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Full Length Research Paper

Aquaculture in Europe: Media representations as a proxy for public opinion

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Fish is traditionally considered a healthy and pure food. However, with the development of modern aquaculture, a range of potentially controversial issues are emerging. These could significantly impact the future success of the industry. In the absence of in-depth data on lay perceptions on farmed fish and fish farming, this paper utilises media representations as a proxy for public opinion. Media representations of aquaculture were investigated in Germany, Norway and the UK over a five-year timeframe (May 2002 to May 2007). A total of 1049 articles from both broadsheet and tabloid newspapers were analyzed with the qualitative software Atlas/ti. We compare the article framings cross-nationally, focusing in-depth on four major analytical themes which emerged: the environment, the economy, human health and trust/regulation. Despite general similarities, these themes are represented with different salience and foci across the countries of analysis. These divergent media representations of aquaculture are discussed in terms of their likely impacts on lay perceptions of farmed fish and fish farming. In turn, the understanding of consumer perceptions is a vital component for policy making about aquaculture.

Key words: Aquaculture, farmed fish, risk, media analysis, cross-national research.

INTRODUCTION

Fish is traditionally considered a healthy dish and labelled as a pure food (Reis et al., 2006). Culturally, fish has symbolised emotional well-being and social healing for at least six millennia (Reis et al., 2006). Christianity regards fish as a sacred food and as both physically and spiritually nourishing (Reis et al., 2006).

Today, there is agreement on the human health benefits of fish consumption. Although there are some uncertainties about the exact health benefits of some nutrients in seafood (Hooper et al., 2006), it is generally accepted that seafood consumption is important for a healthy human diet, with Omega-3, for instance, protecting against cardiovascular diseases. In most countries the health benefits of eating fish, are recognized by experts and public alike. Widely accepted consumption recommendation guidelines exist (Food Standards Agency (FSA), 2008; Institute of Medicine of the National Academies, 2006). In the UK, the advice given by the government to get the full health benefits of fish is to consume at least two portions of fish per week, one of which should be oily (FSA, 2008).

Recently however, fish has become a more controversial topic, largely due to changes in capture and production methods. Global fisheries landings have been declining since the mid 1980s (Pauly et al., 2003). While fish consumption is estimated to increase, production of most capture fisheries has reached its maximum potential (Food and Agriculture Organisation of the United Nations (FAO), 2006). In the context of diminishing wild supplies more and more seafood will be the product of aquacultural activities (FAO, 2006). Aquaculture[1] is the world's fastest growing food-producing sector, growing more rapidly than all other animal food producing sectors (FAO, 2002). The industry accounts for almost 50% of the world's food fish supply and is perceived as having the greatest potential to meet the growing demand for aquatic food (FAO, 2006).

[1] In the literature, the terms aquaculture and fish farming are often used interchangeably and the current research continues in this tradition.

Aquaculture: An expanding industry not without its critics

These developments are not without their critics. Aquaculture carries a range of environmental risks such as its negative impacts on biodiversity (Duarte et al., 2007). Like agriculture, aquaculture produces waste which, if not managed properly, can impact the environment. Effluent discharges can lead to poor water quality, which may in turn promote outbreaks of pathogens and subsequent declines in farm productivity (Volpe, 2001).

Many high value species, such as salmon, are farmed in marine sea cages which are prone to tearing from storms, human error, predators and mass escapes of fish (Volpe, 2001). Moreover, the use of sea cages as well as the monoculture practices of salmon farms may increase the risk of diseases for wild salmon populations (Volpe, 2001). In relation to animal welfare, stimulated by research about pain awareness and suffering in fish, there is a growing concern for fish welfare (European Commission, 2004).

Aquaculture further raises concerns about sustainability. Since the consumption of especially carnivorous fish species is increasing, there is a heightened demand for fish-based feed. An average of 1.9 kg of fish feed is needed for every kilogram of fish raised and one third of all wild fish caught is used to make fishmeal (Naylor et al., 2000). However, there is also an increasing demand from developing nations for small, pelagic fish for human consumption (Naylor et al., 2000). Thus there is the potential risk of a reduction in available human food fish supplies. In terms of human health aquaculture may also present risks as persistent organic pollutants and heavy metals can be found in fishmeal and oil fed to farmed fish (Holmer et al., 2008).

In summary, the growth of aquaculture faces several challenges, such as the availability, suitability and cost of feed, space availability and adverse environmental impacts (Duarte et al., 2009). Moreover, the industry may face public perception problems (Schlag, 2010), which need to be overcome if it is to become a major component of global food production.

Aquaculture in the media

Aquaculture as presently practised is still a new and unfamiliar industry and social scientific research on the topic is only a recent development (Amberg et al., 2008; Burgess et al., 2005; Grigorakis, 2010; Hojier et al., 2006; Schlag, 2010; Verbeke et al., 2008). Due to the relative lack of social science research to date, the investigation of media representations of aquaculture lends itself to an exploration of the topic as how the media reports on the risks and benefits of aquaculture will affect public opinion. There is a long history of debate as to whether the press leads or follows public opinion. The relationship between media coverage and public opinion is ambiguous and the exact influence of the media on public perceptions remains disputed. The media is a dynamic interpreter and mediator of information (Hoijer et al., 2006) but the framings[2] provided by the media do not necessarily determine the public's interpretations. Reporting may be interpreted differently and the public may be critical of the media (Hoijer at al., 2006).

Nevertheless, it is evident that the media has an impact on public opinion (Nelkin, 1995). In relation to genetically modified (GM) foods, Frewer et al. (2002) demonstrated the impact of media reporting on food scares in that reporting was associated with increased public anxiety and as media reporting waned public concerns were also reduced. In like manner, the specific nature of media coverage on farmed fish and fish farming may influence, positively or negatively, public perceptions and subsequent consumer behaviour. Most people are dependent on the media for most of their news information and aquaculture is no exception. As such we consider the press as a proxy for public opinion.

Previous research and our rationale for the present study

Hoijer et al. (2006) and Amberg et al. (2008) investigated media representations of farmed fish in response to particular trigger events. Hoijer et al. (2006) investigated global media coverage of a controversial study by Hites et al. (2004) published in the journal "Science", which effectively suggested that wild salmon are safer to eat than their farmed counterparts.

Notable cross-national differences in how issues were framed were found. In the UK the farmed salmon controversy was framed as an internal threat to its citizens in terms of health risks, while in Norway it was framed as an external threat to the domestic economy (Hoijer et al., 2006). As such differences in political cultures fuelled the framing processes (Hoijer et al., 2006).

Similar to Hoijer et al.'s (2006) study, Amberg et al. (2008) investigated how newspaper coverage fluctuated in the face of two trigger events[3], which compared contaminants in wild and farmed salmon. Their analysis of US newspaper stories about farmed salmon found that health risks were presented as far greater than benefits, leading Amberg et al. (2008) to conclude that the public may perceive the risks as greater than the benefits.

The above cited studies focus solely on farmed salmon

[2] Framing is where a complex problem is simplified in order to support a specific understanding of the issue and/or push an agenda (Hoijer et al., 2006).

[3] Amberg et al.'s (2008) studied trigger events were a paper by the Environmental Working Group (July 2003), which found higher contaminants in farmed salmon, and claimed that eating farmed would significantly increase the risk of cancer and birth defects, as well as Hites et al.'s (2006) research.

Table 1. Newspapers analyzed.

Country		Newspapers	
Germany	TAZ	Sueddeutsche Zeitung	Die Welt
Norway	Aftenposten	Dagbladet	Verdens Gang
UK	The Guardian	The Financial Times	The Daily Mail

and on media responses to trigger events. They do not represent a holistic picture of aquaculture, which could be taken as a proxy for public opinion more generally. Our research aims to understand what information on aquaculture is presented in the media of three European countries in order to elucidate how three countries' respective publics may understand related issues. We did not establish an *a priori* hypothesis as this might have influenced the way we looked at the data but rather let the data guide us.

METHODOLOGY

Traditional quantitative content analysis is useful to produce a comprehensive map of basic structures of news items (Petts et al., 2001) but this approach is limited in that it has little to say about how meanings are produced through language and imagery. Quantitative and qualitative content analytical approaches can illuminate different aspects between media representations and public understandings. Consequently, wherever feasible, it is desirable to coalesce them (Downe-Wamboldt, 1992). Hence we supplement the traditional technique with a qualitative approach to investigate not only what is written about but also how issues are represented (Weber, 1990). This in-depth approach to content analysis has been successfully used to investigate various food-related issues (Hamadeh et al., 2008; Young et al., 2008).

Data collection

We chose Norway, the UK and Germany as countries for analysis because of their interests in aquaculture. Norway is the world's largest salmon producer, the UK (Scotland) is the largest salmon producer in the EU, and Germany has a significant fish processing industry. In each country, articles relating to aquaculture were identified from three daily newspapers between May 2002 to May 2007 (Table 1). Comprising two broadsheets and a mid-market or tabloid newspaper in each country, we covered a spectrum of political orientations and perspectives[4].

Sampling strategy

The multilingual nature of the study required the selection of search terms that were as equivalent as possible to their English counterparts. Native speakers were used for the relevant data selection and analyses. All articles containing the following keywords[5] were collected: "aquaculture, fish farming, farmed fish, farmed salmon".

The on-line service LexisNexis was used to provide hard copies of the identified articles for data collection and coding. As the programme does not support Norwegian newspapers, here the archives of various print media were searched individually. The search was carried out to identify all articles, which included the target words anywhere in the text of the article. A relevancy check was conducted and items excluded from further analysis were, for example, university courses on aquaculture.

Data analysis

Articles were downloaded and imported into the software Atlas/ti (Version 5.2) developed by Muir (1998). The aim was to explore representations of aquaculture capturing key thoughts and concepts. We used an inductive category development as existing theory and empirical research on the topic is limited. Researchers immersed themselves in the data to allow for new insights to emerge and for categories and codes to flow from the data (Kondracki et al., 2002). Codes were then sorted into categories based on how they were related and linked. These emergent categories were further used to organize and group codes into meaningful themes.

Article frames were analyzed for each article followed by an in-depth investigation of a range of thematic codes. Whilst the former were coded singularly per document, multiple codings were possible for the latter. In accordance with Hoijer et al. (2006), we are using the term "framing" in the way in which news coverage draws boundaries around an issue, classifying it as an instance of 'X' rather than 'Y' (that is, of risk rather than benefit). The basic unit of analysis was the thematic section, usually a single sentence or paragraph. Homogenisation of codes between languages was achieved through discussions between coders. For the purpose of analysis, memos comprising a selection of quotes were attached to each code to remind researchers of how a particular concept had been addressed by colleagues.

RESULTS

The article searches resulted in a total of 1049 articles to be evaluated: 244 articles in Germany, 306 articles in Norway, and 499 articles in the UK. Subsequently, the framings of articles are compared before looking in detail at the four major analytical themes (or 'thematic families') and their five most frequent sub-themes.

Framings of articles

In all three countries, the dominant framing of articles is in terms of risk (Figure 1). In Norway risk framings are most pronounced. Within these risk and benefit frames four major themes emerged. In order of decreasing frequency

[4] Whilst the national context is important, the media also should not be interpreted as being a uniform phenomenon, not even in a single country (Hoijer et al., 2006). Future research would benefit from studying divergences between newspapers analyzed.

[5] Germany: *Aquakultur, Fischzucht, Zuchtfisch, Zuchtlachs;* Norway: *akvakultur, fiskeoppdrett, oppdrettsfisk, oppdrettslaks*

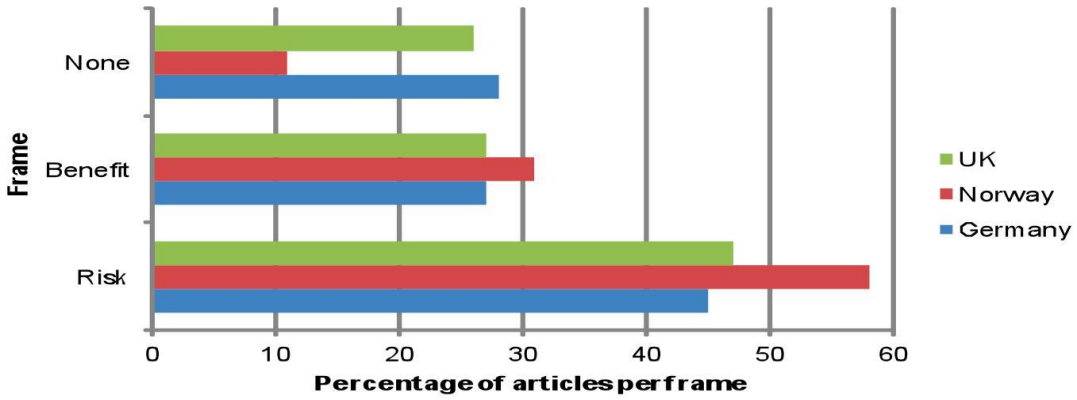

Figure 1. Framings of articles in all countries.

Table 2. Framings per article foci in all countries (%).

	Frame benefit			Frame risk			Frame none		
Country foci	**D**	**N**	**UK**	**D**	**N**	**UK**	**D**	**N**	**UK**
Economic	60	38	49	19	37	25	21	25	26
Environmental	4	13	23	80	85	56	16	2	21
Human health	4	34	14	87	66	79	9	0	7
Trust and regulation	5	22	15	63	52	35	32	26	50

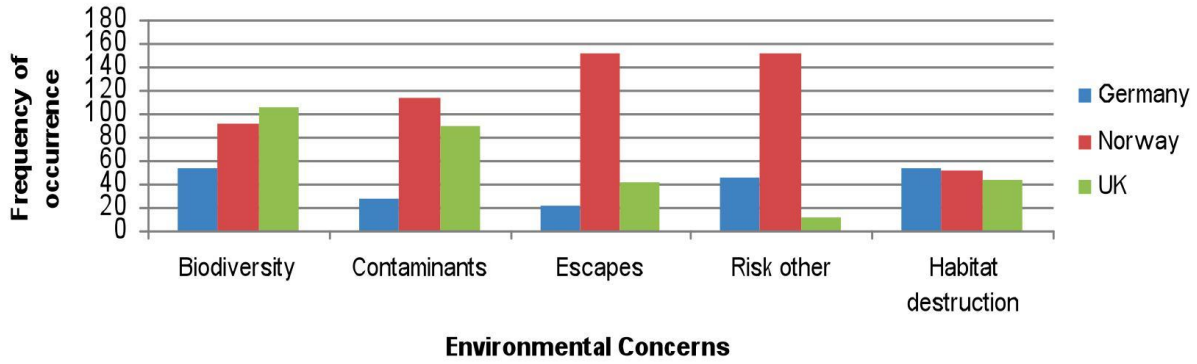

Figure 2. Concerns about environmental risks.

of occurrence these are categorised into environmental, economic, human health and organizational (trust and regulation) issues.

Looking at the framings of articles focused on economic issues (Table 2) it is evident that these tend to be framed in terms of benefits rather than risks. Aquaculture is largely represented in positive terms economically. In contrast, environmental and human health issues are framed predominately in terms of risk in all three countries.

In line with Amberg et al.'s (2008) findings the media's relative neglect of the benefits of aquaculture is evident especially in terms of human health. A risk framing of environmental and human health articles dominates which may amplify public perceptions of the negative impacts of aquaculture. Focusing on the five most frequent sub-themes in each thematic family, the reasons why themes are framed in terms of benefit or risk are shown.

Concerns about environmental risks

When examining all countries' reporting in conjunction, environmental issues related to aquaculture received the most coverage over the five years of analysis. Coverage tends to be negative, predominately focusing on the risks to biodiversity (Figure 2). The media frequently report

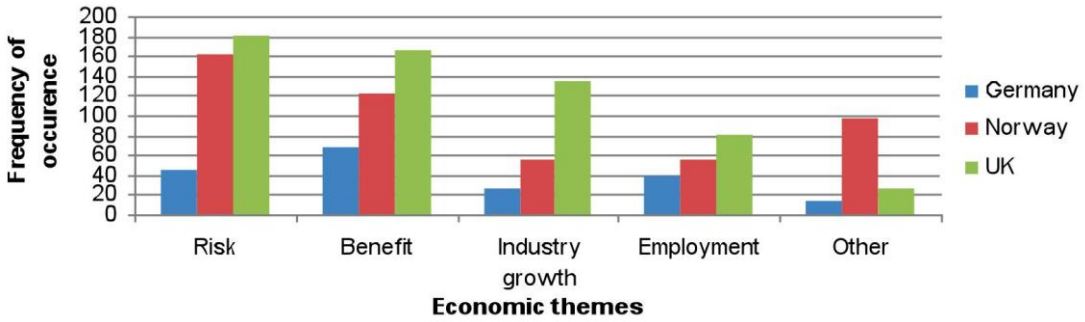

Figure 3. Importance of economic benefits.

that aquaculture leads to the alteration or destruction of natural habitats and related ecological consequences of conversation and changes in ecosystem function. Overall there is agreement that aquaculture does have effects on biodiversity but the exact impacts remain unknown (Volpe, 2001). This high level of scientific uncertainty may be conductive to media reporting on risk.

The Norwegian media represents environmental risks to a greater extent than both other countries. Here the focus is particularly on escapes of farmed fish into the wild, an issue rarely reported in Germany and the UK. This is unsurprising because of Norway's salmon producing capacities both in the country's fjords as well as in offshore locations. Germany, on the other hand, produces mainly carp and trout in inland locations, limiting the risks of escapes. Focusing primarily on Norwegian aquaculture, escapes of farmed salmon into the wild are referred to as:

"Biological cluster bombs, which can pollute an area of up to 30 km" (Die Sueddeutsche, 2005).

Importance of economic benefits

Economic issues related to aquaculture received the second highest amount of newspaper coverage. In terms of the economics of aquaculture, risks and benefits are equally evaluated in all three countries, presenting a balanced perspective to their respective publics (Figure 3).

Economic benefits are of far greater importance in Norway and the UK than in Germany. Especially in the Norwegian media, fish farming is presented as an industry which can lead to significant wealth and to the creation of "fish farming millionaires". Further benefits of aquaculture reported include the provision of rural livelihoods and better incomes as well as the maintenance of culture and identity:

"Salmon farming contributes to employment, income, satisfaction and identity and it is an important part of Norwegian culture and our widespread settlement" (Dagbladet, 2002).

Economic risks are also particularly pronounced in Norway. Often this is related to the competition the Norwegian industry faces from less traditional salmon producing countries and the barriers to trade. Other risks mentioned include the potential destruction of livelihoods, and the constant need to produce more and increase the production area or raise the unit productivity. Consequently the growth of the industry is not always reported in a positive tone. Indeed, the profitability of the caviar production industry in Germany is compared to that of drug smuggling:

"At least when it originates in wild eggs, caviar promises profits which can otherwise only be achieved through heroin dealing" (Die Sueddeutsche, 2007).

Amplification of human health risks

In contrast to Amberg et al.'s (2008) US study human health issues associated with fish farming and farmed fish consumption received less media coverage than either environmental or economic themes. The risk-benefit weigh up of economic issues offers a stark contrast to media representations of human health topics. With the exception of Norway, the focus of the German and UK media is on the health risks of farmed fish at the expense of reporting on the health benefits (Figure 4). Additionally, the media's reporting on health risks is more detailed and specific than reporting on health benefits, which are often presented in a generic manner.

In all three countries the health risks emphasised the most tend to be the most severe or dreadful risks, such as cancer. It seems that the media give preferential attention to certain risks over others. Slovic (1987) found that risks that, for example, elicit feelings of dread and involuntariness are the most feared. Indeed, in relation to aquaculture, it appears that the media are attracted to sensational risks that will best capture the public's attention, even if their actual probability is low:

"Eating such fish more than three times a year could increase the risk of cancer" (Daily Mail, 21/01/2005).

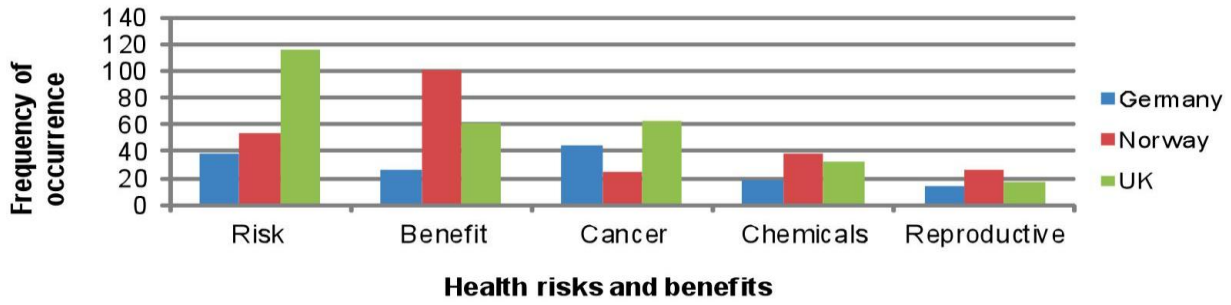

Figure 4. Amplification of human health risks.

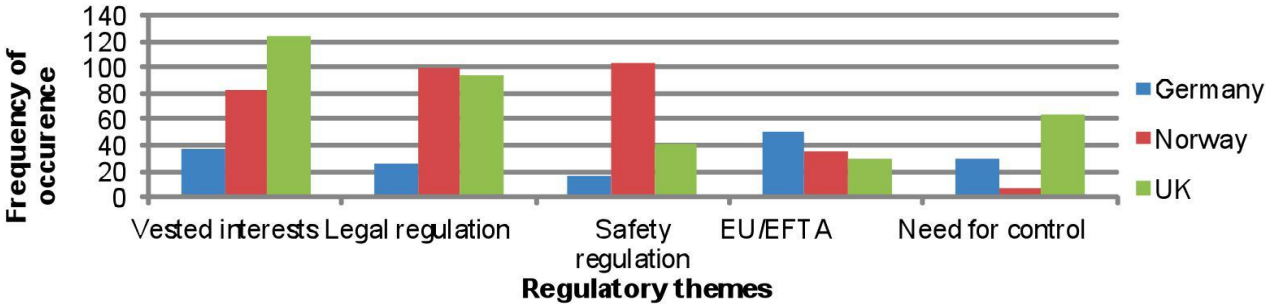

Figure 5. Lack of trust and concern about regulation.

This implies that the health risks of aquaculture are amplified in the media. The lack of emphasis on positive information could induce the public to weigh health risks as being greater than what any of the health benefits could offset. However, as suggested by Amberg et al. (2008), if the health benefits of eating fish are recognized by the public in most countries, they may not need to be reiterated through media reporting.

Organizational issues: Lack of trust and concern about regulation

Moving away from the scientific risks *per se*, the media in all three countries covers organizational and regulatory risks such as concerns about the mismanagement of the industry, the lack of regulation and labelling standards and unease about vested interests (Figure 5). Concerns with the industry's vested interests are reported in all three countries. However, this issue is particularly emphasized in the UK together with a need for more stringent regulation of the industry and improved consumer communications:

"Correct information on the production method to consumers is important to prevent food fraud". (The Guardian, 04/05/2007).

Due to the country's regrettable history with cattle farming, when risk comparisons are made, these tend to be references to the Bovine Spongiform Encephalopathy (BSE) and foot-and-mouth crises. Likewise, as issues surrounding the risks and benefits of GM foods were a major public controversy in the UK, media reporting on fish farming is often anchored in these terms potentially amplifying public perceptions of the risks associated with farmed fish consumption.

The media's emphasis on the industry's regulation is unsurprising as there is a lack of adequate regulation and labelling to date (FAO, 2006). For instance, unresolved issues concern questions related to animal welfare, sustainability, fish feeds and chemical inputs. Indeed, with regard to salmon farming, McDaniels et al. (2005) criticize the fact that so far no enforceable regulatory body exists and that, essentially, salmon aquaculture presents a global risk with no efficient global regulation to date (McDaniels et al., 2005). Consequently as suggested by Luoma et al. (2007), consumers may lack trust in the industry, feel apprehensive about current regulatory standards and, in turn, have heightened perceptions of associated risks.

DISCUSSION

We compared media reporting on aquaculture and farmed fish in Germany, Norway and the UK. The aim was to present an overview of media representations of aquaculture as these will have a likely impact on public

perceptions of the industry and may as such need to be acknowledged in policy making. Clearly, aquaculture operates in a world served by the media who themselves survive on issue-driven stories aimed at generating public interest and concern in order to increase publication sales (Consensus, 2006).

Amberg et al. (2008) suggest that there is growing public unease about the health and safety of modern methods of food production generally and that aquacultural products are already a further example of media controversy over foods. Judging by our media representations, aquaculture shares a variety of characteristics with most modern food risks. It is presented as a complex activity comprising health, environmental, economic and socio-organizational dimensions. Of those, only economic themes are more often framed in terms of benefit rather than risk. As such aquaculture has an overall negative representation in the media of our three countries.

When looking at the wide-ranging risks highlighted in the media and the dominance of reporting on the industry's risks at the expense of its benefits, it is understandable how and why the industry and its diverse applications might elicit public concerns. The images portrayed by the media are often negative. Hence, although the total coverage of aquaculture and farmed fish may be low in comparison to other issues, the publics in Germany, Norway and the UK have been predominately exposed to negative information. In turn the media's amplification of certain risks may skew public perceptions of farmed fish and aquaculture more generally towards risk.

Duarte et al. (2009) propose that just as animal husbandry replaced hunting on land, aquaculture will replace fisheries. However, because of our scientific understanding and environmental awareness today, it should be possible to ensure that "the blue revolution" does not recreate the errors associated with the expansion of agriculture (Duarte et al., 2009).

Current developments indicate that modern aquaculture is following in the footsteps of agriculture, becoming more and more intensive with the overarching aim of increasing production and profit margins. But modern agriculture has long run into trouble with negative consumer perceptions of, for example, environmental risks. Although fish farming has been practised for centuries, modern aquaculture with its diverse production methods and novel technologies may incur public perception problems (Schlag, 2010). If aquaculture will indeed become the global supplier of fish better consumer communications are required.

CONCLUSIONS AND AVENUES FOR FURTHER RESEARCH

Due to the wide range of potential risks as well as benefits, it is unsurprising that during the past decade, media reporting and global awareness of aquaculture has increased (Amberg et al., 2008). Nonetheless, it is unclear what effects media reporting has on public perceptions on the topic. Thus it is important to study the public's perception in addition to any media analyses (Hoijer et al., 2006). Burgess et al.'s (2005) exploratory focus group studies already hint at the multi-dimensionality of public perceptions on aquaculture such as the importance of cultural aspects and lay concerns with nature.

Amberg et al. (2008) call this the next step for research: to link the results of media analyses to public perceptions and behaviour. Will the negative images portrayed in the media have impacts on how the public perceives farmed fish? If not communicated efficiently, the possible health and environmental risks are vulnerable to misinformation (Holmer et al., 2008) which could in turn contribute to consumer concerns and opposition, stunting the growth of aquaculture. Effective risk communication requires an understanding of the lay perceptions of aquacultural risk as fish farming touches on many factors which have been identified in the risk perception literature as causing public concern and controversy. Understanding the impact of media reporting on the risks and benefits of aquaculture on lay perceptions is an essential next research step.

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