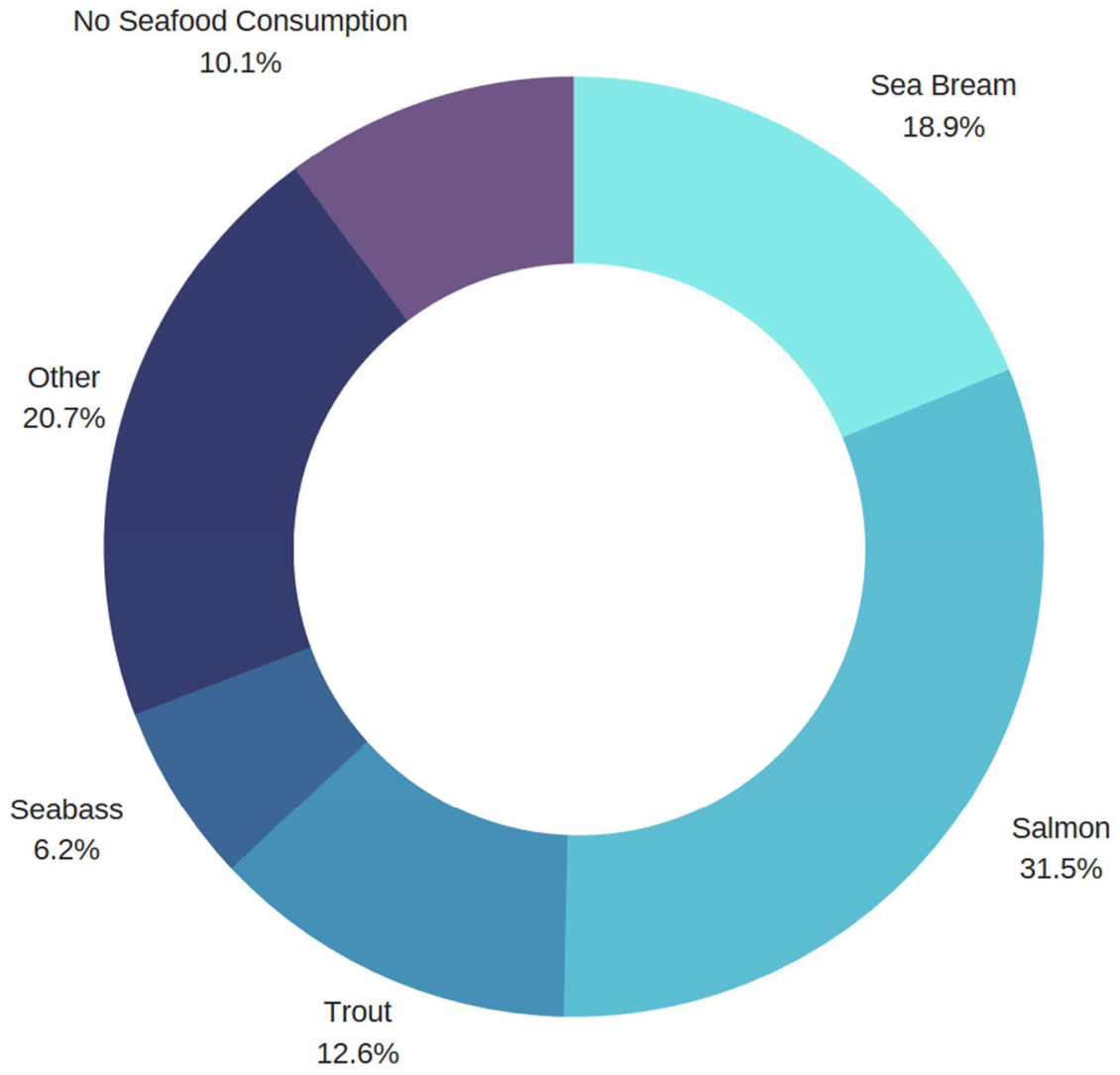

Figure 12 Overall distribution of stated aquaculture species preference (Source: own data).

Additionally, a significant diversity of national preference patterns was detected. For instance, if we compare across nationalities, Germans mentioned only up to 10% eating different species than the four mentioned above. Indeed, roughly up to 68% of all species consumed by Germans can be divided between salmon (35%); sea bream (19%) and trout (14%). However, 21% of German participants state never to eat seafood, which is in stark contrast to Spain, where none of the participants stated such non-preference. Another noteworthy result of the survey pertains to the total number of different species preferred for consumption in Spain, which is remarkably broad. However, here the highest preference is accounted to seabass with 20%, followed by salmon (17%) and seabream (12%), whereas half of the survey participants noted to preferring other species. The latter 18 additional species are displayed in Figure 13.

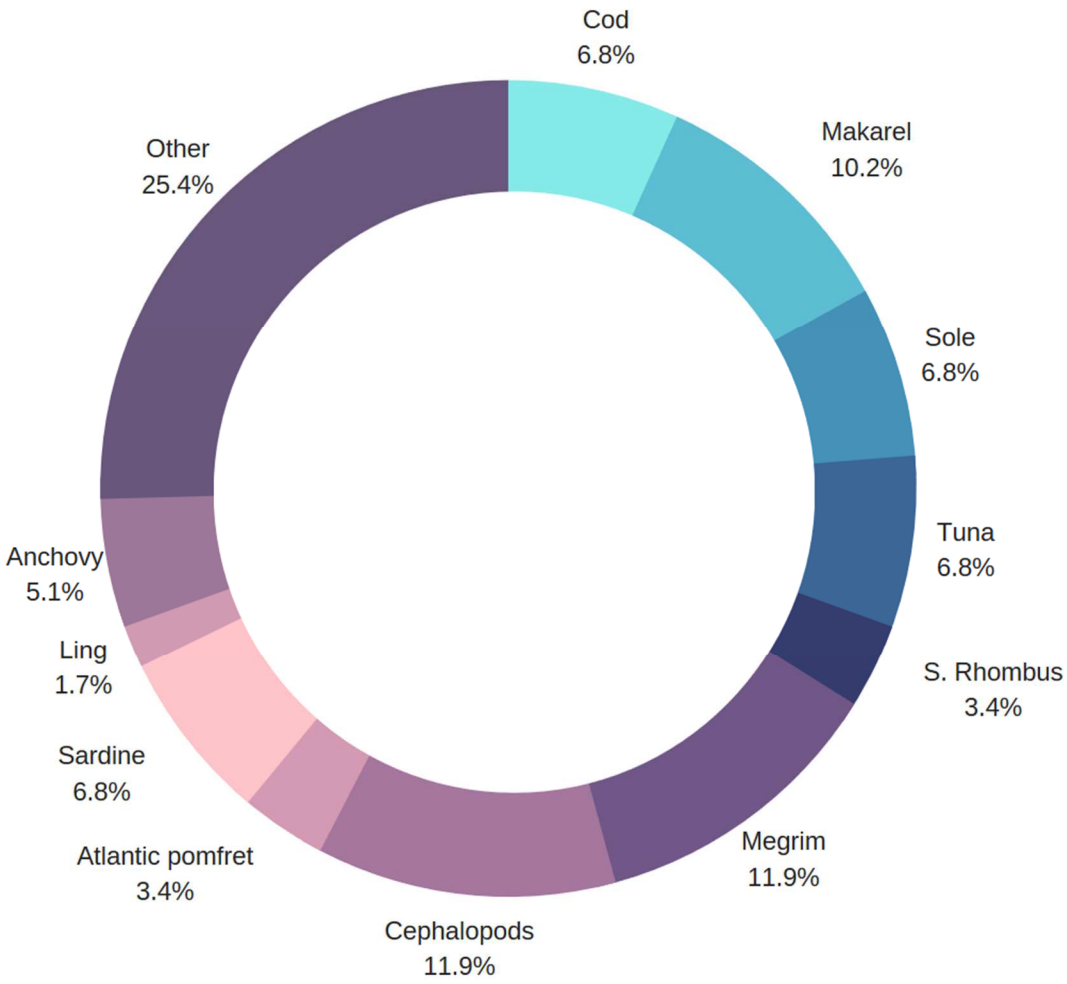

Figure 13 Spanish consumers stated diversity of preferred species (Source: own data).

Contrasting the diverse picture of Spain, 30% of the consumed seafood in Poland are not covered by the central GAIN species, but relate to other species. Of these, perch (31%) and carp (38%) were mentioned most often. In summary, our results for Poland indicate a species preference in order salmon (28%), trout (26%), carp (11%) and perch (9%). Additionally, 11% mentioned not to eat fish or seafood at all, thus following somewhat the detected trend in Germany of rising preference of vegetarian life-styles (see Figure 14).

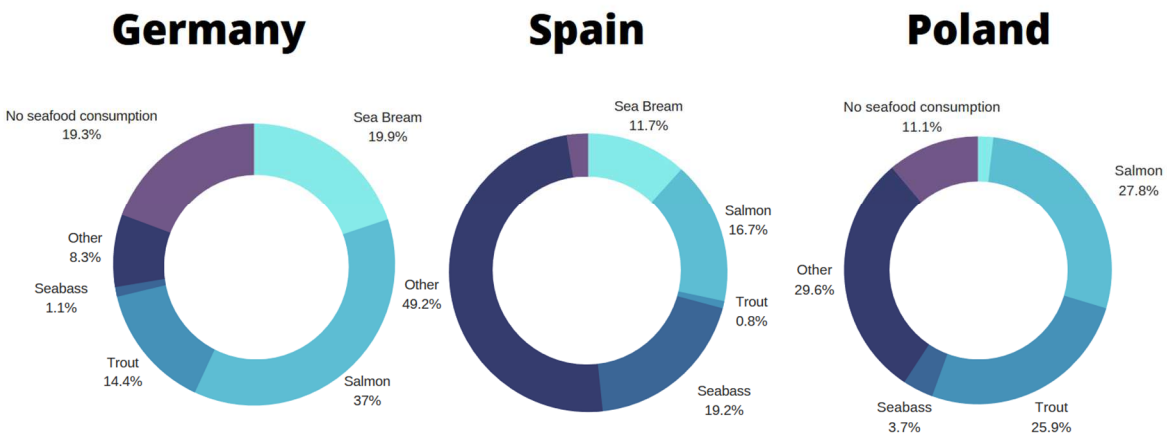

Figure 14 Distribution of aquaculture species preferences per country (Source: own data)

Figure 15 reinforces this detected trend, in which the results from the ICYMARE in Bremen, Germany are displayed. As this part of the survey was conducted at a conference for young marine scientists between 20 and 30 years of age with a rather limited prior knowledge on aquaculture, it is remarkable that over one third stressed not eat seafood or fish at all (37%). Furthermore, this finding is reinforced in this group, as they did not indicate any other seafood species than the three suggested one on the poster. From the part of the group that mentioned to consume seafood, preference was in order, salmon (30%), followed by sea bream (18%) and trout (15%).

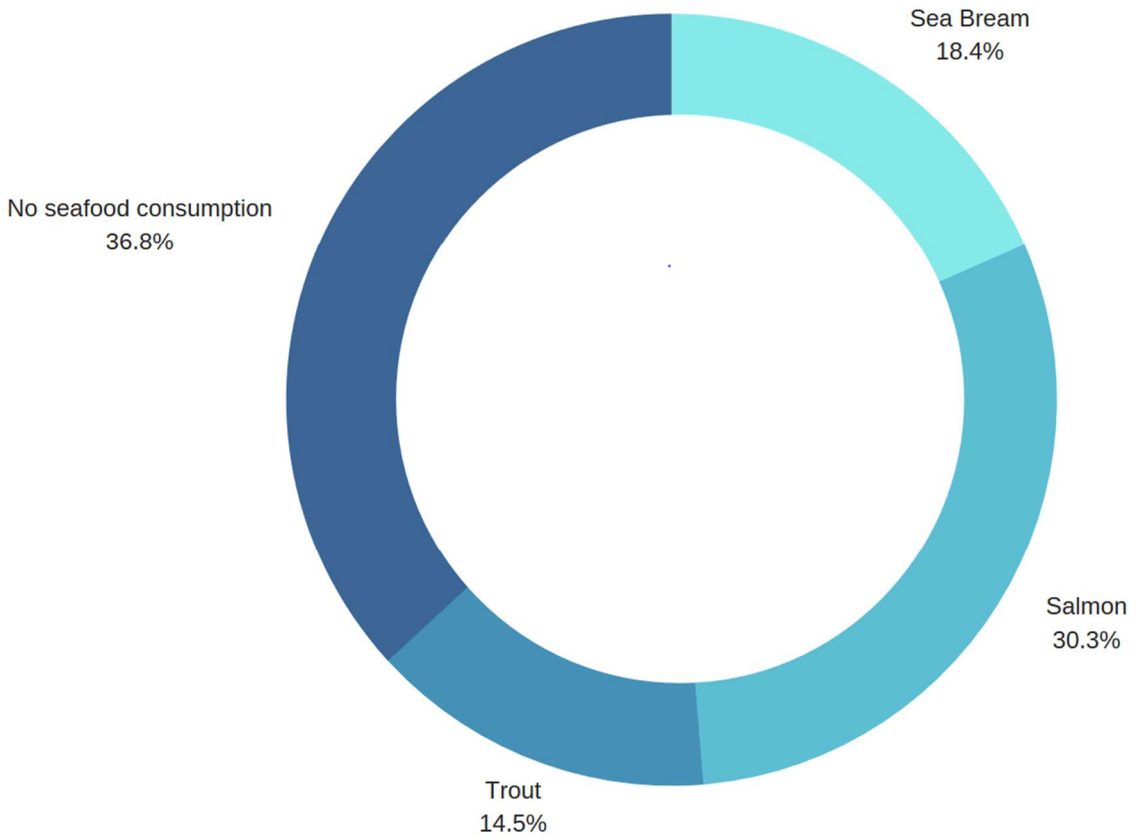

Figure 15 Distribution of aquaculture species preference in the group of the youngest generation (Source: own data, collected at the ICYMARE in Bremen, Germany).

In contrast, Figure 16 summarizes the results for the EAS in Berlin, Germany, where all participants of the survey exposed a high level of knowledge on aquaculture and their products.

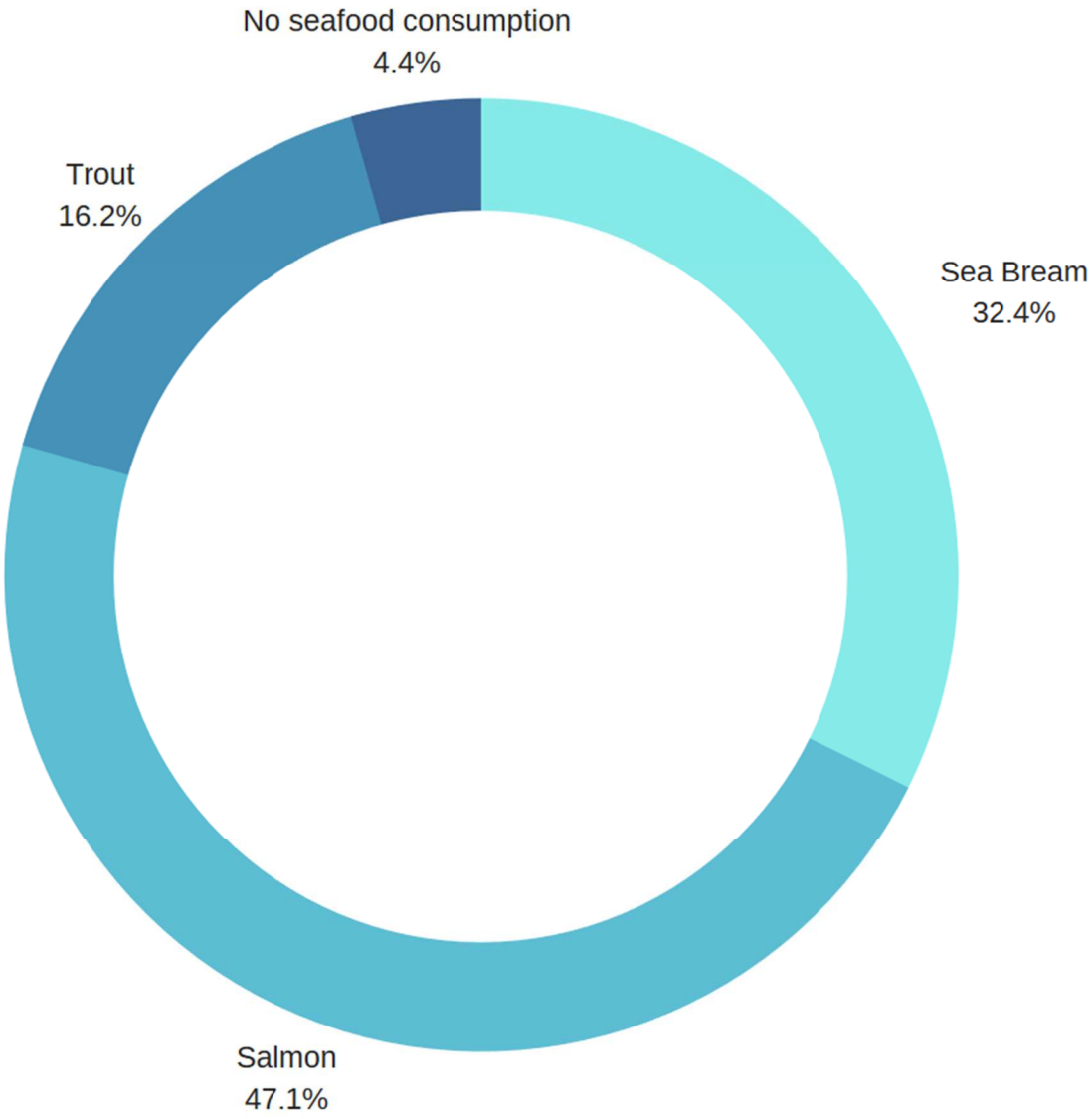

Figure 16 Distribution of stated aquaculture species preference within consumer group with highest knowledge on aquaculture production (Source: own data, collected at European Aquaculture Society Conference in Berlin (EAS)).

Here, the section with non-seafood consumers was only marginal with 5%. Almost half of all participants at this knowledge transfer event indicated salmon being their favourite species (47%). Sea bream was mentioned as second with 32%, followed by trout with 16%. No other species was indicated at this conference.

3.2. Stakeholder Acceptance of Aquaculture

The acceptance and perception of aquaculture differs strongly between the public, the professional stakeholders and the seafood consumers. That said the public displays more often than not, a wide diversity of interests, benefits and concerns about aquaculture. For instance, socio-economic interests, environmental concerns, aesthetic aspects as well as moral, emotional and personal values all influence the public's acceptance and perception of aquaculture to a different extent (Mazur and Curtis 2008, Freeman, Vigoda-Gadot et al. 2012, Alexander, Freeman et al. 2016, Thomas, Nordstrom et al. 2018). In most cases, the public perceives environmental impacts of aquaculture as negative or neutral, especially in regard to pollution from feeds and fish wastes, chemicals and antibiotics (Alexander, Freeman et al. 2016, Thomas, Nordstrom et al. 2018), impacts on the natural coastal scenery by aquaculture farms (Alexander, Freeman et al. 2016), overfishing due to the fish meal demand in aquaculture (Alexander, Freeman et al. 2016), escaped farmed fish feeding on or competing with wild fish (Alexander, Freeman et al. 2016, Thomas, Nordstrom et al. 2018) and the spread of diseases and parasites (Alexander, Freeman et al. 2016). Some environmental aspects such as the prevention of overfishing (Alexander, Freeman et al. 2016) by production of farmed fish as an alternative are perceived as positive. In contrast, economic benefits such as economic boost of coastal areas and the creation of jobs (Alexander, Freeman et al. 2016) are mostly perceived as positive by the public (Mazur and Curtis 2008). In Whitmarsh and Wattage (2006) the public perceived minimizing environmental damage as the most important objective in the salmon farming industry, whereas maintaining employment, improving product quality, avoiding conflicts with other resource users and ensuring fair prices are perceived as less important with very little variations between the surveyed areas. All of the above are mirrored in the GAIN objectives of researching into different pathways of eco-intensification measures within the aquaculture production chain, i.e. developing feeds of enhanced sustainability. Indeed, the plea to develop systems that minimize environmental damage appears to be the central issue of societal concern across the entire value-chain of contemporary aquaculture production.

3.2.1. Stakeholder Identification and Classification

A stakeholder analysis is fundamental for the research process within GAIN. Indeed, stakeholders in the aquaculture production sectors endorse a diverse range, including groups that are directly involved in aquaculture production such as aquaculturists, processors, suppliers, administration and indirectly affected such as NGOs, tourism organisations, the public and fishers (Sevaly 2000). In contrast to these direct stakeholders, consumer groups as such must be viewed rather as indirectly overarching involved stakeholders due to their personal seafood consumption or non-consumption preferences However, all stakeholder groups, either directly or indirectly involved can have a positive, neutral or negative attitude

towards aquaculture and therefore support or inhibit the expansion of aquaculture production.

In order to investigate the consumer and stakeholder acceptance of eco-intensification measures as planned by the GAIN partners, a detailed stakeholder analysis was conducted. We identified stakeholder groups who have interests in the processes of eco-intensification of aquaculture in Europe (Table 3). The different groups and their needs are addressed by different work packages in the GAIN project. In this report, focus was placed on the acceptance and perception of researchers (experts, topical and non-topical), the professional actors within the aquaculture sector and the wider public. Under this umbrella, special attention was placed on the preference, perception and attitude towards aquaculture in general and how they perceive quality and sustainability of farmed fish. These were investigated among the different age groups, separated into distinct age generations, since the latter surfaced most prominently in the poster surveys described above. The presented findings mirror previous studies, in which it could be demonstrated that the age, education and location of stakeholders influence the preferences towards a more sustainable lifestyle (Black and Cherrier 2010, Schoolman, Shriberg et al. 2016, Kapferer and Michaut-Denizeau 2020) and the willingness to accept higher prices of sustainable products (De Pelsmacker, Driesen et al. 2005, Stubbe Solgaard and Yang 2011).

In this report, the generations were categorised by summarizing different sources. In the following these are classified into *Generation Z* (under 25 years), *Generation Y/ Millennials* (25-39), *Generation X* (40-55) and the *Baby Boomers* including *The silent Generation* (over 55 years) (Table 4). Please note that the exact generation boundaries may differ between countries and thus the used classification in this report must be viewed as approximation.

Table 3 Direct and indirect involved stakeholders with interest in eco-intensification of aquaculture in Europe

Directly involved stakeholders	**In GAIN addressed by**
Aquaculturists	WP1, WP2, WP4 & WP6
Policy makers	WP2, WP3 & WP6
Scientific community	WP1, WP2, WP3, WP4 & WP6
Suppliers	WP1 & WP2
Retailers	WP4
Other Supporting Industry	WP2 & WP6
Fishers	
Indirectly involved stakeholders	
Public	WP6
NGO's	WP3 & WP4
Media	WP6
Consumer	WP2

Table 4 Classification of Generations as used in this report and the according age classes

Generation Name	**Births**	**Births**	**Youngest**	**Oldest**

	Start	End	Age	Age	Age Class
Generation Z	1995	2020	25	0	under 25
Millennials/ Generation Y	1981	1994	39	26	25-39
Generation X	1965	1980	55	40	40-55
Baby Boomers	1946	1965	74	55	over 55
The silent Generation	1925	1945	95	75	

3.2.2. Acceptance and Perception of Aquaculture according to Social Positioning

Next to the direct end-consumer, who drives with his perspectives and consumer preference the development of certain seafood production lines, stakeholders directly involved in the European aquaculture production are of central importance when developing and implementing strategies for eco-intensification measures. Especially for identifying potential pathways of improved information-led uptake of scientific findings, good knowledge of the stakeholder landscape and their social positioning that influences decision-making processes related to issues of eco-intensification is required. Without the knowledge of the stakeholders and their mind-sets, priorities and potential levels of acceptance in the first place, increased information on eco-intensification of marine seafood renders the initiative negative already from the onset. In addition, the national context, as well as degree of involvement in the production line matters strongly when addressing social acceptance of aquaculture. For instance, in contrast to the general negative public in Spain and Scotland, professional stakeholders' perception of aquaculture focuses more on the economic benefits and is often weighed against environmental impacts (Whitmarsh and Palmieri 2009, Bacher, Gordoa et al. 2014). In terms of organic salmon aquaculture, professional stakeholders asked for socio-economic performance indicators (Whitmarsh and Palmieri 2009), which can also help to give transparent and credible information to the public (Whitmarsh and Wattage 2006, Mazur and Curtis 2008).

3.2.2.1. Cross-cultural Difference of Knowledge Levels

Former studies showed that the level of knowledge mainly influences the perception and acceptance. The level of knowledge is related to the proximity to aquaculture farms, level of education, frequency of seafood consumption, age and gender. People living in proximity to aquaculture farms display in most cases a better knowledge on aquaculture. However, there is a noteworthy difference in the degree of influence on the attitude between countries. These differences reveal themselves for instance in an increased environmental concerns as shown for Israel (Freeman, Vigoda-Gadot et al. 2012) or a better acceptance levels as shown for local aquaculture in Sweden (Thomas, Nordstrom et al. 2018) and Australia (Mazur and Curtis

2008). In addition, the frequency and cultural pattern and practices of seafood consumption also somewhat indirectly influence the level of knowledge and therefore the acceptance of aquaculture. For example, French consumers, traditionally exposing a well-known culture of concern in quality of food products and especially of animal products, have an overall more positive attitude towards organically farmed salmon. This finding can be related to the perceived assumption that this product fosters higher quality, nutritional value and food safety (Aarset, Beckmann et al. 2004). Comparing wild and farmed fish, French consumers perceive farmed fish being best for environmental sustainability and fish welfare. Additionally, they are noted to have similar preferences of wild fish and farmed fish, if produced locally (Rickertsen, Alfnes et al. 2017). Norwegian consumers, being exposed to salmon farming for a long time, have a good knowledge about farming practices, but are also doubtful about the sustainability of organic salmon (Aarset, Beckmann et al. 2004). In contrast Aarset, Beckmann et al. (2004) showed that consumers from Germany, the UK and Spain are unaware or ignorant of contemporary fish farming practices, which might be related to the missing points of direct contact with aquaculture as in case of Germany and to a lesser extent in the case of the UK, as opposed to the clear preference for wild-capture fish products as in the case of Spain.
Similar patterns were observed for Belgian consumers, being in most parts generally unaware of aquaculture products (Verbeke, Sioen et al. 2007). In the latter study it was found that consumers, who ate fish less than once a week, had very limited knowledge about aquaculture, whereas intensive consumers (more than once a week) were more open to aquaculture and showed higher degree of awareness. However, Belgian and German consumers appear to compare and correlate aquaculture production stronger with agriculture practices (Verbeke, Sioen et al. 2007), especially in terms of animal welfare, drug use, stocking density and organic production (Feucht and Zander 2015). Both studies showed that the perception and acceptance is strongly influenced by emotional and moral standards and values, leading to a romantic and misleading perception of modern aquaculture. Indeed, Aarset, Beckmann et al. (2004), Verbeke, Sioen et al. (2007), Feucht and Zander (2015) showed that there is a perception-reality gap between actual environmental impacts, the sustainability of aquaculture production and the health character and nutritional value of aquaculture products, rendering attitude towards aquaculture products and especially fish more negative.

3.2.2.2. Effects of Knowledge Provision via Labelling and Media

To close this gap and to increase the acceptance of aquaculture through improved knowledge and thus awareness, consumers should have access to transparent and credible information. That said, this must be handled with care, as additional information might create more confusion about production methods and leading to consumers outright rejecting or restraining to buy aquaculture products (Feucht and Zander 2015). Labelling and certification appears to be an unsuitable way of improved information provision about sustainable aquaculture production, since studies in Germany demonstrated that the already existing

variety of labels is more often than not rather confusing for consumers (Feucht and Zander 2015). Most consumers are aware of labels certifying ecological production, because they promise sustainable production, which are for the consumers transferable throughout land-based or aquatic food production (Feucht and Zander 2015). This contradicts somewhat the demand of better labelling by professional stakeholders (Bacher, Gordoa et al. 2014) and the public (Whitmarsh and Wattage 2006).

Next to the problem of "labelism", there is an observable influence of media on consumer acceptance and opinion. Froehlich, Gentry et al. (2017) investigated how media on an international level reflects public acceptance and is held responsible for negative, self-reinforcing repercussion. This was done out of the observation that consumers use news media as a primary source for information from the food sector. In this study, sentiments towards aquaculture from newspaper headlines worldwide were collected. It was found that more often than not, headlines on marine and offshore aquaculture were held more in a negative tone than general aquaculture. The authors also emphasised the lack of knowledge about aquaculture in the public. A more detailed study by Feucht and Zander (2016),investigate the influence of public perception through the media in Germany. Hereby articles of three big over-regional newspapers in Germany were analysed by five main attributes: economy, environment, human health, animal welfare and regulations. Interestingly, the articles were overall written in a positive to neutral tone, whereas the BILD had the most positive tone and the Süddeutsche Zeitung (SZ) the most negative. In the articles the positive tone increased with the time. In the articles animal welfare in aquaculture was often compared with agriculture. Negative aspects of aquaculture were often countered with measures to improvement, thus matching well with the GAIN objectives. In articles of fish meal replacement with plant nutrients, concerns about species-appropriate plant-based fish feed was raised. By and large, German aquaculture was thus shown as eco-friendly and as sustainable. In most articles, fish farmers and scientists were the source of information for the journalists, which lead to the authors' conclusion that the aquaculture sector has a great opportunity to influence media representation (Feucht and Zander 2015).

3.2.2.3 Human Health benefits, Certification, Origin and Animal Welfare as Purchasing Criteria

Many studies have indicated that next to the price of seafood, special attention in the decision-making process of buying a seafood product are related to positive human health effects of seafood, certification schemes that focus on the sustainability of the product as well as animal welfare aspects.

In our poster surveys, it was found that the majority (59%) of all respondents eat seafood because of its benefits for human health. Differences were observed in the pre-test poster survey at the IASS in Potsdam, where all respondents indicated that they eat seafood for health benefit, at the ICYMARE conference the ratio was 50:50 and on the AWI internal section meeting only 32% stated that they eat seafood for health benefits (Figure 17).

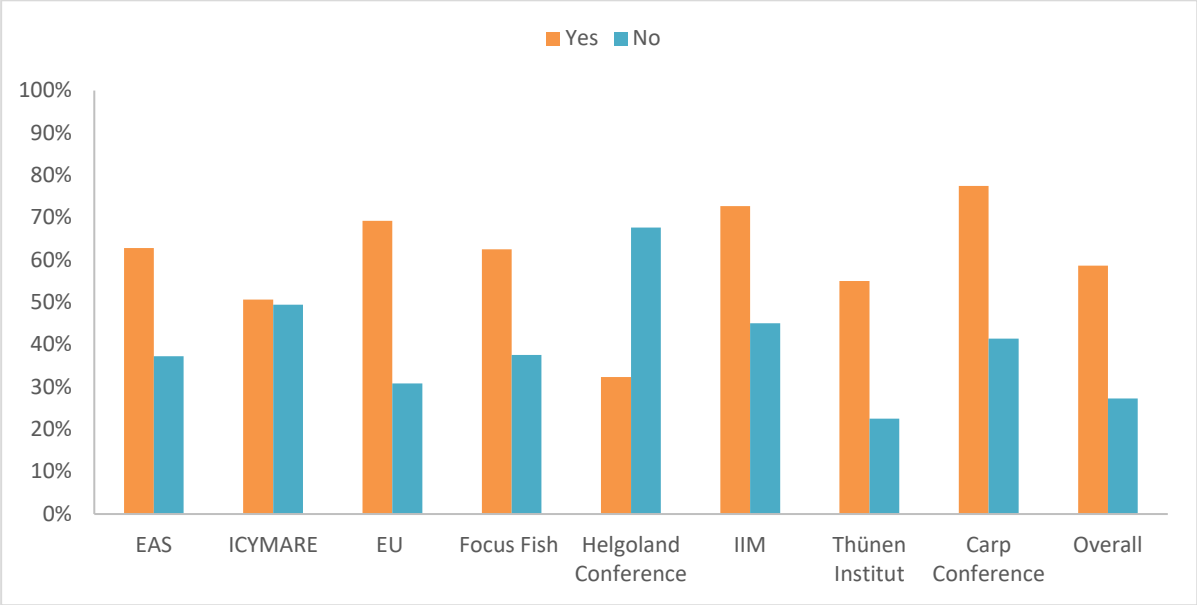

Figure 17 Benefits for human health as stated criterion for seafood purchase decision (Source: own data).

The majority (65%) of all respondents stated that they pay attention to the certification and labelling (MSC, ASC, organic labels etc.) when buying seafood. Here all the respondents in Potsdam agreed with the statement, whereas the majority of respondents at the EU (62%) and IIM (54%) interestingly disagreed with the statement (Figure 18). This is an indication that certification schemes are to be considered more carefully as a solution towards more sustainable purchasing behaviour, rather, it seems to affect different social groups in different ways.

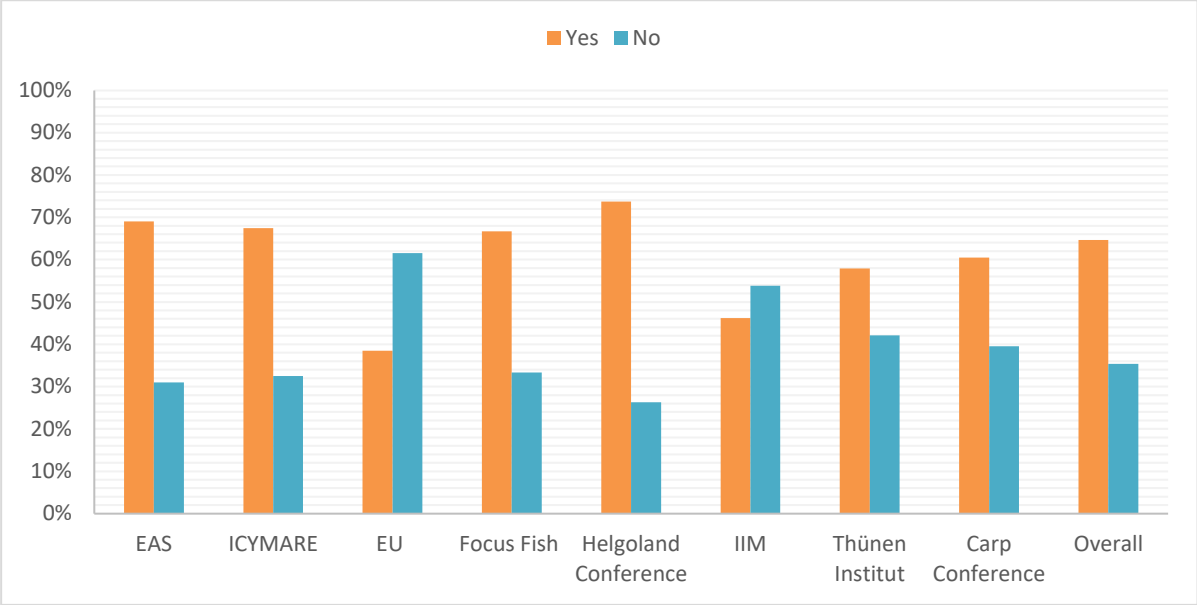

Figure 18 Certification and labelling as purchasing criterion (Source: own data).

86% of all respondents note that animal welfare aspects are important criteria when buying seafood. The respondents in Potsdam (100%), at the ICYMARE, Focus Fish, IIM and the Carp conference (all 92%) indicate an even high importance. In contrast, respondents at the EU and

the Thünen Institute only around 60% agreed with the statement that animal welfare is important (Figure 19). These responses indicate a strong positive correlation to the GAIN research objectives of improving animal welfare. Thus, societal endorsement of GAIN outputs related to eco-intensification whilst improving animal welfare can be expected.

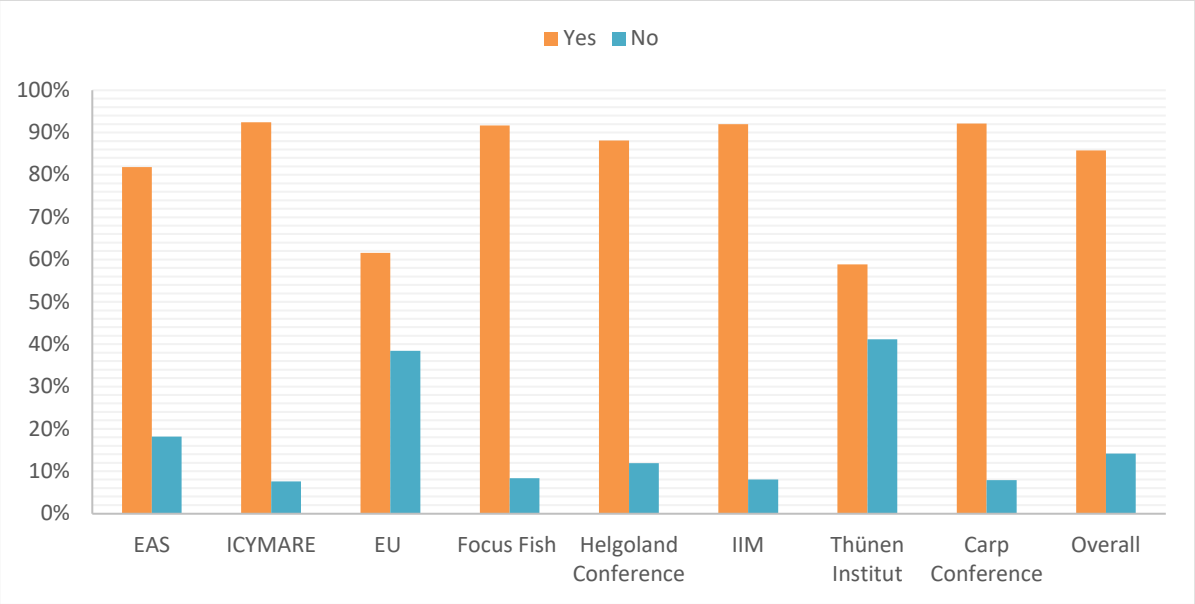

Figure 19 Stated degree of importance of animal welfare aspects as criterion for buying seafood (Source: own data).

This reflects well the potential of consumer acceptance of eco-intensification measures of feed within GAIN, by which central aspects revolve around the improvement of intestinal health and immuno-competence of alternative aqua feeds.

3.2.2.4. Regionality of Aquaculture Products and Perceptions of Sustainability

Since the results of the various surveys indicated a highly contextual variation on how consumers and stakeholders accept aquaculture and eco-intensification measures, the survey also addressed the role of regionality of aquaculture. Interestingly, for more than 84% of the respondents the origin (regionality) of the seafood is an important criterion for the decision on buying seafood. The all respondents in Potsdam, Germany and 97% of the respondents at the carp conference in Poland and 94% of the IIM in Spain agreed with that statement, whereas only 68% at the Thünen Institute, Germany agreed (Figure 20). However, it is noteworthy that many respondents do not differentiate between aquaculture or wild-capture origin and for most cases, such a differentiation appeared to be difficult.

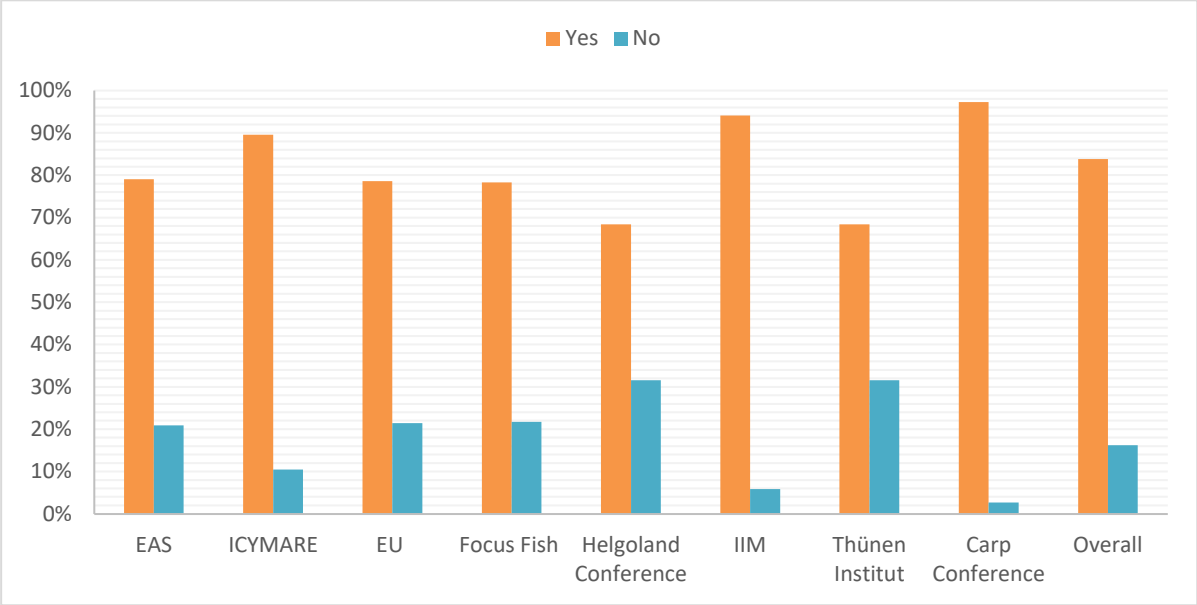

Figure 20 Importance of origin of the seafood in purchasing decision (Source: own data).

These findings show that regionality in the sense of meaning making and identity with working waterfront communities appear to be of high importance as a "soft" driver in the decision-making process. Since identity of placeness can be viewed as a work of the mind (Schama 1995), the premise of the below survey enquiry was that social change towards acceptance of eco-intensification measures in aquaculture would benefit from a better understanding of sustainability thinking among ordinary citizens. Localising onshore processing of by-products is presenting a great opportunity, not only for adding value in terms of improving economic efficiency, but also by framing (and rooting) the food industry in a circular economy perspective. This concept is highly appealing to citizens, however, it requires efforts in co-designing novel ways in logistics and regulations, to name but a few. Hence, it is not sufficient for only experts to be knowledgeable about eco-intensification measures in aquaculture. The public needs sustainability thinking in order to understand processes that take place in our economies, environment and societies towards transformative pathways of future marine food production across Europe. In its wake, forming linkages between different mind-sets, worldviews, cultural belief systems of sustainability create both conceptual and cultural challenges.

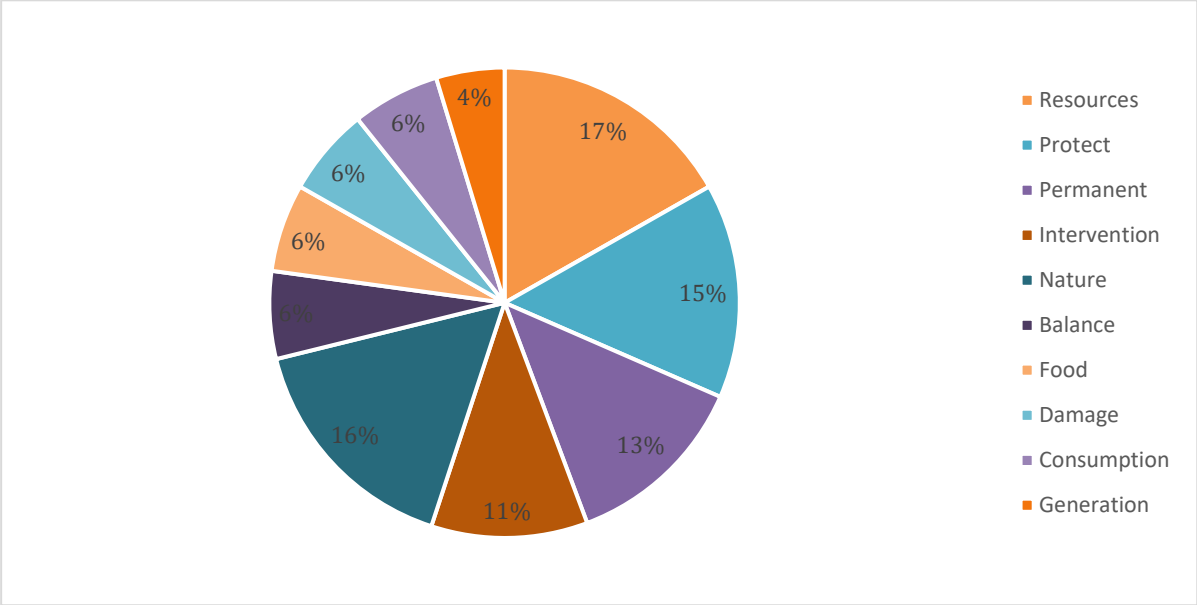

Figure 21 Ten most mentioned keywords of sustainability from public respondents (n = 97; Source: own data).

The diversity of responses shows that not only academics, but all social groups within a society (e.g. politicians, decision-makers, ordinary citizens, children, etc.) need a better (common) understanding of sustainability. In this regard, science is expected to support and to become involved in processes of social learning in order to comply with these new demands (Siebenhüner 2004). "Resources" and "Nature" were most often mentioned as central definitions for sustainability, and surprisingly little attention was voiced on social factors, rather only related to "generation", "food" and "impact" (Figure 21).

3.2.3. Levels of Acceptance According to Social Positioning and Degree of Knowledge

As shown by our results on contextual consumer preferences on the national level and how these reflect prior knowledge, the report details in the following the research the role of age, social positioning and degree of knowledge. The latter items have not yet seen sufficient scientific attention in previous research studies. However, the GAIN poster survey results indicated that these groups were most open to behaviour and acceptance changes. Thus, in order to develop recommendations on how to improve information availability for acceptance of eco-intensification measures, more detailed knowledge is highly relevant. Central focus was placed on younger generations and their levels of acceptance. Next to the poster survey that focussed on capturing different preferences, a questionnaire was developed that looked in more detail on various aspects that relate to the social acceptance of aquaculture. In addition, these questionnaires also enquired about the common understanding of sustainability in order to achieve an better understanding, what consumers and stakeholders assume what sustainability should entail. In the following, central findings are collated.

The questionnaire (see example in Annex III and IV) was developed as handout paper survey as well as an online survey consisting out of the same set of questions. The latter was done to

accommodate the high affinity of younger generations to digital productions. Interestingly however, the ICYMARE paper surveys (n = 46) had a much better response rate than online surveys (n = 6), which was quite unexpected, thus proving the original implicit assumption of younger aged people to be more receptive towards the digital world obsolete. At the EAS handouts of the GAIN questionnaire was not possible, so we were only able to evaluate the online survey responses (n = 5). In contrast to the above limited completion rate of the online questionnaire, the response rate of the HIGHSEA survey was very high (n = 386). This might be related to the way of distribution of the questionnaire, which was conducted by the students themselves via snowball principle. Thereby the respondents were asked by the students to distribute the questionnaire further to family, friends and colleagues via email, thus reaching much more people. Furthermore, being personally addressed by someone asking to fill the survey might be a higher motivation and therefore leading to a higher response rate.

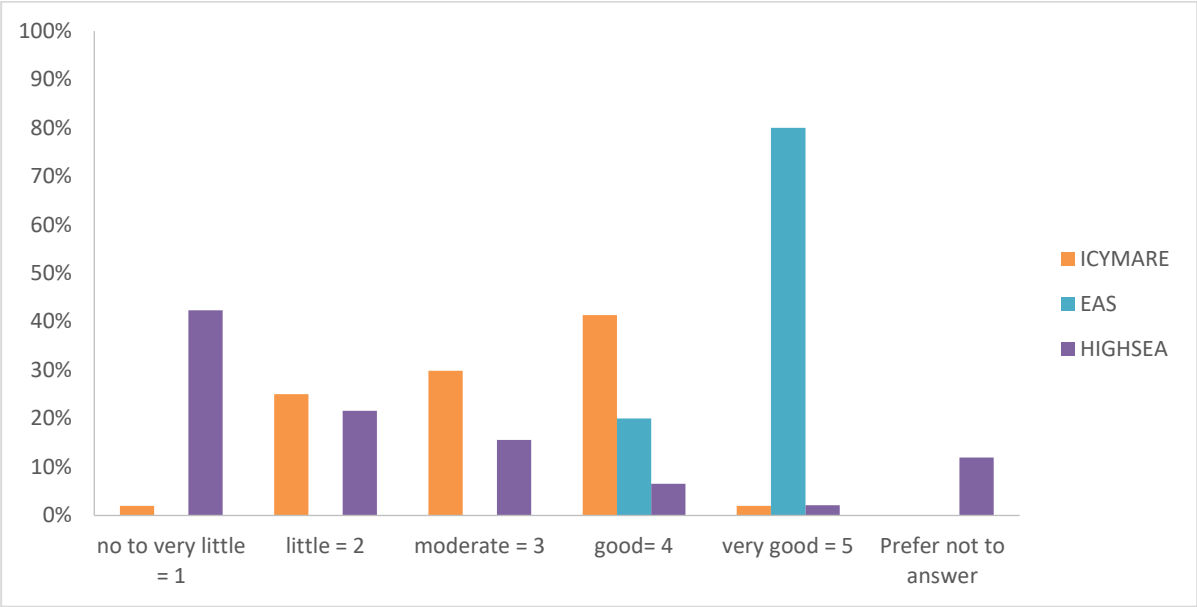

Figure 22 Ranking of self-perceived knowledge on aquaculture by questionnaire respondents at ICYMARE (n = 46) and EAS (n = 5) conferences and HIGHSEA online survey (386 respondents) (Source: own data).

The respondents of the ICYMARE conference represent primarily young marine researchers from various fields (Biology, Geology, Chemistry, Physics and Social Studies) who ranked their knowledge about aquaculture on average 3.2 (moderate). In contrast, the respondents from the Aquaculture Europe Conference (EAS) ranked their knowledge, as somewhat to be expected, as high with on average 4.8. The general public (addressed via the HIGHSEA survey) ranked their prior knowledge with on average 1.7 as little (Figure 22).

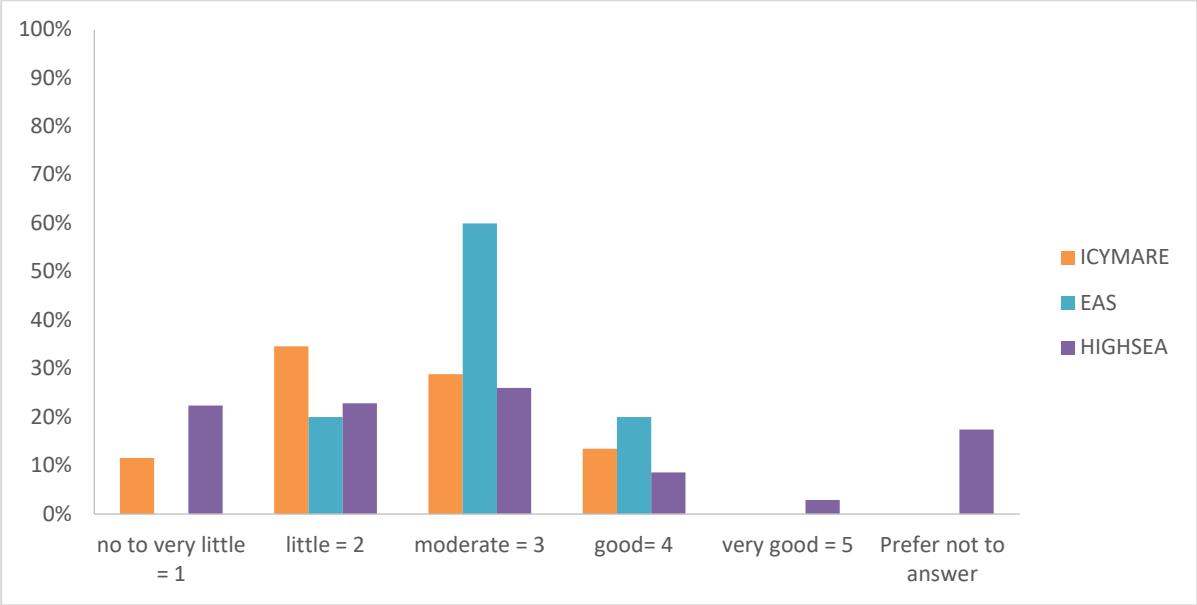

Figure 23 Ranking of perceived sustainability of fish farming by questionnaire respondents at ICYMARE (n = 40) and EAS (n = 5) conferences and HIGHSEA online survey (385 respondents) (Source: own data).

In contrast to knowledge about aquaculture the difference in the ranking of the sustainability of fish farming between the two conferences is little with 2.5 by ICYMARE respondents (n = 40) and 3.0 (moderate) by EAS respondents (n = 5). The general public ranks the sustainability of aquaculture with 1.9 (little) lower than the ICYMARE respondents (Figure 23).

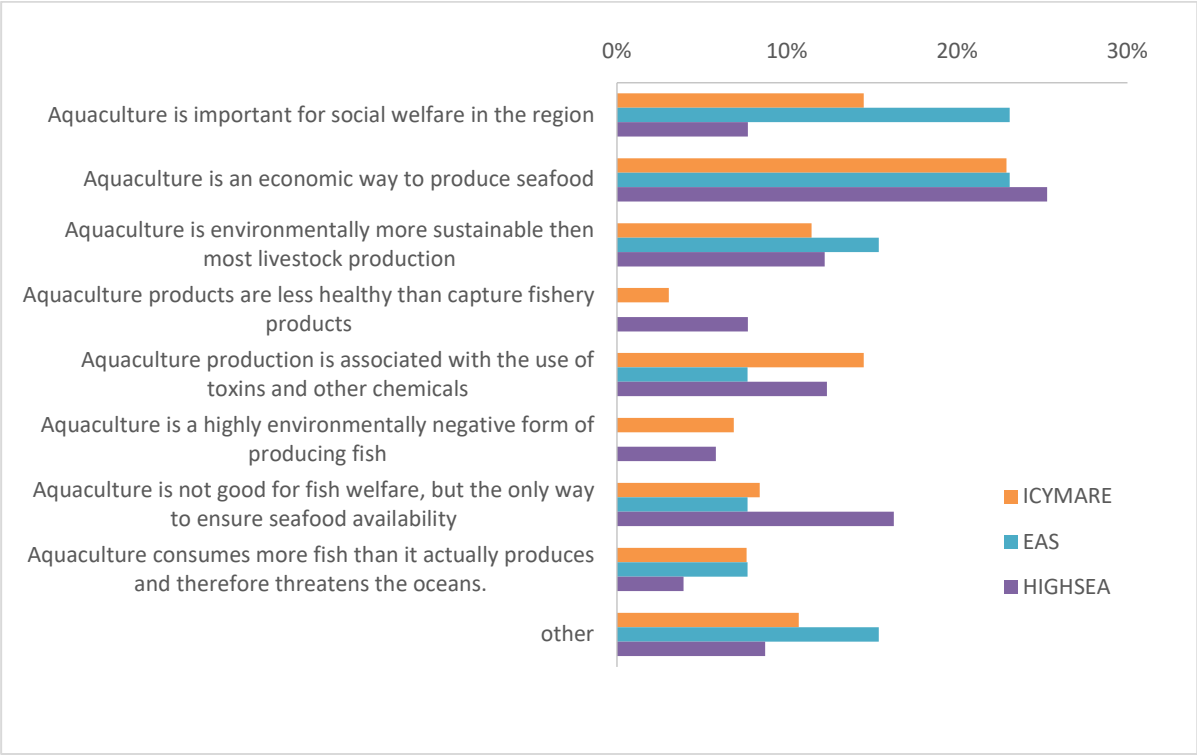

Figure 24 Attitude towards aquaculture by questionnaire respondents at ICYMARE (n = 46) and EAS (n= 5) conferences and HIGHSEA online survey (n = 385). Multiple answers possible (Source: own data).

A central issue of the questionnaire was placed on capturing the existing plurality of attitudes of aquaculture. Figure 24 summarizes the central results and degree of approval to specific statements therein. Again, it is noticeable, that having a moderate to high degree of knowledge affects the perception of aquaculture. For instance, more EAS respondents (23%) agree with the positive statement that aquaculture is important for social welfare in the region than ICYMARE respondents (15%). One quarter (23%) of respondents of both groups agree with the positive statement that aquaculture is an economic way to produce seafood. Comparing the terrestrial livestock production with aquaculture 12% of ICYMARE and 15 % of EAS respondents agree with the positive statement that aquaculture is more sustainable than terrestrial livestock production. Only ICYMARE respondents agree with the negative statements that aquaculture products are less healthy than capture fisheries (3%) and that aquaculture is a highly environmentally negative form of producing fish (7%). More ICYMARE respondents (14%) agree with the negative statement that aquaculture production is associated with the use of toxins and chemicals, compared to the EAS respondents (8%). No differences between the ICYMARE and EAS respondents is detected in the statements that aquaculture is not good for fish welfare, but the only way to ensure seafood availability (8%) and that aquaculture consumes more fish than it actually produces and therefore threatens the oceans (8%). In the option “other” the respondents were able to give their own statement which 10% of ICYMARE and 15% of EAS respondents did.

The answers given in the option “other” could be put into four aspects: (1) The sustainability of aquaculture depends on the culture system (IMTA, RAS, intensity), cultured species and regionality; (2) Aquaculture is necessary to ensure food security, especially in other regions; (3) Aquaculture is not sustainable because of pollution by antibiotics and the spread of parasites, impacts on wild populations; (4) Respondents are uninformed (only HIGHSEA survey) (see Table 5).

Table 5 Comments on the option "other" in the question about the attitude towards aquaculture

Aspects	Statement
(1) The sustainability of aquaculture depends on the culture system (IMTA, RAS, and intensity), cultured species and regionality.	*"Aquaculture, if done in a multi trophic and local scale can be a very sustainable alternative for seafood"*
	"for some species already very sustainable and good; but improvements needed for other species"
	"It all depends on the methods/type of aquaculture"
	"there are semi-intensive AQ systems. AQ can be a sustainable way for fish production, more research and improvement of nutrition, animal welfare has to be done"
	"[...] I think it depends on the manner in which it is done.[…]"
	"Aquaculture is a diverse field, I prefer some production methods to others.(Aquakultur ist ein diverses Feld, einige Produktionsmethoden sind mir lieber als andere.)"
	"Aquacultures only make ecological sense as organic aquacultures (Aquakulturen sind nur als Bio-Aquakulturen ökologisch sinnvoll)"
(2) Aquaculture is necessary to ensure food security, especially in other regions.	*"Aquaculture can be necessary to other regions"*
	"it's a necessity"
	"Aquaculture if done right can be beneficial to feeding humans. […]"
	"The main thing is the fish price and the quality is right (Hauptsache der Fisch Preis und die Qualität stimmt)"
	"Aquaculture is a useful complement to traditional fishing (Aquakultur ist eine sinnvolle Ergänzung zur herkömmlichen Fischerei)"
(3) Aquaculture is not sustainable because of pollution by antibiotics and the spread of parasites, impacts on wild populations.	*"negative effects due to use of antibiotics and spreading of diseases and parasites"*
	"they use antibiotics in aquaculture and thus pollutes the ocean"
	"spread of parasites, aquacultured fish are fed fish"
	"[…] If toxins, overpopulation, wrong waste management occurs, aquaculture can be detrimental to the environment"
	"Aquaculture must be ecologically compatible, otherwise it damages and threatens wild fish, for example salmon in western Canada (Aquakultur muss unbedingt ökologisch verträglich sein, Sonst schädigt und bedroht sie freilebende Fische, zum Beispiel Lachse im Westen Kanadas)"
(4) Respondents are uninformed (only HIGHSEA survey)	"There is too little information on the subject. (Es gibt zu wenig Infos zum Thema)"
	"No knowledge available (Kein Wissen vorhanden)"

3.2.4. Effects of Improved Information Availability

Research insights need to be tailored to specific needs of the respective audiences in order to develop relevant or meaningful outputs (Krause and Schupp 2019). What constitutes relevance or meaningfulness is part of an ongoing negotiation process between academia and society and may vary widely for different social groups and contexts, and different scientific disciplines alike (Hornidge 2014). For contextualization of research findings towards the social realities of stakeholders, the requirements of actors from scientific and societal realms need to be understood in order to design a targeted output (Regeer and Bunders 2003). To this end, an ex-ante and ex-post questionnaire was conducted as the ICYMARE aquaculture session.

In the beginning (*ex-ante*) the personal perceptions across all respondents (n = 11) in self-ranking on aquaculture knowledge was on average 3.5 (moderate to high). They described their attitude being more positive towards even though ranking on their perception of sustainability of fish farming at 2.8 being only moderate. The ICYMARE aquaculture session had a specific focus concerning its consequences for the environment and society alike. Special attention was given on challenges concerning unsustainable feed, chemical and biological pollution as well as merging novel investigations that focussed on improving the relationship between the industry, environment and society by implementing sustainable production practices. The session thus liked natural and social science findings to explore solution-driven research that is able to meet the needed increase in aquatic products. Hence its scope fitted well with the GAIN objectives.

After the aquaculture session (knowledge transfer event at ICYMARE) 7 of 11 respondents stated that their perception did not change (“No”), while arguing that being already aware of the positive aspects (n = 4), positive and negative aspects (n = 2) and negative aspects (n = 1) of aquaculture. Three of the respondents mentioned to have changed their perception towards a more positive attitude due to the information received at the aquaculture session. In this, it could be shown that prior new information, these respondents had ranked the sustainability of fish farming low to moderate. Remarkably, a male respondent in the age group of 55+ ranked his knowledge on aquaculture and the sustainability of fish farming as high (4), whereas his attitude and perception was negative. A female respondent in the age group of 25-39, never consuming seafood is ranking her knowledge and the sustainability of fish farming as high and exposed in general a very positive attitude and perception of aquaculture. Otherwise, no trends could be seen with seafood consumption, gender, age or country of origin Table6). The results thus offer on a very preliminary scale that there are potential shifts possible in the perceived impacts of aquaculture, indicating a learning process on the individual level in the sense that by the engagement with trustworthy knowledge holders (in this case scientists presenting aquaculture related research results) led to topical perception shifts.

Table 6 Ex-ante and ex-post questionnaire results at the ICYMARE (n = 11)

Seafood consumption	Knowledge on aquaculture	Attitude to aquaculture	Sustainability of fish farming	Change of perception	Gender	Age	Country of origin
At least once a week	4	++	3	No	Female	25-39	Germany
At least once a month but less than once a week	4	+/-	3	No, I was already aware of the positive aspects of aquaculture	Male	25-39	Other
At least once a month but less than once a week	3	--	2	Yes I was misinformed about aquaculture and I' m more positive	Female	under 25	Germany
At least once a month but less than once a week	4	-	4	No, I was already aware of the negative aspects of aquaculture	Male	55+	Germany
Several times a year but less than once a month	4	+	3	No, I was already aware of the positive aspects of aquaculture	Female	under 25	Germany
Several times a year but less than once a month	2	+	3	Yes I was misinformed about aquaculture and I' m more positive	Female	25-39	Non-EU Europe
Several times a year but less than once a month	4	+	2	Yes I was misinformed about aquaculture and I' m more positive	Male	25-39	Germany
Less than once a year	3	+/-	2	No, I was already aware of the positive and negative aspects of aquaculture	Female	25-39	Mediterranean/ South EU
Less than once a year	4	+	3	No, I was already aware of the positive and negative aspects of aquaculture	Female	25-39	Germany
Never	4	++++	4	No, I was already aware of the positive aspects of aquaculture	Female	25-39	Germany
Never	3	+	2	prefer not to answer	Female	under 25	Germany

4 Recommendations and Conclusions

The human societies of today developed into multi-faceted highly fragmented and diverse entities with a broad array of different interests, views, knowledge structures, perspectives, norms and values (Becker and Jahn 1999, Krause and Welp 2012). This makes addressing the social dimensions of consumer and stakeholder acceptance a subject so difficult to tackle.
While our findings naturally generated a broad range of new questions, they also led to identifying a number of key issues that significantly enhanced our understanding of the opportunities for, processes of, and approaches to catalyse eco-intensification of marine food systems.
In the following, we present a selection of the main insights – i.e. conditions that seem to be correlated with positive changes towards eco-intensification of aquaculture production. Drawing on the results collected, we employ a social science rubric known as cultural theory (Komendantova and Neumueller 2020), the GAIN survey data can be translated into different worldviews, to categorize the types of opinions into an analysable framework, that is:

1) Hierarchical,
2) Egalitarian,
3) Individualistic

These categories help to endorse the different ways of looking at the world, and how these views influence perceptions of risks, benefits and costs of various policy and market interventions, thus shaping how people act. These differences surfaced strongly in the results, that national context matters, as well as social positioning within and age.

For example, representatives of the hierarchical views would prefer the government taking responsibility for the marine food system transition. The egalitarian would prefer that everybody should be responsible for such transition with the major arguments of fair and equal distribution of risks and responsibilities. The representatives of individual discourse would say that it is a matter of personal responsibility and that such things as technology, innovation, and compensation are important. These differences in worldviews mean that although people may agree on the fundamental truth that food security and sustainability of marine food systems is a problem and something should be done, they may differ in how and what policies should be implemented, as well as in their willingness to change their own behaviour. This understanding could help policymakers develop compromise solutions that reflect these various worldviews. It is thus important to note that despite this categorisation is central for moving towards direct operationalisation of GAIN results, this item requires a very different form of research that only can be conducted once it becomes clearer, what eco-intensification measures work in which ways and who would benefit from these

implementations. GAIN results will thus be a central pillar for such further analysis as described by Komendantova and Neumueller (2020) for the climate change sector.

The below derived pathways for potential action are intended to determine a relative assessment between the individual aspects along the entire GAIN exploitation, production and use of eco-intensification products in the aquaculture chain.

Main pathways for action towards acceptance of eco-intensification measures

Contextual Levels: Consider the different levels from individual to national when analysing and discussing potential change processes.

It is important to carefully analyse the given context and identify whether people are moved by intellectual, emotional, spiritual, economic, or other reasons. These can be very different not only between different countries, i.e. European North-South divide, but also between different social positioning and generation categories. Thus, paying attention to knowledge, power, responsibility, and agency among the members of a given social group is central. Social dynamics can open or close opportunities for change. Social capital is a key concept in this regard (who has it, who does not, how can it be built, how it is used).
Short-term benefits of the change process must be in accordance with long-term benefits. For instance, in the case of Germany, the four biggest supermarket chains, who are mostly under private family-run ownership, hold around 80% of the overall share in the food retail industry (NSC 2019). This points to the need to identify national specific lines of sales to develop information schemes in a transparent process for participation and decision-making facilitate a sense of ownership for new lines of production that root in establishing close linkages from the onset with i.e. retailers.

Regionality: How do distance and particular locations (e.g., fishing areas, working waterfront) affect the needs and perspectives of the consumers?

Regionality and clear framing of the origin of the product matters. On the individual level, this was a clear message that certification schemes, more often than not, appeared to be confusing to the consumer. Rather, transparency about place, location and how they match with their own world-views needs to be improved. Consumers associate e.g. Norwegian fish with “cold climate” and “lots of water” which supposedly has good effects on the fish and “Norwegian people have a fishing tradition”. All those aspects are very superficial but show how important the perception of the country of origin of the seafood product is to the consumer.
Hence, highlighting the origin of the product on the packaging to “convince” the consumer of sustainability may be a straightforward way of bridging the gap to consumers. Indeed, most of the respondents mentioned that buying a particular seafood product is, more often than

not, done due to a "good feeling" rather because of the actual knowledge of sustainability. It is therefore recommended that packaging should provide more information about the region and people involved.

Actors: Who is engaged in the processes, who is not, who leads the change process and why?

Noticeable, the young generation is very aware about food choices and highly receptive to vegetarian and vegan diets. This may limit acceptance and consumption rates of eco-intensification of seafood. Thus, the groups who are currently leading the transformation may focus on different commodities that may be of interest to future consumers. Compelling links to values, emotions and meanings or past experiences are essential to engage people, especially the "customers of tomorrow". Our findings stress that these groups would buy more fresh fish if the fish would be already readily prepared for cooking and if there would be more preparation tips in how to cook the fish. This could be addressed by social media tools that are inclusive of novel trends, such as poke bowls.
To overcome the mismatch between media coverage and perception of consumers, especially in regard to economic vs. environmental concerns, more democratisation of knowledge is called for. For instance, marketing strategies of more sustainable products should focus on informing more who is actually gaining what from specific price margins of a commercial eco-intensification product.

Impact: What does aquaculture mean to the sustainability narrative and who/what is affected or not?

The analysis of the term sustainability by word clouds, identified major elements of ongoing discourses of bridging ecological and economic concerns. Eco-intensification policy measures can be developed to turn awareness about the need to transform current marine food systems to transit into action and to develop compromise solutions, which address narratives of various discourses. Identifying or creating an inspiring narrative to motivate and link different actors in the change process is hereby central. Much can be learned from experiences from the organic food sector and their avenues of information. One example for instance is yummy organics, by which information on effects about the consequences of buying products with different levels of sustainability/ not paying the price is provided to the consumer. However, the contextual role of the social sustainability of eco-intensification measures needs still to be worked out.

The presented recommendations lead to the identification of important questions that are beyond the scope of this report, but need further attention, such as: "How can aquaculture transformation be catalysed?"; "Who are change agents, and why?"; "Who assesses whether a change process was successful, and how can success be assessed?"; "What is needed for a process of implementing eco-intensification measures to be coherent and consistent and to overcome barriers, in order to catalyse and foster more sustainable practices of marine food

security by employing eco-intensification measures?".
Collaboration across scientific disciplines, as well as the integration of perspectives, skills, and insights from civil society and practitioners are required for truly transformative research and for generating new and creative ideas for enabling change toward sustainable futures.

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Annex I Poster Survey

Pre-Test Questions

Table 7 Preference for Aquaculture Species

Place	**Potsdam**	
Overall Participation		35
Sea Bream	23%	8
Salmon	46%	16
Trout	17%	6
Seabass	0%	0
Other	0%	0
No seafood	14%	5

Table 8 Criteria for seafood purchase

Criteria	**in general**	**for wild catches**	**for AQ products**
Taste	11	3	1
Freshness of product	15	4	4
Price	6	3	3
Health issues	7	2	2
Quality	11	4	4
Certification	16	2	7
Origin	15	4	5
Animal Welfare	10	6	5
Sustainability	16	6	7

Which fish do I eat?!

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

J. Peterelt, C. Hörterer, G. Krause

Which fish do you like best?

Please select one of the 3 fish species or one of the alternatives!

the listed fish are the three most popular food fish in Europe

please mark with a cross

Seabream

© ec.europa.eu

- EU is the biggest producer worldwide for aquaculture seabream
- Main producers are Greece and Spain
- Almost no trade between third countries and the EU; mostly intra-EU
- Greece main exporter to Italy, Portugal and France

Salmon

© Scandanvian Fishing Year Book

- Two thirds of total salmon production is in aquaculture
- Main producers: Norway, the EU and Canada
- Rearing first in freshwater tanks and then transferred to a sea site (floating cages)

Trout

© Fischlexikon.eu

- Main Producer worldwide is the EU (Italy, France, Germany and Poland)
- Nearly all fish come from aquaculture
- Mostly in open flow through river systems or recirculating systems

I don't eat fish

I prefer following other species (write down the name):

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ChrisHorterer
gain2020

Jessis_science
christina.hoert
greenaquaculture2020

Which criteria are important for you when buying fish and seafood?

Please mark with a cross!
(Multiple answers possible)

I buy/prefer … seafood	fresh	frozen	processed	no
I pay attention to the price	Yes		No	
I eat seafood because of its benefits for health (e.g. Omega 3- fatty acids)	Yes		No	
What means quality of the product for you? (please name)				
I pay attention to certification of seafood (e.g. MSC, ASC, ecolabels)	Yes		No	
I pay attention to the origin (e.g. regionality, FAO fishing areas)	Yes		No	
Animal welfare aspects are important	Yes		No	

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JessicaPetereit
ChrisHorterer
gain2020

Jessis_science
christina.hoert
greenaquaculture2020

Annex II Aquaculture Knowledge Survey for ICYMARE and EAS

GAIN Green Aquaculture Intensification

ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

HELMHOLTZ GEMEINSCHAFT

Aquaculture Knowledge Survey

The following questionnaire aims at developing a better understanding of seafood consumption and the role of fish farming. This is important information and your feedback contributes to the EU's effort towards sustainability.

Your responses to this questionnaire are anonymous, and will be treated confidentially. Data will be aggregated and summarized from across all responses and further used for improving knowledge transfer at the science-society interface in the GAIN Project and beyond.

1. How frequently do you eat seafood at home, restaurants and other food outlets?

- ○ At least once a week
- ○ At least once a month but less than once a week
- ○ Several times a year but less than once a month
- ○ Less than once a year
- ○ Never
- ○ Don't know
- ○ Prefer not to answer

2. Seafood can be farmed or originates from wild. What would you say?

- ○ I prefer wild products
- ○ I prefer farmed products
- ○ I have no preference
- ○ I don't know if the products I buy or eat are wild or farmed
- ○ It depends on the type of product
- ○ Don't know
- ○ Prefer not to answer

3. How do you rank your knowledge on aquaculture production?

1 = No experience *Excellent knowledge = 10*

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

4. What attitude do you have to aquaculture in general (multiple answers possible)?

- ○ Aquaculture is important for social welfare in the region
- ○ Aquaculture is an economic way to produce seafood
- ○ Aquaculture is environmentally more sustainable then most livestock production
- ○ Aquaculture products are less healthier then capture fishery products
- ○ Aquaculture production is associated with the use of toxins and other chemicals
- ○ Aquaculture is a highly environmentally negative form of producing fish
- ○ Aquaculture is not good for fish welfare, but the only way to ensure seafood availability
- ○ Aquaculture consumes more fish than it actually produces and therefore threatens the oceans.
- ○ Other (Please comment)

_____

_____

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 771330

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JessicaPetereit ChrisHorterer gain2020

Jessi_ptrt christina.hoert greenaquaculture2020

GAIN Green Aquaculture Intensification

AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

HELMHOLTZ GEMEINSCHAFT

5. How do you rank the sustainability of fish farming?

1 = Not sustainable at all *Very sustainable = 10*

1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

6. Do you consider yourself living close to the sea

- o Close (walking distance)
- o Relatively close (by car)
- o Relatively far
- o My country is landlocked
- o Prefer not to answer

7. What is your level of education?

- o Primary education
- o Secondary education
- o Further education (e.g. training or vocational education)
- o Higher education
- o Prefer not to answer

8. What is your gender?

- o Female
- o Male
- o Diverse
- o Prefer not to answer

9. What is your age?

- o Under 14
- o 15-24
- o 25-39
- o 40-54
- o 55+
- o Prefer not to answer

10. What is your country of origin?

- o Germany
- o Northern EU
- o Mediterranean/South EU
- o Eastern EU
- o Western EU
- o Non-EU Europe
- o Other
- o Prefer not to answer

Please ask three friends, family members, colleauges etc. to fill the questionnaire on paper or online.

Follow the shortlink
http://bit.ly/ICYMAREGAIN

Or the QR-quode

For more information visit

www.awi.de/mag

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ChrisHorterer
gain2020

Jessi_ptrt
christina.hoert
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It would be very helpful if you can fill in these 3 questions after the aquaculture session. Thank you.

11. Did the session change your perception on aquaculture?

- No, I was already aware of the positive aspects of aquaculture
- No, I was already aware of the negative aspects of aquaculture
- Yes, I was unaware of aquaculture and got a better idea now
- Yes, I was misinformed about aquaculture and I' m more positive
- Yes, I was misinformed about aquaculture and I' m more negative
- Prefer not to answer

12. Did you learn something today?

- No
- Yes
- Uncertain
- Prefer not to answer

If yes, what did you learned how does this change your seafood consumption behaviour?

.....

13. What you always wanted to say/comments?

.....

Please ask three friends, family members, colleauges etc. to fill the questionnaire on paper online.

Follow the shortlink http://bit.ly/ICYMAREGAIN

Or the QR-quode

For more information visit

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JessicaPetereit ChrisHorterer gain2020

Jessi_ptrt christina.hoert greenaquaculture2020

Annex III HIGHSEA questionnaire

GAIN Green Aquaculture Intensification

AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

HELMHOLTZ GEMEINSCHAFT

Umfrage zum Kenntnisstand über Aquakultur

Wissensanalyse über die Aquakultur
Der folgende Fragebogen soll zu einem besseren Verständnis der Rolle der Fischzucht sowie dem Meeresfrüchtekonsum beitragen. Die von Ihnen an uns gegebenen Informationen, sowie Ihr Feedback, tragen dazu bei die EU in ihren Bemühungen hinsichtlich der Nachhaltigkeit zu verbessern.

Dieser Fragebogen ist anonym und Ihre Antworten werden vertraulich behandelt.
Die Daten werden aus allen Fragebögen gesammelt und zusammengefasst, damit sie zur Verbesserung des Wissensstandes über Aquakultur, sowie als hilfreiche Erkenntnisse im GAIN Projekt und darüber hinaus fungieren können.

Die Beantwortung wird maximal 5 Minuten beanspruchen.

1. **Wie oft essen Sie zuhause, in Restaurants oder bei anderen Lebensmittelausgaben Fisch und Meeresfrüchte?** *Bitte kreuzen Sie an.*

- ☐ mindestens einmal die Woche
- ☐ mindestens einmal im Monat aber seltener als einmal die Woche
- ☐ mehrfach im Jahr aber seltener als einmal im Monat
- ☐ seltener als einmal im Jahr
- ☐ niemals
- ☐ keine Angaben

2. **Fische und Meeresfrüchte können als Wildfang oder aus Zuchtanlagen im Einzelhandel landen.** *Welche Art der Produkte bevorzugen Sie?*

- ☐ Ich bevorzuge natürliche Produkte.
- ☐ Ich bevorzuge gezüchtete Produkte.
- ☐ Ich habe diesbezüglich keine Vorliebe.
- ☐ Ich weiß nicht, ob die Produkte, die ich kaufe, natürliche oder gezüchtete Produkte sind.
- ☐ Keine Angabe

3. **Wie schätzen Sie Ihr Wissen über die Produktion von Aquakultur ein?**
Bitte markieren Sie nur einen Kasten.

1 = kein Wissensstand 10 = ausgezeichneter Wissensstand

1	2	3	4	5	6	7	8	9	10

1

4. **Wie würden Sie Ihre Einstellung zu Aquakultur beschreiben?**
Wählen Sie alle zutreffenden Antworten aus (Mehrfachauswahl möglich).

- ☐ Aquakultur ist wichtig für das soziale Wohlergehen in der Region.
- ☐ Aquakultur ist eine ökonomische Methode zur Produktion von Fischen u. Meeresfrüchten.
- ☐ Aquakultur ist ökologisch nachhaltiger als die meisten Produktionen durch Tierhaltung.
- ☐ Aquakultur-Produkte sind weniger gesund als Fischfangerzeugnisse.
- ☐ Aquakultur-Produktion wird mit der Verwendung von Giften und Chemikalien assoziiert.
- ☐ Aquakultur ist eine ökologisch sehr schlechte Methode.
- ☐ Aquakultur ist nicht gut für das Wohlergehen der Fische, aber die einzige Möglichkeit, die Verfügbarkeit von Fischen sicherzustellen.
- ☐ Aquakultur verbraucht mehr Fische als es tatsächlich produziert und bedroht damit die Meere.
- ☐ Ich habe eine andere Einstellung.
- ☐ Keine Angaben
- ☐

5. **Wenn Sie bei Aufgabe 4 angegeben haben, eine andere Einstellung zu Aquakultur zu haben, wie würden Sie diese beschreiben?**

_____
_____
_____
_____

6. **Wie schätzen Sie die Nachhaltigkeit der Fischzucht ein?**
Bitte markieren Sie nur einen Kasten.

1 = überhaupt nicht nachhaltig 10 = sehr nachhaltig

1	2	3	4	5	6	7	8	9	10

7. **Was bedeutet der Begriff Nachhaltigkeit für Sie?**

_____
_____
_____
_____

2

8. **Verbinden Sie etwas mit diesem Logo?**

- ☐ Ja, ich verbinde etwas mit diesem Logo.
- ☐ Nein, ich verbinde nichts mit diesem Logo.

9. **Wenn Sie in Frage 8 'Ja' angekreuzt haben beschreiben Sie bitte kurz was sie mit diesem Logo verbinden. Wenn Sie 'Nein' angekreuzt haben überspringen Sie bitte diese Frage.**

_____

_____

10. **Über welches Medium möchten Sie am ehesten über Aquakultur informiert werden?**
Bitte markieren Sie nur einen Kasten.

- ☐ Broschüren/Flyer
- ☐ Internetseite
- ☐ YouTube/Videos
- ☐ Plakate
- ☐ Social Media Posts
- ☐ Andere
- ☐ Keine Angabe

11. **Wie nah leben Sie am Meer?**
Bitte markieren Sie nur einen Kasten.

- ☐ nah (fußläufig erreichbar)
- ☐ relativ nah (mit dem Auto erreichbar)
- ☐ relativ weit entfernt
- ☐ Ich lebe in einem Binnenland (von Land umschlossen).
- ☐ keine Angaben

3

12. Was ist Ihr höchster Bildungsabschluss?

Bitte markieren Sie nur einen Kasten.

- ☐ kein Schulabschluss
- ☐ Grund-/Hauptschulabschluss
- ☐ Realschule (Mittlere Reife)
- ☐ Gymnasium (Abitur)
- ☐ abgeschlossene Ausbildung
- ☐ Fachhochschulabschluss
- ☐ Hochschulabschluss
- ☐ Keine Angaben

13. Welches Geschlecht haben Sie?

Bitte markieren Sie nur einen Kasten.

- ☐ männlich
- ☐ weiblich
- ☐ divers
- ☐ keine Angaben

14. Wie alt sind Sie?

Bitte markieren Sie nur einen Kasten.

- ☐ unter 14
- ☐ 15-20
- ☐ 21-25
- ☐ 26-30
- ☐ 31-40
- ☐ 41-50
- ☐ älter als 50
- ☐ keine Angaben

Vielen Dank für Ihre Teilnahme an unserem Fragebogen! ☺

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Annex IV Poster data from all occasions

Table 9 Poster Result

Place	EAS		ICYMARE		EU		Focus Fish		Helgoland Conference		IIM		Thünen Institut		Carp Conference		Overall	
Overall Participation	68		113		15		35		26		63		117		52		489	
I buy/prefer … seafood																		
fresh	39	75%	66	58%	13	100%	21	60%	17	65%	48	76%	13	48%	29	56%	246	65%
frozen	5	10%	9	8%	0	0%	10	29%	6	23%	14	22%	11	41%	11	21%	66	17%
processed	6	12%	3	3%	0	0%	4	11%	1	4%	1	2%	3	11%	6	12%	24	6%
No seafood consumption	2	4%	35	31%	0	0%	0	0%	2	8%	0	0%	0	0%	6	12%	45	12%
SUM	52	100%	113	100%	13	87%	35	100%	26	100%	63	100%	27	100%	52	100%	381	100%
I pay attention to the price																		
Yes	35	83%	65	86%	7	54%	18	72%	3.5	19%	44	88%	10	56%	30	75%	168.5	73%
No	7	17%	11	14%	6	46%	7	28%	14.5	81%	6	12%	8	44%	10	25%	63.5	27%
SUM	42	100%	76	100%	13	100%	25	100%	18	100%	50	100%	18	100%	40	100%	232	100%
I eat seafood because of its benefits for health																		
yes	27	63%	41	51%	9	69%	15	63%	5.5	32%	40	73%	11	55%	31	78%	139.5	59%
No	16	37%	40	49%	4	31%	9	38%	11.5	68%	15	27%	9	45%	9	23%	98.5	41%
SUM	43	100%	81	100%	13	100%	24	100%	17	100%	55	100%	20	100%	40	100%	238	100%
I pay attention to certification of seafood																		
yes	29	69%	56	67%	5	38%	16	67%	14	74%	24	46%	11	58%	26	60%	157	65%
No	13	31%	27	33%	8	62%	8	33%	5	26%	28	54%	8	42%	17	40%	86	35%
SUM	42	100%	83	100%	13	100%	24	100%	19	100%	52	100%	19	100%	43	100%	243	100%
I pay attention to the origin																		
Yes	34	79%	77	90%	11	79%	18	78%	13	68%	48	94%	13	68%	36	97%	202	84%
No	9	21%	9	10%	3	21%	5	22%	6	32%	3	6%	6	32%	1	3%	39	16%
SUM	43	100%	86	100%	14	100%	23	100%	19	100%	51	100%	19	100%	37	100%	241	100%
Animal welfare aspects are important when I buy animal products																		
Yes	36	82%	73	92%	8	62%	22	92%	18.5	88%	46	92%	10	59%	35	92%	202.5	86%
No	8	18%	6	8%	5	38%	2	8%	2.5	12%	4	8%	7	41%	3	8%	33.5	14%
SUM	44	100%	79	100%	13	100%	24	100%	21	100%	50	100%	17	100%	38	100%	236	100%

Annex V Socio-demographic characteristics and sea food consumption of questionnaire respondents

*Table 10 Socio-demographic characteristics in percent of survey respondents at the ICYMARE and EAS conferences and the HIGHSEA online survey. *Surveys were distributed only in Germany.*

Socio-demographic characteristic	Subclassification	ICYMARE[1] (n = 52)	EAS[2] (n = 5)	HIGHSEA[3] (n = 385)
Distance to sea	Close (walking distance)	33%	20%	15%
	Relatively close (by car)	57%	40%	56%
	Relatively far	10%	40%	12%
	My country is landlocked	0%	0%	4%
	Prefer not to answer	0%	0%	13%
Education	Primary education	0%	0%	3%
	Secondary education	0%	0%	16%
	Further education	200%	0%	11%
	Higher education	98%	10%	54%
	Prefer not to answer	0%	0%	16%
Gender	Female	84%	40%	42%
	Male	12%	60%	42%
	Diverse	20%	0%	1%
	Prefer not to answer	0%	0%	15%
Age	under 25[1,2,3]	26%	0%	38%
	25-39[1,2,3]	72%	80%	19%
	40-54[1] (40-50)[2,3]	0%	0%	12%
	55+[1] (50+)[2,3]	2%	20%	17%
	Prefer not to answer	0%	0%	14%
Country of origin	Germany	63%	40%	100%*
	Northern EU	2%	0%	
	Mediterranean/South EU	19%	0%	
	Eastern EU	2%	0%	
	Western EU	4%	0%	
	Non-EU Europe	2%	20%	
	Other	8%	40%	

Table 11 Seafood consumption and preference in seafood origin of survey respondents at the ICYMARE and EAS conferences and HIGHSEA online survey.

		ICYMARE (n = 52)	**EAS (n = 5)**	**HIGHSEA (n = 385)**
Seafood consumption	At least once a week	31%	60%	27%
	At least once a month but less than once a week	19%	20%	31%
	Several times a year but less than once a month	17%	20%	20%
	Less than once a year	10%	0%	6%
	Never	23%	0%	10%
	Prefer not to answer	0%	0%	6%
Seafood origin	I prefer wild products	15%	0%	32%
	I prefer farmed products	8%	20%	7%
	I have no preference	6%	80%	28%
	I don’t know if the products I buy or eat are wild or farmed	7%	0%	28%
	It depends on the type of product	50%	0%	0%
	I prefer not to eat fish	6%	0%	0%
	I don't know	6%	0%	0%
	Prefer not to answer	4%	0%	6%

Annex VI Gain Partnerships

Table A 25 - GAIN Consortium

Participant № (leadership role)	Participant legal name	Country	Type
1 (Coordinator; WP5; WP7)	Università Ca' Foscari Venezia (UNIVE)	Italy	RTD
2 (WP3)	The University of Stirling (UoS)	UK	RTD
3 (WP1)	Alfred-Wegener-Institut Helmholtz- Zentrum für Polar- und Meeresforschung (AWI)	Germany	RTD
4	IBM Ireland Limited (IBM)	Ireland	CORP[1]
5 (WP2)	Agencia Estatal Consejo Superior de Investigaciones Cientificas (CSIC)	Spain	RTD
6 (WP4)	Longline Environment Limited (LLE)	Ireland	SME
7 (WP6)	Sparos Lda (SPAROS)	Portugal	SME
8	Salten Havbrukspark (SHP)	Norway	SME
9	Wageningen University (WU)	Netherlands	RTD
10	Johann Heinrich von Thuenen-Institut, Bundesforschungsinstitut Fuer Laendliche Raeume, Wald Und Fischerei (TI)	Germany	RTD
11	Agrifood and Biosciences Institute (AFBI)	UK	RTD
12	Zachodniopomorski Uniwersytet Technologiczny W Szczecinie (ZUT)	Poland	RTD
13	Asociacion Nacional de Fabricantes de Conservas de Pescados y Mariscos-Centro Tecnico Nacional de Conservacion de Productos de la Pesca (ANFACO)	Spain	NPO[2]
14	WAISTER AS (WAS)	Norway	SME
15	Gildeskal Forskningsstasjon AS (GIFAS)	Norway	SME
16	Lebeche (LEBCH)	Spain	CORP[1]
17	Sagremarisco-Viveiros de Marisco Lda (SGM)	Portugal	SME
18	Fondazione Edmund Mach (FEM)	Italy	NPO[2]
19	Dalhousie University (DAL)	Canada	RTD
20	South China Sea Fisheries Research Institute (SCSFRI)	China	RTD

GAIN is structured in 7 Work Packages, plus an Ethics Work Package, which was added by the EC during the negotiation (see Fig. A1). WP leaders are indicated in Table A1. The main objects of each WP are listed below.

WP1 - Production and Environment: will develop novel sustainable feeds and tools for enhancing aquaculture sustainable management of aquafarm based on Big Data analytics.

WP2 - Secondary products: will develop new co-products, in order to enhance circularity, sustainability and profitability of aquaculture supply chains.

WP3 - Policy and markets will analyse the state-of-the-art of EU and national legislations with respect to the valorisation and marketing of innovative GAIN products and co-products and provide suggestions to policy makers.

[1] Corporation (Not SME)

[2] Non-profit Organisation

WP4 - Eco-intensification: will develop new approaches and tools for assessing the level of eco-intensification of GAIN innovative solutions, in comparison with standard practices.

WP5 - Professional development: will deliver both on-line and in presence courses, in order to facilitate the adoption of GAIN innovative solutions by aquafarm operators.

WP6 - Dissemination, Exploitation, Communication: will maximize GAIN impact, by careful matching communication&dissemination tools to targeted audiences and developing platforms for exploiting GAIN results beyond its life time.

WP7 - Coordination: will ensure the timely delivery of all GAIN contractual items.

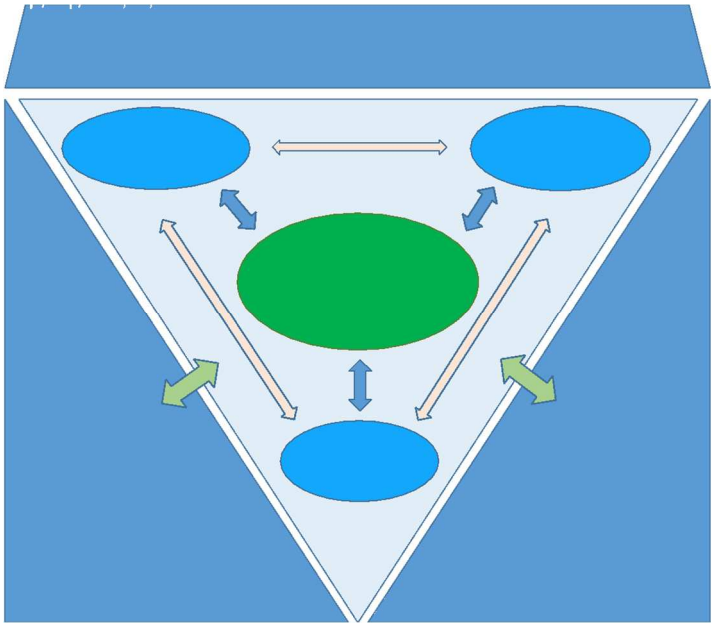

Figure 33 GAIN structure

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